カンボジア国

プノンペン水道公社（PPWSA）

カンボジア国
プンプレック上水道拡張計画

準備調査報告書
（先行公開版）

2022年11月

独立行政法人
国際協力機構（JICA）

株式会社日水コン
クラウンエイジェンツ・ジャパン株式会社
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序　文

独立行政法人国際協力機構は、カンボジア国のプンプレック上水道拡張計画にかかる準備調査を実施することを決定し、同調査を株式会社日水コン、クラウンエイジェンツ・ジャパン株式会社、株式会社 TEC インターナショナルに委託しました。

調査団は、令和 3 年 1 月 9 日から 3 月 14 日（第 1 次現地調査）、令和 3 年 7 月 19 日から 7 月 30 日（第 2 次現地調査）、令和 4 年 8 月 14 日から 8 月 20 日（第 3 次現地調査）、の 3 回にわたりカンボジアの政府関係者と協議を行うとともに、計画対象地域における現地踏査を実施し、帰国後の国内作業を経て、ここに本報告書完成の運びとなりました。

この報告書が、本計画の推進に寄与するとともに、両国の友好親善の一層の発展に役立つことを願うものです。

終わりに、調査にご協力とご支援をいただいた関係各位に対し、心より感謝申し上げます。

令和 4 年 11 月

独立行政法人国際協力機構

地球環境部

部長　森田　隆博

要　約

１．国の概要

カンボジア国の総人口は約 1,560 万人[1]、国土面積 181,035 km^2（日本の約 2 分の 1 弱）を有する。北部ラオスから国際河川であるメコン川が南に流れており、中央平原にはトンレサップ湖が存在する。トンレサップ湖からはトンレサップ川が流れ首都プノンペンでメコン川と合流している。国土の大部分は低地であるが、東北部、北部、北東部には山脈が存在する。また、ベトナム、ラオスと国境を接する北部、北東部は深い森林に覆われ、野生動物や原生林の宝庫となっている。

気象は、高温多湿な熱帯地域に属し、一年は大きく雨期（5 月から 10 月）と乾期（11 月から 4 月）に分けられる。特に、2 月～4 月は酷暑となり、日中気温が 35～40℃になる。カンボジアの年間降水量は 1,400 – 2,000 mm[2]である。

カンボジア国の経済は、2018 年の一人当り国内総生産（GDP）は約 1,607USD[3]で近隣諸国に比べても低く、未だ後発開発途上国である。近年は、比較的安定した政治状況を保っており、2004 年から 2007 年には平均国内総生産成長率が 4 年連続して 10%を超える著しい経済成長を果たしていたが、2008 年に入ってからの原油・食糧価格の高騰、特に 2009 年は世界金融危機の影響により 2009 年の経済成長率は、0.1%にまで急低下した。しかしながら 2010 年は 6.0%まで急回復し、2011 年以降は、ほぼ 7.0%を維持し続けている。国際通貨基金（International Monetary Fund 、以下「IMF」）によると、2020 年に新型コロナウイルス感染症（Coronavirus disease 2019（以下、「COVID-19」））流行の影響により、成長率が急低下するものの、2022 年以降は回復し、今後も 6%から 7%の成長が続くと予想している。また、カンボジア国は、1990 年代初頭の内戦終結後に、経済関連の国際機関に加盟し、1999 年の東南アジア諸国連合（ASEAN）加盟、2004 年の世界貿易機関（WTO）加盟など、地域経済及び世界経済との統合を強化している。

2020 年の産業別 GDP 構成比は農業が 22.9%、工業が 37.8%、サービス業が 39.4%である 。2010 年と比較すると農業が経済に占める割合は低下している一方で、インフラ需要や都市開発に伴い、建設業が大きく成長しており、同分野は今後も拡大が見込まれている。

世帯当り月所得は、年々上昇しており、首都プノンペンと地方の差は年々減少しているものの 2017 年の首都プノンペンと地方（Other rural）には約 1.6 倍の差がある。カンボジア国の貧困層は、2004 年には 50%を超えていたが、2018 年には約 12% まで大幅に低下した。しかし、貧困の削減はカンボジア国の重要課題であり、貧困削減のためには、産業構造の多様化と生産性の向上に基づく包括的な成長が欠かせないとしている。

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[1] General Population Census of Cambodia 2019
[2] Climate Change Knowledge Portal, World Bank
[3] IMF, World Economic Outlook Database, October 2021

２．プロジェクトの背景、経緯及び概要

カンボジアの上水道セクターは 1990 年代中頃より内戦終結後の本格的な施設の改修・拡充が開始され、首都プノンペン都及び地方主要都市を中心に整備が進んでいる。全国に 2 つの水道公社と 8 つの公営水道局があり、その他に 300 以上とも言われる多数の民間水道事業者が存在する。

プノンペン都では、内戦終結後、1993 年に JICA の支援により策定された「プノンペン市上水道整備計画」に基づき、わが国及び他ドナーが連携して、浄水場の建設及び改修、運営・維持管理技術にかかる技術協力が実施され、24 時間給水を実現し給水率は 90%以上に達した。この間 JICA は、4 件の無償資金協力、1 件の円借款により施設整備を支援したほか、2 回のマスタープラン策定、北九州市からの個別専門家派遣、技術協力プロジェクトの実施によって能力強化も支援してきた。しかし、プノンペン都を中心とするプノンペン水道公社（Phnom Penh Water Supply Authority、以下、「PPWSA」という。）の給水区域内では、人口及び商業施設が急増し、2018 年時点の日平均給水需要は 58 万 m^3 と既にその給水能力（56 万 m^3）を上回っており、2030 年には約 157.8 万 m^3 となる見込みであり、水需要の急増に伴って水圧が低下する地区が発生しているなど、給水能力の増強が課題となっている。加えて、過去に整備した施設の劣化やポンプ制御システムのエネルギー非効率等が確認されており、持続性の確保と運転維持管理におけるエネルギー効率改善が課題となっている。

これらの課題に対し、PPWSA は 2017 年に策定した第 3 次の上水道整備マスタープラン（以下、「MP」という。）に沿って、ドナー資金を活用して新規の浄水場の整備を進めている。JICA も、事業・運営権対応型無償資金協力（以下、「事業権無償」という。）による「タクマウ上水道拡張計画」（2020 年 G/A、供与限度額 34.21 億円）によって 3 万 m^3／日の能力の浄水場の新設を支援中であり、さらに水需要の急増に対応したマスタープランの見直しを「プノンペン都上水道開発に係る情報収集調査」によって支援した。

プンプレック浄水場は 10 万 m^3/日の処理能力の施設として 1966 年に運転を開始した。その後 1995 年にフランス政府と日本政府の無償資金により既存施設のリハビリテーションを経た後、2003 年に日本政府の無償資金協力「プンプレック浄水場拡張計画」（2001 年 E/N 締結）により 5 万 m^3/日の施設が増設され、現在は 15 万 m^3／日の浄水処理能力を有する、PPWSA の基幹浄水場の 1 つである。水源はメコン河の支流であるトンレサップ川であり、凝集沈殿・急速ろ過法によって浄水処理を行っている。プンプレック浄水場はプノンペン都の中心地区に配水している重要な浄水場であるため、水需要の増大に対応した能力の増強を行うことの効果は大きい。また、フランスの支援によって建設された当初施設は老朽化が進んでおり、改修の必要性が高い。

以上の背景を踏まえ、カンボジア政府から、MP に位置付けられているプンプレック浄水場の改修・拡張事業を行うため、我が国の民間企業の技術・知見・資金を活用して効率的な施設整備、運営・維持管理を行う、事業権無償による「プンプレック上水道改修・拡張計画」（以下、「本事業」という。）の要請があった。

３．調査結果の概要とプロジェクトの内容（概略設計、施設計画・機材計画の概略）

（１）調査結果の概要

前述の背景から JICA は、以下の通り計 3 回にわたり協力準備調査団をカンボジア国に派遣した。

第 1 次現地調査：　2021 年 1 月 9 日～同年 3 月 14 日
第 2 次現地調査：　2021 年 7 月 19 日～同年 7 月 30 日
第 3 次現地調査：　2022 年 8 月 14 日～同年 8 月 20 日

カンボジア国側からの要請内容を確認し、プロジェクトの背景、目的及び内容を把握し、効果、技術的・経済的妥当性を検討のうえ、協力の成果を得るために必要かつ最適な事業内容・規模につき概略設計を行い、概略事業費を積算するとともに、プロジェクトの成果・目標を達成するために必要な相手国側分担事業の内容、実施計画、運営・維持管理等の留意事項などを提案することを目的とする本準備調査を実施した。

その結果、協力対象事業として、事業権無償により、45,000 m^3/日の浄水施設を建設し、その運営を最大 10 年間の期間において特別目的会社（以下、「SPC」）が行うことをカンボジア国側と合意した。

（２）プロジェクトの内容

本プロジェクトはプノンペン都中央部への給水の為の浄水施設（45,000m^3/日）を建設し、SPC により最長 10 年間の運営・維持管理（以下、「O&M」）が行われるものである。本邦企業による O&M が行われることにより、本邦技術の O&M の技術移転が行われるとともに、本邦企業による事業実施経験が培われるものである。協力の内容は以下のとおりである。

施設	プンプレック浄水場	取水施設	取水能力：47,250 m^3/日 取水施設（フロート式） 取水ポンプ 受配電施設
		浄水施設	浄水能力：45,000 m^3/日 浄水処理施設 薬品生成・溶解・注入システム 受配電施設
		配水施設	配水池：6,000 m^3 配水ポンプ場 配水ポンプ
		SCADA	浄水場内の中央監視システム
コンサルティング・サービス			入札補助
			設計確認
			施工段階における工程管理・品質管理・コスト管理・支払い支援等の各種マネジメント業務

４．プロジェクトの工期及び概略事業費

（１）プロジェクトの工期

本プロジェクトの実施工程は、工事内容・工期の関係から初年度に入札を行い、翌年度から工事（設計・施工・維持管理準備）を実施するものとする。工期は、入札期間が 10 ヶ月、設計・施工が 39 ヶ月である。

（２）概算事業費

１）日本側負担費用

事業者契約認証まで非公表とする。

２）カンボジア側負担費用

	負担事項	内容	USD	百万円
1	用地準備	取水場、浄水場、資材置場の用地準備費用	100,000	11.1
2	不発弾・地雷調査	プロジェクト対象用地に不発弾及び地雷等がないか事前に調査を行う費用	40,000	4.4
3	PPWSA 職員の配置	D&B 業務のマネジメント費用	120,000	13.3
4	受電に係る費用	建設用の受電及びプラント運転用受電の手続き、工事等の負担費用（取水・浄水施設への一次側受電設備の工事負担費用）	10,000	1.1
5	導水管の整備	新規取水施設から浄水施設（今回増設分）までの導水管 φ800 mm、L=1.9km (非開削の場合)	8,500,000	942.7
6	銀行手数料	銀行取決めに係る手数料	41,000	4.5
合　計			8,811,000	**977.2**

注）　施設建設完了の 2027 年までにかかる経費合計

５．プロジェクトの評価

（１）妥当性

<u>プロジェクトの裨益対象</u>

本プロジェクトによりプノンペン都への給水能力が改善され、プノンペン都の裨益人口が増加する。浄水場の増水能力の拡張に加え、現状の給水サービスの向上が図られるため、増加する給水人口に対する裨益のみならず、現在給水を受けている住民に対しても給水サービスが改善することとなる。

<u>プロジェクトの緊急性</u>

PPWSA は既存の水道システムを有してはいるが、現在の浄水能力では 2030 年時点でのプノンペン都における水需要の 35%程度しかない[4]。上水道施設の拡張による給水量の増加なしでは水不足が予測され、上水道施設の拡張が急務となっている。

<u>プロジェクトの上位計画との整合性</u>

カンボジア政府は、国家戦略開発計画（NSDP）により、2025 年までに都市部人口の 100%に対して安全な水へのアクセスを確保するという目標を掲げており、本プロジェクトはプノンペン都

[4] 既存浄水能力 592 千 m^3／2030 年日最大需要 1,714 千 m^3＝0.35

において、その実現に寄与するものである。

我が国の援助政策との整合性

カンボジアに対する我が国の援助方針の事業展開計画（2016 年 9 月）では、カンボジアの開発目標達成を支援し、「社会開発の促進」を援助の重点分野の一つとし、「上下水道インフラの整備」を開発課題としており、本プロジェクトの実施は、我が国の援助政策と整合している。

（２）有効性

本プロジェクトの有効性に関しては、以下の定量的効果及び定性的効果が見込まれる。

定量的効果

プンプレック浄水場の増水能力を拡張することにより、下表に示すような効果が期待できる。

No.	指標	基準値(2021 年)	目標値(2030 年) （供用開始後 3 年）
1	給水能力 （日平均）	150,000 m^3/日	195,000 m^3/日*

定性的効果

定性的効果は以下の通りである。

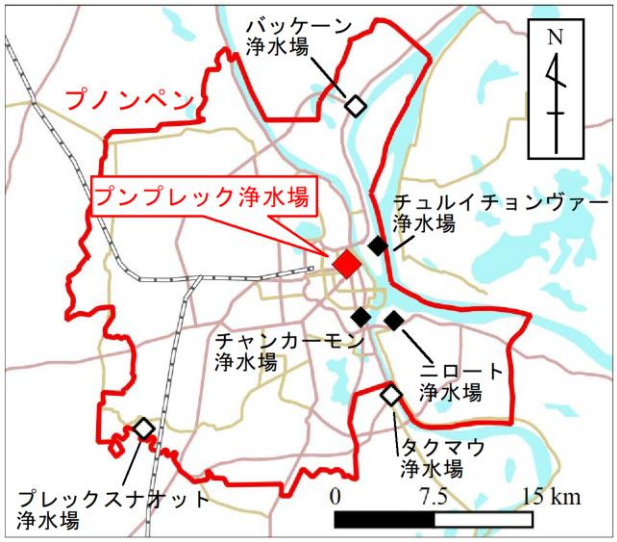
① 給水栓からの水量・水圧不足の改善
② 浄水場の運営・維持管理に関する技術移転による運営・維持管理能力の向上
③ 公衆衛生の向上

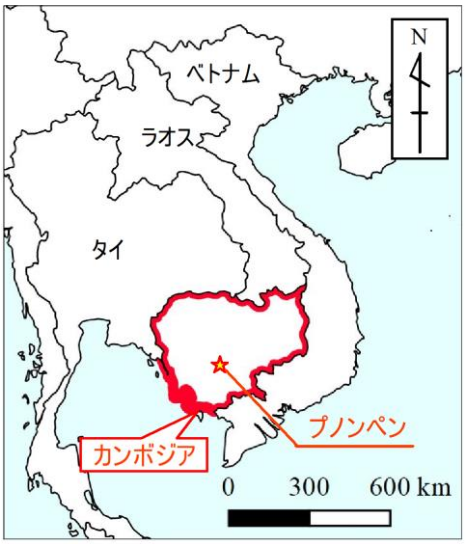
以上の内容により、本プロジェクトの妥当性は高く、また有効性が見込まれると判断される。

目　次

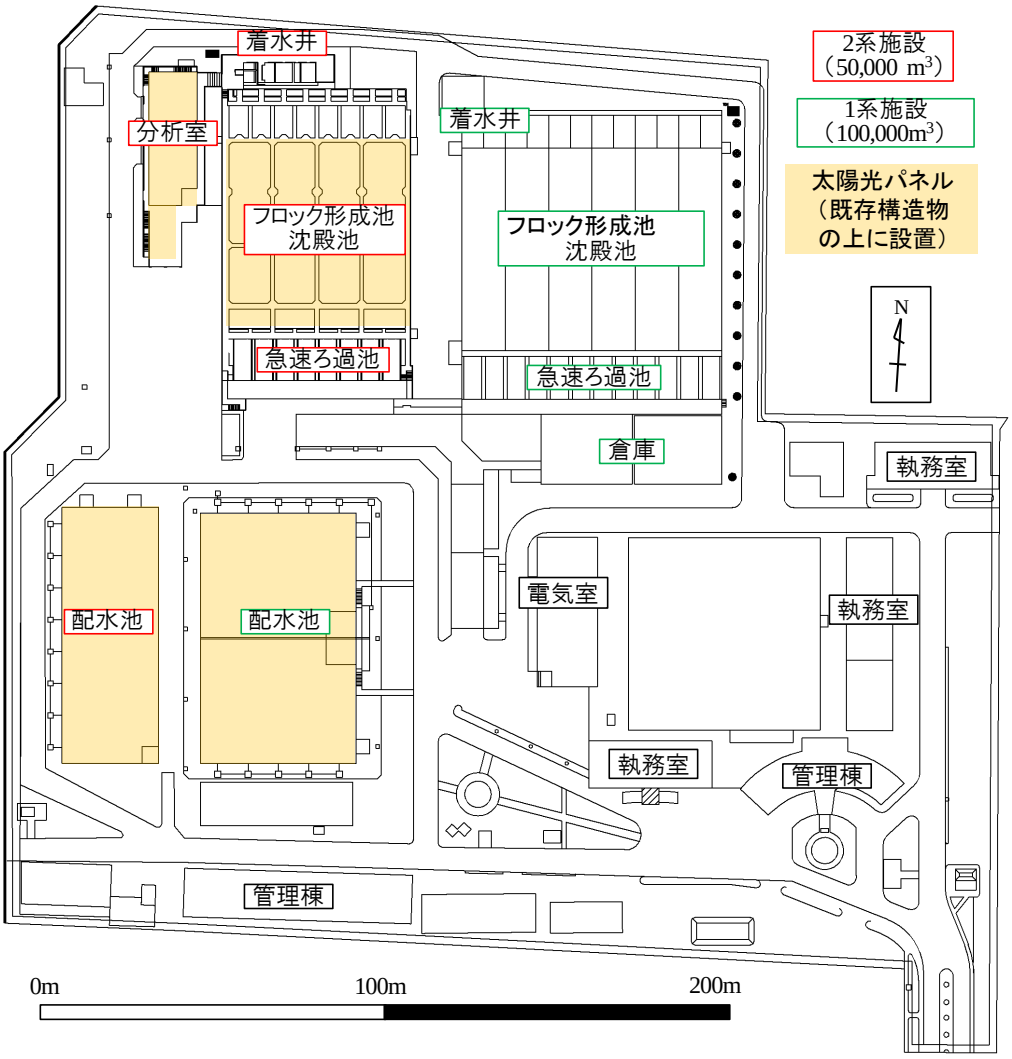
［資料］

プロジェクト位置図

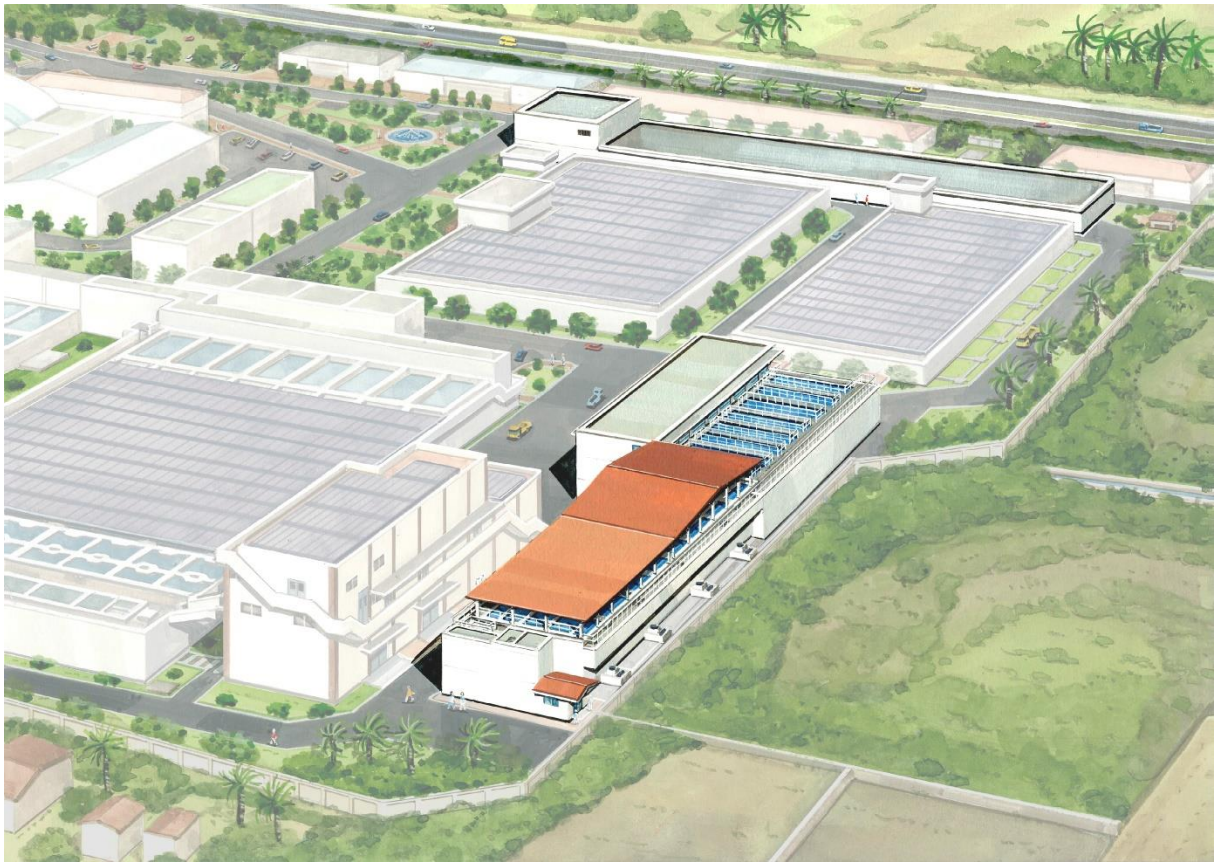




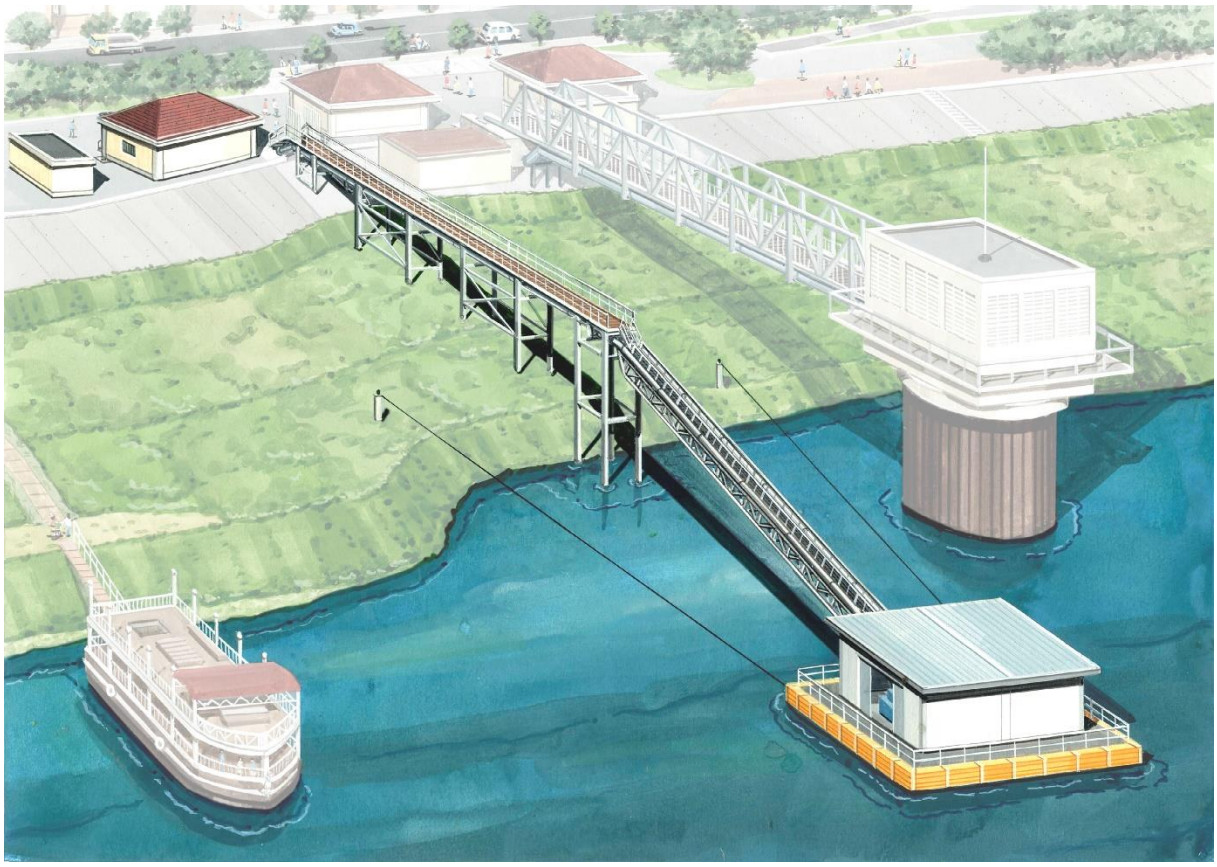
【プンプレック浄水場平面配置図】



浄水場完成予想図



取水場完成予想図



写真

写真-1：取水施設予定地の現状
取水施設建設予定地には、既存の取水塔がある。増設されるフロート式取水施設は既存取水施設の敷地内に建設される計画である。

写真-2：既存プンプレック浄水場
既存のプンプレック浄水場は２期にわたって建設が行われており、場内の利用可能エリアは限定的である。

写真-3：既存プンプレック浄水場内 PPWSA 本局
既存プンプレック浄水場にはプノンペン水道公社の本局が設置されており、同公社の運営維持管理を一括して管理している。

写真-4：フロック形成及び沈殿池建設予定地
フロック形成及び沈殿池の建設予定地は利用面積が非常に限られている。

写真-5： ろ過池建設予定地
ろ過池の建設予定地はある程度利用面積が確保されている。（写真の右半分エリア）

写真-6：配水池及び配水ポンプ場建設予定地
配水池及び配水ポンプ場予定地も利用可能なエリアがかぎられている。なお、同エリアは現在倉庫として利用されている。

図表リスト

略 語 表

ADB	Asian Development Bank	アジア開発銀行
AfD	Agence Française de Développement (French Development Agency)	フランス開発庁
CDC	The Council for Development of Cambodia	カンボジア開発評議会
CNMC	Cambodia National Mekong Committee	カンボジアメコン川委員会
CPI	Consumer Price Index	消費者物価指数
D&B	Design and Build	設計施工
DD	Detail Design	詳細設計
DSCR	Debt Service Coverage Ratio	元利金返済カバー率
EDC	Electricite du Cambodge	カンボジア電力公社
EIB	European Investment Bank	欧州投資銀行
GDT	General Department of Taxation	カンボジア租税総局
IEIA	Initial Environmental Impact Assessment	初期環境影響評価
JICA	Japan International Cooperation Agency	国際協力機構
MEF	Ministry of Economy and Finance	経済財政省
MoE	Ministry of Environment	環境省
MOWRAM	Ministry of Water Resources and Meteorology	水資源気象省
MRC	Mekong River Commission	メコン川委員会
NRW	Non-Revenue Water	無収水
NSDP	National Strategic Development Plan	国家戦略開発計画
O&M	Operation and Maintenance	運営・維持管理
PDE	Provincial Department of Environment	地方環境局
PISC	Provincial Investment Sub-Committee	地方投資準委員会
PPP	Public–Private Partnership	官民連携
PPWSA	Phnom Penh Water Supply Authority	プノンペン水道公社
QIP	Qualified Investment Project	適格投資プロジェクト
SOP	Standard Operating Procedures	標準運営手順
SPC	Special Purpose Company	特別目的会社
UXO	Unexploded Ordnance	地雷・不発弾
VAT	Value Added Tax	付加価値税
VFD	Variable-Frequency Drive	可変速ドライブ
WTP	Water Treatment Plant	浄水場

第1章 プロジェクトの背景・経緯

1-1 当該セクターの現状と課題

1-1-1 現状と課題

カンボジア国の上水道セクターは 1990 年代中頃より内戦終結後の本格的な施設の改修・拡充が開始され、首都プノンペン都及び地方主要都市を中心に整備が進んでいる。全国に 2 つの水道公社と 8 つの公営水道局があり、その他に 300 以上とも言われる多数の民間水道事業者が存在する。

プノンペン都では、内戦終結後、1993 年に JICA の支援により策定された「プノンペン市上水道整備計画」に基づき、わが国及び他ドナーが連携して、浄水場（以下、WTP）の建設及び改修、運営・維持管理技術にかかる技術協力が実施され、24 時間給水を実現し給水率は 90%以上に達した。この間 JICA は、4 件の無償資金協力、1 件の円借款により施設整備を支援したほか、2 回のマスタープラン策定、北九州市からの個別専門家派遣、技術協力プロジェクトの実施によって能力強化も支援してきた。しかし、プノンペン都を中心とするプノンペン水道公社（Phnom Penh Water Supply Authority、以下、「PPWSA」という。）の給水区域内では、人口及び商業施設が急増し、2018 年時点の日平均給水需要は 58 万 m^3 と既にその給水能力（56 万 m^3）を上回っており、2030 年には約 157.8 万 m^3 となる見込みであり、水需要の急増に伴って水圧が低下する地区が発生しているなど、給水能力の増強が課題となっている。加えて、過去に整備した施設の劣化やポンプ制御システムのエネルギー非効率等が確認されており、持続性の確保と運転維持管理におけるエネルギー効率改善が課題となっている。

1-1-2 開発計画

1-1-2-1 国家開発計画

1-1-2-1-1 四辺形戦略

四辺形戦略（Rectangular Strategy Phase IV）とは、2004 年 7 月 16 日の第三次政権成立後の初閣議においてフン・セン首相が表明した国家開発戦略で、戦略の四辺に①農業分野の強化、②インフラの復興と建設、③民間セクター開発と雇用創出、④能力構築と人材開発を掲げ、その中心部に「良き統治（グッドガバナンス）」を置いている。「良き統治」の内容としては、汚職撲滅、法・司法改革、行財政改革及び国軍改革を優先課題としている。

1-1-2-1-2 国家戦略開発計画

国家戦略開発計画 2019～2023 年（National Strategic Development Plan（NSDP））は、カンボジア国の国家戦略である「四辺形戦略」を実施するためのアクションプランとして位置付けられている。水道分野については、目標値として 2018 年までに都市部の 85%が水道システムへのアクセスを得るこ

と、2025 年に都市部での安全な水にアクセスできる人の割合を 100%にすることとしている。また、都市給水の優先課題を下記のように示している。

- 法制度（水道法等）の整備
- 中央省庁による経済的技術的な規制の下での地方分権の推進
- 地方水道局の国営企業としての自立（公社化）
- 資金調達の増加（開発戦略・ビジネスプラン等の策定、プライベイトセクターの活用、”Water for All” program の実施等）
- 業績及び水道普及の改善（既存施設の更新、課題の抽出と解決、人材育成、水道協会設立、PPWSA の有効活用、適切な水質管理システム等）
- 水源保全

1-1-2-2　都市開発計画

1-1-2-2-1　土地利用計画

首都プノンペンの土地利用計画は、当時の国家戦略開発計画（2014～2018 年）を踏まえた上で、2015 年を目標年とする都市開発戦略（City Development Strategy、以下「CDS」）を 2005 年に策定した。CDS では、今後の首都プノンペンの発展と市民生活の向上を目的とした開発計画構想における 5 つの重点分野として「①土地利用と住宅」、「②環境と天然資源」、「③社会資本整備と交通」、「④社会福祉」、「⑤経済発展」を挙げている。

CDS に基づき、フランス政府及びパリ市の支援により、2020 年を目標年としたプノンペン都の総合都市開発計画（White Book on Development and Planning of Phnom Penh, 2015、以下「White Book」）を 2007 年に策定した。その後、目標年次を 2035 年に延伸し、王令により設立された土地管理都市計画国家委員会による可決を経て、2015 年 12 月 23 日付の政令（Sub-decree）の発出により承認された。総合都市開発計画では、首都プノンペンへの一極集中を防ぐための郊外の開発と都市圏の拡大、住宅・土地開発における官民連携の促進、景観・環境都市としてのアイデンティティの確立等の計画が提案されている。White Book における土地利用計画については「第 4 章」に記載する。

1-1-2-2-2　首都プノンペンの開発計画

首都プノンペン及び周辺部で実施中の主要な大規模開発計画を**図 1-1.1** 及び**表 1-1.1** に示す。

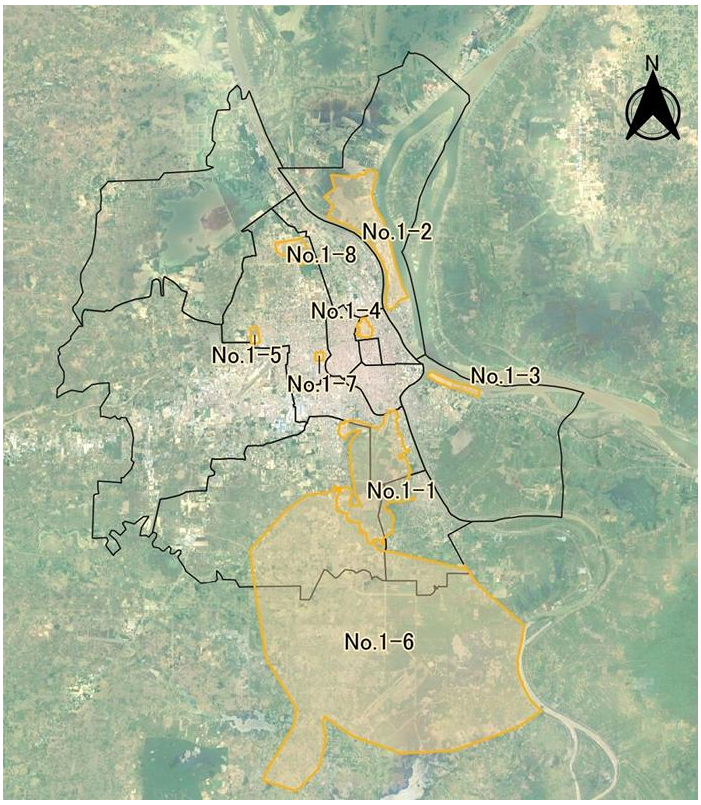


図 1-1.1　首都プノンペンの大規模開発計画の概要

出典：PPWSA 提供資料及びヒアリングを基に調査団作成

表 1-1.1　首都プノンペンの大規模開発計画の概要

No	Name	Area	Description
1-1	ING City	2,572 ha	4 stages, 5 year/stage, 2 stages are assumed to be completed until 2030
1-2	OCIC & Okide Villa	1,300 ha	Condominium, resident area
1-3	Kos Norea Project	124 ha	30,000m^3/day by Master Plan, backfilling is finished in next 2 years, Commercial, business, high-rise buildings for residence
1-4	Boeng Kak	80 ha	Business area
1-5	Okide Villa	50 ha	Villa, a few condominiums, business center, commercial area
1-6	New Airport City	2,600 ha	New Inaternational Airport and New Airport City
1-7	Booyoung Town	27 ha	40 apartments and 7 complexes,
1-8	Grand Phnom Penh International City	150 ha	Golf course and housing area

出典：PPWSA 提供資料及びヒアリングを基に調査団作成

1-1-2-2-3　　道路開発計画

2035 年を目標年次とする首都プノンペンにおける総合都市交通計画として、都市交通マスタープラン（The Phnom Penh Urban Transportation Master Plan、以下「PPUTMP」）が策定された。PPUTMP の中で、道路開発計画が整理されている。

道路開発計画の概要を**図 1-1.2** に示す。首都プノンペンの主要幹線道路は、環状道路（Ring Road 以下、「RR」）と国道（National Road、以下「NR」）で構成されている。PPUTMP では、RR1 から RR4 までの 4 つの環状道路及び中心部より伸びる NR1 から NR6 までの 6 つの国道で道路網を整備する計

画である。

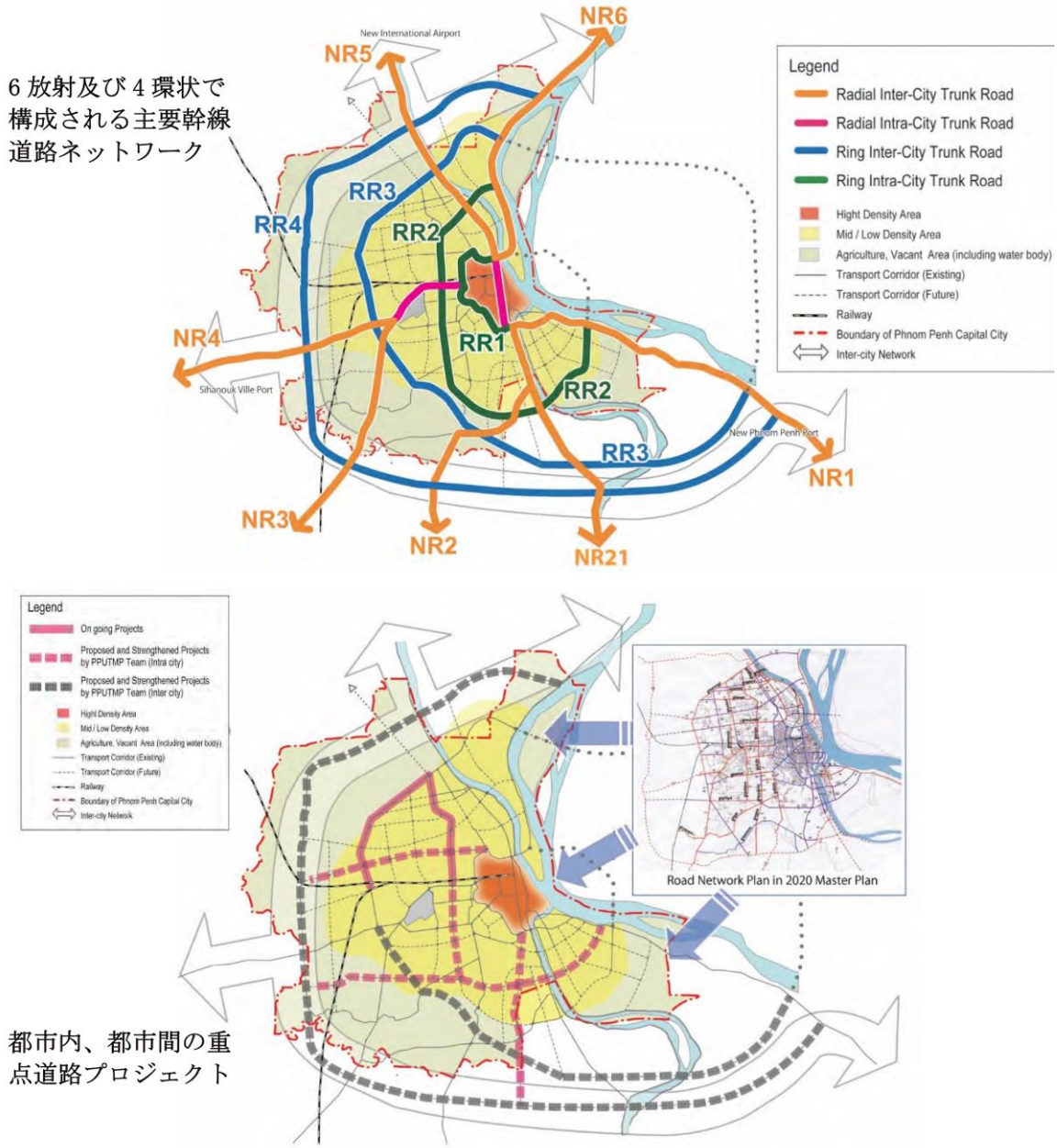


図 1-1.2　2035 年における道路開発計画の概要

出典：The Phnom Penh Urban Transportation Master Plan

将来 PPUTMP により、主要幹線道路が整備されること、主要道路等について公共交通の導入等が予定されており、送配水管の整備や維持管理において影響があることについても留意する。

また、首都プノンペンの Khan Chrouy Changvar とカンダール州の District Lvea Aem を結び Mekong 川を横断する橋（Changvar-Svay Chrum 橋）の建設が計画されている。橋の建設予定地を**図 1-1.3** に示す。橋の建設は、2019 年から 2023 年の韓国の援助プログラムの中で優先プロジェクトとしてあげられた。加えて、首都プノンペンの Khan Chbar Ampov とカンダール州の Khsach village を結ぶ Areiy

Ksatr – KdeyTakoy 橋のフィージビリティ・スタディ調査（以下、「F/S」）が実施されている。橋の建設後に、現カンダール州の Svay Chrum や Areiy Ksatr が首都プノンペンに属することが予定されており、都市圏の拡大及び一層の発展が予想される。

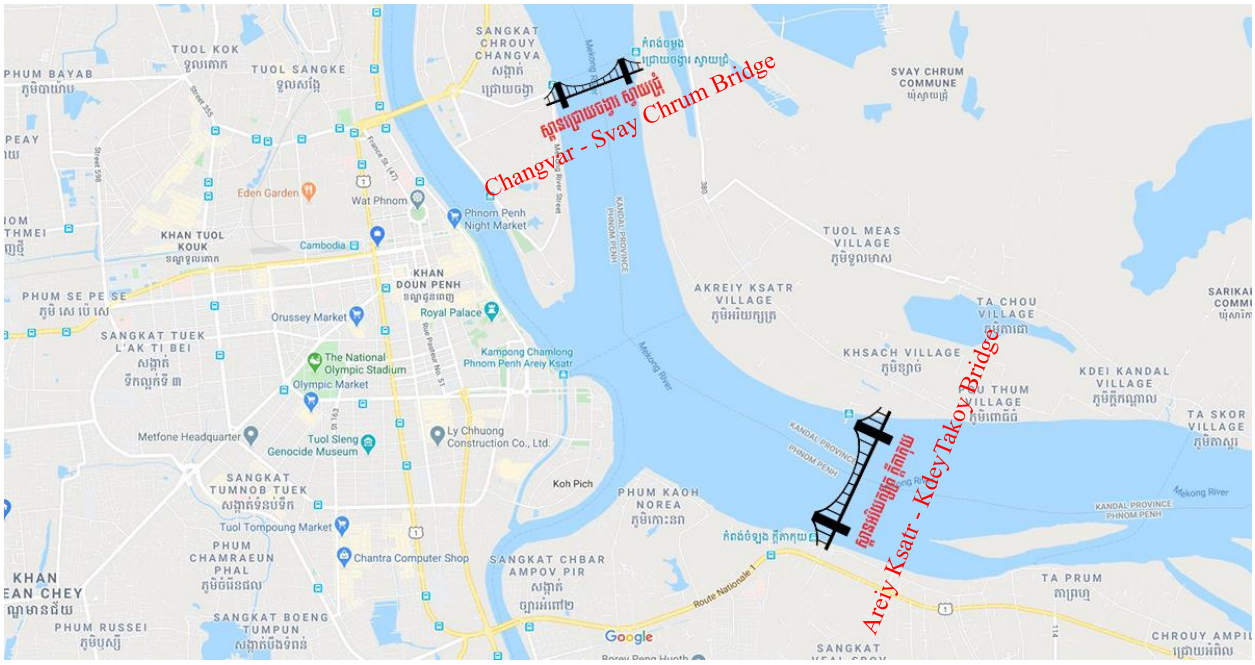


図 1-1.3　橋の建設予定位置

出典：the Cambodia Constructors Association

1-1-2-2-4　　PPWSA の開発計画

PPWSA は 2017 年に策定した第 3 次の上水道整備マスタープラン（以下、「MP」という。）に沿って、ドナー資金を活用して新規の浄水場の整備を進めている。JICA も、事業・運営権対応型無償資金協力（以下、「事業権無償」という。）による「タクマウ上水道拡張計画」（2020 年 G/A、供与限度額 34.21 億円）によって 3 万 m^3／日の能力の浄水場の新設を支援中であり、さらに水需要の急増に対応したマスタープランの見直しを「プノンペン都上水道開発に係る情報収集調査」によって支援した。

1-1-3　社会経済状況

カンボジア国の経済は、2018 年の一人当り国内総生産（GDP）は約 1,607USD[5]で近隣諸国に比べても低く、未だ後発開発途上国である。近年は、比較的安定した政治状況を保っており、2004 年から 2007 年には平均国内総生産成長率が 4 年連続して 10%を超える著しい経済成長を果たしていたが、2008 年に入ってからの原油・食糧価格の高騰、特に 2009 年は世界金融危機の影響により 2009 年の経済成長率は、0.1%にまで急低下した。しかしながら 2010 年は 6.0%まで急回復し、2011 年以降は、ほぼ 7.0%を維持し続けている。国際通貨基金（International Monetary Fund 、以下「IMF」）によると、

[5] IMF, World Economic Outlook Database, October 2021

2020 年に新型コロナウイルス感染症（Coronavirus disease 2019（以下、「COVID-19」））流行の影響により、成長率が急低下するものの、2022 年以降は回復し、今後も 6%から 7%の成長が続くと予想している。また、カンボジア国は、1990 年代初頭の内戦終結後に、経済関連の国際機関に加盟し、1999 年の東南アジア諸国連合（ASEAN）加盟、2004 年の世界貿易機関（WTO）加盟など、地域経済及び世界経済との統合を強化している。

2020 年の産業別 GDP 構成比は農業が 22.9%、工業が 37.8%、サービス業が 39.4%である 。2010 年と比較すると農業が経済に占める割合は低下している一方で、インフラ需要や都市開発に伴い、建設業が大きく成長しており、同分野は今後も拡大が見込まれている。

世帯当り月所得は、年々上昇しており、首都プノンペンと地方の差は年々減少しているものの 2017 年の首都プノンペンと地方（Other rural）には約 1.6 倍の差がある。カンボジア国の貧困層は、2004 年には 50%を超えていたが、2018 年には約 12% まで大幅に低下した。しかし、貧困の削減はカンボジア国の重要課題であり、貧困削減のためには、産業構造の多様化と生産性の向上に基づく包括的な成長が欠かせないとしている。

1-2　無償資金協力の背景・経緯及び概要

プンプレック浄水場は 100,000 m^3/日の処理能力の施設として 1966 年に運転を開始した。その後 1995 年にフランス政府と日本政府の無償資金により既存施設のリハビリテーションを経た後、2003 年に日本政府の無償資金協力「プンプレック浄水場拡張計画」（2001 年 E/N 締結）により 50,000 m^3/日の施設が増設され、現在は 150,000 m^3／日の浄水処理能力を有する、PPWSA の基幹浄水場の 1 つである。水源はメコン河の支流であるトンレサップ川であり、凝集沈殿・急速ろ過法によって浄水処理を行っている。プンプレック浄水場はプノンペン都の中心地区に配水している重要な浄水場であるため、水需要の増大に対応した能力の増強を行うことの効果は大きい。また、フランスの支援によって建設された当初施設は老朽化が進んでおり、改修の必要性が高い。

プノンペン都の人口増加と水需要に対応するためには、既存のプンプレック浄水場の能力増強が必要であり、カンボジア国政府は我が国に対して、プンプレック浄水場の改修・拡張をすることにより、水需要への対応と安全な水へのアクセス率向上を図ることを目的とした事業権無償事業の要請を行った。

カンボジア国側からの要請書に記載されている要請内容は**表 1-2.1** の通りである。

表 1-2.1　本プロジェクトの要請内容

項目	内容
プロジェクト内容	①　概要 プンプレック浄水場の能力を 150,000 m^3 /日から 195,000 m^3 /日に拡大。効果的な維持管理を目的とした IT 技術を駆使した先進的な日本の維持管理システムによる施設の増改築。 ②　取水施設 －　ポンプ 5 台の更新（4 台常用、1 台予備）、能力 35 m^3/分、全揚程 25 m、 出力 210 kW、フライホイール・スペアパーツ・潤滑油 －　コントロールパネル・サービスパネル、監視室・通信機器、取水施設躯体の補強、計測機器 ③　浄水施設（195,000 m^3/日） －　着水井、高速凝集沈殿池、急速ろ過、逆洗システム、コントロールパネル・サービスパネル、監視室・通信機器 －　既存施設（100,000 m^3/日沈殿ろ過池）の補強 －　既存施設（10,000 m^3 配水池）の補強 －　薬品注入システム ④　配水施設 －　ポンプ 3 台の更新、能力 29 m^3/分、全揚程 42 m、出力 280 kW、スペアパーツ －　コントロールパネル・サービスパネル、監視室・通信機器 －　配水池：50 m×20m×6 m（6,000 m^3） －　計測機器 ⑤　SCADA システム －　コントロールデスク、モニター －　アセットマネジメント機能を有する維持管理支援コンピュータ ⑥　コンサルティング・サービス、ソフトコンポーネント －　コンサルティング・サービス：入札補助、設計審査、施工調達管理 －　ソフトコンポーネント：なし
対象地域	カンボジア国　プノンペン都
関係官庁・機関	実施機関（主管官庁）：カンボジア工業科学技術革新省（Ministry of Industry Science Technology and Innovation: MISTI） 事業実施機関（水道事業実施機関）：プノンペン水道公社（Phnom Penh Water Supply Authority: PPWSA）

出典：要請書

この要請を受けて JICA は、事業規模の妥当性を検討した上で、無償資金協力として適切な概略設計を行い、事業計画を策定し、概略事業費を積算することを目的とする本協力準備調査（以下、「本業務」）を実施した。

本業務期間中に行った協議の結果、事業権無償の適用による浄水施設の整備の実施を合意した。尚、要請内容のうち、既存取水施設と既存浄水施設のリハビリテーションは無償部分から除外することを PPWSA との協議により合意した。

カンボジア国側との協議内容を踏まえカンボジア国側と要請内容の変更を確認した結果、要請内容は**表 1-2.2** の通りである。

表 1-2.2　カンボジア側と確認された要請内容結果

項目	内容
プロジェクト内容	①　概要 プンプレック浄水場の能力を 150,000 m³/日から 195,000 m³/日に拡大。効果的な維持管理を目的とした IT 技術を駆使した先進的な日本の維持管理システムによる施設の補修・改築。 ②　取水施設（47,250 m³/日） － **フロート式取水施設の新設** － **受配電施設の新設** － ポンプ 2 台**の新設**（1 台常用、1 台予備）、能力 33 m³/分、全揚程 24 m、出力 200 kW、フライホイール・スペアパーツ・潤滑油 － コントロールパネル・サービスパネル、通信機器、計測機器 － オイルフェンス等必要機材 ③　浄水施設（45,000 m³/日） － 受配電施設の新設 － **着水井、混和地、**高速凝集沈殿池もしくは代替施設、急速ろ過、逆洗システム、ミキサー、コントロールパネル・サービスパネル、計測機器、監視・制御室・通信機器 － **薬品生成・溶解・注入システム** ④　配水施設 － ポンプ 3 台**の新設**、能力 29 m³/分、全揚程 42 m、出力 280 kW、スペアパーツ － コントロールパネル・サービスパネル、監視・制御室・通信機器 － 配水池：6,000 m³ － **配水ポンプ場** － 計測機器 ⑤　SCADA システム － コントロールデスク、モニター － アセットマネジメント機能を有する維持管理支援コンピュータ ⑥　コンサルティング・サービス、ソフトコンポーネント － コンサルティング・サービス：入札補助、設計審査、施工調達監理 － ソフトコンポーネント：なし
対象地域	カンボジア国　プノンペン都
関係官庁・機関	実施機関（主管官庁）：プノンペン水道公社（Phnom Penh Water Supply Authority: PPWSA） 事業実施機関（水道事業実施機関）：プノンペン水道公社（Phnom Penh Water Supply Authority: PPWSA）

*赤文字は要請書の内容から調整が行われたもの。

出典：調査団

1-3　我が国の援助動向

我が国によるカンボジア国に対する過去の都市水道分野に関連する援助を**表 1-3.1**、**表 1-3.2** に示す。

表 1-3.1　技術協力及び有償資金協力プロジェクトの実績（都市給水分野）

協力内容	実施年度	案件名/その他	概要
技術協力プロジェクト	2003～ 2006 年度	水道事業人材育成プロジェクト	プノンペン水道公社における水道施設の運転・維持管理能力の強化に資する協力
	2007～ 2011 年度	水道事業人材育成プロジェクト・フェーズ 2	地方 8 州都の公営水道局における水道施設の運転・維持管理能力の強化に資する協力
	2012～ 2017 年度	水道事業人材育成プロジェクト・フェーズ 3	地方 8 州都の公営水道局における水道事業体運営及び経営管理能力の強化に資する協力
	2018～ 2023 年度（予定）	水道行政管理能力向上プロジェクト	工業・手工芸省における水水道行政管理能力の強化に資する協力
開発計画調査型技術協力プロジェクト（旧開発調査）	1992～ 1993 年度	プノンペン市上水道整備計画	プノンペン市の上水道マスタープラン及び既存施設の緊急改修計画の策定
	1996～ 2000 年度	シェムリアップ市上水道整備計画調査	シェムリアップ市の上水道マスタープランの策定及び優先プロジェクトのフィージビリティ調査の実施
	2004～ 2005 年度	プノンペン市上水道整備計画（フェーズ２）	プノンペン市及びカンダール都市部における上水道マスタープランの策定及び優先プロジェクトのフィージビリティ調査の実施
	2009～ 2011 年度	シェムリアップ上水道拡張整備事業準備調査	上水道施設の拡張に係る新規水源及び取水方式の選定、施設整備計画の策定及びフィージビリティ調査、地下水使用の現状評価の実施
有償資金協力	2008 ～ 2013 年度	ニロート上水道整備計画（供与限度額：35.13 億円）	プノンペン市における上水道施設の整備。フランス開発機構との協調融資
	2011～ 2023 年度（予定）	シェムリアップ上水道拡張整備計画（供与限度額：71.61 億円）	上水道設備の拡張（トンレサップ湖を水源とする取水施設・導水管建設，浄水場施設・配水管の建設）及び人材育成・組織強化の支援
	2021 ～ 2023 年度	シェムリアップ上水道拡張計画（第二期）（供与限度額 63．36 億円）	上水道設備の拡張（トンレサップ湖を水源とする取水施設・導水管建設，浄水場施設・配水管の建設）及び人材育成・組織強化の支援

出典：JICA 資料を基に調査団作成

表 1-3.2　我が国の無償資金協力実績（都市給水分野）

実施年度	案件名	供与限度額（億円）	概要
1993～ 1994 年度	プノンペン市上水道整備計画	17.71	プンプレック浄水場の改修と一部配水施設を整備。
1997～ 1999 年度	第 2 次プノンペン市上水道整備計画	21.12	漏水量の削減を目的とする配水管更新と給水区域拡張を目的とする配水管新設を含む。
2000～ 2003 年度	プンプレック浄水場拡充計画	0.60 25.80	詳細設計 プンプレック浄水場の拡張と一部の老朽化した施設の改修。
2004～ 2005 年度	シェムリアップ上水道整備計画	15.37	従前の一部配水施設を活かし、取水施設／浄水施設を含むほぼ全面的な水道施設整備の実施。
2010～ 2013 年度	地方州都における配水管改修及び拡張計画	27.60	プルサット、シハヌークビル、バッタンバンの各州都における配水管網の更新・拡張工事
2013～ 2016 年度	コンポンチャム及びバッタンバン上水道拡張計画	33.55	コンポンチャム市及びバッタンバン市における上水道施設の拡張。
2016～ 2018 年度	カンポット上水道拡張計画	29.85	カンポット市における上水道施設の拡張。
2019 年度～	コンポントム上水道拡張計画	32.71	コンポントム州都で給配水施設を建設することにより、地域の給水能力の増強。
2020 年度～	プルサット上水道拡張計画	24.05	プルサット市及びスバイリエン市における上水道施設の拡張。
2021 年度～	タクマウ上水道拡張計画	34.21	タクマウ市周辺地区を対象とした浄水施設の新設。
2022 年度～	スバイリエンにおける上水道拡張計画	27.86	スバイリエンにおける上水道施設の拡張。

出典：JICA 資料を基に調査団作成

1-4　他ドナーの援助動向

PPWSA の実施中及び計画案件の概要を**表 1-4.1** に示す。

表 1-4.1　実施中及び計画案件の概要

ITEM	DESCRIPTION
Project title	The Project for Construction of Water Treatment Plant in Bakheng Phase I
Target year of commencing operation	Construction (2018-2023), Operation (2023)
Finance source	AfD (Loan), EIB (Loan and Grant), PPWSA
Project component	Component 1: Construction of the Bakheng Water Production Facility (195,000 m^3/day) Component 2: Reinforcement and extension works of the network Component 3: Technical assistance
Project cost	USD 247,000,000
Project status	Under construction
Project title	Bakheng Water Supply Project Phase I
Target year of commencing operation	Construction (2020-2024)
Finance source	EU (Grant)
Project component	The Supply and Delivery of distribution systems for Low Income Household
Project cost	USD 15,000,000
Project status	Under preparation
Project title	The Project for Construction of Water Treatment Plant in Bakheng Phase II
Target year of commencing operation	Construction (2022-2023), Operation (2023)
Finance source	AfD (Loan)
Project component	Component 1: Water Production Facility (195,000 m^3/day) Component 2: Network extension Component 3: Engineering and water supply improvement
Project cost	USD 134,400,000
Project status	Under construction
Project title	The Project for the Expansion of Water Supply System in Ta Khmau
Target year of commencing operation	Construction (2022-2024), Operation (2024)
Finance source	Japan Govt/JICA (Grant)
Project component	Construction of the Ta Khmau Water Treatment Plant (30,000 m^3/day)
Project cost	-
Project status	Under bidding

出典：PPWSA 提供資料を基に調査団作成

第2章 プロジェクトを取り巻く状況

2-1 プロジェクトの実施体制

2-1-1 組織・人員

2022 年 10 月末時点での PPWSA の従業員数は 1,259 人となっている。

PPWSA の組織図を**図 2-1.1** に示す。

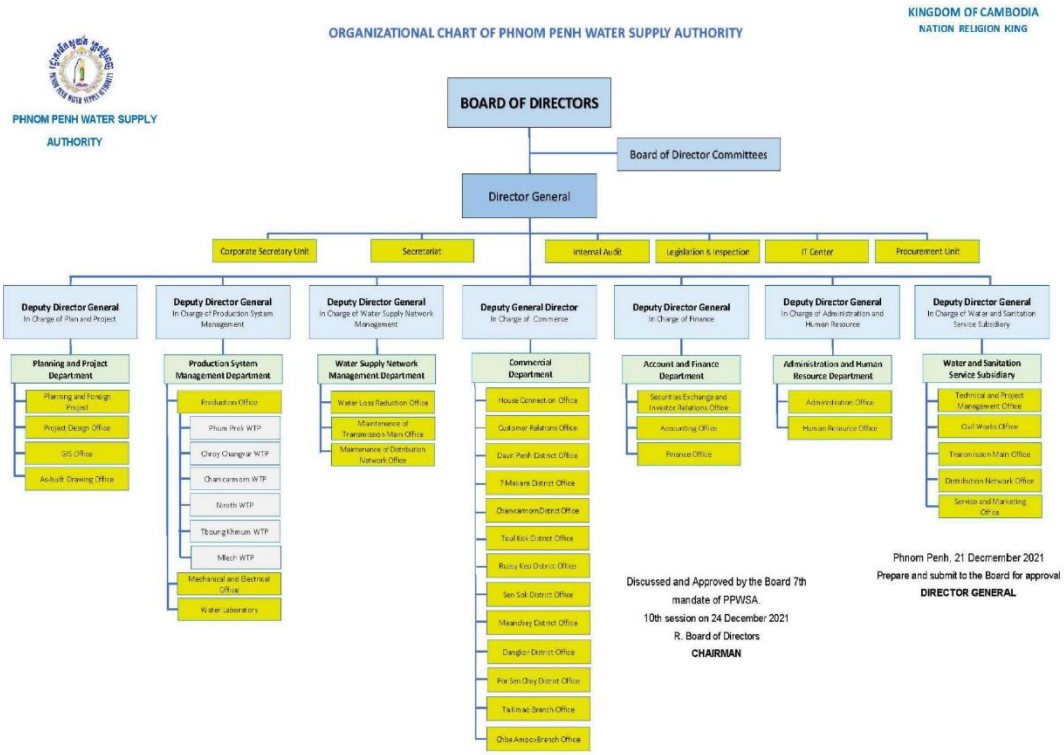


図 2-1.1 PPWSA の組織図

出典：PPWSA

2-1-2 財政・予算

2-1-2-1 PPWSA の財政状況

PPWSA はカンボジア証券取引所に登録している上場企業であり、2012 年の上場以降堅調な業績で推移している。PPWSA の売上高は需要の拡大に伴い長期的な成長が続いており、効率的な運営管理により営業利益も同様に増加している。2020 年の流動比率、自己資本比率、DSCR はそれぞれ 127%、53%、153%と健全な財務体質となっている。フリーキャッシュフロー（営業キャッシュフローと投資

キャッシュフローの合計）がマイナスとなっている年度（2018 年、2020 年）もあるが、投資活動が極めて活発であることが主因であり営業キャッシュフローは安定的にプラスとなっている。本プロジェクトの事業者の視点では、PPWSA の財務リスク・信用リスクは極めて限定的である。ただし、需要の拡大に伴う更なる追加投資、大規模修繕の実施、有償プロジェクトの償還等により長期的な財務リスクには留意が必要である。

尚、カンボジア国際財務報告基準（CIFRS）の適用にあたり、会計処理上の変更が一部生じたことが主因となって 2019 年の売上高が落ち込んでいる。これまで、カンボジアでは、長い間旧フランス式（General Accounting）、旧カンボジア会計基準（Cambodia Accounting Standard：CAS）、カンボジア国際財務報告基準（CIFRS）が混在して使用されてきたが、これを 2018 年、2019 年に渡って CIFRS として見直す作業がおこなわれた。この会計基準の変更による売上の減少であり、PPWSA の本業における要因ではない。

2020 年 3 月の水道料金改定時に、使用水量が小さいセグメントの料金単価を据え置き、大口の料金単価を引き上げたことで全体として水道料金単価は 20%程度上昇し、PPWSA の収益性及び長期的な投資余力は向上しており、予算の確保も順調である。

2-1-3　技術水準

PPWSA は 4 箇所の浄水場（合計 592,000 m^3/日）の運営とプノンペン都及びカンダル州タクマウ市に給水を行っている。PPWSA はカンボジア国内の水道公社、公営水道、民営水道の模範となっており、さらに、各国からの研修生を受け入れるなど、高い技術水準を維持している。

2-1-4　既存施設・機材

2-1-4-1-1　全体概要

1992 年に建設された Phum Prek 浄水場は、当時 56,000 m^3/日の生産能力を有していた。その後、我が国の無償資金協力事業によって 1993 年から 1994 年（Phase I）にリハビリを行い 100,000 m^3/日へと回復された後、2001 年から 2003 年（Phase II）に 50,000 m^3/日の拡張が実施され、現在に至る。

取水ポンプ及び付帯設備については、上記無償資金協力事業の Phase II に更新され、2019 年の生産能力は 150,000 m^3/日まで拡大した。

2-1-4-1-2　取水施設

Phum Prek 取水施設の取水塔は Phnom Penh Port の近くにあり、Sap 川の Prek Pnov 橋から 900 m 下流、河岸から 40 m 程沖合に入った地点に建設され、河岸からはアクセス用の橋がかけられている（**図 2-1.2**）。

図 2-1.2　Phum Prek 取水塔の位置

出典：調査団

取水塔の一般図及び設備のレイアウトは**図 2-1.3** に示すとおりである。

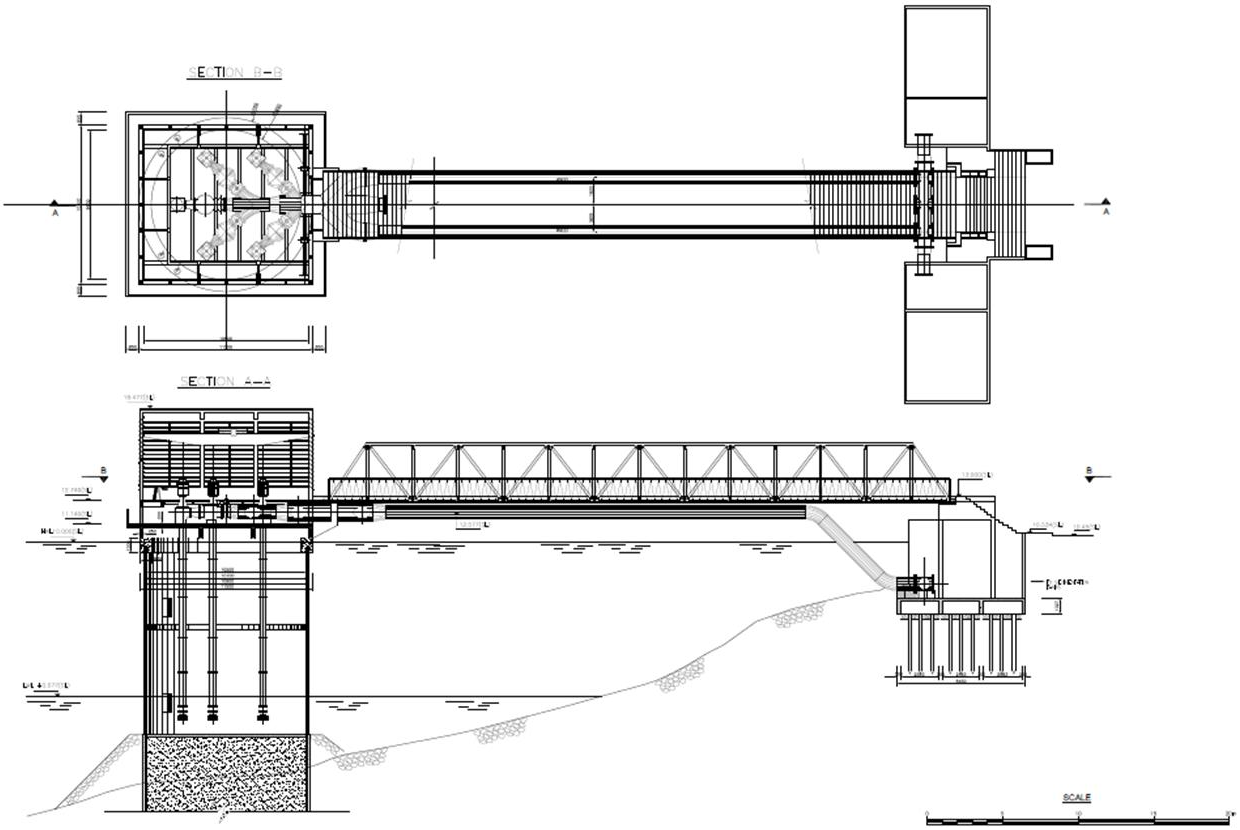


図 2-1.3　Phum Prek 取水塔の一般図

出典：PPWSA

取水施設の主要な設備は**表 2-1.1** に示すとおりである。

2003 年の設計諸元によれば、設計取水量は 158,400 m^3/日であり、維持管理用水として浄水量の 5.6% 相当が考慮されている。

表 2-1.1　Phum Prek 取水施設の主要なコンポーネント

項目	内容
取水形式	取水塔式
建設年次	躯体: 1966 年 ポンプ設備: 2003 年
設計取水量	158,400 m^3/日（日最大生産量の 5.6% 相当の維持管理用水を含む）
最大取水量	202,027 m^3/日（2019 年 9 月）
水位	HWL: +10.900 m AMSL, LWL: +1.580 m AMSL
ポンプ形式	立型斜流ポンプ
吸込管	鋳鉄管　呼径 500 mm
ポンプ能力	Q=2,200 m^3/時（設計値） [ポンプデータ] 吐出量: 35 m^3/分, 全揚程: 25 m, 電動機出力: 210 kW 水撃圧対策用フライホイール付
ポンプ台数	5 台（常時運転 4 台、スタンバイ 1 台）
取水開口部	4 箇所 （HWL 用 2 箇所、LWL 用 2 箇所） 手動開閉式角型ゲート付
寸法	ポンプ室: 10 m（L） x 11 m（W） x 8.7 m（H） 取水部ピット: φ4.95 m x 11.6 m（深度）
付帯設備	電動式ホイストクレーン（6 ton）、水位計

項目	内容
その他	導水管水撃対策用の圧力タンク 取水地点の地盤高: +11.040 m AMSL

出典：PPWSA

現在の運転維持管理状況は**表 2-1.2** のとおりである。

表 2-1.2　Phum Prek 取水施設の運転維持管理状況

項目	内容
運転の現状	1. 常時運転ポンプ: 乾期 5 台、雨期 4 台 2. 一日運転時間: 24 時間 3. 消費電力: 月平均 480,683kWh、5,768,200 kWh (2019 年) 2003 年に JICA 無償で設置されたポンプ設備が稼働中
取水量の調整	手動式流量調整バルブがあるが、常時フルオープンの状態
流量計測	導水管に設置した挿入式電磁流量計による計測
水位低下の影響	河川水位の低下で取水が不可能となったことはない。 最も低い水位の場合でも、ポンプのインペラーから 0.7 m 以上が確保されていた。
電力事情	停電によるポンプの運転停止はあるが頻繁には発生しない。 電圧降下が許容レベルを下回る事態はこれまで発生していない。
維持管理作業	取水ポンプは常に 24 時間オペレーターが監視し、日常目視点検はオペレーターの担当。 制御盤、振動、温度等の機械設備の状態は 1 週間に 1 回維持管理チームが巡回して確認。 ポンプ設備の清掃は 1 ヵ月に 1 回、運転を一時停止して行う

出典：PPWSA からの提供資料より調査団作成

- 現在の取水塔の躯体は 1966 年に建設されたもので、既に 55 年が経過している。内壁のコンクリートや鋼製部材の劣化が著しいため、更新時期を迎えている。
- 取水塔に対する主要な電力供給ライン上に港湾通信省のビルが建設された。2021 年の時点では損傷を受けた電力線は依然としてビルの下に通ったままの状態にあるため、維持管理上の問題となっていた。この問題は 2022 年以降に予定される Phum Prek 浄水場拡張時の受電設備の新設によって解決される見通しである。
- 1965 年から 1966 年の取水塔建設と同時に敷設された導水管（口径 700 mm × 2 条）は老朽化しているが、その後の無償資金協力事業により口径 1200 mm の導水管が整備されたため、バックアップとして位置づけられていた。
- 2022 年以降に予定される Phum Prek 浄水場拡張に伴い、口径 800 mm の導水管が PPWSA により新設される予定であり、この新設管は拡張分 45,000 m^3/日の導水用として運用され、老朽化した導水管は使用停止となる。

2-1-4-1-3　原水導水管

取水場、原水導水管、および浄水場の概要を**図 2-1.4** および**図 2-1.5** に示す。

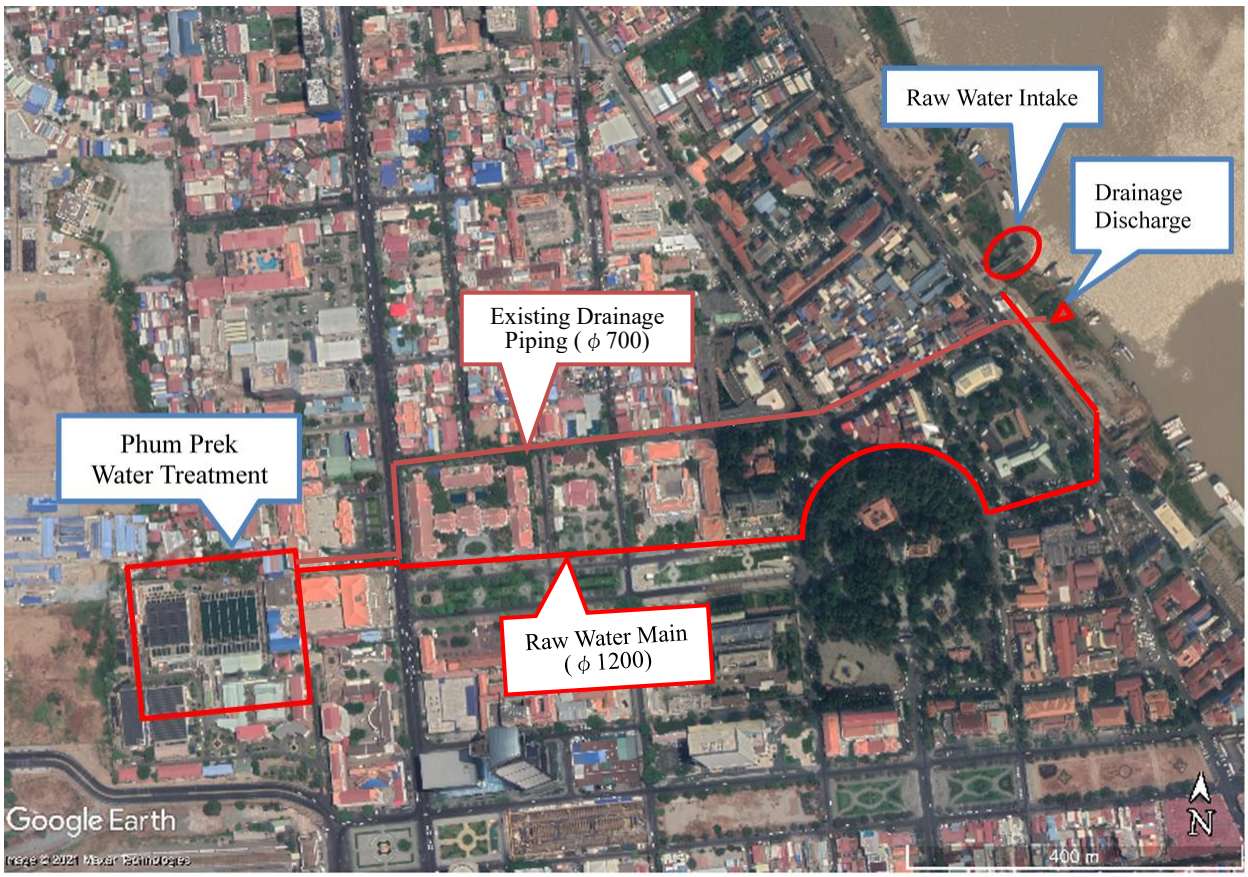


図 2-1.4　Phum Prek 取水場、原水導水管、および浄水場

出典：PPWSA 提供資料より調査団作成

2003 年に直径 1,200 mm のダクタイル鋳鉄管を備えた原水送水本管及び送電線が布設された。 既存の原水導水管は 1958 年と 1966 年に布設された口径 700 mm の 2 本の鋳鉄管と、2003 年に布設された直径 1,200 mm が存在しているが、現在 2 条の 700 mm 原水導水管は通常使用されておらず、1966 年に布設された口径 700 mm の鋳鉄管が河川水位低下等の非常時に限定的に使用されている。

原水導水管の概要を**表 2-1.3** に示す。

表 2-1.3　Phum Prek 原水導水管の概要

場所	距離　(m)	地表高さ　(m ASL)	管頂レベル　(m AMSL)	土被り　(m)
取水場	0	+11.040	+9.340	+1.700
浄水場	1,500	+12,500	+11.961	+0.539

＊m AMSL　海抜メートル（Meters Above Mean Sea Level）
出典：PPWSA 提供資料より調査団作成

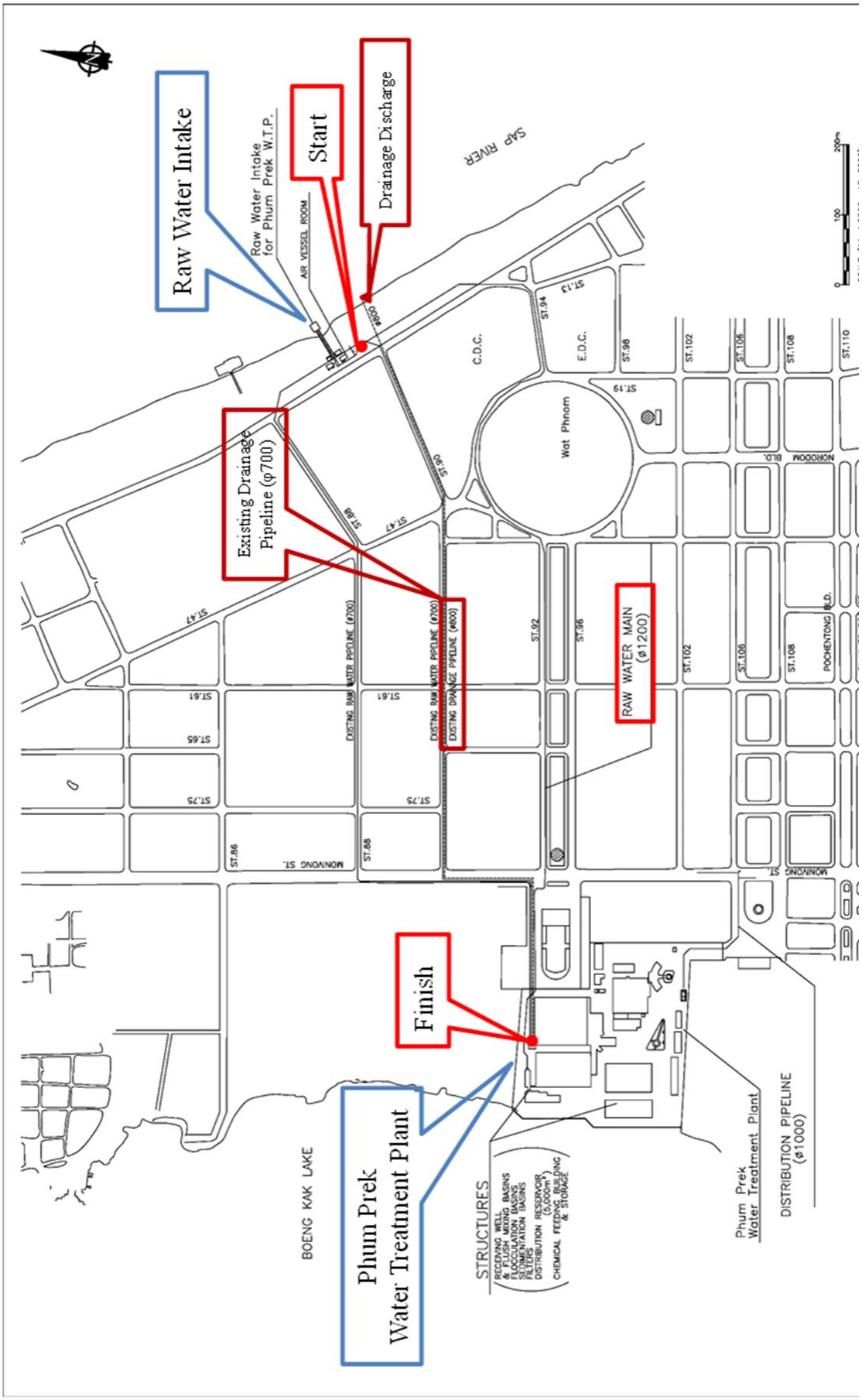


図 2-1.5　Phum Prek 取水場、原水導水管、および浄水場　位置図

出典：PPWSA 提供資料より調査団作成

出典：PPWSA からの提供資料より調査団作成

2-1-4-1-4　　浄水場

(1)　概要

Phum Prek 浄水場の全体と施設の配置を**図 2-1.6** に示す。

Phum Prek 浄水場は 2 期にわたって建設された。1965 年に生産能力 100,000 m^3/日の Phase I 施設が建設され、1988 年と 1995 年にリハビリが実施された。その後 2003 年に生産能力 50,000 m^3/日の Phase II 施設が建設された。

Phum Prek 浄水場のプロセス・フローと水位高低図を図 2-1.7 に示す。

取水、浄水施設の主要な設備を**表 2-1.4** にまとめた。

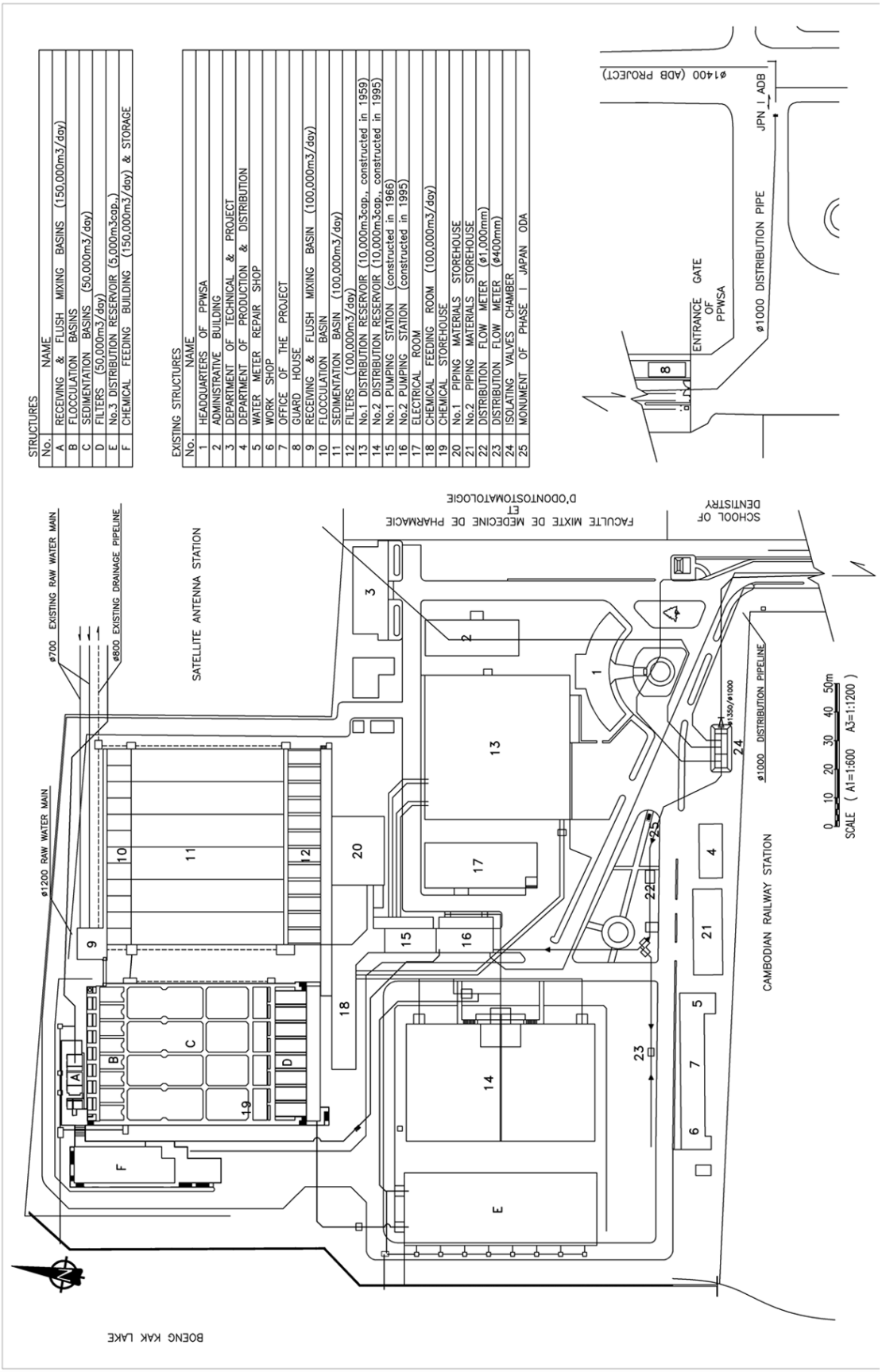


図 2-1.6 Phum Prek 浄水場 位置図

出典：PPWSA 提供資料より調査団作成

出典：PPWSA からの提供資料より調査団作成

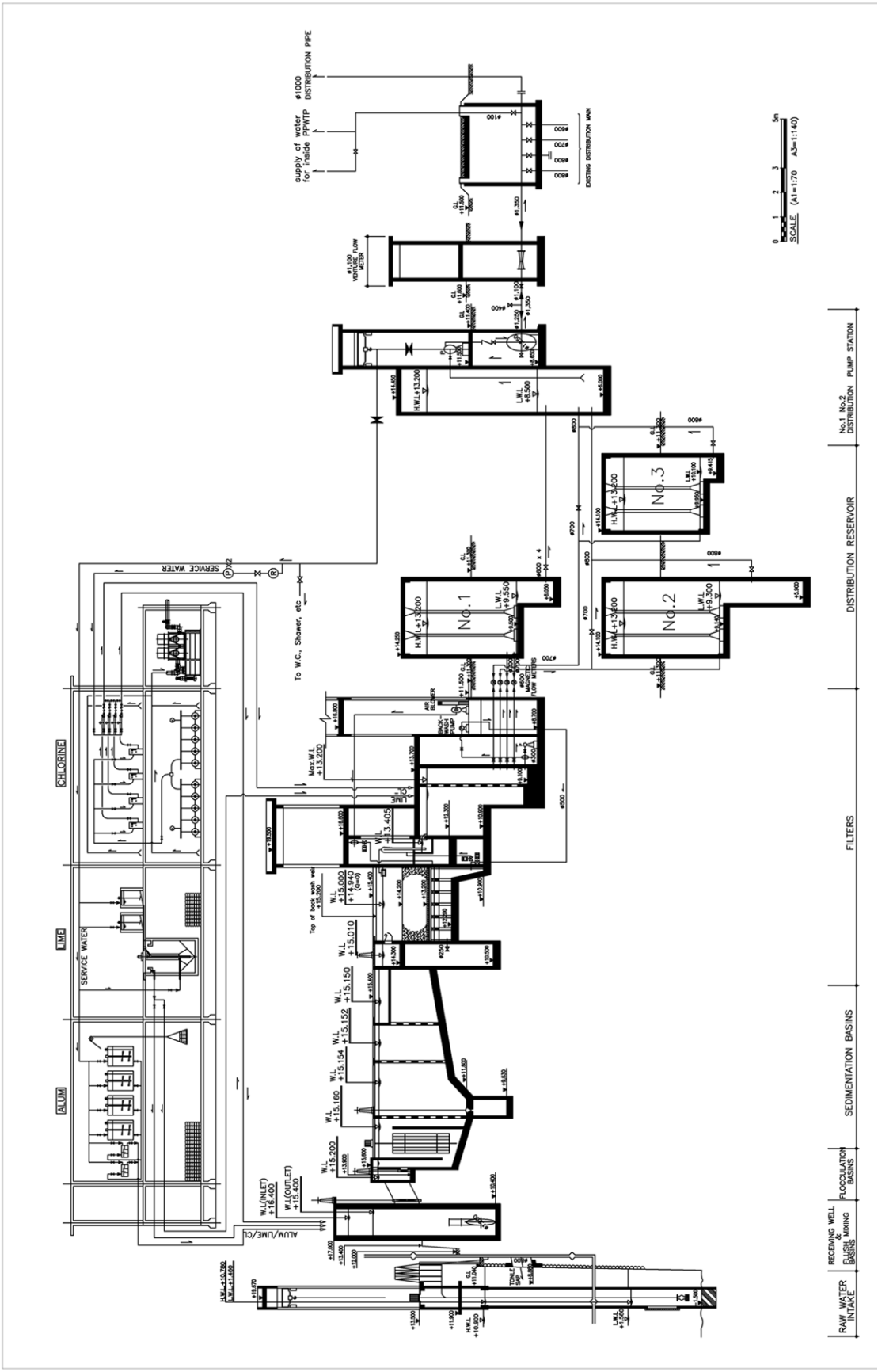


図 2-1.7 Phum Prek 浄水場 水位高低図

出典：PPWSA 提供資料より調査団作成

出典：PPWSA からの提供資料より調査団作成

表 2-1.4 Phum Prek 浄水場の主要設備

Capacity		100,000 m^3/d (Old) 50,000 m^3/d (New)
Water Source		158,400 m^3/d Tonle Sap HWL = 10.9 m, LWL = 1.5m
Construction		1965 costruction of old plant
		1988, 1995 rehabilitation of old plant
		2003 construc construction of new plant
Intake Facilities		Tonle Sap HWL = 10.78 m, LWL = 1.46m
	Type	Raw Water Pumping
	Intake Pump	(existing) : 36.7 m^3/min x 21 m x 3 units
		(new) : 36.7 m^3/min x 21 m x 2 units
Receiving Well		
	Type	Recutangular
	Retention Time	4.1 min
	Size & Q'ty	5.3 mW x 15 mL x 5.3 mD x 1 unit
Name of Water Treatment Plant :		Phum Prek - Old
Capacity		100,000 m^3/d (Old)
Treatment Process		
1. Rapid Mixing		
2. Flocculation		
3. Sedimentation		
4 Filtration		
5 Disinfection		
Flocculation		
	Type	Horizontal Flow
	Retention Time	24.8 min.
	Size	8.0 mW x 11.0 mL x 3.27 mD
	Q'ty	6 units
	Equipment	Vertical Flocculator 6 units
Sedimentation Tank		
	Type	Horizontal Flow
	Retention Time	126.8 min 2.1 hr
	Size	11 mL x 53 mW x 2.52 mD
	Q'ty	6 units
	Flow Velocity	0.52 m/min
	Surface Load	119.2 mm/min
	Trough/Pipe	Orifice Trough
	Sludge Removal	Sludge Extraction Valve (Manual)
	Equipment	Sludge Extraction Valve
	Operation	Sludge Removal - Manual
Filter		
	Type	Gravity, Single Media, Constant Flow, Level Control
	Filtration rate	156 m/d (6.50 m/hr) 170 m/hr at washing
	Filter Bed Area	53.6 m^2
	Size & Q'ty	4.5 mW x 11.9 mL x 12 filters
	Filter Media	Sand : 0.8-1.0 mm x 1000 mm
	Washing Rate	Air Scour : 0.934 m/min Wash : 0.342 m/min Rincing : 0.342 m/min
	Washing System	Air Scouring (4 - 5 min), Air Scouring + Backwashing (4 - 7 min), Rincing (15 - 20 min)
	Wash Trough	None
	Equipment	Inlet Gate, Outlet Valve, Level Control Siphon, Siphon Regulation System
		Washwater Inlet Valve,Washwater Discharge Gate, Washwater Pump
		Scour Air Inlet Valve, Air Blower
	Operation	Manual(Original-Automatic & Step-by-step)
Sludge Disposal		
		Direct Discharge to the river

Name of Water Treatment Plant :	Phum Prek - New
Capacity	50,000 m^3/d
Treatment Process	
1. Rapid Mixing 2. Flocculation 3. Sedimentation 4 Filtration 5 Disinfection	
Rapid Mixing	
Type	Weir
Retention Time	73 sec
Size & Q'ty	1.8 mW x 5.0 mL x 4.7 mD x 1 unit
Equipment	None
Flocculation	
Type	Horizontal Flow
Retention Time	26.2 min.
Size	11.3 mW x 7.0 mL x 2.9 mD
Q'ty	4 units
Equipment	Vertical Flocculator 8 units
Sedimentation Tank	
Type	Horizontal Flow
Retention Time	145.7 min 2.4 hr
Size	43.4 mL x 11.3 mW x 2.6 mD
Q'ty	4 units
Flow Velocity	1.19 m/min
Surface Load	71.4 mm/min
Trough/Pipe	Orifice Trough
Sludge Removal	Sludge Extraction Valve (Manual)
Equipment	Sludge Extraction Valve
Operation	Sludge Removal - Manual
Filter	
Type	Gravity, Single Media, Constant Flow, Level Control
Filtration rate	128 m/d (5.33 m/hr) 146 m/hr at washing
Filter Bed Area	48.8 m^2
Size & Q'ty	4.5 mW x 10.85 mL x 8 filters
Filter Media	Sand : 0.8-1.0 mm x 1000 mm
Washing Rate	Air Scour : 1.024 m/min Wash : 0.375 m/min Rincing : 0.42 m/min
Washing System	Backwashing (0.5 min), Air Scouring + Backwashing (4 - 7 min), Rincing (10 - 15 min)
Wash Trough	None
Equipment	Inlet Gate, Outlet Valve, Level Control Siphon, Siphon Regulation System
	Washwater Inlet Valve,Washwater Discharge Gate, Washwater Pump
	Scour Air Inlet Valve, Air Blower
Operation	Automatic & Step-by-step
Sludge Disposal	
	Direct Discharge to the river
Chemicals	
Alum	Tank + Mixer : 4 , Dosing Tank : 2 (1)
Lime	Tank + Mixer : 2, Lime Saturator : 1, Flowmeter : 4 (2)
Chlorine	Chlorinator -Pre : 2(1), -Post : 3(1)
Clear Water Reservoir	HWL = 13.2 m, LWL = 9.3 m
No. 1	10,000 m^3
No. 2	10,000 m^3
No. 3	5,000 m^3
Clear Water Pump	HWL = 13.2 m, LWL = 8.5 m
Transmission	(1 to 2) 18.0 m^3/min x 42 m x 180 kW x 2 units
Distribution-1	(1 to 3) 35.0 m^3/min x 42 m x 320 kW x 3 units
Distribution-2	(4) 50.8 m^3/min x 46 m x 520 kW x 1 unit (VSD)
Distribution-3	(5 to 6) 18.0 m^3/min x 42 m x 180 kW x 2 units
Distribution-4	(7) 27.5 m^3/min x 47 m x 272 kW x 1 unit (VSD)

出典：PPWSA 提供資料より調査団作成

(2)　運転状況

Phum Prek 浄水場は適切に運転されているが、首都プノンペンの水需要が高く、供給が十分でないため、常に過負荷の状態での運転が継続されている。一方、浄水場施設については、Phase I 施設が 1965 年に建設され、その後 1988 年及び 1995 年に改修が行割れた。Phase II 施設は 2003 年に建設された。Phase I に建設されたコンクリート構造物は劣化や漏水が見られ、機械電気設備は、一部寿命を迎えており、更新が必要な機器もある。

PPWSA は、以下が Phum Prek 浄水場の主要な問題点であると考えている。

- ろ過池逆洗用ブロアーおよびポンプからの配管が古く、エア漏れ、水漏れが発生している。
- 新旧ろ過池の水位計（ろ坑計）に、いくつか故障が見られる。
- Phase I に建設された 12 池の凝集池に設置された急速・緩速撹拌機が老朽化しており、頻繁に故障が発生している。
- PAC 注入設備が老朽化しており、バルブも故障しているため、注入量制御が適切に行えない。
- また、注入設備が 1 ラインしかなく、故障時の修理が困難である。
- 塩素注入設備が老朽化しており、また、予備の液体塩素の調達が困難な状況が頻繁に発生している。

旧施設 100,000 m^3/日は、すでに機械電気設備が寿命を迎えており、全面的改築が必要になっている状況である。

(3)　逆洗排水および汚泥排出

沈殿池汚泥およびろ過池逆洗排水は排水管をとおり、Tonre Sap 川に直接排出されている。

2-2　プロジェクトサイト及び周辺の状況

2-2-1　関連インフラの整備状況

2-2-2　自然条件

2-2-2-1　気象

カンボジア国は、熱帯性モンスーン気候であり、モンスーンによる雨期（6 月から 12 月）と乾期（1 月から 5 月）の 2 つの異なる季節がある。雨期には、南西風が雲と湿気をもたらし、雨期における降水量は国の年間降水量の 80%から 90%をしめる。平均気温は、全国で比較的均一であり、2 月から 4 月は酷暑となり、日中気温が 35℃から 40℃となる。カンボジア国における月の平均気温及び平均降水量を**図 2-2.1** に示す。

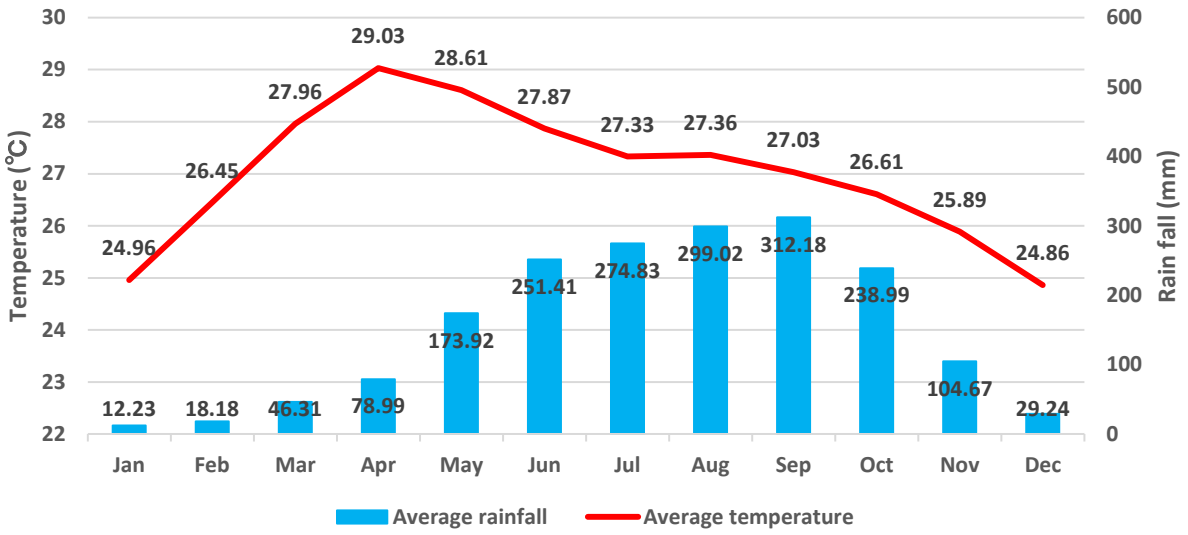


図 2-2.1　カンボジア国の月平均降水量及び月平均気温

＊1901 年から 2016 年までの平均値
出典：　Climate Change Knowledge Portal, World Bank

2-2-2-2　　地勢

カンボジア国は、国土面積 18 万 1,035 km^2（日本の約 2 分の 1 弱）を有する[6]。国土の大部分は低地であるが、東北部、北部、北東部には山脈が存在する。また、ベトナム国、ラオス国と国境を接する北部、北東部は深い森林に覆われ、野生動物や原生林の宝庫となっている。

首都プノンペンの河川状況を**図 2-2.2** に示す。北部ラオスから国際河川であるメコン川が南に流れており、中央平原には Sap 湖が存在する。Sap 湖からは Sap 川が流れ、首都プノンペンで Mekong 川と合流している。Mekong 川は Bassac 川に分岐し、Bassac 川はプノンペン南部で Prek Thnot 川と合流している。首都プノンペンの北部には Tamok 湖、南部には Cheung Aek 湖があり、近年は、近郊の都市化に伴い、小規模の湖や湿地の埋め立てが進められている。

[6] National Institute of Statistics Ministry of Planning (NIS): General Population Census of the Kingdom of Cambodia 2019 National Report on Final Census Results

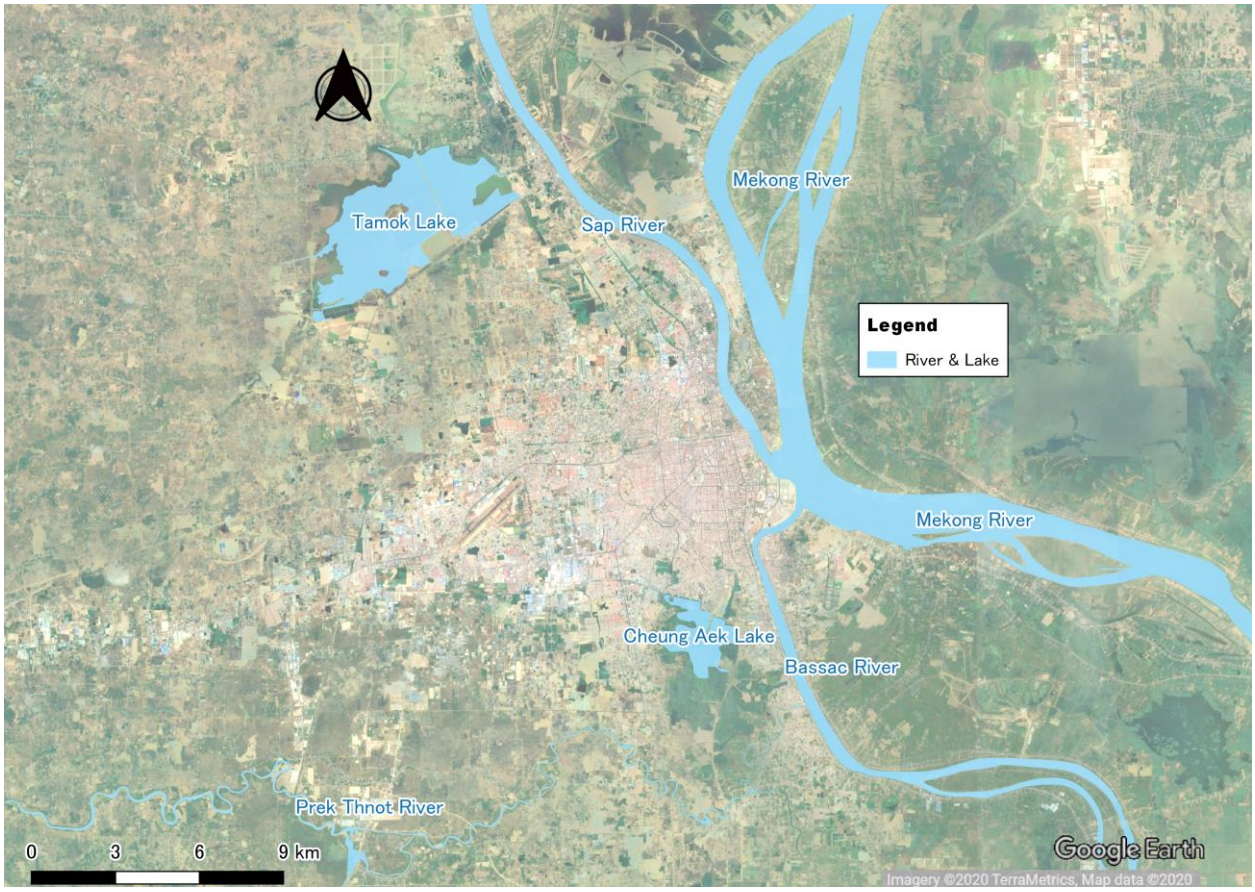


図 2-2.2　首都プノンペン周辺の河川

出典：調査団

首都プノンペンは比較的平坦であり、標高値は 10 m AMSL[7]から 15 m AMSL である。標高値が Mekong 川の最高水位より低い場所もあり、首都プノンペンの市街地及び郊外は、典型的な洪水氾濫原地域である。首都プノンペン及び近郊の標高値を**図 2-2.3** に示す。

[7]海抜メートル（Metres Above Mean Sea Level）

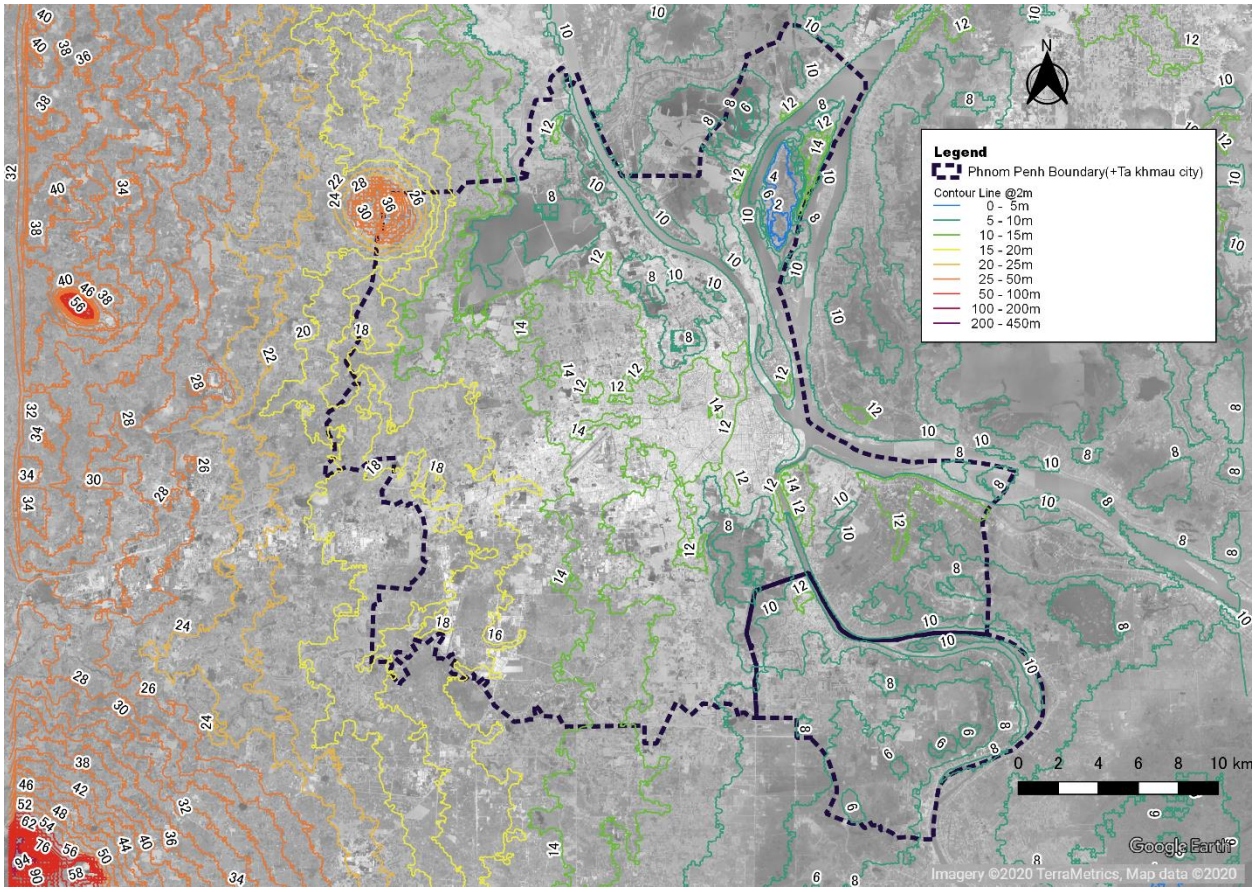


図 2-2.3　プノンペンの標高

出典：PPWSA 提供測量データ（Khan Daun Penh、Khan 7 Makara、Khan Chamcar Mon）及び GPS Visualizer データを基に調査団作成

2-2-2-3　地質・土壌

カンボジア国の地質は、第四紀堆積岩や未固結堆積物等の比較的新しい層から構成される。また、東北部では上部ジュラ紀から白亜紀の堆積物、また南西部では下部ジュラ紀中期堆積物等の比較的古い土壌もみられる。プノンペン都の地質は、主に第四紀堆積岩で構成されている。

Mekong Delta 地域の地質は先カンブリア紀から完新世の時期に形成された。旧沖積層は、鮮新世と更新世の間に、Mekong 川とその支流によって三角州状に形成され、その後完新世の三角州状沖積層が形成された。広いレンズ状の砂を伴った未固結性の泥と粘土からなる完新世沖積層が全体的に三角州をおおっている。首都プノンペンの完新世沖積層の層は一般的に 25 m 以下の厚さである。完新世沖積層はラテライトを伴わずより細かい肌目で比較的多くの貝や亜炭の層を有することで旧沖積層と異なる。

首都プノンペンの表面の地質は、部分的な軟性の粘土とともに西から東に傾斜した基礎地盤の上を砂質の泥が覆っている状況にある。

2-2-3　環境社会配慮

2-2-3-1　環境影響評価

本事業に関し、国際協力機構「環境社会配慮ガイドライン（2010 年 4 月）」（以下、「JICA 環境ガイドライン」）に基づくカテゴリ分類は B と想定された。

本調査で再度スクリーニングした結果として、本事業は、「国際協力機構環境社会配慮ガイドライン」（2010 年 4 月公布）に掲げる影響を及ぼしやすいセクター・特性および影響を受けやすい地域に該当せず、環境への望ましくない影響は重大ではないと判断されるため、カテゴリ B に分類された。

本プロジェクトにおいては、環境関連法に規定される EIA/IEIA/EPC の内、最も手続きが簡易な EPC (Environmental Protection Contract) のみが要求される。調査団は環境省（MoE：Ministry of Environment）に登録された現地コンサルタント（SUSTINAT Green Co., Ltd.）に再委託を行い、PPWSA が EPC 取得を行うサポートを行うとともに、JICA 環境ガイドラインにおけるカテゴリ B 案件に必要な IEE（初期環境調査：Initial Environmental Examination）レベルの調査を同時に行った。なお、IEE レベル調査はカンボジア国側からの要求事項ではない。

EPC は 2021 年 8 月に MoE から承認を受けた（添付資料-1）。IEE 調査は COVID-19 の影響により進捗が遅れたものの、同年 9 月にフィールド調査を終了した。

2-2-3-1-1　環境社会影響を与える事業コンポーネントの概要

(1)　事業名称

- 「カンボジア国プンプレック上水道拡張計画」
- 「Project for Expansion of Phum Prek Water Treatment System in the Kingdom of Cambodia」

(2)　対象地域

本プロジェクト対象地域は**図 2-2.4** に示す。事業対象はカンボジア国プノンペン都、PPWSA 本部が置かれているプンプレック浄水場内及びトンレサップ川河岸に位置する同取水施設敷地内である。

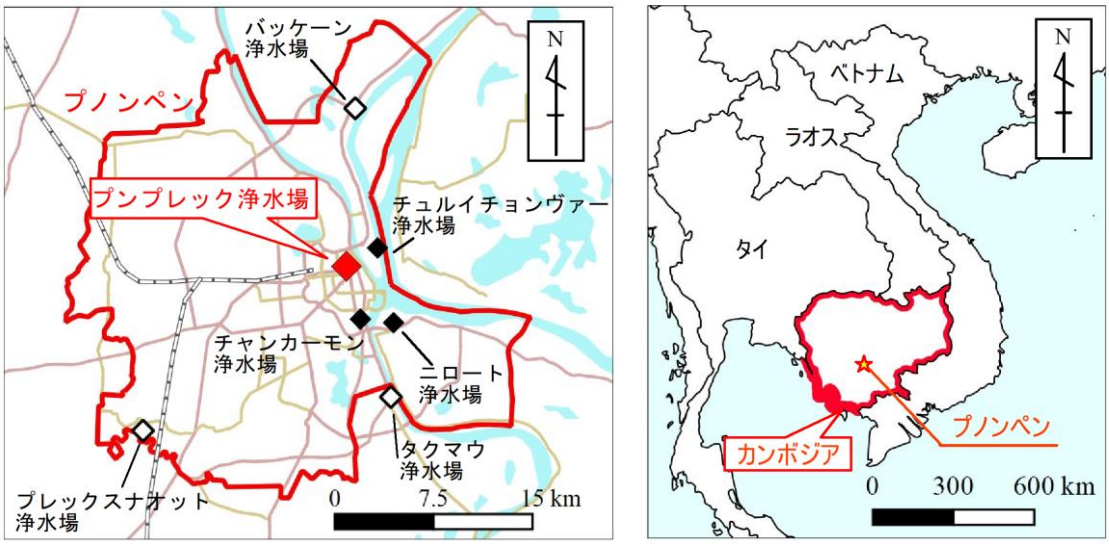


図 2-2.4　本プロジェクト対象地域の位置図

出典：調査団

(3)　施設の概要

本プロジェクトの構成要素は、新規取水施設、新規浄水施設（既設浄水場敷地内）、配水池（既設浄水場敷地内）から成る。各コンポーネントは PPWSA の所有地（新規取水施設を含む）内に建設する計画である。全てのコンポーネントに関して住民移転は発生しない。

2-2-3-1-2　　ベースとなる環境社会の状況

(1)　自然環境

1)　気象

プノンペン市の気候区分は熱帯性モンスーン気候である。乾期は 11 月から 4 月までで、雨期は 5 月から 10 月であり、年間降雨量の約 70%が集中している。プノンペンでは、気温は年によってほとんど変化せず、過去 5 年間で、最高気温の平均は約 30.7 度、最低気温の平均は約 27 度であった。プノンペン市の過去 5 年間の月平均値を**図 2-2.5** に示す。

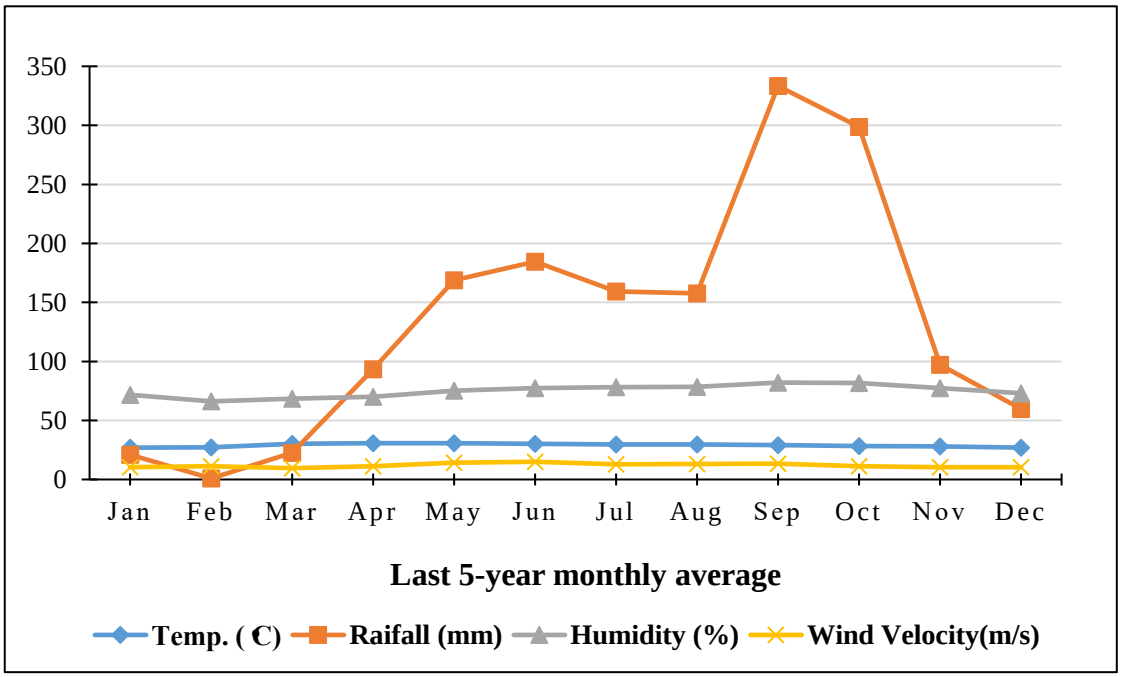


図 2-2.5　過去 5 年間の月平均値(2016-2020)

出典：General Department of Water Resources and Meteorology

2)　地形・地質

2002 年の JICA による GIS データによると、プンプレック浄水場の平均高度は海抜 12 m AMSL（Above Mean Sea Level）である。また、Intake の標高は、道路の地上レベルで海抜約 11 m（AMSL）、堤防で約 7 m AMSL、川岸で約 3～4 m AMSL 程度となっている。プノンペンが属する中央平野部は、メコン川とトンレサップ川の低地河川流域で構成されており、更新世と完新世の砂、粘土、砂利の厚い堆積物で構成されている。また堆積層は主に新年代の沖積層等である。

3)　水環境

(a)　水質

水源水質調査を再委託により実施した。期間は 2021 年 2 月から月 1 回の頻度で採水・分析を行い、7 月までの半年間実施した。結果は **3-2-1-2-4 原水水質**を参照。

(b)　水量・水位

プンプレック WTP 取水施設付近の Phnom Penh Port 観測所におけるトンレサップ川の最近 10 年間の水位データ（2011-2020）を**図 2-2.6** に示す。なお、当該データを用いて算出した各指標は以下の通りである。

- 平均水位：　3.47　m AMSL
- 平均年最大水位：　8.19　m AMSL
- 平均年最小水位：　0.88　m AMSL
- 最大高水位：　10.07　m AMSL (Oct.-2020)
- 最小低水位：　0.57　m AMSL (May-2011)
- 乾期平均水位：　1.18　m AMSL　（4 月の平均）

以上は最近 10 年間のデータ（2011-2020）に基づく計算結果であるが、過去には最大高水位として 10.16 m AMSL (2000 年 9 月)や、最小低水位として 0.52 m AMSL (1993 年 5 月)、0.20 m AMSL (1960 年 5 月) などを記録している。

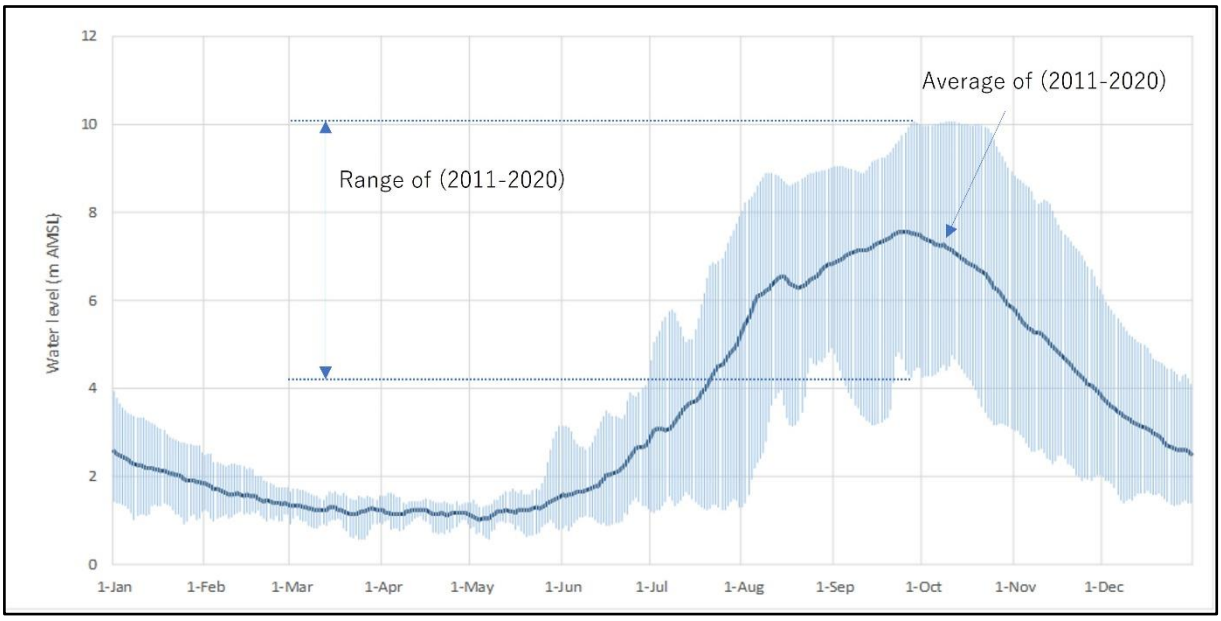


図 2-2.6　トンレサップ川の平均水位変動 (2011-2020)

出典：MoWRAM

(c)　トンレサップ川の自然環境・水生環境

前項に示した通り、トンレサップ川の水位変動は激しく、低水位期間（乾期）において生息する魚類は水流と共に上流から下流に移動する。一方、雨期にメコン川の水位が上昇すると、支流として接続しているトンレサップ川の流れが逆になり、トンレサップ湖にまで水が流れ込み、水域面積が最小面積の 4 倍以上に増加する。またトンレサップ湖の深さは、乾期の 0.5 メートルから雨期の最大 9 メートルまでと変動範囲が大きい。

トンレサップ湖およびトンレサップ川から成るトンレサップ生態系では少なくとも 149 種の魚が記録されている。この多様性は、主にその生態系とメコンの生態系（流入-流出）の複雑さによるものと推定されている。なお、そのうち約 30 種の魚が商業的に取引されている。

本調査における IEE 調査では、本事業対象であるプンプレック取水場の周辺にて生物調査を実施した。当調査にて記録された魚は、32 の魚種であり、いずれも頻繁に見られる一般的な種であり、絶滅危惧種等は含まれなかった（詳細は **2-2-3-1-7**, **表 2-2.10** 参照）。なお、この周辺水域においては、水路輸送（観光船やその他の輸送）が盛んであり、商業的漁業活動は行われていない。

4)　保護区

2017 年までに、MoE は、国土の 41%に相当する 750 万ヘクタール以上をカバーする 50 の保護地域を指定した。当該保護地域は、プノンペン近辺には存在しない。また、生物多様性の保全上重要な地域である Key Biodiversity Area や、ラムサール条約湿地等国際条約上保護が求められる地域は、事業対象地とその周囲には存在しない。

5)　社会環境

(a)　人口

カンボジア国では、2019 年に人口統計調査（General Population Census of Cambodia 2019、以下「GPCC 2019」）が実施された。カンボジア国における人口推移を**図 2-2.7** に示す。

GPCC 2019 より、2019 年のカンボジア国の総人口は約 15.6 百万人である。

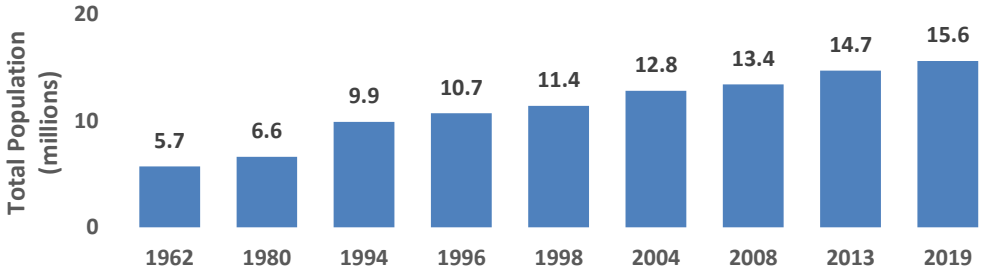


図 2-2.7　カンボジア国における人口推移

出典：General Population Census of the Kingdom of Cambodia 2019 National Report on Final Census Results、National Institute of Statistics Ministry of Planning を基に調査団作成

2019 年における各都市の人口を**図 2-2.8** に示す。GPCC 2019 では、首都プノンペンが 2,281,951 人で全人口に対する割合が 14.7%、人口密度が 3,361 人/km^2 を占め、2008 年の人口統計調査の 1,327,615 人（9.9%）と比較して、近年の 10 年間で首都プノンペンへの人口集中及び人口増加が生じている。

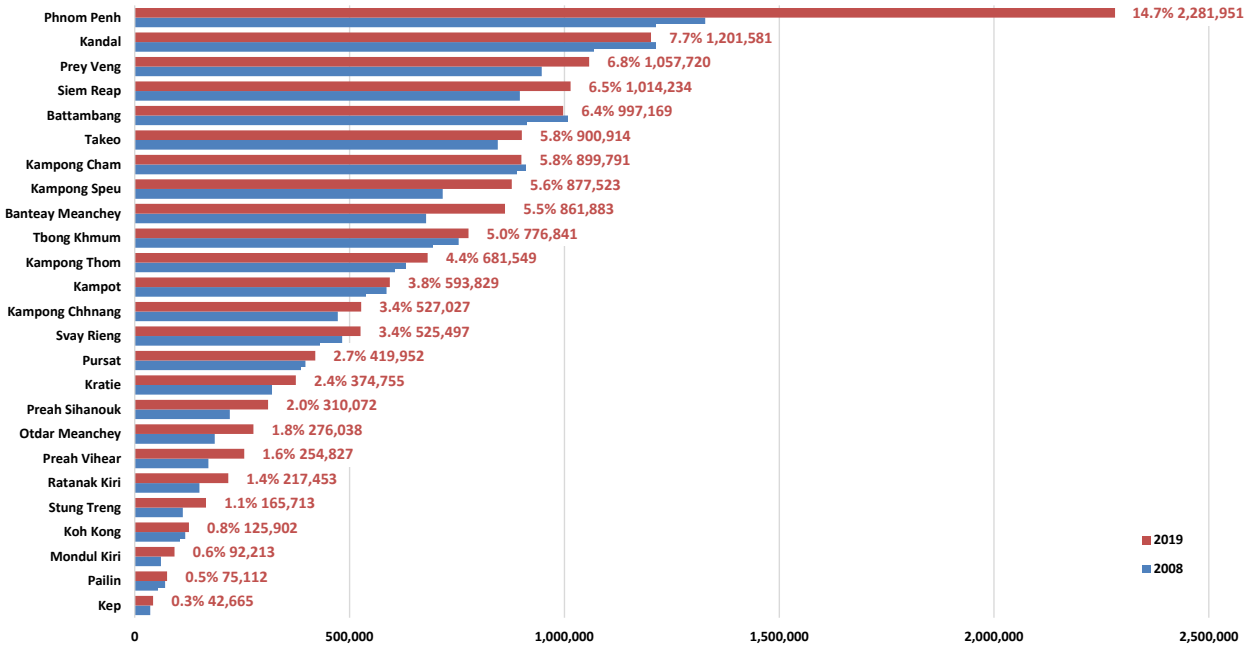


図 2-2.8　2019 年における各都市の人口

＊図中の数値は 2019 年の調査結果を記載

出典：General Population Census of the Kingdom of Cambodia 2019 National Report on Final Census Results、National Institute of Statistics Ministry of Planning を基に調査団作成

次いで隣接するカンダール州が 1,201,581 人で 7.7%を占めており、首都プノンペンに隣接するタクマウ市の人口は 75,629 人である[8]。

(b)　行政区画

カンボジア国における行政区画を**図 2-2.9** に示す。カンボジア国は、地方行政法[9]に基づき、2009 年より、首都プノンペンと 24 の地方都市からなる州で構成されている。

首都プノンペンは、区（カーン、以下「Khan」）と地区（サンカット、以下「Sangkat」）に区分される。州は、市（シティ（City））と郡（ソック（Srok））に別れ、市は Sangkat、郡は町（Khum）で構成される。

[8] National Institute of Statistics Ministry of Planning: General Population Census of the Kingdom of Cambodia 2019 National Report on Final Census Results
[9] The Law on Administrative Management of the Capital, Provinces, Municipalities, Districts and Khans, 2008

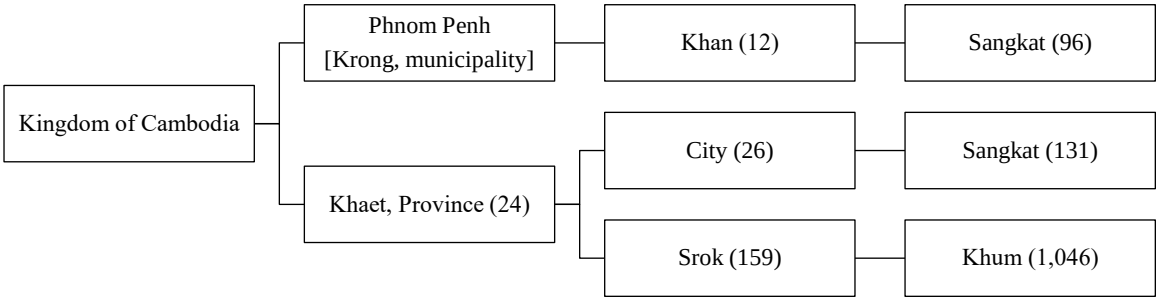


図 2-2.9　カンボジア国の行政区画

＊（）内は行政区画数

出典 : カンボジア王国 地方行政法運用のための首都と州レベルの能力開発プロジェクト詳細計画策定調査・実施協議報告書を元に調査団作成

本調査対象である首都プノンペン及びカンダール州タクマウ市の行政界の変遷を**表 2-2.1** に示す。

表 2-2.1　行政区画の変遷

YEAR	CONTENTS
2010	Khan Russei Keo was split to create Khan Sen Sok
2011	Khan Dangkao was split to create Khan Por Sen Chey
2012	Twenty (20) communes of the Kandal province were integrated into Phnom Penh Municipality, representing an additional 304 km^2 and a population of 170,000
2013	Three (3) new Khans were created: Khan Mean Chey was split to create Khan Chbar Ampov Khans Sen Sok and Por Sen Chey were split to create Khan Prek Pnov Khan Russei Keo was split to create Khan Chroy Changvar
2018	Khan Chamkar Mon was split to create Khan Chamkar Mon and Khan Boeng Kengkang Khan Boeng Kengkang was established by the sub-decree issued on 8 Jan 2019. It is comprised of 7 Sangkat of Khan Chamkar Mon: 1- Boeng Kengkang Ti Muoy, 2- Boeng Kengkang Ti Pir, 3- Boeng Kengkang Ti Bei, 4- Olympic, 5- Tumnob Tuek, 6- Tuol Svay Prey Ti Muoy, 7- Tuol Svay Prey Ti Pir Khan Pour Saenchey was split to create Khan Pour Saenchey and Khan Kambol and Khan Dangkao was split to create Khan Dangkao and Khan Kambol Khan Kambol which was established by the sub-decree issued on 8 Jan 2019, is comprised of 6 Sangkat from Khan Pur Senchey and 1 Sangkat from Khan Dangkao; 1- Kamboul, 2- Kantouk, 3- Ovlaok, 4- Snaor, 5- Phleung Chheh Roteh, 6- Boeng Thum, 7- Prateah Lang (from Dangkao Khan)
2019	Four (4) sangkat included in Ta Khmao city (Svay Rolum, Kaoh Anlong Chen, Setbou, and Roka Khpuos)
	Chroy Chongva -AkreiyKsatr 橋の建設後に、カンダール州の Lvea Aem 地区の一部が首都プノンペン統合される予定である

出典：第三次マスタープラン（M/P2017）及び PPWSA 提供資料より調査団作成

2018 年に首都プノンペンの中心部の行政区画が改編されたが、PPWSA の料金徴収や維持管理においては、2018 年以前の行政区画を用いて運営が行われている。そのため、本調査では PPWSA の行政区画にて整理する。PPWSA の行政区画を**図 2-2.10** に示す。

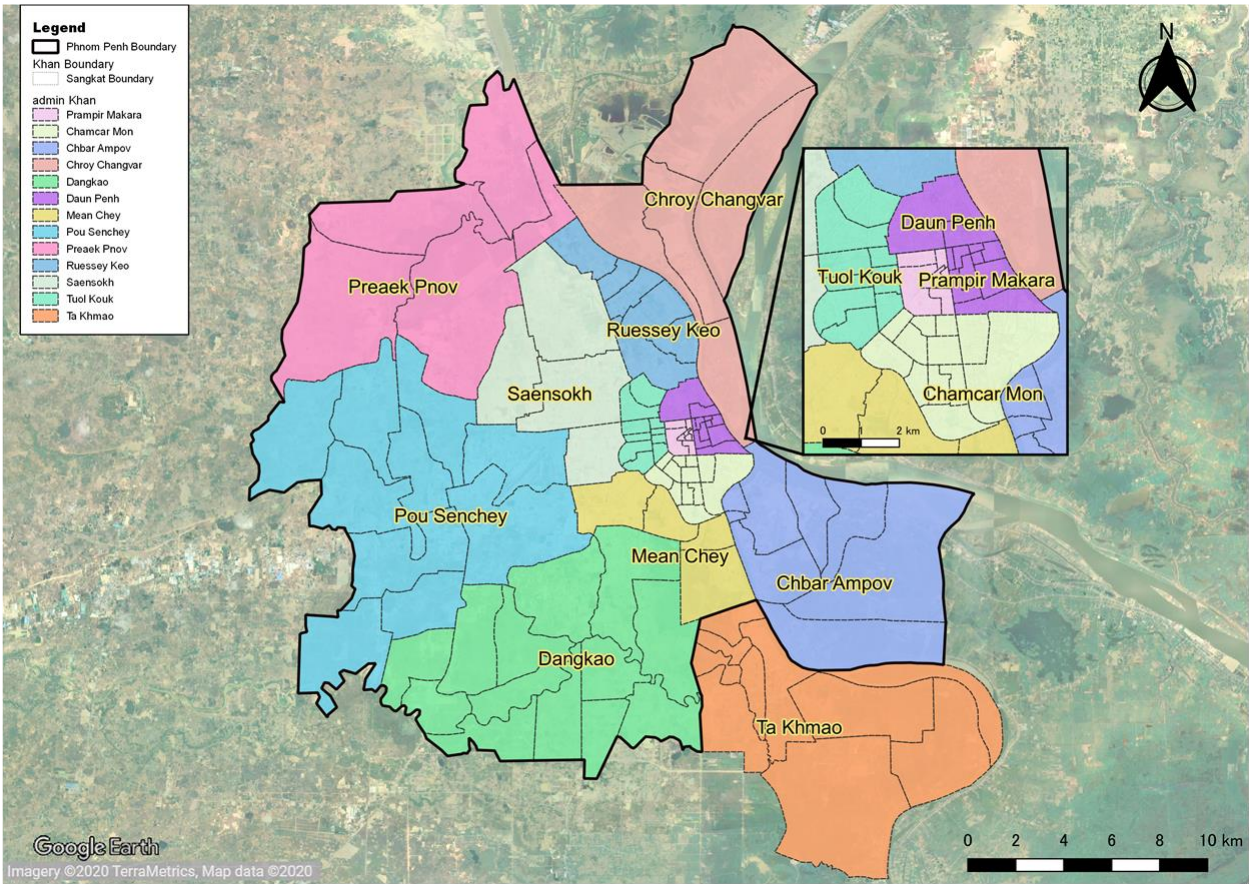


図 2-2.10　首都プノンペン及びその近郊の行政区画

出典：第三次マスタープラン（M/P2017）及び PPWSA 提供資料より調査団作成

6)　経済状況

カンボジア国の一人当り名目国内総生産（Gross Domestic Product Per Capita、以下「 GDP」）は約 1,620USD[10]である。近隣諸国及びアジア主要国の一人当り GDP を**表 2-2.2** に示す。カンボジア国の GDP は、近隣諸国に比べても低く、また、後発開発途上国（Least Developed Country（LDC））に含まれている。

表 2-2.2　近隣諸国及びアジア主要国の一人当り GDP の比較

Country	Cambodia	China	Hong Kong	India	Indonesia	Japan	Lao P.D.R.
Gross domestic product per capita, current prices (USD)	1,620	10,287	48,627	2,098	4,197	40,256	2,661
Country	**Malaysia**	**Myanmar**	**Philippines**	**Singapore**	**Taiwan**	**Thailand**	**Vietnam**
Gross domestic product per capita, current prices (USD)	11,193	1,299	3,512	65,234	25,873	7,807	3,416

出典：IMF, World Economic Outlook Database, October 2020 を基に調査団作成

カンボジア国の一人当り名目 GDP と実質 GDP 成長率の推移を**図 2-2.11** に示す。

[10] IMF, World Economic Outlook Database, October 2020

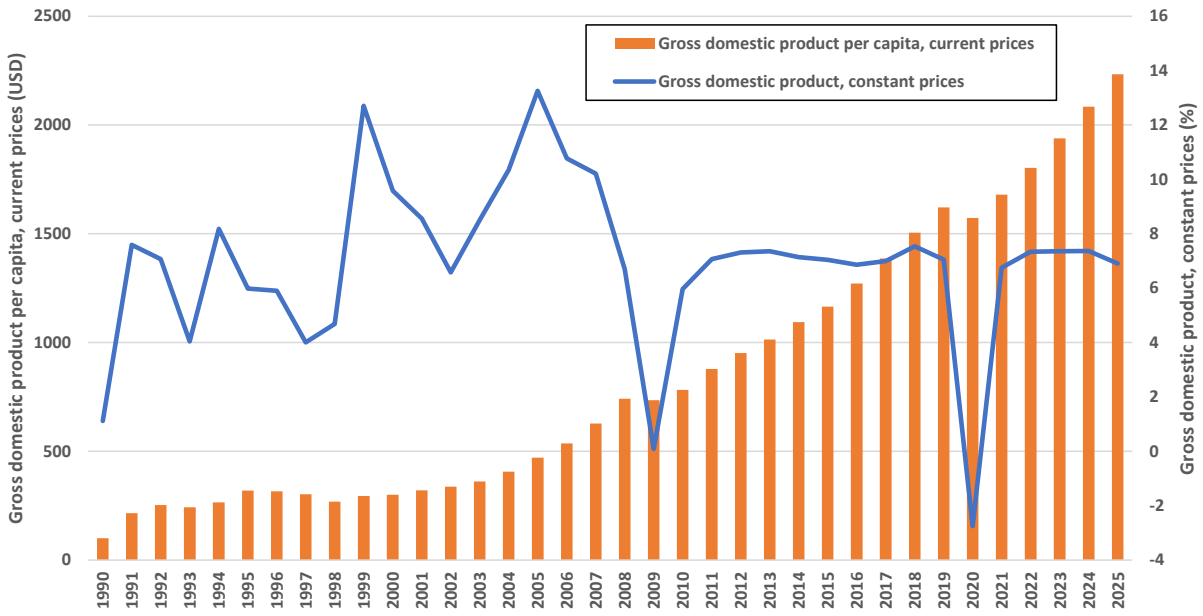


図 2-2.11　一人当り名目 GDP と実質 GDP 成長率の推移

＊2018 年以降は予測値

出典：IMF, World Economic Outlook Database, October 2020 を基に調査団作成

近年は、比較的安定した政治状況を保っており、2004 年から 2007 年には平均国内総生産成長率が 4 年連続して 10%を超える著しい経済成長を果たしていたが、2008 年に入ってからの原油・食糧価格の高騰、特に 2009 年は世界金融危機の影響により成長率は低下し、2009 年の経済成長率は、0.1%にまで急低下した。しかしながら 2010 年は 6.0%まで急回復し、2011 年以降は、ほぼ 7.0%を維持し続けている。国際通貨基金（International Monetary Fund 、以下「IMF」）によると、2020 年に新型コロナウイルス感染症（Coronavirus disease 2019（以下、「COVID-19」））流行の影響により、成長率が急低下することが予測されているものの、2022 年以降は回復し、今後も 6%から 7%の成長が続くと予想している。また、カンボジア国は、1990 年代初頭の内戦終結後に、経済関連の国際機関に加盟し、1999 年の東南アジア諸国連合（ASEAN）加盟、2004 年の世界貿易機関（WTO）加盟など、地域経済及び世界経済との統合を強化している。

産業別 GDP 構成比を**図 2-2.12** に示す。2019 年の産業別 GDP 構成比は農業が 22.1%、工業が 36.5%、サービス業が 41.4%である[11]。2010 年と比較すると農業が経済に占める割合は低下している一方で、インフラ需要や都市開発に伴い、建設業が大きく成長しており、同分野は今後も拡大が見込まれている。

[11] Asian Development Bank (ADB)：Key Indicators for Asia and the Pacific 2020

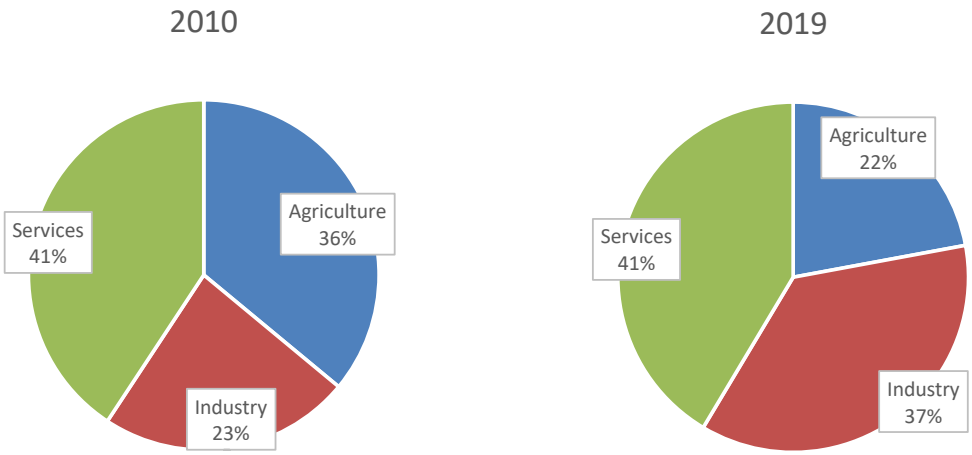


図 2-2.12　産業別の GDP 構成比

出典：Asian Development Bank (ADB)、Key Indicators for Asia and the Pacific 2020

カンボジア国では、社会経済調査（Cambodia Socio-Economic Survey（CSES））が 2013 年から 2017 年に実施された。世帯当り月所得を**表 2-2.3** に示す。

表 2-2.3　世帯当り月所得

Income per Month (Thousand Riel)	2013	2014	2015	2016	2017
Cambodia	1,236	1,434	1,619	1,777	1,960
Phnom Penh	2,517	2,856	2,938	2,907	2,853
Other urban	2,112	1,872	2,250	2,461	2,498
Other rural	931	1,163	1,329	1,517	1,760

出典：Cambodia Socio-Economic Survey（CSES）2017

カンボジア国の世帯当り月所得は、年々上昇しており、首都プノンペンと地方の差は年々減少しているものの 2017 年の首都プノンペンと地方（Other rural）には約 1.6 倍の差がある。

カンボジア国の貧困層は、2004 年には 50%を超えていたが、2018 年には約 12%[12]まで大幅に低下した。しかし、貧困の削減はカンボジアの重要課題であり、貧困削減のためには、産業構造の多様化と生産性の向上に基づく包括的な成長が欠かせないとしている。

7)　文化遺産等

カンボジア国内法上、考古学的、歴史的、文化的に固有の価値を有する文化遺産等は事業対象地周辺に存在しない。

2-2-3-1-3　相手国の環境社会配慮制度・組織

(1)　カンボジアの環境社会配慮関連法規の概要

カンボジア国における環境社会配慮に関する法制度を**表 2-2.4** に示す。

[12] Asian Development Bank (ADB)：Poverty Data Cambodia

表 2-2.4　カンボジアにおける環境社会配慮に関する法制度

No.	Law and Regulation	Date
1	Law on Environmental Protection and Natural Resource Management	Nov. 1996
2	No. 72 ANRK.BK, Anukret (Sub-decree) on Environmental Impact Assessment (EIA) Process	Aug. 1999
3	No. 376 BRK.BST, Prakas (Declaration) on General Guideline for Developing IEIA/EIA Reports	Sep. 2009
4	Prakas (Joint Declaration) between MOE and MEF on Determination of Service Fee for EIA Reviewing and Monitoring	2000 2012
5	No. 215 BRK, Prakas (Declaration) on Registration of Consulting Firm for Studying and Preparing Environmental and Social Impact Reports	May 2014
6	No.27 ANRK/BK, Anukret (Sub-decree) on Water Pollution Control	Apr. 1999
7	No.36 ANRK.BK, Anukret (Sub-decree) on Solid Waste Management	Apr. 1999
8	No. 42 ANK/BK, Anukret (Sub-decree) on the Control of Air Pollution and Noise Disturbance	Jul. 2000
9	Law on Water Resources Management	Jun. 2007
10	No. NS/RKM/0208/007, Law on Protected Area Management (Protected Areas Law)	Feb. 2008
11	Sub decree 103 Revision of Sub-decree on Water Pollution Control	Jun. 2021

注：Prakas は告示を意味する

出典：調査団

(2)　カンボジアの EIA 制度と JICA ガイドラインの乖離

カンボジア国における環境影響評価制度については、JICA ガイドラインから大きな乖離はないが、戦略的環境アセスメント、環境モニタリングフォーム、情報公開、代替案の比較に関する詳細な規定はない。JICA ガイドラインとカンボジア法規制の比較を**表 2-2.5** に示す。

表 2-2.5　JICA ガイドラインとカンボジア法規制の比較

Item	JICA Guidelines	Cambodian Guidelines	Gaps of JICA and Cambodian GLs, Measures
Underlying principles	Environmental impacts that may be caused by projects must be assessed and examined in the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan.	An IEIA/EIA shall be conducted on every project and shall be approved by the MoE. Both positive and negative environmental and socio-economic impacts arising from their project activities shall be assessed.	Basically same as JICA guidelines, but alternatives analysis is not clarified. Alternative analysis was conducted in the Project.
Information disclose	EIA reports must be written in the official language or in a language widely used in the country in which the project is to be implemented. When explaining projects to local residents, written materials must be provided in a language and form understandable to them. EIA reports are required to be made available to the local residents of the country in which the project is to be implemented. The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents and copying must be permitted.	Information disclosure is carried out through public participation such as stakeholder meeting.	Information disclosure is not clarified. In the Project, written materials will be provided to PPWSA in Khmer language for information disclosure.

Item	JICA Guidelines	Cambodian Guidelines	Gaps of JICA and Cambodian GLs, Measures
Public consultation	For projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans. In preparing EIA reports, consultations with stakeholders, such as local residents, must take place after sufficient information has been disclosed. Records of such consultations must be prepared. Consultations with relevant stakeholders, such as local residents, should take place if necessary throughout the preparation and implementation stages of a project. Holding consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared.	Public participation is one of the important contents in the EIA report in Declaration on General Guideline for conducting IEIA/EIA Reports, 2009 (Annex 1). In IEIA/EIA report, following contents have to included: - Dissemination by the project owner with local authorities and local communities of the development project; - Feedback from relevant ministries/ agencies/ departments and relevant local authorities; - Comments from relevant non-government organizations (NGOs); - Consultation with affected local communities	No significant gaps. However, no specific requirements for records and timing of stakeholder meetings provided. In the Project, public consultation records were prepared and meetings were held during the preparatory survey.
Impacts assessment items	The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety. In addition to the direct and immediate impacts of projects, their derivative, secondary, and cumulative impacts as well as the impacts of projects that are indivisible from the project are also to be examined and assessed to a reasonable extent. It is also desirable that the impacts that can occur at any time throughout the project cycle should be considered throughout the life cycle of the project.	Detailed assessment of physical, biological and socio-economic environment and resources are required, based mainly on primary data on the area within or in the surrounding the project site. This will form the basis for identification, prediction and analysis of potential adverse environmental and social impacts by project activities, aiming to identify actions to minimize negative impacts and maximize positive impacts. Following items have to be included in IEIA/EIA report: Physical resources: soil, climate, air quality, hydrology. Biological resources: forest, wildlife species, habitats, biodiversity and ecology system, wet land system. Socio-economic aspects: demography and settlement, economic status, land use, water use, energy use, infrastructure, education, public health and well-being, cultural heritages, tourism area	Basically same as JICA guidelines, but no detailed items are clarified. JICA Guidelines has been applied.

Item	JICA Guidelines	Cambodian Guidelines	Gaps of JICA and Cambodian GLs, Measures
Monitoring	Project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders. When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, forums for discussion and examination of countermeasures are established based on sufficient information disclosure, including stakeholders' participation in relevant projects. Project proponents etc. should make efforts to reach an agreement on procedures to be adopted with a view to resolving problems.	Environmental monitoring is required under EMP. However, no monitoring forms are clarified.	It is proposed to apply monitoring forms based on JICA guidelines.
Ecosystem and biota	Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests.	Description and impacts analysis of biological resources (including forest, wildlife species, habitats, biodiversity and ecology system, wet land system) are required in the Declaration on General Guideline for conducting IEIA1/EIA Reports, 2009 (Annex 1).	Basically same as JICA guidelines.
Indigenous peoples	Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures must be taken to minimize impacts and to compensate indigenous peoples for their losses.	Description and impacts analysis of ethnic minority or indigenous people are required.	Basically same as JICA guidelines.

出典：調査団

(3) EIA/IEIA 手続き

本プロジェクトにおいては、環境関連法に規定される EIA/IEIA/EPC の内、最も手続きが簡易な EPC (Environmental Protection Contract) のみが要求され、EIA または IEIA は必要とされない。なお、EPC は 2021 年 8 月 16 日に MoE により承認済みである（**添付資料 6-2**）。

関連機関の役割と責任は**表 2-2.6** の通りである。

表 2-2.6 関連機関の役割と責任

No.	Organization	Roles and Responsibilities
1	MoE	MoE is responsible for project screening and scoping (approval of TOR), review and evaluation of IEIA/EIA report, monitoring and follow-up on EMP etc. (projects with more than 2 million USD investment) MoE is also responsible for examination and approval of EPC
2	PDE	PDE is responsible for project screening and scoping (approval of TOR), review and evaluation of IEIA/EIA report, monitoring and follow-up on EMP etc. (projects with less than 2 million USD investment)
3	CDC	CDC is responsible for approving the IEIA/EIA report and supporting FDI (Foreign Direct Investment) for IEIA/EIA study. Facilitates and coordinates government-donor relations.
4	PISC	Supports provincial governor for approving the IEIA/EIA report (small project).
5	MISTI	As regular member for concerned ministry for industrial compliance and monitoring.
6	MOWRAM	Approval for intake water
7	MLMUPC	Responsible for construction permit and compliance based on Sub-Decree No.86
8	CNMC	Approval for intake water
9	ISC	Responsible for establishing national standards

PDE: Provincial Department of Environment
PISC: Provincial Investment Sub-Committee
MISTI: Ministry of Industry, Science, Technology and Innovation
MOWRAM: Ministry of Water Resources and Meteorology
MLMUPC: Ministry of Land Management, Urbanization and Construction
CNMC: Cambodia National Mekong Committee
ISC: Institute of Standards of Cambodia
出典：調査団

2-2-3-1-4　代替案（事業を実施しない案を含む）の比較検討

環境へのマイナス影響を回避・最小化するため、事業を実施しない案を含む代替案の検討を技術面、環境社会面等を勘案して行った。結果は**表 2-2.7** の通りであり、安定的な給水および公衆衛生性等を重視し、事業実施を推奨案とした。

表 2-2.7　代替案の検討

Item		Alternative 1	Alternative 2
		Without Project	With Project
WTP	Capacity	0	45,000 m^3/day
	Location	-	Within the existing facility site owned by PPWSA
	Shortage of drinking water supplied	Negative impacts	Positive impacts
Technical aspect	Dealing with raw water pollution	-	Partly yes
	Transmission water from other WTPs	Needed	Not needed
	Construction cost	0	High
	O&M cost	High (long distance transmission)	Mid (short distance transmission)
	O&M level	-	Mid-level
Environmental and social considerations	Land acquisition	Not needed	Not needed
	Public health	Negative impacts (no water supply during water stop period due to limited treated water volume from other WTPs)	Positive impacts (stable water supply)
	Waste (sludge etc.)	-	Light impacts (sludge production)
	Low income households	Light impacts (tariff may be increased)	Positive impacts (tariff may be reduced)
Preferred option		Not recommended (unstable water supply and negative impacts on public health)	Recommended (stable water supply and positive impacts on public health)

出典：調査団

2-2-3-1-5　スコーピング

本プロジェクトは JICA「環境社会配慮ガイドライン」（2010 年 4 月）が掲げる、”影響を及ぼしやすい特性及び影響を受けやすい地域”には該当せず、環境カテゴリ B に分類される。よって、当該ガイドラインに基づき、IEE（初期環境調査：Initial Environmental Examination）レベル調査を行った。

IEE レベル調査は、JICA 環境社会配慮ガイドラインにおいて“既存データ等比較的容易に入手可能な情報、必要に応じた簡易な現地調査に基づき、代替案、環境影響の予測・評価、緩和策、モニタリング計画の検討等を実施するレベル”と定義される。本プロジェクトに関するスコーピング結果を**表 2-2.8** に示す。

表 2-2.8　スコーピングチェックリスト

No.	Impact Item	Evaluation		Comments
		P & C	O	
Social Environment				
1	Resettlement			**Construction (C) / Operation (O) :** Since the WTP will be constructed on the land owned by PPWSA, there will be no land acquisition or involuntary resettlement for the Project.
2	Local economy (employment and livelihood etc.)	✓		**C :** Construction activities will create working opportunities but interruption of businesses should be considered. **O :**Water supply project will create positive impacts on the local economy due to increase of service level.
3	Land use and utilization of local resources (fishing)	✓	✓	**C / O :** Some impacts to the fishing activities may occur. Some countermeasures will be necessary to reduce the impacts.
4	Water usage/water right	✓	✓	**C :** Construction activities may cause water use near the intake site. **O :** Additional intake amount (approx.60,000 m^3/d) may have light impacts on water usage (the water right will be approved).
5	Social institutions			**C / O :** For water supply system construction, negative impacts on social institutions are not expected.
6	Existing social infrastructures and services (such as traffic etc.)	✓	✓	**C :** Traffic disruption by entrance and exit may occur during construction. The conditions of the roads between the Intake and the WTP as well as the traffic conditions should be examined. **O :** No negative impacts by improvement of water supply is expected.
7	Poor households		✓	**C :** Construction activities will create working opportunities and may affect poor household positively. **O :** Appropriate water tariff with consideration for low income users will be studied.
8	Indigenous, or ethnic people			**C / O :** There are no indigenous people living in the Project area (Sangkat Srah Chak and Sangkat Wat Phnom). (2020 village/commune data)
9	Misdistribution of benefit and damage			**C / O :** This is not expected since no difference for distribution is planned by the Project.
10	Local conflict of interests			**C / O :** This is not expected since no difference for distribution is planned by the Project.
11	Gender			**C :** During construction stage, female workers will be recruited equally for construction works. (on the other hand, the number of female applicants are very few based on past experience of projects in Cambodia.) **O :** Workload of women and children in collecting water from wells and public water taps will be reduced after operation.
12	Children's rights			**C :** No imployment of underage workers are planned. **O :** Public sanitation and the health of children are expected to be improved.
13	Cultural heritage			**C / O :** No cultural heritages exist in the Project area as well.
14	Infectious diseases such as HIV/AIDS	✓		**C :** Some local workers will be employed for the construction and there may be a potential of infectious diseases such as HIV/AIDS. Some measures will be taken. **O :** No flows of workers will be expected after construction.
15	Accidents (risk etc.) and working environment	✓	✓	**C :** Some accidents (collapse etc.) and poor working environment (such as forced overtime work etc.) should be considered. However, some safety measures will be taken to prevent accidents. **O :** SPC will transfer Japanese O/M know-how to PPWSA staff to ensure safe operation of the facilities. PPWSA will also conduct monitoring on working environment.
Natural Environment				
16	Geographical features			**C / O :** The scale of excavation for the raw water intake station is approximately 15m(d)x30m(w)x60m(l). The excavated space will be filled with the half underground facility and topography / geology of the site will not be changed significantly.
17	Ground subsidence			**C / O :** No ground subsidence is expected due to surface water usage (not ground water) and no construction affecting the underground.
18	Bottom sediment			**C :** During construction of the intake, higher turbidity water may cause little more bottom sediment only in a limited period but not measurable scale. **O :** Discharged water from WTP is only supernatant after treatment.
19	Biota and ecosystem	✓	✓	**C / O :** Some impacts to the ecosystem in Tonle Sap river may occur. Some countermeasures will be necessary to reduce the impacts.
20	Meteorology (global warming)			**C :** During construction, no significant GHG emitting activities are planned. **O :** By the increase of water supply, other methods for water transportation with GHG emission are expected to be reduced.

No.	Impact Item	Evaluation		Comments
		P & C	O	
21	Landscape			**C / O :** Facilities in the WTP premises will be out of the public view. The intake facility will alternate the existing intake facility as a newer building. Thus, deterioration of landscape is not expected.
22	Protected areas			**C / O :** There is no protected area near Phnom Penh.
Pollution				
23	Air pollution	✓		**C :** Dust and exhaust gas may be generated by construction equipment, vehicles, and excavation activities. **O :** No negative impact on air pollution is expected because no significant SO_2, NO_2, CO, or dust will be discharged.
24	Water pollution	✓	✓	**C :** Water pollution may occur due to construction of intake facility and discharge of wastewater from construction sites. **O :** Backwash water and withdrawn sludge should be treated to prevent discharging water with turbidity.
25	Soil pollution	✓	✓	**C :** Soil pollution may occur due to construction if maintenance of machineries is not sufficient. **O :** Sludge produced through water treatment process should be disposed according to the related regulation (Sub Decree No.235 on Drainage Control and Wastewater Treatment System)
26	Waste	✓	✓	**C :** Domestic and construction wastes will be generated. **O :** Sludge through water treatment process will be produced.
27	Noise and vibration	✓		**C :** It should be checked that if there are hospitals, schools and residence adjacent to the construction site. **O :** Pumps will be housed in the pumping station.
28	Offensive odor			**C / O :** No odor will be produced at any stage of the Project.

P & C: Pre-construction and construction phase
O: Operation phase
出典：調査団

2-2-3-1-6 環境社会配慮調査の TOR

スコーピング結果に基づき、自然環境及び社会環境に対する潜在的なマイナス影響の調査方法を提案した（**表 2-2.9**）。

表 2-2.9 IEE（IEIA）の TOR

No.	Impact Item	Study Item	Proposed Study Method and Alternatives
1	Land use and utilization of local resources (fishing)	Number of fishing activity around the WTP	1) Collection of information from local fishery groups. 2) Collection of information by IEIA study team at site.
2	Water usage/water right	Low flowrate of Tonle Sap River	1) Collection of information from PPWSA and MOWRAM. 2) Obtain approval from related authorities.
3	Existing social infrastructures and services (such as traffic etc.)	Current traffic situation	1) Confirmation of traffic situations between the WTP and the Intake. 2) Confirmation of road conditions such as walkways, width and possible alternative routes.
4	Poor households	1) Poverty rate 2) Current tariff system	1) Literature survey 2) Collection of information from PPWSA and local authority.
5	Infectious diseases such as HIV/AIDS	Laws and regulations	1) Confirmation of related laws and regulations. 2) Consideration of COVID-19
6	Accidents (risk etc.)	Safety regulations and records	1) Confirmation of related laws and regulations. 2) Collection of information from PPWSA and other WTPs for accident records.
7	Biota and ecosystem	Ecosystem in Tonle Sap River	1) Field survey for aquatic organisms in Tonle Sap River. 2) IUCN Categories
8	Air pollution	1) Air quality standards 2) Current air quality	1) Confirmation of the environmental standards 2) Measuring current air quality.
9	Water pollution	1) Surface water quality standards 2) Current water quality	1) Collection of surface water quality standards. 2) Water quality survey in Tonle Sap River

No.	Impact Item	Study Item	Proposed Study Method and Alternatives
10	Soil pollution / Waste	Reuse methods and regulations etc.	1) Calculation of solid wasted produced by construction. 2) Calculation of solid wasted produced by operation.
11	Noise and vibration	1) Noise standards 2) Current noise level	1) Collection of environmental standards for noise. 2) Measuring current noise level.

出典：調査団

2-2-3-1-7 環境社会配慮調査結果（予測結果を含む）

前節で作成した TOR に従い作成した調査結果について、**表 2-2.10** で整理する。

表 2-2.10 環境社会配慮調査結果

No.	Impact Item	Results of Assessment
1	Land use and utilization of local resources (fishing)	With direct observation and interview with Chief of Sangkat Srah Chork, along the Tonle Sap in vicinity of Intake station, only household or non-license fishing activities were evident because the area is less yield in fish catching and business of waterway transport (tourist board and other shipping). Also, it was confirmed that no large-scale fishing activities were conducted at the upstream and downstream.
2	Water usage/water right	Increased raw water of 0.69 m^3/s (approx.60,000 m^3/d) will be taken from Tonle Sap River, which is 0.26% of monthly minimum flowrate (245 m^3/s) of the River. In addition, an approval letter will be issued from Cambodia National Mekong Committee (CNMC) and Ministry of Water Resources and Meteorology (MOWRAM). Therefore, the impacts on water usage are very low.
3	Existing social infrastructures and services (such as traffic etc.)	By field observation, conditions of the roads between the Intake and the WTP as well as the traffic conditions were examined. On some of the roads, traffic congestion was observed but enough width for alternative lanes were found for all the roads. This result was also used for pipeline layout planning. 
4	Poor households	Poverty rates in Cambodia, Phnom Penh City and districts in vicinity of the Project are presented in the following tables.

Representation	Per Capital Daily Poverty Line (KR)	Per Capital Daily Poverty Line ($)	Per Capital Monthly Poverty Line ($)	Poverty Rate (%)
Cambodia	3,871	0.93	28.39	22.9
Phnom Penh	6,347	1.53	46.55	12.8

<table>
<tr><th>No.</th><th>Impact Item</th><th>Results of Assessment</th></tr>
<tr><td></td><td></td><td>Source: ADB 2014 (CAMBODIA COUNTRY POVERTYANALYSIS)

<table>
<tr><th>Capital</th><th>Sangkat</th><th>Village</th><th>Number of family (Poor.1 – very poor)</th><th>Number of family (Poor.2 - poor)</th></tr>
<tr><td rowspan="5">Phnom Penh</td><td rowspan="4">Srah Chak</td><td>Phum6</td><td>50</td><td>25</td></tr>
<tr><td>Phum9</td><td>0</td><td>0</td></tr>
<tr><td>Phum12</td><td>4</td><td>29</td></tr>
<tr><td>Phum13</td><td>0</td><td>0</td></tr>
<tr><td>Wat Phnom</td><td>Phum10</td><td>9</td><td>5</td></tr>
<tr><td colspan="3">Total</td><td>63</td><td>59</td></tr>
</table>

Source: Commune data base 2020

PPWSA has set appropriate water tariff system and house connection fee for low income households based on its water supply for poor program. Comparing the water tariff system of 2001 to 2017, current unit tariff has been reduced by 9% to 27% for low water consumption (0 to 7 m^3/month). In addition, the WTP will be constructed using Japanese Grant Aid, which will reduce the financial pressure of PPWSA, allowing it to set lower tariff to the public.
Therefore, the impacts on poor households are low or even positive.</td></tr>
<tr><td>5</td><td>Infectious diseases such as HIV/AIDS</td><td>Law on the prevention and control of HIV/AIDS in Cambodia (2002) stipulates the importance of information, education and communication. If some education and control measures according to the law are applied, the impacts are considered to be low.
Also, prevention of various infectious disease, especially covid 19 in the project site should be considered.</td></tr>
<tr><td>6</td><td>Accidents (risk etc.)</td><td>Cambodian construction workers are facing many health and safety issues at work, with some losing their lives while others are often disabled. The International Labour Organization (ILO) cited several reasons, including the absence of an Occupational Safety and Health (OSH) law and regulation for labour inspection in construction sites, lack of resources to enforce standards and unsatisfactory data on work-related accidents. During the construction phase of the Project, some countermeasures have to be applied to avoid accidents.</td></tr>
<tr><td>7</td><td>Biota and ecosystem</td><td>Fishery direct observation was conducted in IEE survey (May 19 2021) in vicinity to the intake station. The fish caught during the observation were recorded 32 fish species which are frequently caught and commonly exist. As listed below, according to IUCN category, no kinds of endangered species were found.

<table>
<tr><th>No</th><th>English Name</th><th>Scientific Name</th><th>Family</th><th>IUCN</th></tr>
<tr><td>1.</td><td>-</td><td>Amblyrhynchichthys truncatus</td><td>Cyprinidae</td><td>LC</td></tr>
<tr><td>2.</td><td>Goldfoil/Tinfoil barb</td><td>Barbonymus schwanenfeldii</td><td>Cyprinidae</td><td>LC</td></tr>
<tr><td>3.</td><td>Java/Sliver bard</td><td>Barbonymus</td><td>Cyprinidae</td><td>LC</td></tr>
<tr><td>4.</td><td>-</td><td>Cosmochilus harmandi</td><td>Cyprinidae</td><td>LC</td></tr>
<tr><td>5.</td><td>Bangkok River sprat</td><td>Corica laciniata</td><td>Cyprinidae</td><td>DD</td></tr>
<tr><td>6.</td><td>Spotted hampal barb</td><td>Hampala dispar</td><td>Cyprinidae</td><td>LC</td></tr>
<tr><td>7.</td><td>Siamese mud carp</td><td>Henicorhynchus siamensis</td><td>Cyprinidae</td><td>NA</td></tr>
<tr><td>8.</td><td>-</td><td>Hybsilbarbus lagleri</td><td>Cyprinidae</td><td>NA</td></tr>
<tr><td>9.</td><td>Goldfin tinfoil barb</td><td>Hybsilbarbus malcolmi</td><td>Cyprinidae</td><td>NA</td></tr>
<tr><td>10.</td><td>Thinlip barb</td><td>Probarbus labeaminor</td><td>Cyprinidae</td><td>NA</td></tr>
<tr><td>11.</td><td>Snail eating barb</td><td>Puntioplites proctozysron</td><td>Cyprinidae</td><td>NA</td></tr>
<tr><td>12.</td><td>Sickle fin barb</td><td>Puntioplites falcifer</td><td>Cyprinidae</td><td>LC</td></tr>
<tr><td>13.</td><td>-</td><td>Panggasius elongatus</td><td>Pangasiidae</td><td>NA</td></tr>
<tr><td>14.</td><td>Fringed barb</td><td>Cyclocheilichthys heteronema</td><td>Cyprinidae</td><td>LC</td></tr>
<tr><td>15.</td><td>Cycloheilichthys lagleri</td><td>-</td><td>Cyprinidae</td><td>LC</td></tr>
<tr><td>16.</td><td>White eye barb</td><td>Cyclocheilichthys repasson</td><td>Cyprinidae</td><td>LC</td></tr>
<tr><td>17.</td><td>Reticulate flying fox</td><td>Crossocheilus reticulatus</td><td>Cyprinidae</td><td>LC</td></tr>
<tr><td>18.</td><td>long-fin flying minnow</td><td>Esomus longimanus</td><td>Cyprinidae</td><td>DD</td></tr>
<tr><td>19.</td><td>flying minnow</td><td>Esomus metallicus</td><td>Cyprinidae</td><td>NA</td></tr>
<tr><td>20.</td><td>-</td><td>Neolissochilus stracheyi</td><td>Cyprinidae</td><td>LC</td></tr>
<tr><td>21.</td><td>-</td><td>Yasuhikotakia</td><td>Cobitidae</td><td>NA</td></tr>
<tr><td>22.</td><td>Speckle-tailed Loach</td><td>Caudipunctata</td><td>Cobitidae</td><td>NA</td></tr>
<tr><td>23.</td><td>Sun loach</td><td>Yasuhikotakia eos</td><td>Cobitidae</td><td>NA</td></tr>
<tr><td>24.</td><td>Tiger botia</td><td>Syncrossus helodes</td><td>Cobitidae</td><td>NA</td></tr>
<tr><td>25.</td><td>Whitelip sole</td><td>Achiroides leucorhynchos</td><td>Soleidae</td><td>NA</td></tr>
<tr><td>26.</td><td>Blacklip sole</td><td>Achiroides melanorhynchus</td><td>Soleidae</td><td>LC</td></tr>
<tr><td>27.</td><td>Smallscale tonguesole</td><td>Cynoglossus microlepis</td><td>Cynoglossidae</td><td>LC</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>No.</th><th>Impact Item</th><th>Results of Assessment</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>28.</td><td>-</td><td>Paralaubuca oxygastoides</td><td>Cyprinidae</td><td>NA</td></tr>
<tr><td>29.</td><td>-</td><td>Rasbora amplistringa</td><td>Cyprinidae</td><td>NA</td></tr>
<tr><td>30.</td><td>Blackline Rasbora</td><td>Rasbora borapetensis</td><td>Cyprinidae</td><td>LC</td></tr>
<tr><td>31.</td><td>-</td><td>Rasbora dussonensis</td><td>Cyprinidae</td><td>NA</td></tr>
<tr><td>32.</td><td>-</td><td>Rasbora rubrodorsalis</td><td>Cyprinidae</td><td>NA</td></tr>
</table>
Note: LC = Least Concern, DD = Data Deficient, NA= Not Available
Source: IEIA Report (2021)
</td></tr>
<tr><td>8</td><td>Air pollution</td><td>
Air quality at the WTP / the Intake station and the standard of Cambodia are shown in the following table.
<table>
<tr><th rowspan="2">No</th><th rowspan="2">Parameter</th><th rowspan="2">Unit</th><th colspan="2">Result</th><th rowspan="2">Standard (MoE)</th></tr>
<tr><th>WTP</th><th>Intake</th></tr>
<tr><td>1</td><td>Carbon monoxide (CO)</td><td>mg /m^3</td><td>0.114</td><td>0.206</td><td>20</td></tr>
<tr><td>2</td><td>Nitrogen dioxide (NO_2)</td><td>mg /m^3</td><td>0.052</td><td>0.037</td><td>0.1</td></tr>
<tr><td>3</td><td>Sulphur dioxide (SO_2)</td><td>mg /m^3</td><td>0.041</td><td>0.049</td><td>0.3</td></tr>
<tr><td>4</td><td>Ozone (O_3)</td><td>mg /m^3</td><td>0.037</td><td>0.053</td><td>0.2</td></tr>
<tr><td>5</td><td>Dust (TSP)</td><td>mg /m^3</td><td>0.028</td><td>0.083</td><td>0.33</td></tr>
<tr><td>6</td><td>Dust (PM10)</td><td>mg /m^3</td><td>0.028</td><td>0.044</td><td>0.05</td></tr>
<tr><td>7</td><td>Dust (PM2.5)</td><td>mg /m^3</td><td>0.025</td><td>0.029</td><td>0.5</td></tr>
</table>
Source: IEIA Report (2021)

In the project area, all parameters are within the standard, however the level of PM10 at Intake site is slightly under the standard. Thus, dust pollution control during construction is required.
</td></tr>
<tr><td>9</td><td>Water pollution</td><td>
PPWSA conducts water quality tests of Tonle Sap River as raw water source. The raw water quality recorded at Phum Prek WTP during 2017-2020 shows following characteristics.

・pH is relatively high with the lowest values continuously over 7.0. On the other hand, highest values are slightly over 8.0 even in the late dry seasons (Dec.-Apr.) when sunshine duration is longer and the photosynthesis by phytoplankton is actively carried out.

・Turbidity lowers in the dry seasons with the values from 20 to 100NTU. It increases in the wet seasons with the values over 200NTU in many cases and over 1,000NTU in some cases. Since the turbidity values shifts in a wide range, it is required to adjust the dosage rate of the coagulant accordingly.

・Ammonium nitrogen (NH_4-N) shifts from <0.1 to 1.2mg/L with various trends in different months. This shift makes the forecast so difficult that the attention should be kept because the concentration of NH_4-N affects the chlorination operation.

Thus, the water quality is not excellent but good enough for raw water for treatment which indicates the pollution is not significant in the river.

For the detail of water quality, refer to **2-1-2-4**.
</td></tr>
<tr><td>10</td><td>Soil pollution</td><td>
During construction phase, by solid waste management, sludge will be well kept in an isolated place. For the management of discharged water with sludge, PPWSA will set up a sludge thickener with a storage capacity of up to 480 cubic meters, and then the solid waste will be collected and transported to the landfill.
During operation phase, wastes produced by the main activities that could affect the environment include (1) all types of oil leakage or spill used by PPWSA, (2) sludge from the treatment site, (3) solid waste and wastewater from the office building and (4) wastewater from cleaning and filter backwashing. Based on the water treatment plant plan, additional treated water is 45,000 m^3/day, and produced sludge will be approximately 350-400 m^3/day.
Subsequently, clear supernatant from sludge will be drained to the existing discharge drainage system while the bottom sludge of basin will be managed and collected to be used as fertilizer for agricultural crops and in case of oversupply, it will be collected and transport to landfill under the direction and coordination from MoE and/or PPDoE accordingly.
</td></tr>
<tr><td>11</td><td>Waste</td><td>
During construction phase, produced solid by excavation will be used for backfilling. The extra sludge to be disposed for landfilling during construction will be totally 20,200 m^3.
During operation phase, sludge from WTP will be managed and collected to be used as fertilizer for agricultural crops and in case of oversupply, it will be collected and transport to landfill under the direction and coordination from MoE and/or PPDoE accordingly.
</td></tr>
<tr><td>12</td><td>Noise and vibration</td><td>
Noise standard of Cambodia and Japan is shown in the following table. All components of the Project is located in category “4” as “heavy industries mixed with residential areas”. In addition, there is no
</td></tr>
</table>

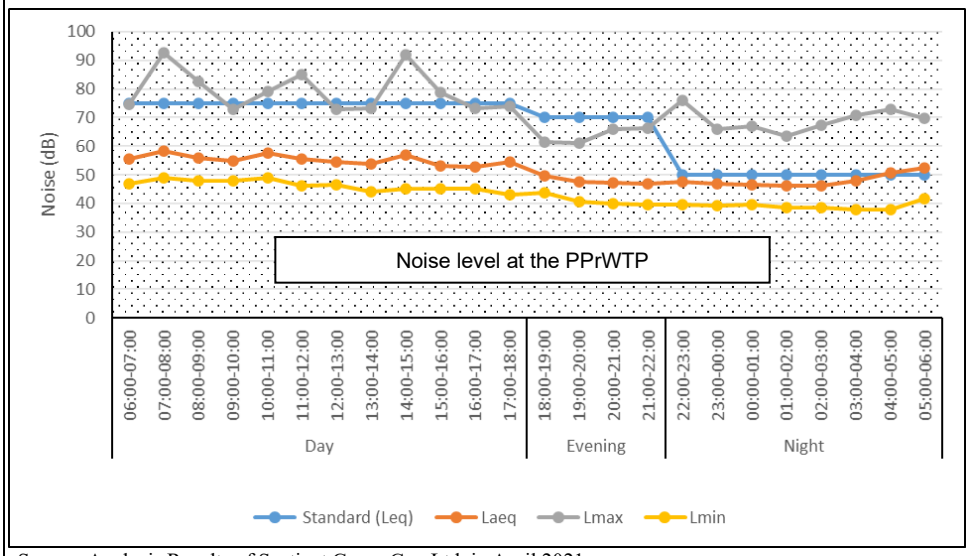
No.	Impact Item	Results of Assessment

standard for vibration in Cambodia.

No.	Location	Duration		
		6:00-18:00	18:00-22:00	22:00-6:00
1	Silent areas (hospitals, schools, libraries and kindergartens)	≤ 45 (50)[1)]	≤ 40 (50)	≤ 35 (40)
2	Residential area (hotel, administration offices, villa, apartment)	≤ 60 (55)	≤ 60 (55)	≤ 45 (45)
3	Mixed commercial, business and service areas	≤ 70 (65)	≤ 65 (65)	≤ 50 (60)
4	Heavy industries mixed with residential areas	≤ 75 (70)	≤ 70 (70)	≤ 50 (65)

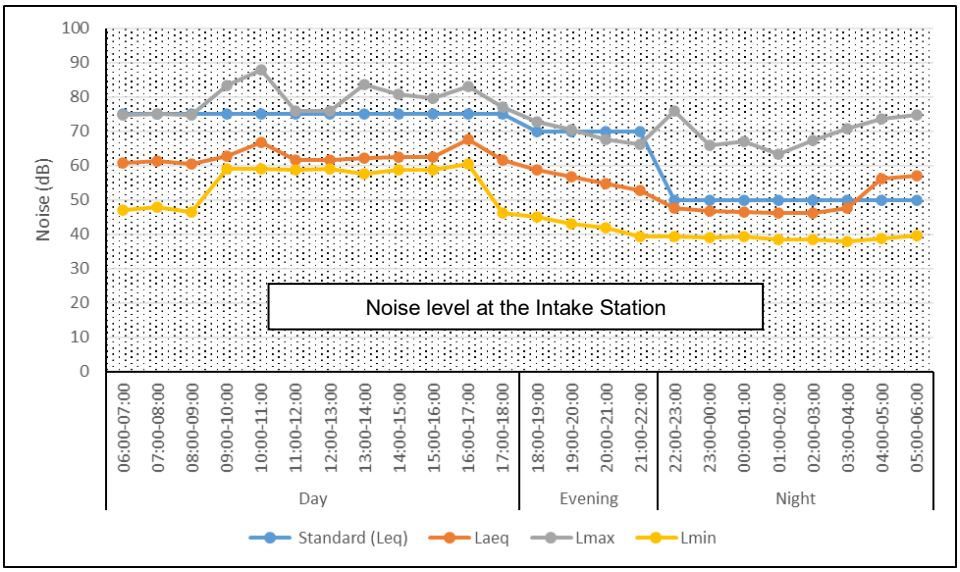
Source: MoE, 1): Japanese noise standard.

In this project, a noise survey was conducted at the WTP site and the intake site. The results are summarized in the following figure.



Source: Analysis Results of Sustinat Green Co., Ltd, in April 2021

As shown in the Figure above, the average noise is below the allowable standard at daytime standard and for night time standard the results showed that the noise is approximately at the same level and a little more than standard in the night from 4pm to 6pm because of wind and little seasonal raining.



Source: Analysis Results of Sustinat Green Co., Ltd, in April 2021

The average noise is below the allowable standard at daytime standard and for night time

No.	Impact Item	Results of Assessment
		standard the results showed that the noise is approximately at the same level and a little more than standard in the night from 4am to 6am because of traffic near project area.

出典：調査団

2-2-3-1-8 影響評価

1-4-1-8 の調査結果に基づき、本事業による環境社会影響を評価した。その結果を**表 2-2.11** に示した。また、スコーピング時の影響評価も併記した。

表 2-2.11 影響評価の結果

No.	Item	Assessment in Scoping Phase		Assessment by Survey Results		Contents
		P&C	O	P&C	O	
Social Environment						
1	Resettlement			N/A	N/A	-
2	Local economy (employment and livelihood etc.)	✓		B-	N/A	**Construction (C) :** The construction of the WTP may create traffic disruption. Preparation of a detailed traffic control plan and construction schedule are needed.
3	Land use and utilization of local resources (fishing)	✓	✓	B-	B-	It was confirmed that no major fishing activities were conducted at the upstream and downstream. (only household or non-license fishing activities were evident) **C :** Impacts on fish resources may occur by the construction of the raw water intake located on the Tonle Sap River, possible sources of the impacts are; land erosion due to land clearing, land reclamation, building construction, storage of fuel and waste from workers, waste from construction, wastewater from bathing, laundry, toilets and so on. **Operation (O) :** The activities of intake facility operation might affect aquatic biodiversity resources of Tonle Sap River, caused by fuel leakage during repairing of intake pumps. However, impacts can be minimized by mitigation measures.
4	Water usage/water right	✓	✓	D	D	**C :** Major water usage such as commercial fishing activities were not conducted **O :** Additional intake of 0.26% of monthly minimum flowrate of the River will not have significant impacts on water usage. Approval letters will be obtained from Cambodia National Mekong Committee and MOWRAM.
5	Social institutions			N/A	N/A	-
6	Existing social infrastructures and services (such as traffic etc.)	✓	✓	B-	D	**C :** In some possible roads affected by the construction, traffic congestion was observed. Therefore, some measures should be taken. On the other hand, enough width for alternative lanes were found for all the roads. **O :** The impacts on traffic are expected to be very limited as well as before the Project.
7	Poor households		✓	N/A	B+	**O :** Total number of Poor 1 (very poor) and Poor 2 (poor) householders in vicinity of the Project is 122. The WTP will be constructed by using Japanese Grant Aid, which will reduce the financial pressure of PPWSA, allowing it to set lower tariff to the public. PPWSA has also set appropriate water tariff system and house connection fee for low income households. Therefore, the impacts are expected to be positive.
8	Indigenous, or ethnic people			N/A	N/A	-
9	Misdistribution of benefit and damage			N/A	N/A	-

No.	Item	Assessment in Scoping Phase		Assessment by Survey Results		Contents
		P&C	O	P&C	O	
10	Local conflict of interests			N/A	N/A	-
11	Gender			N/A	N/A	-
12	Children's rights			N/A	N/A	-
13	Cultural heritage			N/A	N/A	-
14	Infectious diseases such as HIV/AIDS	✓		B-	N/A	**C :** Education and control measures according to the law should be applied and the impacts are considered to be mitigable and limited. Also, prevention of various infectious disease, especially COVID-19 in the project site should be considered.
15	Accidents (risk etc.)	✓	✓	B-	B-	**C :** Some safety measures should be taken to prevent accidents. **O :** SPC will transfer Japanese O/M know-how to PPWSA staff to ensure safe operation of the facilities. PPWSA will also conduct monitoring on working environment.
Natural Environment						
16	Geographical features			N/A	N/A	-
17	Ground subsidence			N/A	N/A	-
18	Bottom sediment			N/A	N/A	-
19	Biota and ecosystem	✓	✓	B-	B-	**C :** During construction phase, impacts on fish resources may occur by the construction of the raw water intake located on the Tonle Sap River. **O :** The activities of intake facility operation might affect aquatic biodiversity resources of Tonle Sap River, caused by fuel leakage during repairing of intake pumps. However, there are no endangered species around the river and impacts can be minimized by mitigation measures.
20	Meteorology (global warming)			N/A	N/A	-
21	Landscape			N/A	N/A	-
22	Protected areas			N/A	N/A	-
Pollution						
23	Air pollution	✓		B-	N/A	**C :** Equipment, vehicles, and excavation activities will generate limited amounts of dust and exhaust.
24	Water pollution	✓	✓	B-	B-	**C :** The amount of wastewater generated from the construction site is estimated to be very limited and treated. **O :** Backwash water will be treated before discharging applying the standard. Therefore, the impacts of the Project are expected to be very small.
25	Soil pollution	✓	✓	B-	B-	**C :** Extra sludge will be well kept in an isolated place. For the management of discharged water with sludge, PPWSA will set up a sludge thickener with a storage capacity of up to 480 cubic meters, and then the solid waste will be collected and transported to the landfill. **O :** Sludge produced through water treatment process should be disposed to landfill sites according to the related regulation (Sub Decree No.235 on Drainage Control and Wastewater Treatment System) Thus, the impact is considered to be not significant.
26	Waste	✓	✓	B-	B-	**C :** Large portion of surplus soil waste will be reused for backfilling at construction sites. For the management of discharged water with sludge, PPWSA will set up a sludge thickener with a storage capacity of up to 480 cubic meters, and then the solid waste will be collected and transported to the landfill. **O :** PPWSA will collect and transport sludge to the landfill site. In addition, now PPWSA is preparing a plan to sell sludge to local construction company who intends to reuse sludge as backfilling materials. Thus, the impact is considered to be not significant.

No.	Item	Assessment in Scoping Phase		Assessment by Survey Results		Contents
		P&C	O	P&C	O	
27	Noise and vibration	✓		B-	N/A	**C :** There are no sensitive facilities such as (hospital or school etc.) adjacent to the construction sites. Noise level at the WTP site and the Intake site in the daytime are approximately 20 dB and 15dB (respectively) lower than the standard. Generation of noise and vibration should be mitigated by low noise equipment and slower traffic. On the other hand, there are still margins to the standard value.
28	Offensive odor			N/A	N/A	-

P & C : Pre-construction and construction phase
O : Operation phase
A+/- : Significant positive/negative impact is expected.
B+/- : Positive/negative impact is expected to some extent.
C+/- : Extent of impact is unexpected, further study is needed
D : Limited/ negligible impact, further study is not needed.
N/A : Impact assessment is not conducted because the item was categorized as D in scoping phase.
出典：調査団

2-2-3-1-9 緩和策（環境管理計画）および実施のための費用

本プロジェクトの環境へのマイナス影響を回避・最小化するための緩和策を以下に提案する（**表 2-2.12** 及び**表 2-2.13**）。

表 2-2.12 本プロジェクトにおける環境社会影響に対する緩和策（工事中）

No.	Item	Proposed Mitigation Measures	Implementing & (Inspection) Organization	Estimated Cost (USD/year)
Social/natural Environment				
1	Local economy / Land use and utilization of local resources (fishing) / Water usage/ Biota and ecosystem	1) Design riverbank protection to prevent land erosion 2) If worker camp is needed, locate accommodation of construction workers with distance of at least 20m from Tonle Sap River. 3) Prepare temporary toilets or a septic tank for staff-worker for daily use. 4) Prepare location for fuel and fuel residue storage tanks. 5) Waste from construction activities, such as rubble from excavations, will be cleared immediately after construction 6) Educate staff-workers on the implementation of sanitary measures in the construction field.	Contractor (PPWSA & communes)	No additional cost for EMP
2	Existing social infrastructures and services (such as traffic etc.)	The construction of the WTP may create traffic disruption. 1) Prepare a detailed traffic control plan and to coordinate with local government. 2) Prepare proper construction schedule and methods to reduce traffic disruption and traffic accident. 3) Assign traffic control person at the entrance of the sites while construction is taking place. 4) Cooperate with the Traffic Police to facilitate traffic.	Contractor (PPWSA, Traffic Police Office, communes)	No additional cost for EMP
3	Infectious diseases such as HIV/AIDS	1) Prepare appropriate manning plan. 2) Educate staff/workers on the sanitation safety. 3) Set up regularly inspection etc.	Contractor (PPWSA, supervised by MISTI)	No additional cost for EMP
4	Accidents (risk etc.)	1) Prepare appropriate construction plan. 2) Educate staff/workers on the safety. 3) Set up regularly inspection etc.	Contractor (PPWSA, supervised by MISTI)	No additional cost for EMP
Pollution				
1	Air pollution	1) Cover stored materials with plastic or other materials. 2) Cover trucks, and to spray exposed areas with water. 3) Wash vehicles before going out the construction site.	Contractor (MoE/PDE, PPWSA)	No additional cost for EMP

No.	Item	Proposed Mitigation Measures	Implementing & (Inspection) Organization	Estimated Cost (USD/year)
		4) Minimize traffic over freshly exposed surfaces. 5) Install barrier walls for limiting wind dispersing if necessary. 6) Prepare air quality monitoring plan and carry it out during construction. (for details, see Environmental Monitoring Plan)		
2	Water pollution	1) Steel sheet pile will be installed to prevent scouring on the bottom of the main body. 2) Carry out water quality monitoring. 3) Temporary toilets will be placed to store domestic wastewater during construction.	Contractor (MoE/PDE, PPWSA)	No additional cost for EMP
3	Waste	1) Prepare reasonable plan for solid waste disposal, especially for excavated soil. 2) Install temporary toilets at the construction site for workers, and set sanitary bins for domestic wastes. 3) Dispose solid wastes appropriately.	Contractor (MoE/PDE, PPWSA)	PPWSA may benefit from it (selling the wastes to buyer)
4	Noise and vibration	1) Prepare a detailed plan for noise control and coordinate with local government. 2) Prepare proper construction schedule and methods. 3) Set speed limits for vehicles and train workers on mitigation measures for environmental impacts. 4) Use low noise level equipment, if necessary. 5) Prepare noise monitoring plan and carrying out monitoring during construction.	Contractor (MoE/PDE, PPWSA)	No additional cost for EMP

出典：調査団

表 **2-2.13** 本プロジェクトにおける環境社会影響に対する緩和策（供用時）

No.	Item	Proposed Mitigation Measures	Implementing & (Inspection) Organization	Estimated Cost (USD/year)
Social/natural Environment				
1	Land use and utilization of local resources (fishing) / Biota and ecosystem	1) Monitor the sources that could lead to the leakage of oil into the water body. 2) Prohibit the disposal of fuel residue into Tonle Sap River that affects both the quality of water to be used and the water quality of downstream Tonle Sap River.	Operator (PPWSA, supervised by MISTI)	No additional cost for EMP
2	Water usage/water right	1) Monitor the water level (flowrate) of Tonle Sap River. 2) Monitor the water usage around the Intake facility.	Operator (PPWSA, supervised by MISTI)	No additional cost for EMP
3	Accidents (risk etc.)	1) Prepare appropriate O/M plan. 2) Educate staff/workers on the safety. 3) Set up regularly inspection etc.	Operator (PPWSA, supervised by MISTI)	No additional cost for EMP
Pollution				
1	Water pollution	1) Keep the facilities and equipment in good condition. 2) Carry out water quality monitoring for raw water and discharged water.	Operator (MoE/PDE, PPWSA)	No additional cost for EMP
2	Soil pollution / Waste	1) Prepare reasonable plan for solid waste disposal, especially for sludge. 2) Thickened sludge will be transported to the landfill site by PPWSA or sold to local construction company as backfilling materials. Thus, check the volume of sludge transported.	Operator (MoE/PDE, PPWSA)	PPWSA may benefit from it (selling the wastes to buyer)

出典：調査団

2-2-3-1-10 モニタリング計画および実施のための費用

前項に環境管理計画として示した項目を実施するに当たり、必要となるモニタリング計画を**表 2-**

2.14 に示した。内容に関しては、今後の詳細設計等の段階で変更や追加が必要となることが予想され、適宜変更するものとする。

表 2-2.14　モニタリング計画（案）

Monitoring Parameter	Monitoring Location	Monitoring Parameter	Compliance Standards	Monitoring Frequency	Implementing & (Inspection) Organization	Estimated Cost (USD/year)
Pre & During Construction Phase						
Water environment	(1) at the Intake site	Any impacts to Sap Riv. (visual observation)	-	During working hours of each day	Contractor (PPWSA)	No additional cost for EMoP
Traffic	(1) at the entrance of the WTP (2) at the entrance of the Intake facility	Traffic status (visual observation)	-	During working hours of each day	Contractor (PPWSA, Traffic Police Office)	No additional cost for EMoP
Infectious diseases	(1) at each site (2) at each worker camp	Records of educational training		Once, at the beginning of working, Once/3 months during construction	Contractor (PPC-DoH, PPWSA)	No additional cost for EMoP
Accidents	(1) at the WTP (2) at the Intake facility	Items on the checklist	-	Each day during construction	Contractor (PPWSA)	No additional cost for EMoP
Air quality	(1) at the WTP boundary (2) at the Intake facility boundary	CO, NO_2, SO_2, O_3, TSP, PM10 and PM2.5	Sub-Decree No. 42 on Air Pollution Control and Noise Disturbance	Once, preconstruction : Once/6 months during construction	Contractor (MoE/PDE, PPWSA)	1,500 USD / time x 2 places x (1+2) times = 9,000 USD / year
Water pollution	(1) at downstream of the Intake	pH, DO, SS, turbidity, COD, NH_4-N, Coliform	Sub-Decree No. 42 on Water Pollution Control	Once, preconstruction : Once/6 months during construction	Contractor (MoE/PDE, PPWSA)	500 USD / time x (1+2) times = 1,500 USD / year
Waste	(1) at the WTP (2) at the Intake facility	Volume of wastes	-	Once/week	Contractor (MoE/PDE, PPWSA)	No additional cost for EMoP
Noise	(1) at the WTP boundary (2) at the Intake facility boundary	Equivalent continuous A sound level ($L_{aeq, 10}$)	Sub-Decree No. 42 on Air Pollution Control and Noise Disturbance	Once, preconstruction : Once/6 months during construction	Contractor (MoE/PDE, PPWSA)	1,500 USD / time x 2 places x (1+2) times = 9,000 USD / year
During Operation Phase						
Water environment	(1) at the Intake site	Any impacts to Sap Riv. (visual observation)	-	During working hours of each day	Contractor (PPWSA)	No additional cost for EMoP
Water usage	(1) at the Intake facility	Water level	-	Each day during operation	Operator (PPWSA)	No additional cost for EMoP
Accidents	(1) at the WTP (2) at the Intake facility	Items on the O/M manual	-	Each day during operation	Operator (PPWSA)	No additional cost for EMoP
Water pollution	(1) WTP discharged water	pH, DO, SS, turbidity, COD, NH_4-N, Coliform	Sub-Decree No. 42 on Water Pollution	Once/3 months	Operator (MoE/PDE, PPWSA)	500 USD / time x 4 times = 2,000 USD / year

Monitoring Parameter	Monitoring Location	Monitoring Parameter	Compliance Standards	Monitoring Frequency	Implementing & (Inspection) Organization	Estimated Cost (USD/year)
			Control			
Waste	(1) at the gate of the WTP	Volume of wastes	-	In each case of disposal	Operator (MoE/PDE, PPWSA)	No additional cost for EMoP

出典：調査団

2-2-3-1-11　ステークホルダー協議

事業内容説明・情報公開、また社会的合意を目的として複数回の協議を行った。当該期間に当たる 2021 年 5 月～6 月はプノンペンにおいて COVID-19 の感染拡大が懸念されていたため、従来の集会型の会議を避け、個別（少人数）、電話、オンラインの形式による協議を行った。事業内容に対するステークホルダーの理解を促進し、より多くのフィードバックを得るため、環境社会配慮を含む調査結果を説明した。質疑応答が活発になされ、工事に伴う一時的な不便などへの懸念が示されたものの、プロジェクト実施に対して概ね賛成が得られた。

それぞれの会議形態は、個別ステークホルダー会議として、プロジェクト対象地区の住民代表との協議は当該地区における web インフラの未発達および不慣れによる会議の混乱を避けるため、代表者協議とした。さらにプノンペン環境局をはじめとする関係者を対象に公聴会形式にて行った。なお、補足として JICA カンボジア事務所との協議、公聴会結果報告を行った。それぞれの協議の概要を**表 2-2.15** に示す。

表 2-2.15　ステークホルダー協議の概要

Date, Venue, Participants	Key Concern and Suggestion	Response
Stakeholder meeting with local resident representatives		
On May 19th, 2021 (9:40 am) - Sustinat Green Co., Ltd. (SG) National Experts - Ms. In Saphorn, Srah Chork commune chief (face-to-face meeting)	There are concerns about the interruption of water use, business and traffic jam for people who living along raw water transmission (RWTM)s routes and also the public hospital service. (around 125 families are living along the st.88 and the st.61 to st.75 belong to Village 9 and also a Kantha Bopha hospital 1)	- Response from PPWSA, the pipe installation will have conducted in existing route, and destitution system will be remaining for securing the clean water supply to local particularly those live on the RWTM installation ways. - The impact could be short term, and mitigation could be adopted by accelerating the installation. - each recommendation is inserted into the EMP.
	Srah Chork commune chief expressed strongly support for the project and provide the recommendations as following; - Arrange the name list of worker or related documents to the commune chief, district chief and city hall when process the project. - PPWSA should request to city hall for execution of all construction of whole project as it is under the administrative of City Hall. - PPWSA should inform to the commune chief of Srah Chork and Wat Phnom during execution of construction to observe the impaction of the project. - Due to the st.47 to st.61 is closed, thus, PPWSA should cooperate with Kantha Bopha hospital 1 to reduce the traffic jam. - the installation of new RWTM could lead to the interruption the water use of people living there - PPWSA need to arrange Staffs to coordinate the traffic flow.	
On May 20th 2021 (9:00 am) - SG National Experts - Mr. Bun Sombo, Wat Phnom commune chief	Wat Phnom commune chief had worried that the installation of raw water transmission mains can disturb people who doing the household business along the st.88 (around 61 families are living along the st.88 and the st.61 to st.75 belong to Village 9)	- As indicated from PPWSA, people living along the road, and they utilize the road pavement for some informal business, - The impact could be short term, and mitigation could be adopted by accelerating the installation.
	He will cooperate with PPWSA and JICA for	

Date, Venue, Participants	Key Concern and Suggestion	Response
(The meeting via telephone meeting)	processing this project. Therefore, he had some suggestions as following; - Arrange the requested document to Srah Chork commune chief and city hall. - Coordinate and solve the people's problem who living around the on the project pipe route (Ex: provide the compensation for them in case of any damage).	- Considerations for each recommendation is discussed in this IEIA and inserted into the EMP. - No question
May 20th 2021 (10:00 AM) - SG National Expert - Ms. Mech Sokha, Phum 9 Village chief in Songkat Srah Chork (The meeting via telephone meeting)	Mrs. Mech Sokha visited the project area and She was aware of the presence of the project.	- Each recommendation is inserted into the EMP. - No question
	The impact on the sound is unaffected, but the dust from the transport of rocky sand also requires proper management. However, it can be cause traffic jam for short time, mostly at seven o'clock for starting work in the morning or in the event of an accident.	
	There are some suggestions such as: - Help decrease the price of water supply - Attention to the dust problems caused by various transportation.	
May 20th 2021 (10:30 AM) - SG National Expert - Mr. Keo Buntheoun, Phum 10 Village chief in Sangkat Wat Phnom (The meeting via telephone meeting)	Mr. Keo Buntheoun is concerned that construction or expansion of piped water could cause shortage of water or disconnection for some time and damage to roads due to clearing or the main connection. He worried that the installation of raw water transmission mains can disturb people who doing the business around the project site (along the st.88)	- The impact could be short term, and mitigation could be adopted by accelerating the installation. - Each recommendation is inserted into the EMP - No question
	He supported 100% of the project to serve the water demand for people in the village to get clean water and safety.	
Public Consultation meeting with Related Department of Phnom Penh		
- 25th May 2021 at 8:30 AM - (22 Participants include 3 females) - Meeting under coordination from PPDoE - list of organizations of participants are; From Phnom Penh Department of Environment (PPDoE), ➢Head Office, ➢Pollution Control Office, ➢Solid Waste Mgmt Office, ➢Water Quality Mgmt Office. From Phnom Pehn City; ➢Dep. of Industry, Science, Technology and Innovation ➢Dep. of Mines and Energy ➢Dep. of Labour and Vocational Training ➢Dep. of Agriculture, Forestry and Fisheries ➢Dep. of Public Work and Transportation ➢Dep. of Planning ➢Dep. of Water Resources and Meteorology ➢Dep. of Women Affairs ➢Dep. of Health Waste and Env. Mgmt Office of PP Municipality PP Road Traffic Police Office Public Work, Transportation, Sanitation, Env. and Public Order of Khan Daun Penh.	1) Traffic issue and accessibility, occupation of families along the RWTM line	PPWSA response - The project will not impact too much for travelling because construction site is not on the big road. - Arrange the staff for traffic improvement. - The impact could be short term, and mitigation could be adopted by festering the installation.
	2) Apply permit from MoE (Waste discharge permit)	- PPWSA will work closely with MoE for any guideline and law in force from MoE.
	3) Apply and adhere to sub-degree No. 235 date on December 25, 2017 about sewage management system and wastewater treatment system.	- General Suggestion.
	4) Air, noise and vibration control during contraction and operation	Reponses: Air, Noise control plan will be prepared by contractor and PPWSA will conduct regular inspection.
	5) Bank protection at Intake station	PPWSA and JICA also have detail study for better design and bank protection.
	6) Sand, soiled Transported truck management	Suggestion
	7) Drainage designed and effluent management 8) Solid, liquid and sludge proper management	- With the current and existing WTP, its own drainage is already in place and used. No any problem with public drainage. - PPWSA will use its owned the existing underground basin for effluent and sludge collection, the clear water will be drained in existing drainage to Tonle Sap River. - With expansion of 45000 m^3, less sludge is generated.
	9) Staff/worker safety and health, the Covid-19 safe measure	PPWSA adopted all the regulation and measure imposed by MoH and Government.
	10) Chemical use in treatment and complaint water quality from foreigner and water pressure.	- PPWSA always apply and obey WHO standard for water quality check. - Water pressure is challenging particularly for High rise building- suggest having storage tank. - Most foreigners live in apartment which storage tank is equipped resulted in water quality issue, PPWSA used to solved many of those issued by advice to proper clean of tank.
	11) Good Cooperation with local related authorities, advanced informed, report and responsive to related environment and social issue may occurs.	PPWSA: Applied the permit from Phnom Penh municipality for all civil work for all project components.

Date, Venue, Participants	Key Concern and Suggestion	Response
PPWSA Nihon Suido Consultants Sustinat Green - Online meeting-(Telegram Base Meeting)		
Stakeholder meeting with JICA		
June 25th 2021 (4:30 PM, local time) - Mr. Say Bora - Ms. Tokumoto Aya - Piseth Som - Chandara Ty (Microsoft Team meeting)	1) Who were invited during the public consultation meeting?	Sustinat Green clarification: 22 personals from related department of Phnom Penh, local authority, project owner and consultant.
	2) Will the project involve the relocation or resettlement along the new raw water transmission mains?	Sustinat Green clarification: according to the plan and information from PPWSA, there will be no any relocation or resettlement along the new raw water transmission mains because the new pipe installment will be executed within the alignment existing route.

出典: IEIA Report by Sustinat Green Co., Ltd. (2021)

2-2-3-2　用地取得・住民移転

本プロジェクト予定地は、PPWSA が所有する既存浄水場および取水施設の敷地内であり、用地取得や住民移転は発生しない。

2-2-3-3　その他

2-2-3-3-1　モニタリングフォーム（案）

モニタリングフォーム（案）を**添付資料 6-5** に記載する。

2-2-3-3-2　環境チェックリスト

環境チェックリストを**添付資料 6-3** に記載する。

2-2-3-3-3　環境社会配慮関連の今後の予定

現地再委託による初期環境影響評価（IEIA）調査は、2021 年 9 月にフィールド調査を終了した。

2-2-3-4　気候変動の適応策について

JICA の気候変動対策支援ツール／適応策「気候リスク評価・適応策検討のガイダンス」（2019 年）に基づく気候リスク評価、適応策の検討結果は次のとおりである。

(1)　当該プロジェクトにおける事業方針

(a)　事業の方針、プロジェクトの評価

事業の方針を**第 3 章**に、プロジェクトの評価を **4-4** に示す。

(b)　実施工程計画

実施工程計画を **3-2-4-4** に示す。

(c)　実施工程計画のうち、人材育成等、技術支援活動などのソフトコンポーネント

本件にはソフトコンポーネントは含まれない。

(d)　当該プロジェクトの対象地域

当該プロジェクトの対象地域を **2-2-3-1-1** に示す。

(e)　当該プロジェクトの実施体制、運営機関

実施機関は PPWSA であるが、施設完成後から 10 年間は特別目的会社（以下、「SPC」）が事業運営を実施する。また気候関連のリスクは MoE が管轄する。

(f)　カウンターパートとの情報共有

カウンターパートである PPWSA と気候変動の適応策について、情報共有を行っている。

(2)　当該プロジェクトにおける「曝露」

気候関連のハザードにさらされうると考えられるプロジェクトのコンポーネントは、取水場、浄水場である。

(3)　当該プロジェクトに関わる「ハザード」

気候ハザードは、気温の変化と降雨量の変化を想定する。カンボジア国における過去（1991 年～2020 年）の平均降雨量及び平均気温を**図 2-2.13** に示す。

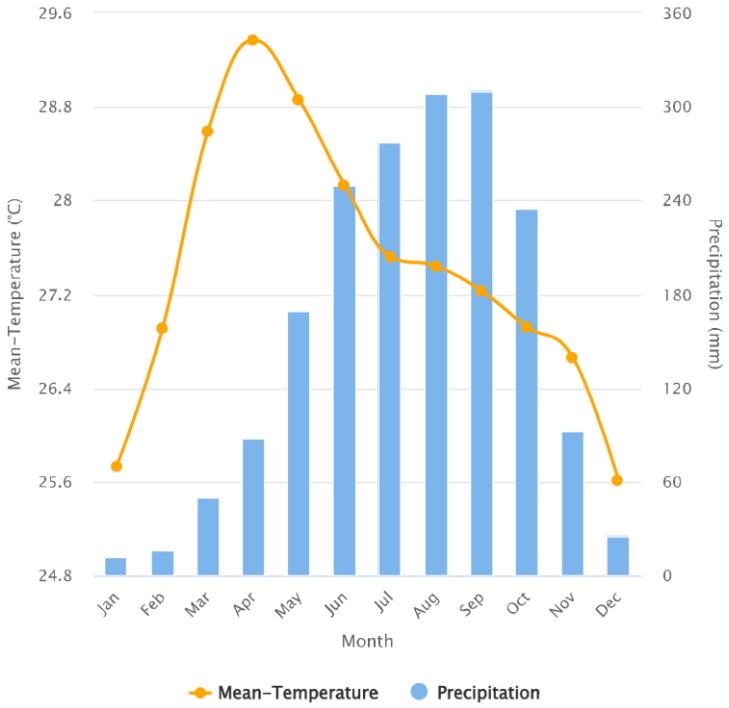


図 2-2.13　カンボジア国の平均降雨量と平均気温(1991~2020)

出典：World Bank, Climate Change Knowledge Portal

Climate Change Knowledge Portal では、カンボジアの平均気温は 2060 年までに 0.7 から 2.7℃、2090 年までに 1.4 から 4.3℃ 上昇すること、月平均降雨量の変化量は 2049 年から 2059 年に-47mm から +80mm（**図 2-2.14**）、2080 年から 2099 年に-65mm から+130mm（**図 2-2.15**）と予測しており、降雨量の下降トレンドは認められない。よって、水源の水量が将来にわたり十分確保可能であると判断ができ、取水に問題が発生する可能性は、僅少と考えられるため、干ばつへの懸念は想定されない。

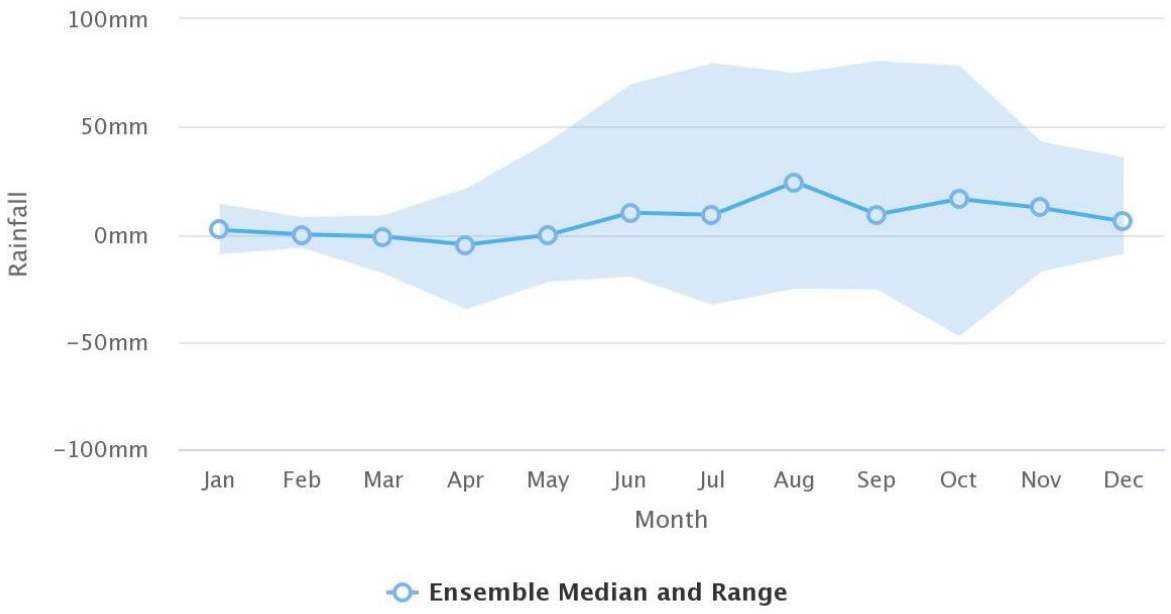


図 2-2.14　カンボジア国における平均月降水量の変化量予測（2049 年から 2059 年）

出典：World Bank, Climate Change Knowledge Portal　（RCP8.5 シナリオ、ensemble モデル）

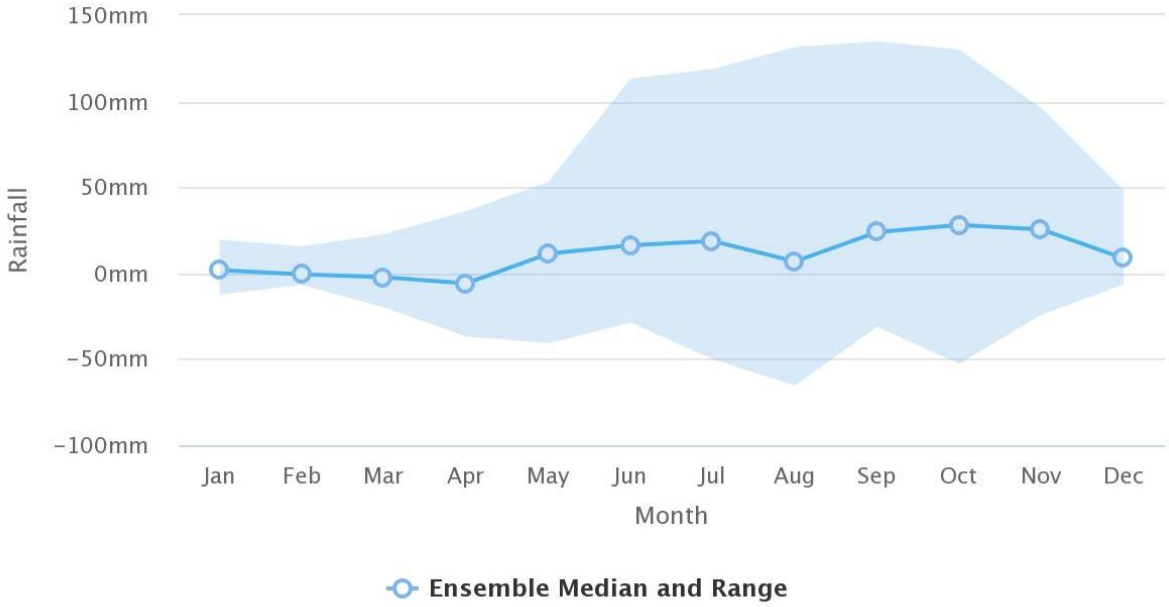


図 2-2.15　カンボジア国における平均月降水量の変化量予測（2080 年から 2099 年）

出典：World Bank, Climate Change Knowledge Portal　（RCP8.5 シナリオ、ensemble モデル）

(4)　気候リスク評価のマトリクスを用いた「気候リスク評価」

気候リスク評価マトリクスを**図 2-2.16** に示す。

		気候ハザード（Hazard）						
		H1 気温の変化	H2 降雨量、降雨パターンの変化、洪水の発生	H3 降雨パターンの変化に伴う河川流量の変動				
	現状での発生状況（頻度等）	+	+	+	脆弱性（Vulneralibility）		今後重要（顕著）となりうる気候リスク（Climinate Risk）	適用オプション候補（Potential Adaption Option）
	将来の見込み	→	↗	↗	・過去・現在の取り組み、対処状況 ・計画している取り組み	カウント		
暴露（Exposure）	E1 取水場	0 ↗	2 ↗	1 ↗	・降雨パターンの変動による水位の変化 ・水位変動による洪水の発生 ・高濁度による原水水質の悪化 ・洪水の発生による機器の故障	2	・高濁度による取水の停止 ・洪水の発生による機器の故障の発生	・河川水位、水質をモニタリングするための計装機器の設置 ・高濁度発生時のリスク対応や運転管理計画の作成 ・送水連絡管による各浄水場からの相互送水をできるようにする。 ・機器故障時に即修繕対応が可能なようにスペアパーツの整備
	E2 浄水場	0 ↗	2 ↗	1 ↗	・降雨パターンの変動、水位変動による高濁度の発生に伴う原水水質の悪化、浄水水質の異常 ・洪水の発生による機器の故障	2	・高濁度による浄水場の停止 ・洪水の発生による機器の故障の発生	・高濁度発生時のリスク対応や運転管理計画の作成 ・送水連絡管による各浄水場からの相互送水をできるようにする。 ・機器故障時に即修繕対応が可能なようにスペアパーツの整備
	カウント	0	2	1				

図 2-2.16　気候リスク評価のマトリクス

出典：JICA Climate FIT を基に調査団作成

1)取水場の脆弱性について

取水場の気候ハザードの H2 降雨量、降雨パターンの変化、洪水の発生、H3 降雨パターンの変化に伴う河川流量の変動についての脆弱性について以下に示す。

・降雨パターンの変化により、雨期において水位の変動が発生する可能性がある。
・水位変動による洪水の発生リスクが高まる可能性がある。
・上記の内容により、取水が予想外の高濁度となり、原水水質の悪化が懸念される。
・洪水の発生により、設置機器が浸水して、故障が発生することが懸念される。

2)浄水場の脆弱性及び対応について

浄水場の気候ハザードの H2 降雨量、降雨パターンの変化、洪水の発生、H3 降雨パターンの変化に伴う河川流量の変動についての脆弱性及び対応について以下に示す。

・取水場の脆弱性に示した降雨パターンの変動、水位変動により、取水が高濁度となり、原水水質の悪化や浄水水質の異常となることが懸念される。
・洪水の発生により、設置機器が浸水して、故障が発生することが懸念される。

3)今後重要となりうる気候リスク

上記 1)、2)の脆弱性による気候リスクとしては、高濁度による取水場、浄水場機能の停止が考えられる。理由としては、降雨パターン変化、水位変動により、取水を行うトンレサップ川が高濁度となることが懸念される。高濁度が継続されると、取水を行っても、浄水場で適切な処理が行うことができなくなる。よって、取水場及び浄水場の停止となり、必要な水量を確保することが困難となる。

また、洪水の発生により、取水場、浄水場の機器が浸水して、故障が発生することが懸念される。

(5)　「気候リスクツリー」について

「気候リスクツリー」は、次のとおりである。

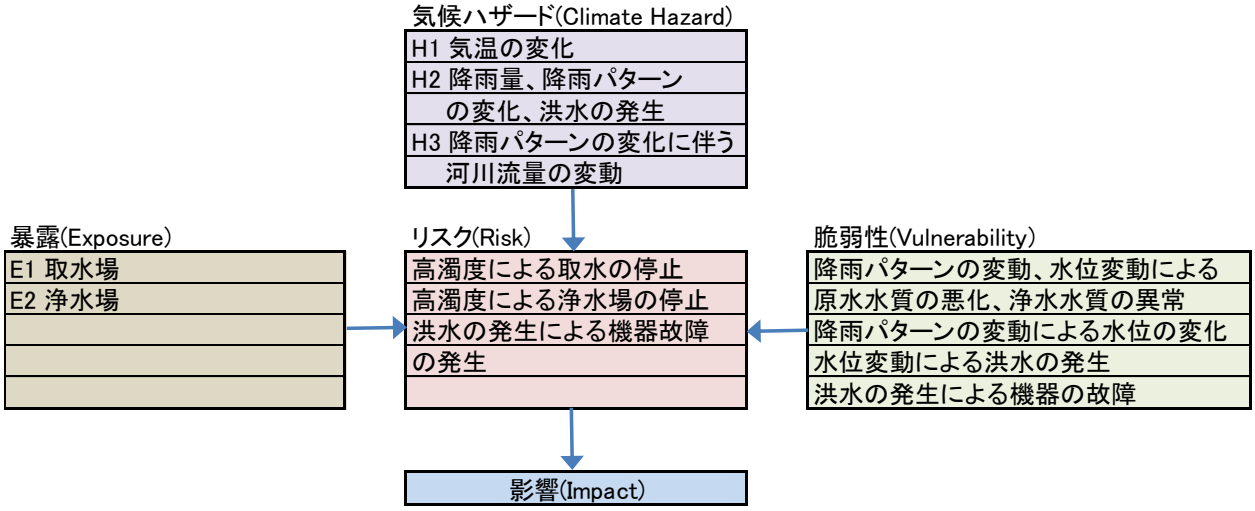


図 2-2.17　本プロジェクトにおける気候リスクツリー

出典：JICA Climate FIT を基に調査団作成

(6)　「適応オプション」について

考えられる「適応オプション」は次のとおりである。

リスク	対象 JICA 事業で将来重大となりうると考えられる影響気候リスク	気候リスクに対する適応オプション	対応する SDGs 項目
1	高濁度による取水の停止	・河川水位、水質をモニタリングするための計装機器の設置 ・高濁度発生時のリスク対応や運転管理計画の作成 ・送水連絡による各浄水場からの相互送水をできるようにする。	
2	高濁度による浄水場の停止	・高濁度発生時のリスク対応や運転管理計画の作成 ・送水連絡による各浄水場からの相互送水をできるようにする。	
3	洪水の発生による機器の故障	・機器故障時に即修繕対応が可能なようにスペアパーツの整備	

出典：JICA Climate FIT を基に調査団作成

(7)　「適応オプション」候補群について、プロジェクト計画での最終的な考慮結果

考えられる「適応オプション」候補群について、プロジェクト計画での最終的な考慮結果は次のとおりである。

・河川水位、水質をモニタリングするための計装機器の設置：河川水位、水質を把握して、取水、浄水の運転方法の判断をする。
・高濁度時のリスク対応や運転管理計画の作成：高濁度時の取水、浄水機能を確保するために、

常時及び高濁度等の問題が発生した時の運転方法を計画する。

・送水連絡による各浄水場からの相互送水：高濁度時に取水、浄水機能が停止しても、他の浄水場から必要水量を配水可能とする。

・機器故障時に即修繕対応が可能なようにスペアパーツの整備：洪水時の浸水による機器故障から早急に復帰するためにスペアパーツの整備及び維持管理を行う。

尚、施設完成後から 10 年間は SPC が事業運営を行うため、上記に関しては、維持管理マニュアルに明記することを入札図書の要求水準書に含める。その後は、PPWSA が施設を管理することとなる。PPWSA は、上記マニュアルの引き継ぎが実施されるとともに、これまでの技術協力プロジェクト等により、データ管理、計画策定、浄水場運転管理、水質管理、管路の維持管理、財務管理、水資源管理の知識・意識を含め、水道事業に対する能力強化が実施されていることから十分な対応が可能である。

第3章 プロジェクトの内容

3-1 プロジェクトの概要

本プロジェクトはプノンペン都中央部への給水の為の浄水施設（45,000m^3/日）を建設し、SPC により最長 10 年間の運営・維持管理（以下、「O&M」）が行われるものである。本邦企業による O&M が行われることにより、本邦技術の O&M の技術移転が行われるとともに、本邦企業による事業実施経験が培われるものである。協力の内容は以下のとおりである。

施設	プンプレック浄水場	取水施設	取水能力：47,250 m^3/日 取水施設（フロート式） 取水ポンプ 受配電施設
		浄水施設	浄水能力：45,000 m^3/日 浄水処理施設 薬品生成・溶解・注入システム 受配電施設
		配水施設	配水池：6,000 m^3 配水ポンプ場 配水ポンプ
		SCADA	浄水場内の中央監視システム
コンサルティング・サービス			入札補助
			設計確認
			施工段階における工程管理・品質管理・コスト管理・支払い支援等の各種マネジメント業務

出典：調査団

3-2 協力対象事業の概略設計

3-2-1 設計方針

3-2-1-1 基本方針

プノンペン都は上述の通り、水需要の急増に伴って水圧が低下する地区が発生しているなど、給水能力の増強が課題となっている。プンプレック浄水場はプノンペン都の中心地区に配水している重要な浄水場であるが、過去に整備した施設の持続性の確保と運転維持管理におけるエネルギー効率の改善が課題となっており、浄水場の敷地が狭く施設の拡張余地も限定的である。かかる背景と制約の下、支援効果を最大化するため、事業権無償により民間企業の創意工夫を活用することが本事業の重要な実施方針である。特に PPWSA が経験・ノウハウを有しない浄水処理方式の導入や効果的・効率的な運営・維持管理体制の構築に留意して事業スキームを検討する。

本事業権無償は、カンボジアにおける法的整合性を考慮し、事業権無償の英語の正式名称として Japanese Grant Aid with O&M を用いる。無償資金は機材調達・施設整備及び関連するコンサルティング・サービスに活用される。無償資金で調達する事業者及び代表コンサルタントは交換公文で定めるところの日本人（Japanese Nationals）を基本とする。競争入札によって選定された事業者は、施設整

備に係る D&B 契約、運営維持管理に係る O&M 契約、PPWSA の能力向上に資するトレーニング契約及び事業の実施方針と各契約の関係性を定めた包括合意書に基づき、これらの業務を一体的に遂行する。事業者入札においては、事業者の提案を技術的、商業的、財務的及び法務的な観点から総合的に評価する総合評価落札方式を採用する。外務省が公表している一般的な事業権無償のスキーム及び本件の事業スキームを**図 3-2.1** と**図 3-2.2** に示す。

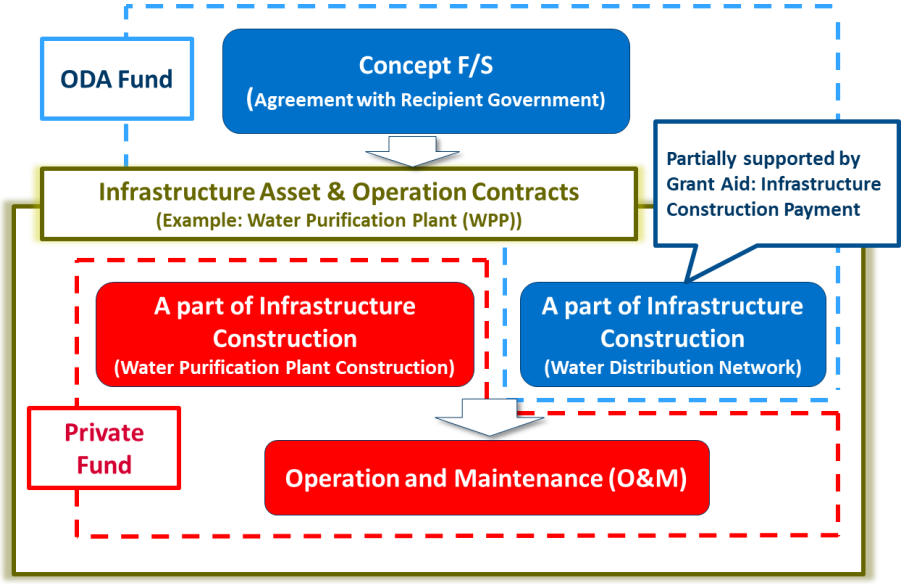


図 3-2.1　事業権無償のスキーム

出典：外務省

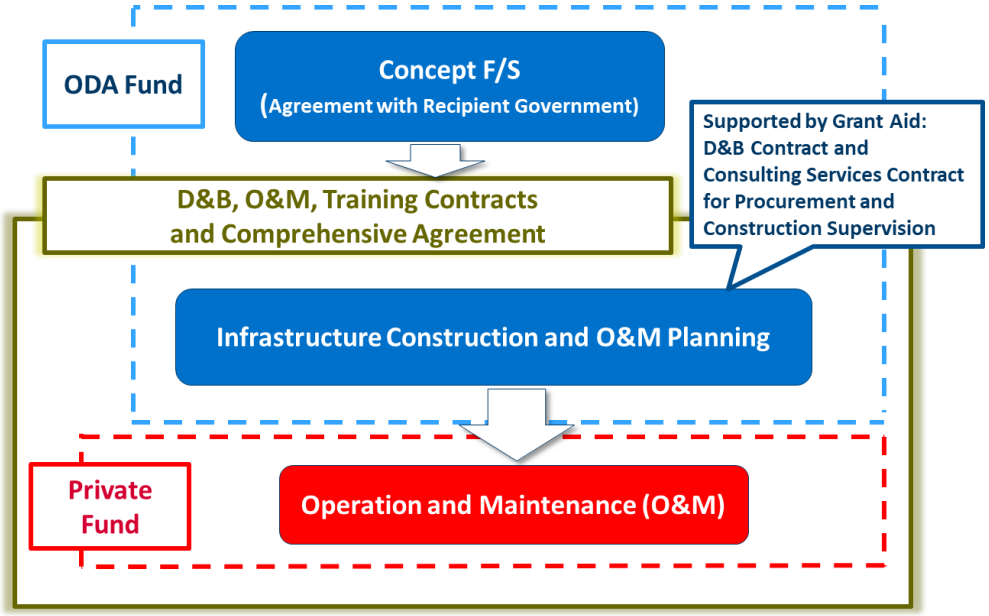


図 3-2.2　本件の事業権無償のスキーム

出典：外務省

本プロジェクトは、事業権無償を活用し、設計施工一括発注方式による実施を想定しているため、最終的な施設の設計は事業者の提案に基づくこととなる。無償資金協力の事業規模の検討、要求水準書案の作成、運営・維持管理費の試算等のために、本業務において想定標準施設（以下、コンパラター施設）を想定した概略設計を行う。コンパラター施設は、以下の方針に基づき概略設計を実施した。

① 試運転を含めた施設の建設完了は 2027 年とし、計画対象水需要は 2030 年とする。
② 増強する浄水能力は、45,000 m^3/日とする。
③ カンボジア国には設計基準が無く、基本的に現在実施中もしくは過去数年以内に実施した無償資金協力事業の設計方針（日本の「水道施設設計指針」（公益社団法人日本水道協会））に準ずるものとし、カンボジア国での過去の案件及び PPWSA で使用している設計基準等も参考にする。
④ 施工体制は、現地建設業者の能力、規模、実績を勘案の上、日本の請負業者の下で現地建設業者を十分活用することとする。
⑤ 運営維持管理は、SPC（現地法人）により 10 年間行う。
⑥ 取水施設の施工工程は河川内での工事となるため、河川水位上昇のある雨期期間中を避けることとする。

3-2-1-2 自然環境条件に対する方針

3-2-1-2-1 降水量

プノンペン市の気候区分は熱帯性モンスーン気候である。乾期は 11 月から 4 月までで、雨期は 5 月から 10 月であり、年間降雨量の約 70%が集中している。降水量等の自然条件を考慮し、施工計画に反映する。

3-2-1-2-2 地形・地質

(1) 取水施設周辺

現況地盤高から 21 m 付近において N 値 20 以上の粘性土層が確認され、支持層であると判断される。主要構造物は杭基礎が想定される。

(2) 浄水場内

現況地盤高から 17～20 m 付近において N 値 50 以上の粘性土が堆積していることが確認された。既存施設の杭長も同程度であり、支持層と判断する。主要構造物は杭基礎が想定される。

3-2-1-2-3 水量および水位

トンレサップ川のプノンペンポート観測所における平均水位（1996-2017）によれば、乾期である 4 月の平均水位は 3.93mAMSL、平均年最大水位は 8.67 m AMSL、最大高水位および最小定水位は、それぞれ 10.16 m AMSL(Sep.-2000)および 0.52 m AMSL(May-1993)である。また、Prek Kdam Station（Intake

の約 30 ㎞上流）で観測された流量（2016-2020）は、最大 4,106 m^3/s（8 月）、平均-895 m^3/s、最小-5,944 m^3/s（11 月）であった。（流量の(-)値は上流方向を示す。）

3-2-1-2-4　原水水質

水源水質調査を再委託により実施した。期間は 2021 年 2 月から月 1 回の頻度で採水・分析を行い、7 月までの半年間実施した。水質検査結果は、**表 3-2.1** の通りである。

表 3-2.1　プンプレック浄水場原水水質（2021 年 2～7 月）

No	Parameter	Unit	18-Feb	11-Mar	21-Apr	17-May	14-Jun	14-Jul	CNDWQS
1	pH	-	6.8	7.2	7.5	7.5	7.8	7.4	6.5-8.5
2	Water Temperature	°C	26.7	30.2	30.9	31.9	29.4	30.6	NV
3	Turbidity (Turbidity)	NTU	98	14	30	98	18	36	<5.0
4	Color	mg/L Pt	25	20	35	50	15	12	<5.0
5	Alkalinity (as CaCO3)	mg/L	32	19	33	32	29	18	NV
6	Total Hardness (as CaCO3)	mg/L	34	23	24	60	58	70	<300
7	Biochemical Oxygen Demand(BOD5)	mg/L	0.8	1.6	1.4	1.2	2.0	0.8	NV
8	Cyanide (CN-)	mg/L	ND	ND	ND	ND	ND	ND	NV
9	Chloride (Cl-)	mg/L	6.7	13.2	10.9	12.9	12.9	11.2	<250
10	Fluoride (F-)	mg/L	ND	0.05	0.06	0.75	0.27	0.70	<1.5
11	Ammonia Nitrogen (NH4-N))	mg/L	0.49	0.14	0.20	0.37	0.09	0.11	<1.5
12	Nitrite Nitrogen (NO2-N)	mg/L	ND	ND	0.02	0.02	0.01	0.03	<3.0
13	Nitrate Nitrogen (NO3-N)	mg/L	0.3	0.7	0.2	0.4	0.7	0.8	<50
14	Sulphate (SO4-2)	mg/L	4	24	14	24	34	18	<250
15	Aluminum (Al)	mg/L	ND	ND	0.1	ND	ND	ND	<0.2
16	Cadmium (Cd)	mg/L	ND	ND	0.0008	ND	ND	ND	<0.003
17	Chromium (Cr)	mg/L	0.002	0.001	ND	0.030	0.002	0.008	<0.05
18	Copper (Cu)	mg/L	0.012	ND	0.007	ND	ND	0.0003	<1.00
19	Iron (Fe)	mg/L	0.02	0.46	0.02	0.08	ND	0.08	<0.3
20	Mercury (Hg)	mg/L	0.0001	ND	0.0006	0.0003	0.0002	0.0007	<0.001
21	Lead (Pb)	mg/L	ND	ND	0.003	ND	ND	0.004	<0.01
22	Manganese (Mn)	mg/L	0.003	0.02	0.02	0.02	0.02	0.04	<0.1
23	Zinc (Zn)	mg/L	ND	ND	ND	ND	0.08	0.003	<3.00
24	Odor	-	No smell	No smell	No smell	No smell	No smell	No smell	Acceptable
25	Phenol	mg/L	0.004	0.480	-	-	ND	-	NV
26	Thermo tolerant Coliform (E-Coli)	MPN/100ml	$2.4x10^3$	$4.6x10^3$	$2.3x10^2$	$2.4x10^3$	$9.3x10^2$	$4.6x10^3$	0

*) 黄色マーカーの値：注目すべき値、CNDWQS　：カンボジア国飲料水質の基準値（MISTI (MIH) 2015 年）、ND：不検出、NV：設定値無し

出典：調査団

今回得られた結果から示唆される当該原水水質の概要は、以下の通りである。

i)　pH

正常な範囲で推移している。

ii)　濁度 / 色度

いずれの月もカンボジア飲料水基準値を超過した。当然、原水であるから基準値を満たす必要は無く、例年の平均的な数値であり、プンプレック浄水場における通常通りの凝集沈殿処理で除去できて

いるため問題視する必要は無い。

iii)　その他一般性状項目

上記以外の一般性状項目（Alkalinity, Total Hardness, BOD）にも問題は見られない。特に BOD は十分低く良好な数値であった。

iv)　アンモニア態窒素

アンモニア態窒素は、最大値で 0.49 mg/L であった。決して良好とは言えないものの、長期データと比較しても低く、現在の処理条件を維持できることを示している。

v)　硝酸･亜硝酸態窒素

十分に低く、良好な数値であった。

vi)　金属類

鉄が 3 月に基準値を超過したものの、マンガンも含めて全般的に低かった。鉄は従来の処理方法で除去が可能であるため問題視する必要は無い。なおクロムおよび水銀が検出されており、飲料水基準に近い値も見られることから監視を継続すべき項目である。

vii)　フェノール

乾期（2 月）に 1 回、雨期（3 月・6 月）に 2 回測定を行ったフェノールであるが、不検出であったり高い数値で検出したり、傾向が定かでない。カンボジアにおいては基準値が設定されていないものの、日本の飲料水基準値（0.005 mg/L）と比較すると 3 月の 0.48 mg/L は相当の高濃度と言える。フェノールは浄水場における塩素処理によりクロロフェノールを生成して異臭の原因となる。これまでプンプレック浄水場においては関連した問題が報告されていないことから、3 月の検出値は突発的なものと推定されるが、注視すべき項目として挙げられる。

viii)　大腸菌（E-Coli）

2～3 桁で検出しているが当該河川では平均的な値である。適切な塩素注入を行う限り問題はない。

以上、今回の結果から、水道原水水質として利用可能と判断される。一方、クロム、水銀、フェノールの検出は懸念すべき事項である。これらは一般に人為的汚染が疑われる項目である。原因は特定されていないが、採水地点周辺では船の修繕行為や小規模な工事が観察されている。

3-2-1-3　社会経済条件に対する方針

プンプレック浄水場はプノンペンの中心部に位置している。浄水場の周辺は商業施設の中心地区であるため、工事期間中の車両通行の維持と通行の安全確保について十分考慮する必要がある。

3-2-1-4　建設事情／調達事情に対する方針

建設一般資材のなかで、セメントはカンボジア国で生産している。プノンペン都周辺には多くのセ

メント工場がある。生産されているセメントは、普通ポルトランドであり、市場で調達可能である。また、構造用鋼材、鉄筋は、カンボジア国で生産されていないものの、主にベトナム、タイなどからの輸入品が市中で入手可能である。

浄水の機器・設備はカンボジア国では生産しておらず、本邦企業において競争性を確保した上で調達を行い、コストの縮減が図れるように配慮する。浄水処理用の薬品類については、可能な限りカンボジア国内で調達する想定とする。

3-2-1-5　現地業者の活用に係る方針

カンボジア国で実施された無償資金協力のプロジェクトでは、ほとんどがカンボジア国内の下請けを活用して施工されている。土工事、コンクリート工事などに使用する汎用機械を保有している会社も多く、また揚重機械もプノンペンの各所で見受けられた。日本の元請業者からのヒアリングでは、一般的な施工機械を用いた施工能力については、カンボジア国業者は一定のレベルを有していると判断される。施工機械の整備が十分でない、特殊な工事の機械はカンボジア国内では調達できない、安全管理の徹底がなされない、という点から本邦施工業者が管理・指導を行う必要がある。カンボジア業者を下請けとして活用することは十分に可能であり、一部、人的あるいは特殊施工機械の補強が必要である。

3-2-1-6　運営・維持管理に対する対応方針

本事業で増設される浄水施設の O&M は SPC によって実施される。コンパラター施設における運営・維持管理体制を検討する。

3-2-1-7　施設、機材等のグレードの設定に係る方針

機械・電気設備は維持管理性やスペアパーツの入手性を考慮して選定する。特に、大型機器となる取水ポンプ・配水ポンプについては本邦企業において競争性を確保し、コストの縮減が図れるように配慮する。

3-2-1-8　工法／調達方法、工期に係る方針

取水施設の建設は雨期・乾期によって大きく影響されるため、着工時期と工期の設定に注意を払う必要がある。また、浄水場の増設計画にあたっては、既存の浄水処理を止めることが無い様に工程を設定する。

3-2-1-9　事業権無償にかかる入札、契約に係る方針

本プロジェクトは、事業・運営権対応型無償の適用を前提として、無償資金の対象となる設計施工契約（D&B 契約）、運営期間における維持管理契約（O&M 契約）及びトレーニング契約と、上記 3 契約の一体性を規定する包括合意書を、総合評価落札方式による競争入札によって単一の事業者（単

独企業或いは共同事業体）に発注することを想定する。詳細は 3-3 に記載の通り。

3-2-2　基本計画（施設計画／機材計画）

3-2-2-1　水需要

「プノンペン上水道開発に係る情報収集・確認調査」にてマスタープランがレビューされ、プンプレック浄水場からの配水地域の、2030 年における水需要は約 195,000 m^3/日と予測されており、浄水場の処理能力として既存施設の浄水能力 150,000 m^3/日に増設分の 45,000 m^3/日を加えた施設の総合浄水能力 195,000 m^3/日は妥当であるといえる。

3-2-2-2　施設計画に係る全体方針

- 本プロジェクトはプンプレック浄水場の増量（150,000 m^3/日を 195,000 m^3/日）を目的とする。
- 取水施設は既設とは分離して 47,250 m^3/日（浄水量 45,000 m^3/日に浄水ロス分として浄水量の 5%を加算）の施設を新設する。新設フロート式取水施設（取水ポンプ 2 台）と受電施設を建設する。
- 導水管は 800 mm 管を新設する。PPWSA と協議の結果 PPWSA 自身で 800 mm 管を敷設することとなった。
- 既設浄水施設は 100,000 m^3/日と 50,000 m^3/日の施設が有り、建設年の古い 100,000 m^3/日の施設について構造物の補強が要請されたが、調査の結果、既存施設の補強は現実的ではない。延命措置は可能であるが、コンクリート強度の低下・鉄筋の腐食が確認されているので、表面のコンクリートを斫って鉄筋の防錆処理を行って補修したとしても耐用年数がどれだけ伸びるか予測できない。期間が不明の延命措置は裨益効果を評価出来ないので無償資金の目的に合わないと考えられるため範囲外とし、PPWSA による再建設を検討することとなった。
- 45, 000 m^3/日の浄水施設（薬品混和池、凝集沈殿池、ろ過池）を敷地内に建設する。
- 配水池は 6,000 m^3 を敷地内に新設する。
- 配水ポンプ室と配水ポンプ 3 台を新設する。
- 増設施設用の受電施設、薬品生成・溶解・注入施設を新設する。

既存施設の改修・補修方法を**表 3-2.2** に施設の拡張方針を**表 3-2.3** に示す。

表 3-2.2　既存施設の改修・補修方法

施設名	建設年	劣化段階	劣化状況	改修・補修方法
取水塔	1966 年	加速期後半～劣化期	鉄筋腐食、欠損、耐力低下	補修せずに既設用に継続使用。 将来建て替えを推奨する。
導水管 Φ700	1958 年、1966 年	劣化期	全面腐食、腐食凹凸、欠け	既設管は撤去し、新たに導水管 Φ800 を布設する
導水管 Φ1,200	2002 年	良好（潜伏期以前）	－	補修の必要なしと判断。 そのまま既設用に使用。
沈殿ろ過池 100,000 m^3/日	1965 年	加速期後半～劣化期	鉄筋腐食、クラック、浮き、剥落、析出物、漏水	補修せずに使用を継続。 将来建て替えを推奨する。
沈殿ろ過池	2005 年	良好（潜伏期以前）	－	補修せずに使用を継続。

施設名	建設年	劣化段階	劣化状況	改修・補修方法
50,000 m^3/日				
配水池 10,000 m^3	1959 年	加速期後半～劣化期	鉄筋腐食、クラック、浮き、析出物、コケ汚れ	補修せずに使用を継続。 将来建て替えを推奨する。

出典：調査団

表 3-2.3　施設の拡張方針

施設名	方式	備考
取水施設（47,250 m^3/日）	フロート式取水施設（取水ポンプ 2 台）、受電施設。	新設施設用
導水管	Φ800 mm を PPWSA 自身で新設する。	新設施設用
浄水施設（45,000 m^3/日）	受電施設 着水井 混和池 高速凝集沈殿池 急速砂ろ過池 薬品生成・溶解・注入施設	新設施設用 新設施設用 新設施設用 スラッジ・ブランケット型 空気＋水洗浄（単独／同時） PAC 及び生成次亜塩素
配水池（6,000 m^3）	配水ポンプ室付き	配水ポンプ 3 台
SCADA	既存及び新設の統合システム	

出典：調査団

3-2-2-3　取水・導水施設計画

3-2-2-3-1　計画取水量

原水はトンレサップ川から取水する。原水取水量は、浄水処理損失水量（浄水処理過程で発生する損失水量【沈殿汚泥排泥及びろ過池洗浄排水等】として 5%を設定）を加味し、浄水処理量、45,000 m^3/日に対し、47,250 m^3/日（45,000 m^3/日 x 105 % = 47,250 m^3/日）を計画取水量とする。

3-2-2-3-2　取水施設計画

取水施設は既設とは分離して 47,250 m^3/日の施設を新設する。新設取水施設用のフロート式取水施設（取水ポンプ 2 台）と受電施設を建設する。

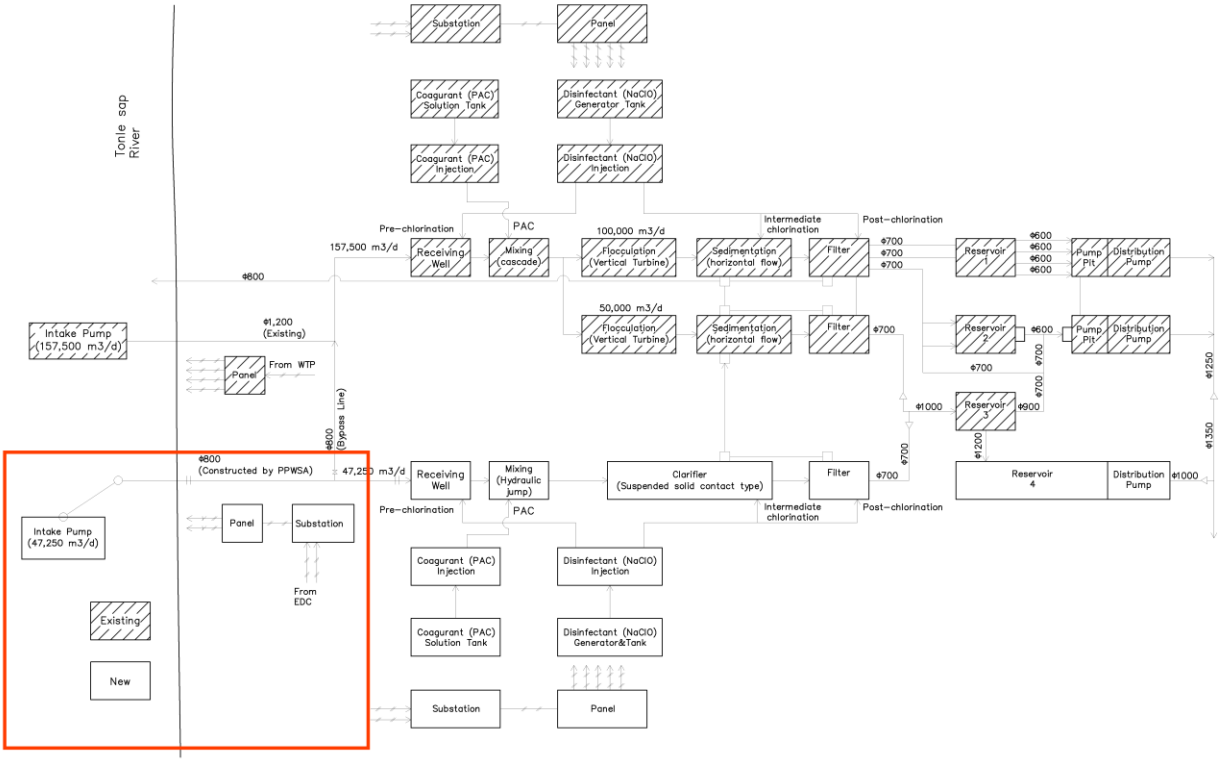


図 3-2.3　コンパラター施設の概略設計における取水施設(フローシート)

出典：調査団

コンパラター施設の概略設計を行うにあたって、以下の方針とする。

- フロート式取水施設とし、河川の水位変動に対応して確実に取水できる構造とする。
- 横軸ポンプとして、建設費を低く抑え、メンテナンスを容易にする。

取水施設を以下に示す。

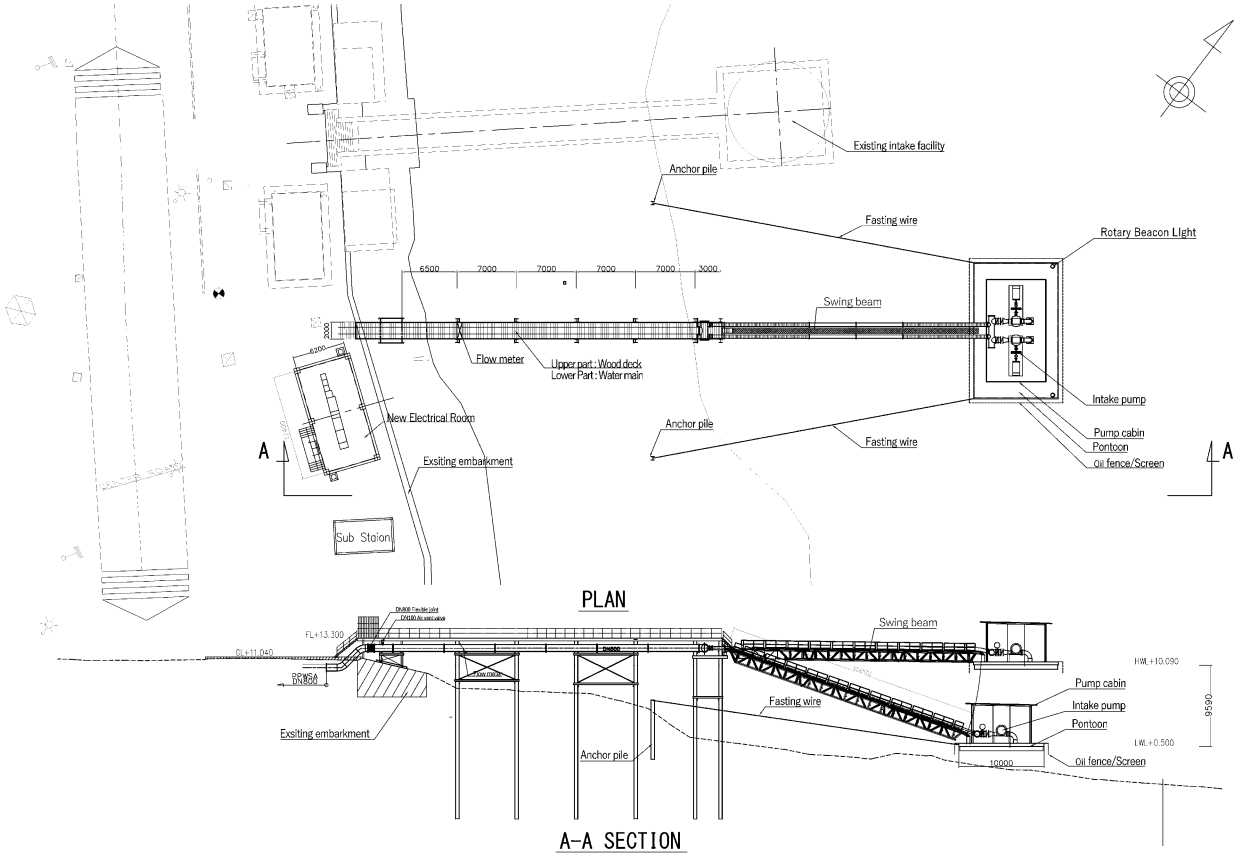


図 3-2.4　取水施設の概要

出典：調査団

表 3-2.4　取水施設に必要となる付帯設備

設備名	設置目的
浮き台船	取水ポンプを川に浮かべるための船台。川岸と船台を連絡する鋼製桟橋を付帯する。
オイルフェンス及び細目スクリーン	オイル吸込み防止と塵芥を除去する。
ポンプ廻り配管	ポンプ廻り配管（弁類含む）台船の上下に追従するための可撓性を有したゴムホース。
その他設備	スクリーンや備品等を保管・洗浄するための施設＆設備 屋内外照明　等

出典：調査団

3-2-2-3-3　　取水ポンプ計画

コンパラター施設の概略設計として、取水ポンプはフロート式取水施設（台船）に設置し、横軸ポンプとして、建設費を抑制する。なお、ポンプは渦巻ポンプとする。取水水位変動が約 10 m と大きいため、経済的取水流量制御を考慮し、ポンプは回転数制御付きとする。

新設取水ポンプは 2 台（内 1 台予備）設置する。1 台分（45,000 m^3/日）は Stage3（45,000 m^3/日の浄水施設の増設を Stage3 とする、なお、Stage1 は 100,000 m^3/日施設、Stage2 は 50,000 m^3/日施設である。）用に新設 φ800 管で導水する。現状通り既設（150,000 m^3/日）は Stage1, Stage2 用に既設 Φ1200 導水管で導水する。仕様を**表 3-2.5** に示す。

トンレサップ川の最大高水位 : 10.16 m AMSL（2000 年 9 月 20 日）、最小低水位 : 0.52 m AMSL（1993 年 5 月 3 日）が過去に記録されており、取水の HWL を 10.2 m AMSL、LWL を 0.5 m AMSL とする。

表 3-2.5　新設取水ポンプ仕様

仕様	ポンプ
	No.1,2
数量	2 台（内 1 台予備）
容量（m^3/hr）	1980 m^3/hr
揚程（m）	24 m
動力（kW）	200 kW
制御	可変速ドライブ（VFD: Variable-Frequency Drive）
水撃対策	Fly Wheel

出典：調査団

3-2-2-3-4　　導水施設計画

既設導水管は φ700（1958 年）、φ700（1966 年）、φ1200（2002 年）である。

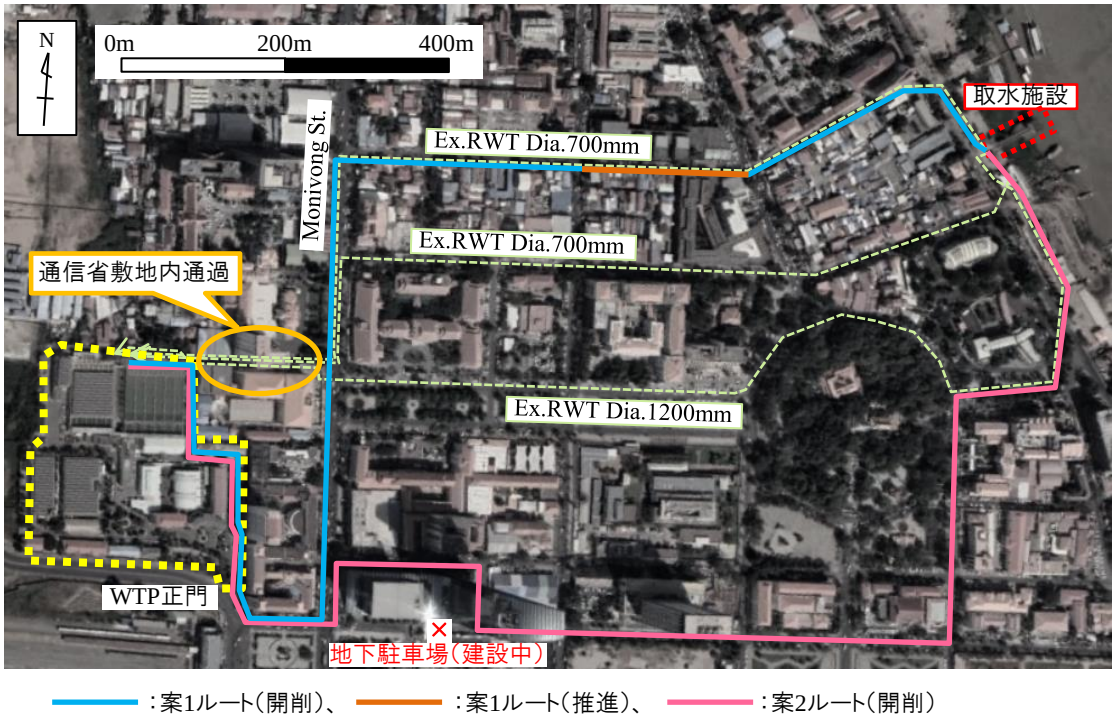
φ700 の 2 本の導水管は劣化が著しいため使用せず、現状の Φ1200 を使用する。更に取水に係る維持管理費の低減と処理プロセスの異なる浄水施設の区分けを行うため、新たに導水管 φ800 を敷設する。（但し、無償資金協力本体のスコープ外として PPWSA が建設する。）

コンパラター施設の概略設計として、2002 年に建設された Φ1200 の導水管は Stage1 及び Stage2 用（150,000 m^3/日）として継続使用し、新設する φ800 の導水管を Stage3 用（45,000 m^3/日）として使用する。

(1)　平面計画

既存導水管 3 本は浄水場の東側に隣接する通信省の敷地内を通過して浄水場へ流入している。また、通信省敷地内の路線上の一部区間には駐車場が建設されており、新規導水管の同ルート上への計画は現実的ではない。よって、浄水場付近の平面計画としては、延長は長くなるものの浄水場正門側に迂回させ浄水場へ流入させる平面計画とする。

PPWSA が要望するルート案を案 1 とし、現実的な建設が可能と考えられる対案として案 2 のルート案を合わせて**図 3-2.5** に示した。



出典：調査団

図 3-2.5　導水管ルート案

案 1 と案 2 についての比較を**表 3-2.6** に示した。案 1 は路線途中の一部区間（約 200m）が病院用地として利用されており、開削工法による施工が困難な場合は、別のルートを選択するか、推進工法による施工が必要となる。PPWSA は最短ルートとなる案 1 で、全線推進工法の適用も可能であるように予算の確保を行う意向である。ただし、今後精査する中で極力開削工法とし、開削による施工が不可能な区間のみ推進工法とする意向である。

表 3-2.6　導水管 2 案の概要・比較

項目	案 1	案 2
概要	既存 φ700 mm 導水管のルートに新設 φ800 mm 導水管を敷設。既存 φ700 mm は撤去。	新規ルートに新設 φ800 mm 導水管を敷設
課題	路線の一部区間は病院用地として利用されており、病院敷地内での開削工事は困難と想定される。当該区間は非開削工法の適用も考えられる。	地下駐車場を建設している箇所があることから、これを回避する必要があり、一部冗長な平面計画となる。
施設内容	開削もしくは非開削工法 φ800 mm、L=1890 m（浄水場内の路線長を含む）	開削 φ800 mm、L=2130 m（浄水場内の路線長を含む）
概略建設費	8,500（1000 USD）	3,852（1000 USD）
評価	Monivong 通りの延長が長く、PPWSA の要望通りに既存 φ700 mm 導水管を撤去しながらの施工となると工期が嵩み、交通への影響が大きい。	提案ルートは道路幅員と交通量から施工は比較的容易である。開削工事のみの対応で済むことから事業費は案 1 と比較して安価となる。
	採用	

出典：調査団

3-2-2-4　浄水施設計画

3-2-2-4-1　原水水質及び必要水処理用薬品

原水となるトンレサップ川の原水水質は、2017 年から 2020 年の間のプンプレック浄水場における原水水質の記録によると次のような特徴が見られる。

- pH値は、最低値でも常に 7.0 を上回る比較的高い数値であるが、日照時間が長く、植物プランクトンによる光合成が盛んとなる乾期（12-4 月）の終盤であっても 8.0 をわずかに上回る程度であり、異常値は見られない。
- 濁度は、乾期に低下し、平均値は 20-100 NTU 程度で推移するが、雨期に上昇し 200 NTU を上回ることも多い。特に雨量の多い 9-10 月に最高濁度を記録し、1,000 NTU を超えることもある。このように変動が激しいことから、凝集剤の注入率を適正に保つ必要がある。
- アルカリ度は変動しながらも十分に含まれている。低下する月にも 20 mg/L を下回ることはなく、凝集剤にアルカリ度消費の少ない PAC を使用する限り、問題は予想されない。
- アンモニア態窒素は、低い時期は 0.1 mg/L を下回る一方、高い時には 1.2 mg/L に達するような変動を示し、更に各年における傾向が定かではないため予想がしにくい。アンモニア態窒素濃度の変動は塩素注入率に影響を与えることから今後も注視すべき項目である。

コンパラター施設において、アンモニア態窒素は塩素により対応する方針とし、概略設計における水処理用薬品としては、以下とする。（既設処理方法と同じ）

- 凝集剤：PAC
- 消毒剤：次亜塩素酸ナトリウム

3-2-2-4-2　浄水施設計画　（概略設計計画）

プンプレック浄水場の原水濁度より、コンパラター施設の浄水場処理対象濁度を以下の通りとする。

- 設計最大濁度　1000 NTU
- 設計平均濁度　100 NTU
- 設計最小濁度　10 NTU　（10NTU を下回っても凝集剤注入率はほとんど変わらないため）

なお、過去 10 年間のプンプレック浄水場の原水濁度は以下のようであった。

- 乾期平均濁度　70 NTU
- 雨期平均濁度　122 NTU
- 全期平均濁度　100 NTU

・ 全期最高濁度　　1163 NTU
・ 全期最小濁度　　7 NTU

平均濁度は 100NTU であり、乾期から雨期にかけて±30NTU 程度の幅がある。

本コンパラター施設の設計として、原水最大濁度を 1000 NTU とした。以下の**図 3-2.6** の通り、1000 NTU を超える場合はまれである。また、その場合には浄水処理が非常に非経済的になり、更にろ過池への過負荷等が懸念されるため、取水量の制限又は取水停止を行うことを想定する。雨期に濁度が上昇する傾向が見られるが、**図 3-2.6** の通り濁度が 800 NTU を超えたことは過去 10 年で 3 度のみとなっている。

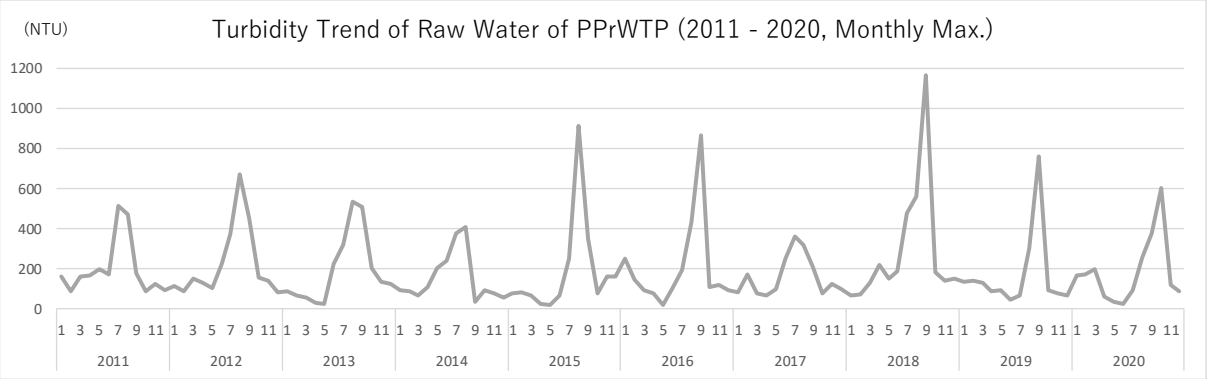
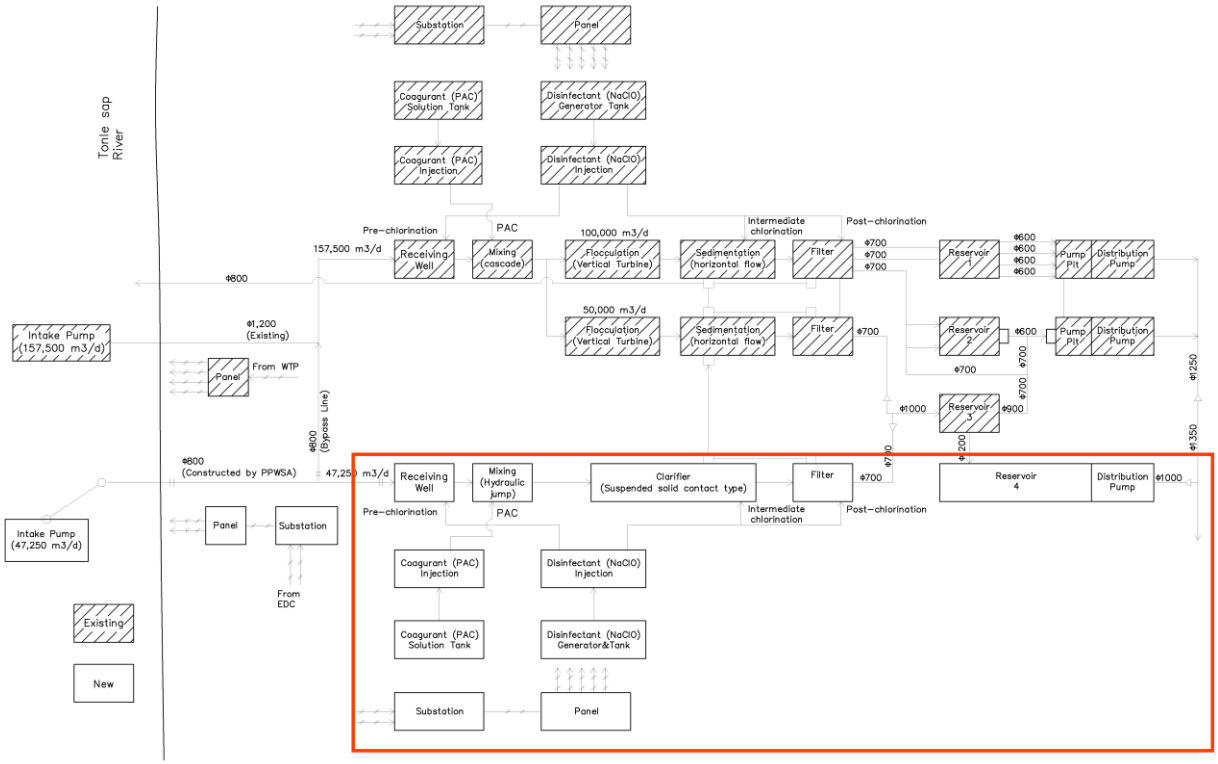


図 3-2.6　プンプレック浄水場原水の濁度の推移

出典：PPWSA 提供資料を基に調査団作成

3-2-2-4-3　　浄水施設プロセス

コンパラター施設の概略設計として、経済的建設費及び運転費を考慮し、浄水処理プロセスを**図 3-2.7** に、浄水処理プロセスの概要を**表 3-2.7** に示す。浄水処理プロセスは、要請書で記載された高速凝集沈殿池＋急速砂ろ過池とする。敷地の制約からみてコンベンショナルな凝集沈殿＋急速ろ過ではない浄水処理方式（高速凝集沈殿池）を提案する。



出典：調査団

図 3-2.7　コンパラター施設の概略設計における浄水処理プロセス(フローシート)

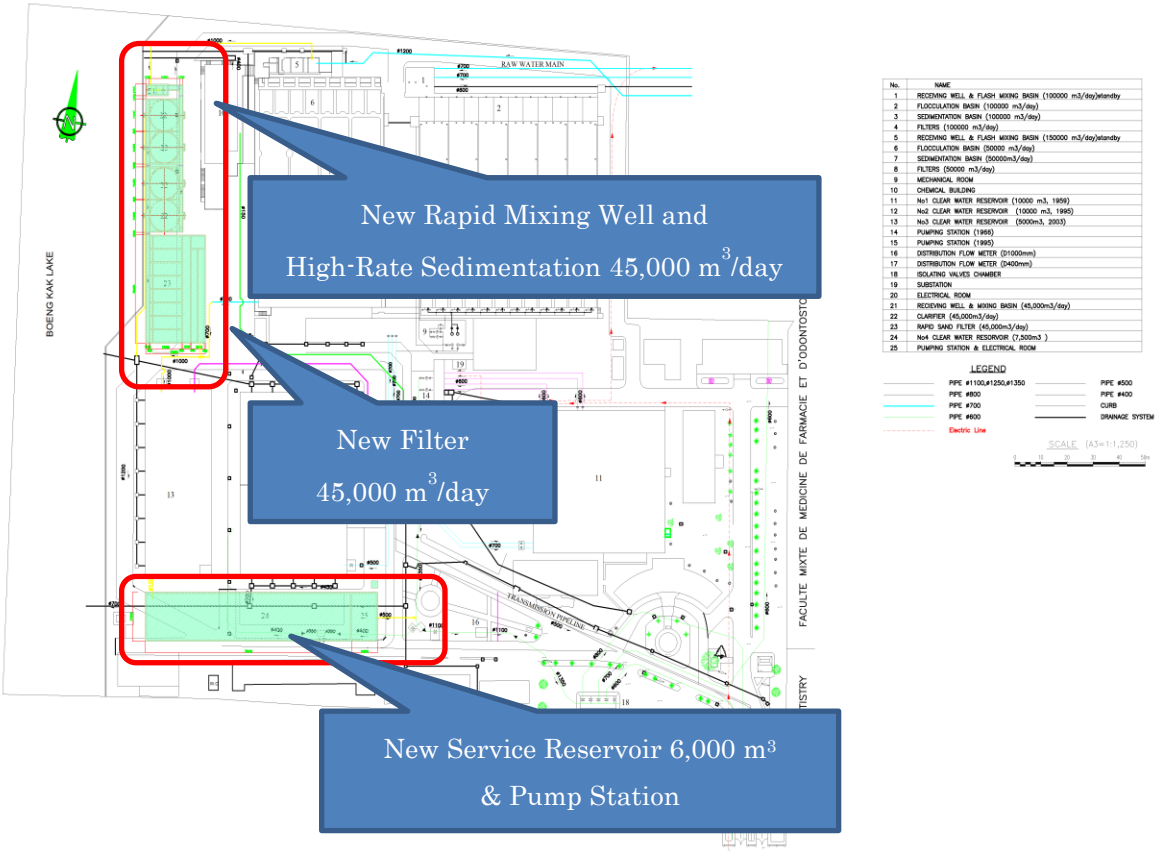
表 3-2.7　浄水処理プロセスの概要

処理プロセス	処理目的
着水井	取水ポンプの吐出圧力変化を抑え、その後の処理プロセスに水理的変動を与えず、最適に運転出来るようする。
混和プロセス（急速攪拌）	原水に凝集剤を注入し、出来るだけ短い時間に大きい攪拌エネルギーを与え原水と凝集剤を混和し微細なフロックを形成させる。 跳水方式を採用する。凝集剤を注入した原水が傾斜水路を流れ落ちた部分で跳水を発生し混和する重力式攪拌方式である。この方式は他方式（機械式攪拌機等）に比べて次の利点がある。 ・ 独立した混和池は不要。 ・ 短い時間で確実な混和が行える。 ・ 攪拌機等の機器を使用しない為、建設費・維持管理費が不要。 ・ 保守管理が全く不要で、保守管理での長期混和池停止がない。
沈殿プロセス	スラッジ・ブランケット型高速凝集沈殿池とする。 凝集した原水を沈殿池下部に流入させ浮遊しているスラリーの中を上方向に通過する際に除濁される。 傾斜管を併用することにより濁質の流出を抑え、後続のろ過プロセスにかかる負担を軽減させる。 浄水場建設敷地に制限があるので、面積負荷を大きくとる事が出来る本方式を採用する。要請書においても、敷地制限を満足するために本方式を要請している。
ろ過プロセス	沈殿プロセスで処理出来なかった微細フロックを持つ沈殿水をろ過プロセスで処理する。 比較的有効径の大きなろ材（砂）を用い、ろ材全体で微細フロックを捕捉し空気と水でろ材の洗浄を行う方式と比較的有効径の小さなろ材（砂）を用い、ろ材表層で微細フロックを捕捉し水のみでろ材の洗浄を行う方式がある。カンボジア国のほとんどの浄水場が前者の方式を採用し、多くの運転実績がある為。比較的有効径の大きなろ材（砂）を用い、ろ材全体で微細フロックを捕捉し空気と水でろ材の洗浄を行う方式とする。

処理プロセス	処理目的
配水池	ろ過水に後塩素を注入し、出来上がった浄水を貯える施設であると同時に浄水量と配水量の不均衡を調節緩和する。
排水処理プロセス	沈殿スラッジとろ過洗浄水は、既設の排水ピットに排水して、以降の処理・処分は PPWSA の責任で行う。
薬品注入プロセス	**1.　凝集剤注入設備** 粉末 PAC を使用し、新設の溶解設備により溶解された PAC 溶液を移送して貯槽に貯蔵する。注入ポンプにより注入する。注入量は最大濁度: 1000 NTU 時に対応する事とする。 **2.　塩素剤注入設備** 塩素は、塩を電気分解し生成次亜塩素酸ナトリウムとする。新設の設備で生成した次亜塩素酸ナトリウムを貯蔵し注入ポンプにより注入する。 塩素注入設備は、注入量は通常の注入処理（前塩素、中塩素、後塩素）に加えアンモニア態窒素を処理できる施設と容量を確保する。 **3.　アルカリ剤注入設備** アルカリ剤として粉末消石灰が入手可能である。原水水質より判断すると、pH が比較的高くかつ PAC を凝集剤と使用するため、アルカリ剤の注入設備を建設する必要はない。既設に溶解・注入設備は有るが長期間使用していない。

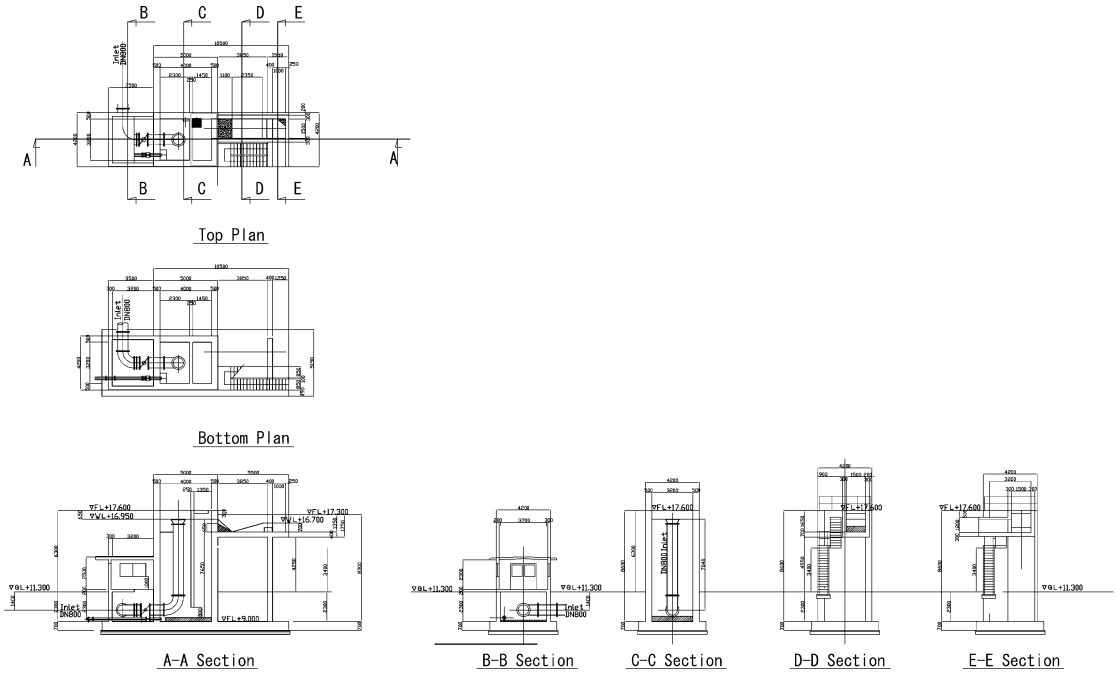
出典：調査団

3-2-2-4-4　　概略設計計画



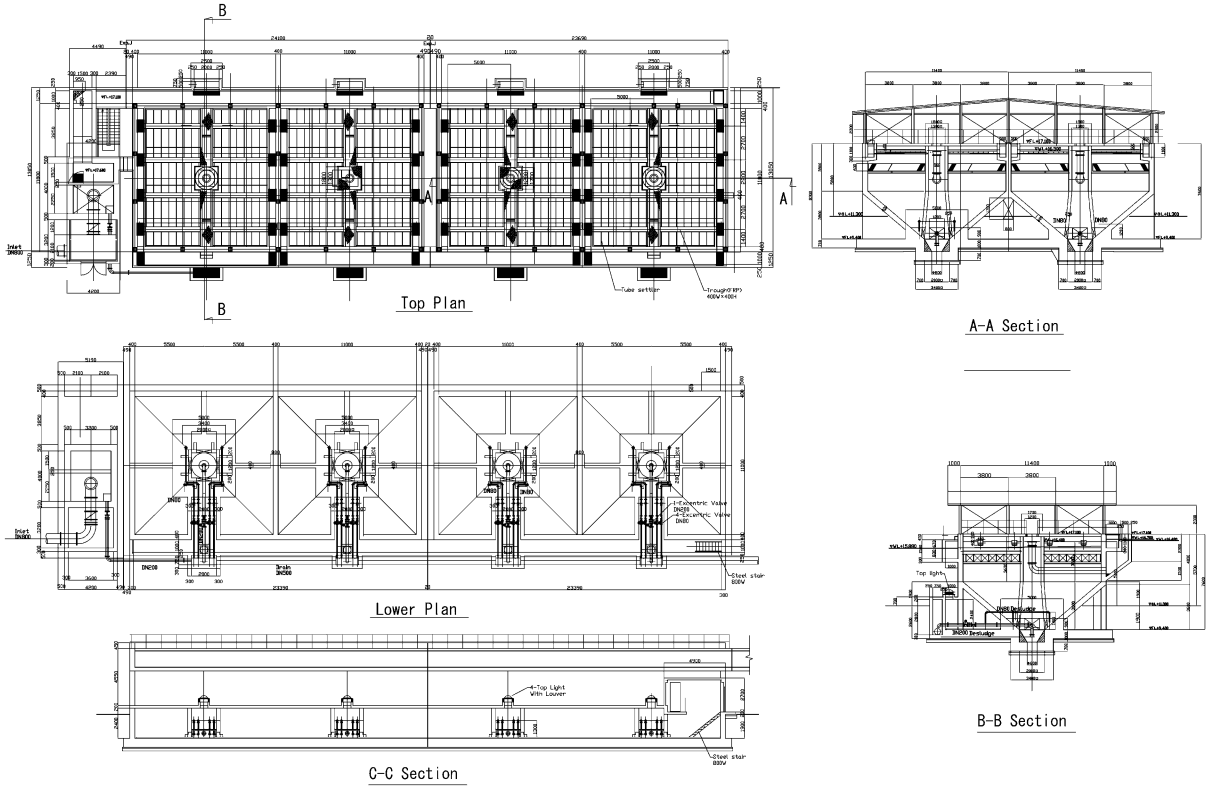
出典：調査団

図 3-2.8　コンパラター施設の概略設計における平面配置図（案）



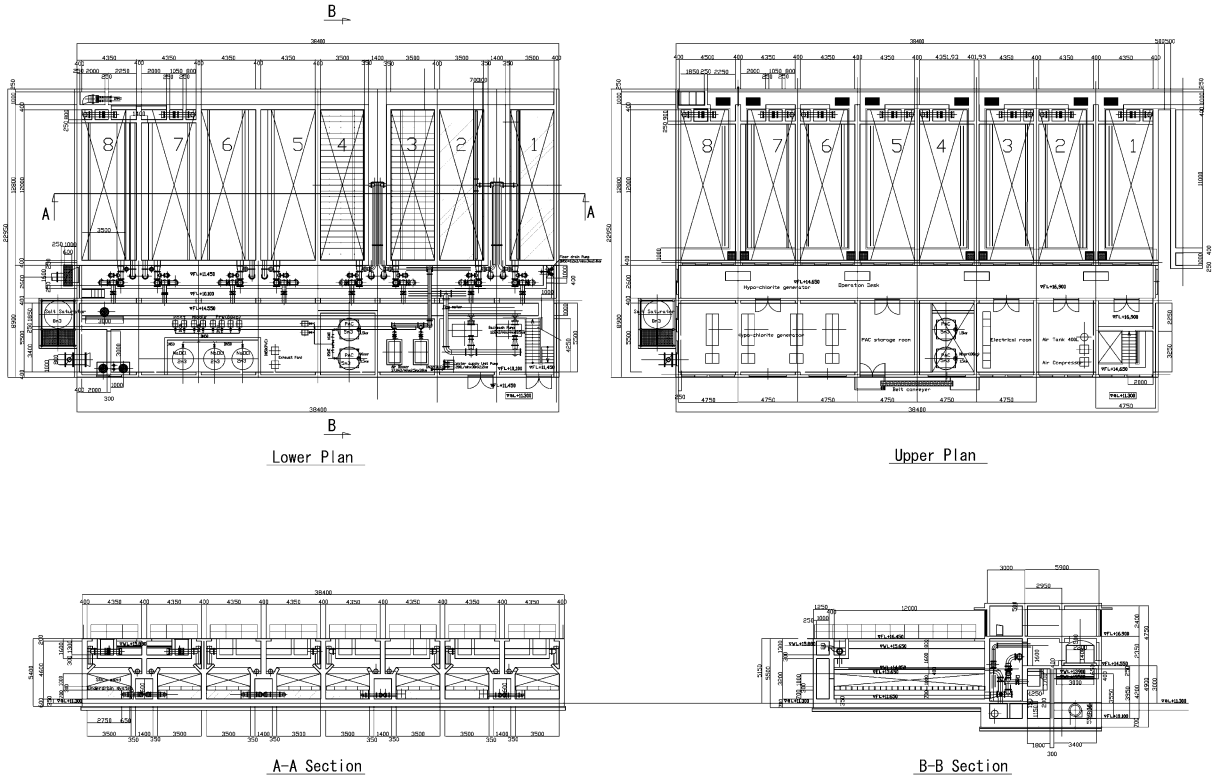
出典：調査団

図 3-2.9　コンパラター施設の概略設計における着水井・混和池



出典：調査団

図 3-2.10　コンパラター施設の概略設計における沈殿池



出典：調査団

図 3-2.11　コンパラター施設の概略設計における急速ろ過池

3-2-2-5　送配水施設計画

3-2-2-5-1　配水計画

コンパラター施設の概略設計として、給水地域がほぼ平坦であることと配水エネルギーの経済性を考慮して、ポンプ直配水システムを採用する。ポンプ直配水システムは、配水ポンプの吐出圧力を一定に保つこととし、配水圧力はポンプ台数（回転数制御含む）で制御を行う。

3-2-2-5-2　配水量時間変動及び配水池容量

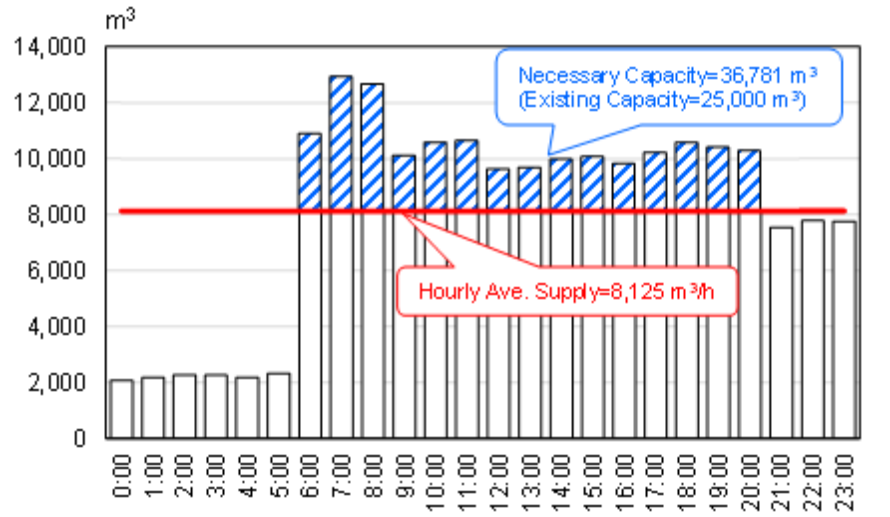
拡張改修に利用可能なスペースと過去のプンプレック浄水場の配水流量記録を考慮し、配水池容量の検討を行った結果を**図 3-2.12** に示す。

ただし、時間変動は 2020 年のプンプレック浄水場の配水流量記録から最も条件の悪いケースの時間変動を考慮して検討を行った。

計画一日最大配水量は 195,000 m^3/日であり、時間平均配水量は 8,125 m^3／時である。配水量の時間変動に必要な配水池容量は、時間平均配水量を超えた面積部（**図 3-2.12** の網掛け部）の 36,781 m^3 となり、新設分の配水池必要容量は既存の配水池容量 25,000 m^3 を差引き 11,781 m^3（≒12,000 m^3）となる。

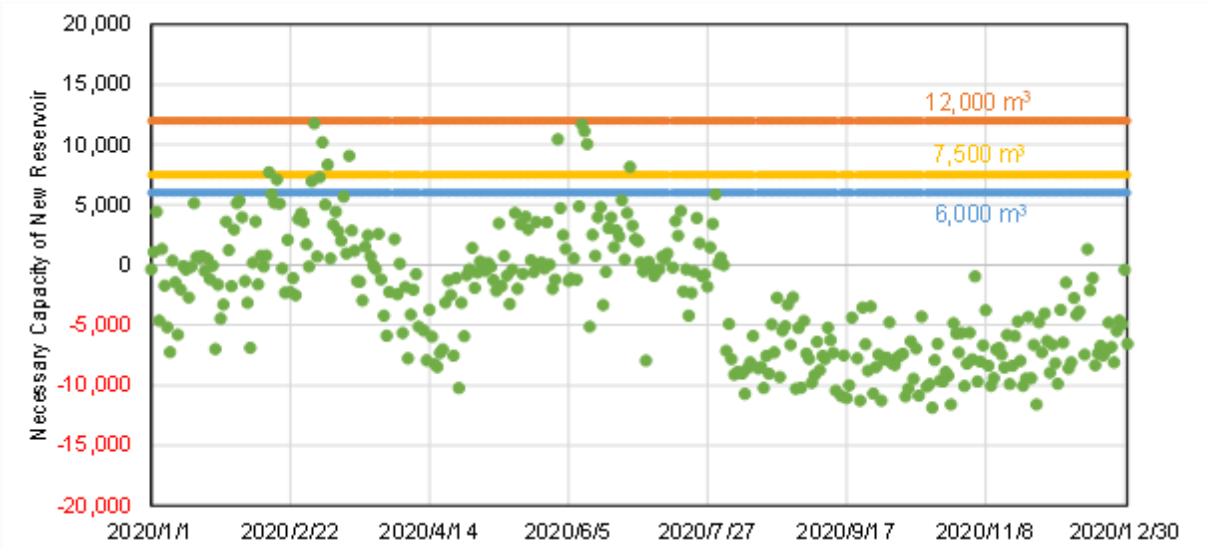
2020 年毎日の配水トレンドを用いて面積法により新設配水池容量を算出した結果を**図 3-2.13** に示す。上記の容量（12,000 m³）に加えて、要請書記載の容量（6,000 m³）、既存施設の滞留時間 4.0 時間と同等となる配水池容量（7,500 m³）も示す。

2020 年 3 月と 6 月において特異的な時間変動を記録している数日を除けば、配水池容量 6,000 m³ または 7,500 m³ でも必要容量を上回る結果となる。コンパラター施設の概略設計としては、PPWSA と協議し決定した、配水池容量 6,000 m³ を採用する。配水池・配水ポンプ室概略図を**図 3-2.14** に示す。



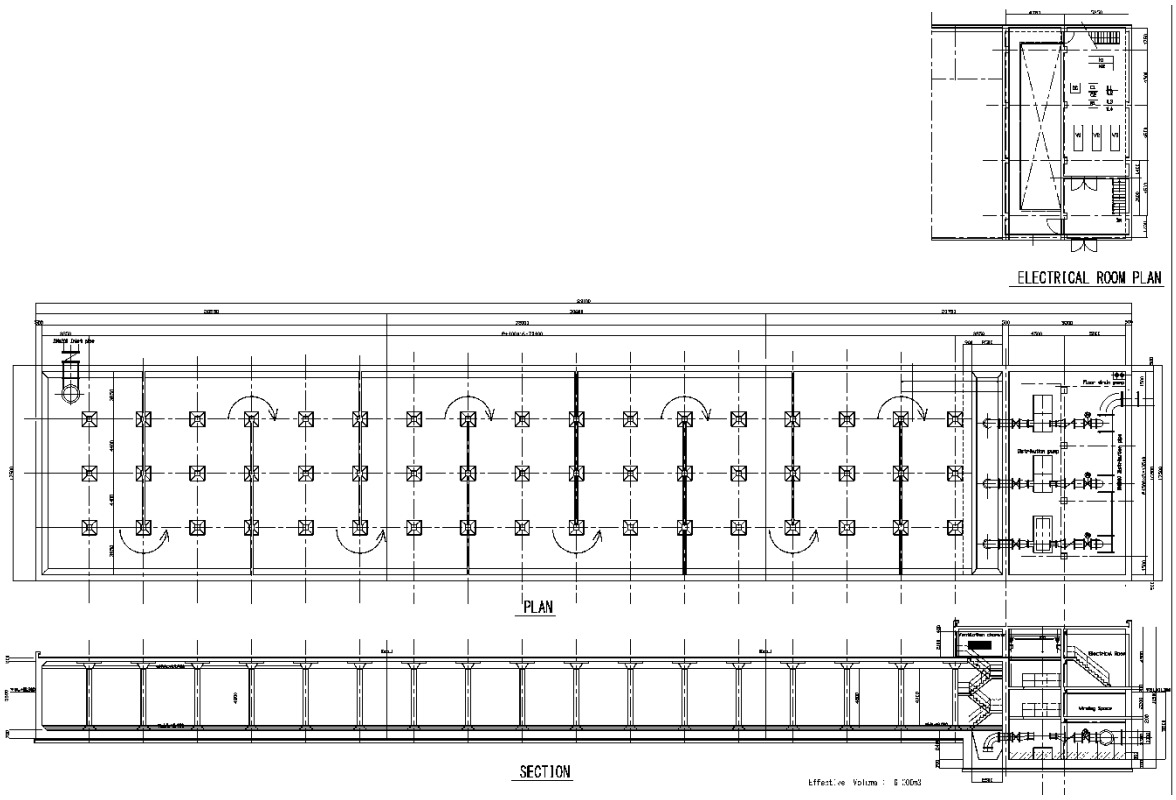
出典：調査団

図 3-2.12　配水量時間変動（2020 年 3 月 2 日）



出典：調査団

図 3-2.13　2020 年毎日の配水トレンドを用いて算出した新設配水池必要容量



出典：調査団

図 3-2.14　コンパラター施設の概略設計における配水池・配水ポンプ室

3-2-2-5-3　　配水ポンプ計画

配水ポンプは 3 台要請されている。既存のポンプを更新すると、流量が更に多くなるのでポンプ井の容量不足が深刻化する。その解決策として、今回導入する以下の仕様のポンプ用に新たに配水ポンプ室を設ける。取り換えて撤去する予定であった 1995 年製のポンプは撤去せずに予備とする方針とする。

表 3-2.8　新設配水ポンプ仕様一覧

名称	No.8D	No.9D	No.10D
容量（m^3/min）	29	29	29
揚程（m）	42	42	42
動力（kW）	280	280	280
制御	(VFD)	(VFD)	(VFD)

出典：調査団

3-2-2-6　　機械設備計画

コンパラター施設の概略設計として、機械設備は、基本的に高効率で長寿命、故障の少なく、且つ初期投資額並びに維持管理費が安価なものとする。コンパラター施設の主要機械設備を**表 3-2.9** に示す。

表 3-2.9　主要機械設備

機械設備名	設置個所
１．取水ポンプ設備 - 取水ポンプ - 浮き台船 - 鋼製桟橋 - オイルフェンス及び細目スクリーン - ポンプ廻り配管（弁類含む）	取水ポンプ場
２．沈殿池汚泥引き抜き配管（自動弁類含む）設備	沈殿池
３．凝集剤注入配管・塩素剤注入配管	混和池・ろ過池
４．薬品生成・溶解・注入設備 - 次亜塩素酸ナトリウム生成装置 - 薬品貯槽 - 薬品注入ポンプ	ろ過池薬品注入室
５．ろ過池設備 - 流入弁及び流出、洗浄配管（自動弁含む）設備 - 逆洗ポンプ - 空気洗浄用ブロアー	ろ過池
６．配水ポンプ設備 - 配水ポンプ - 配水ポンプ流入・吐出配管（弁類含む） - 機器搬入用クレーン	配水ポンプ場

出典：調査団

3-2-2-7　電気設備計画

3-2-2-7-1　受変電計画

(1) 取水場

受変電設備は、取水場の規模から、カンボジア電力公社（以下、EDC）の配電線より 22 kV、2 回線受電を行う。受電された 22 kV は、取水場内 Substation 設置予定の変圧器により降圧して、各盤に配電を行う。EDC により Substation を建設するものとする。ただし、EDC 指定仕様の変圧器を購入して、コントラクターにより設置しても良い。受電に関する手続きについてはカンボジア国側の負担とする。

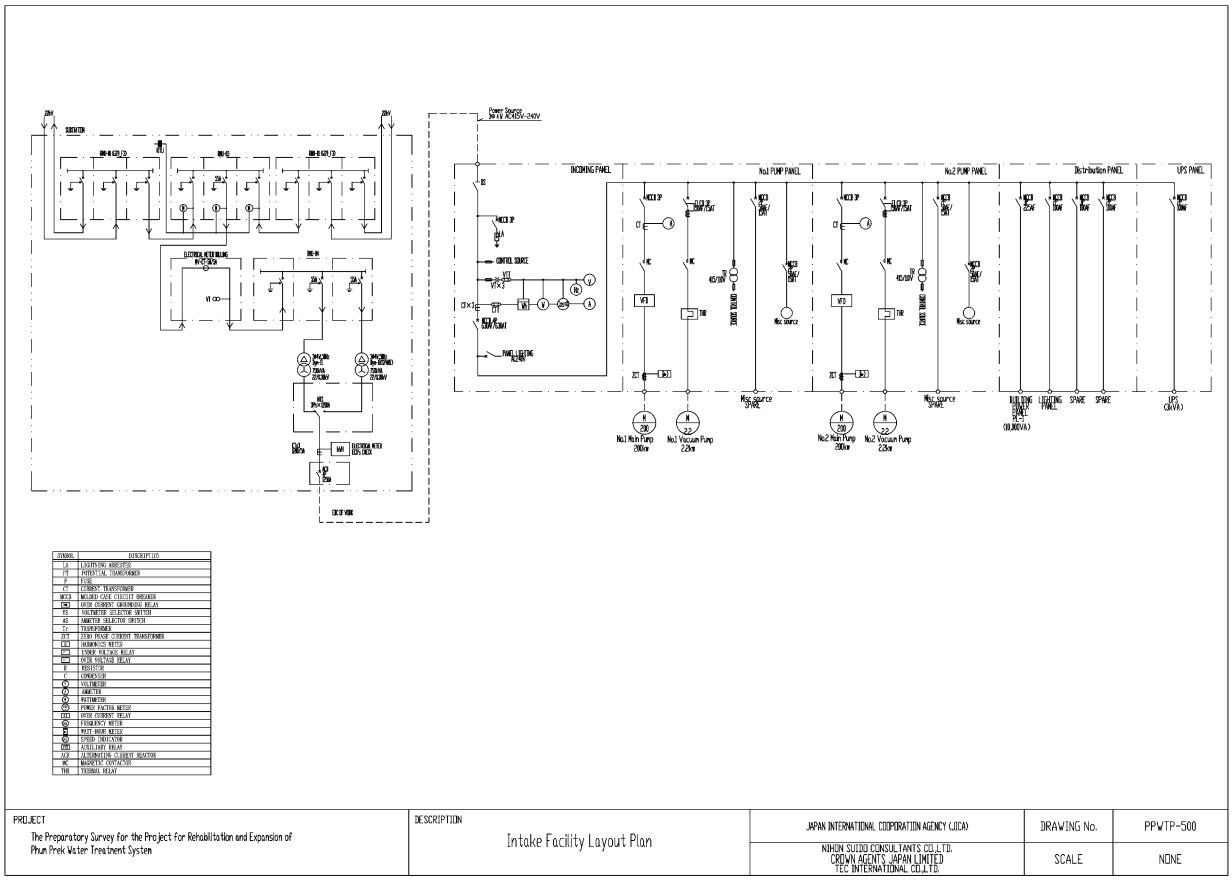


図 3-2.15　コンパラター施設の概略設計における取水場単線系統図

出典：調査団

(2)　浄水場

コンパラター施設の電気系統は受変電から機器末端まで、既設浄水施設と分離するものとする。取水場と同様に EDC の配電線より 22 kV、2 回線受電を行う。受電された 22 kV は、コンパラター施設の Substation 設置予定の変圧器により降圧して、各盤に配電を行う。EDC により Substation を建設するものとする。ただし、EDC 指定仕様の変圧器を購入して、コントラクターにより設置しても良い。受電点から変圧器までの電柱及び配管配線の工事、受電に関する手続きについてはカンボジア国側の負担とする。

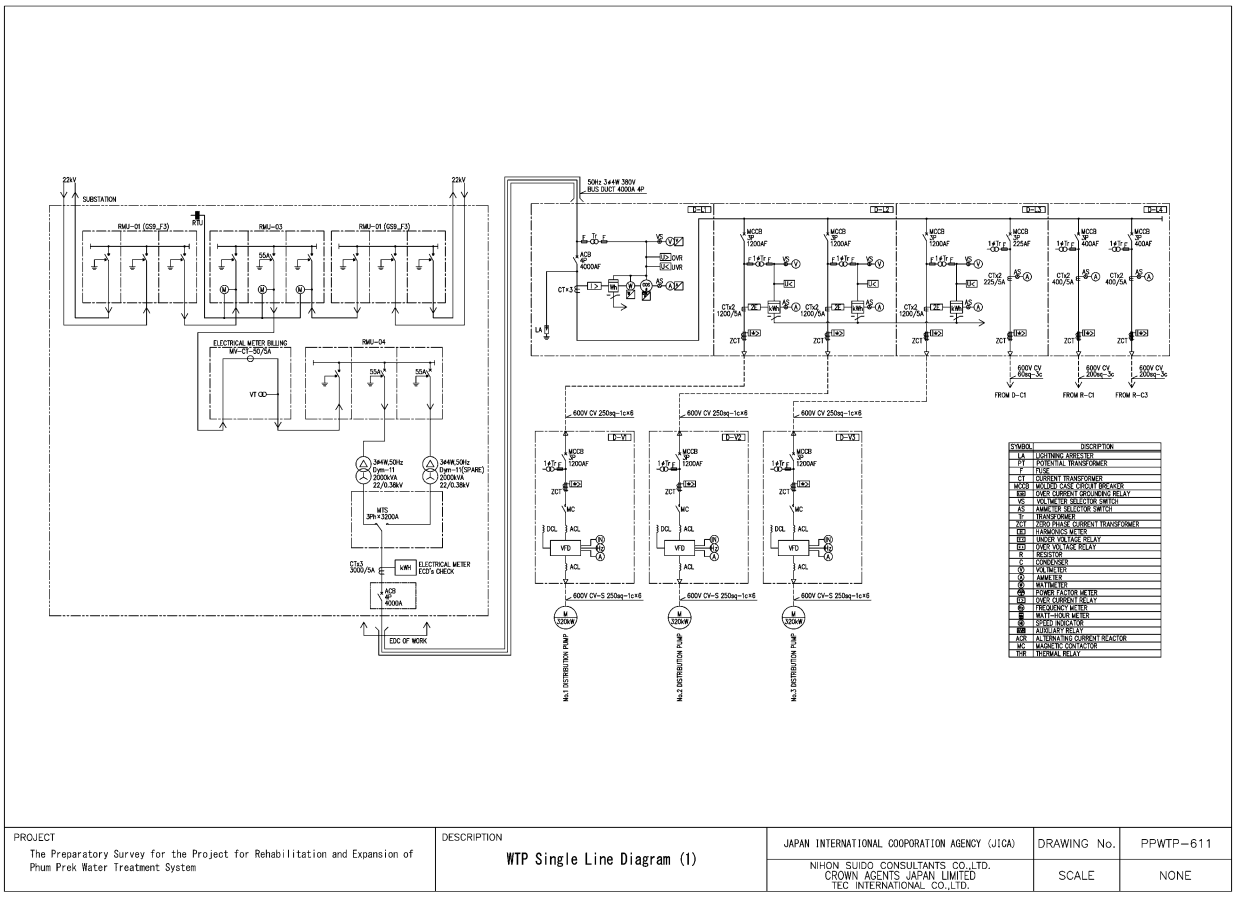


図 3-2.16　コンパラター施設の概略設計における浄水場単線系統図

出典：調査団

3-2-2-7-2　　停電時対策

プンプレック浄水場は、別々の変電所からの 2 回線受電を行っている。停電において、運転が停止することが無いように運用している。なお、停電の頻度は以下である。

表 3-2.10　プンプレック浄水場の停電頻度

停電時間（プンプレック浄水場）		
年	回数	合計時間
2015	9	4時31分
2016	2	0時21分
2017	9	3時26分
2018	-	-
2019	9	5時57分
2020	11	15時10分

出典：EDC 提供資料を基に調査団作成

取水場においても停電時対策として、2 回線受電とする。理由としては、自家発電設備と 2 回線受

電設備の工事費を比較すると自家発電設備の方が高価となる。また、敷地に制約があり、2 回線受電設備の方が省スペースで設置が可能である。尚、2017 年に完成したニロート浄水場でも常用と予備の 2 回線を受電する方式を採用しているし、タクマウ浄水場でも 2 回線受電を計画している。

3-2-2-7-3 電気料金

電気料金を**表 3-2.11** に示す。PPWSA は、0.137 USD/kWh 支払っている。2020 年 3 月に料金が下がる改訂がなされた。

表 3-2.11 電気料金

No.	Condition	Unit	Tariff
1	**From HV Substation:**		
	- Option to pay by average rate	$/kWh	0.1170
	- Option to pay by time frame and power		
	1. Rate of Power consumption	$/kW/month	2.90
	2. Rate of Energy consumption during many loads (7:00 AM to 9:00 PM)	$/kWh	0.1150
	3. Rate of Energy consumption during less loads (9:00 PM to 7:00 AM)		
	- Customers with own solar energy	$/kWh	0.0940
	1. Rate of Power consumption	$/kW/month	2.90
	2. Rate of Energy consumption (24h)	$/kWh	0.1150
2	**From MV Substation in Phnom Penh and Ta Khmao:**		
	- Option to pay by average rate	$/kWh	0.1320
	- Option to pay by time frame and power		
	1. Rate of Power consumption	$/kW/month	4.40
	2. Rate of Energy consumption during many loads (7:00 AM to 9:00 PM)		
	3. Rate of Energy consumption during less loads (9:00 PM to 7:00 AM)	$/kWh	0.1310
	- Customers with own solar energy		
	1. Rate of Power consumption	$/kWh	0.0960
	2. Rate of Energy consumption (24h)		
		$/kW/month	4.40
		$/kWh	0.1310
3	**From MV Substation outside of Phnom Penh and Ta Khmao:**		
	- Option to pay by average rate	$/kWh	0.1210
	- Option to pay by time frame and power		
	1. Rate of Power consumption	$/kW/month	3.20
	2. Rate of Energy consumption during many loads (7:00 AM to 9:00 PM)		
	3. Rate of Energy consumption during less loads (9:00 PM to 7:00 AM)	$/kWh	0.1190
	- Customers with own solar energy		
	1. Rate of Power consumption	$/kWh	0.0960
	2. Rate of Energy consumption (24h)		
		$/kW/month	3.20
		$/kWh	0.1190
4	**Industrial and Agricultural Customers from MV line:**		
	- Option to pay by average rate	$/kWh	0.1370
	- Option to pay by time frame and power		
	1. Rate of Power consumption	$/kW/month	5.00
	2. Rate of Energy consumption during many loads (7:00 AM to 9:00 PM)	$/kWh	0.1300
	3. Rate of Energy consumption during less loads (9:00 PM to 7:00 AM)	$/kWh	0.1100
	- Customers with own solar energy		
	1. Rate of Power consumption	$/kW/month	5.00
	2. Rate of Energy consumption (24h)	$/kWh	0.1300
5	**Commercial, Administration and other Customers from MV line:**		
	- Option to pay by average rate	$/kWh	0.1580
	- Option to pay by time frame and power		
	1. Rate of Power consumption	$/kW/month	5.80
	2. Rate of Energy consumption during many loads (7:00 AM to 9:00 PM)		
	3. Rate of Energy consumption during less loads (9:00 PM to 7:00 AM)	$/kWh	0.1500
	- Customers with own solar energy		
	1. Rate of Power consumption	$/kWh	0.1240
	2. Rate of Energy consumption (24h)		
		$/kW/month	5.80
		$/kWh	0.1500
6	**Industrial and Agricultural Customers from Distribution Transformer through LV meter:**		
	A) Own transformer investment		
	- Option to pay by average rate	$/kWh	0.14248
	- Option to pay by time frame and power		
	1. Rate of Power consumption	$/kW/month	5.00

No.	Condition	Unit	Tariff
	2. Rate of Energy consumption during many loads (7:00 AM to 9:00 PM)		
	3. Rate of Energy consumption during less loads (9:00 PM to 7:00 AM)	$/kWh	0.13520
	- Customers with own solar energy		
	1. Rate of Power consumption	$/kWh	0.11440
	2. Rate of Energy consumption (24h)		
	B) Transformer by supplier	$/kW/month	5.00
	- Option to pay by average rate	$/kWh	0.1352
	- Option to pay by time frame and power	$/kWh	0.15048
	1. Rate of Power consumption	$/kW/month	5.00
	2. Rate of Energy consumption during many loads (7:00 AM to 9:00 PM)	$/kWh	0.14320
	3. Rate of Energy consumption during less loads (9:00 PM to 7:00 AM)	$/kWh	0.12240
	- Customers with own solar energy		
	1. Rate of Power consumption	$/kW/month	5.00
	2. Rate of Energy consumption (24h)	$/kWh	0.1432
7	**Commercial, Administration and other Customers from Distribution Transformer through LV meter:**		
	7.1) Own transformer investment	$/kWh	0.16432
	- Option to pay by average rate		
	- Option to pay by time frame and power	$/kW/month	5.80
	1. Rate of Power consumption		
	2. Rate of Energy consumption during many loads (7:00 AM to 9:00 PM)	$/kWh	0.15600
	3. Rate of Energy consumption during less loads (9:00 PM to 7:00 AM)		
	- Customers with own solar energy	$/kWh	0.12896
	1. Rate of Power consumption		
	2. Rate of Energy consumption (24h)	$/kW/month	5.80
	7.2) Transformer by supplier		
	- Option to pay by average rate	$/kWh	0.1560
	- Option to pay by time frame and power		
	1. Rate of Power consumption	$/kWh	0.17232
	2. Rate of Energy consumption during many loads (7:00 AM to 9:00 PM)	$/kW/month	5.80
	3. Rate of Energy consumption during less loads (9:00 PM to 7:00 AM)	$/kWh	0.16400
	- Customers with own solar energy	$/kWh	0.13696
	1. Rate of Power consumption	$/kW/month	5.80
	2. Rate of Energy consumption (24h)	$/kWh	0.1640
8	Customers from LV distribution line		
	8.1 Domestic from LV distribution line		
	- 1 ~ 10 kWh/month	Riels/kWh	380
	- 11 ~ 50 kWh/month	Riels/kWh	480
	- 51 ~ 200 kWh/month	Riels/kWh	610
	- Over 200 kWh/month	Riels/kWh	730
	8.2 Non-domestic customers	Riels/kWh	730
	8.3 Water pumping for agriculture (9:00PM ~ 7:00 AM)	Riels/kWh	480
	8.4 Schools, Hospitals, Health Centers at rural area	Riels/kWh	610

出典：EDC

3-2-2-7-4 監視制御装置（SCADA）

(1) 既存施設の調査結果

コンパラター施設の概略設計として、機器の操作、状態及び計測項目を一括で監視制御するためのSCADA の導入について検討する。既設監視制御設備のシステム構成を**図 3-2.17** に示す。

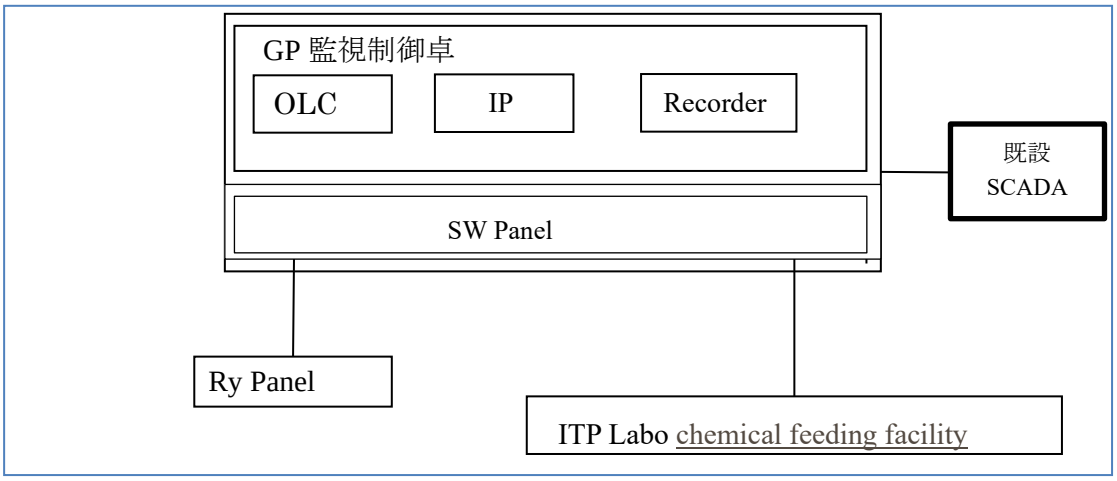


図 3-2.17　浄水場監視制御装置（SCADA）のシステム構成

出典：調査団

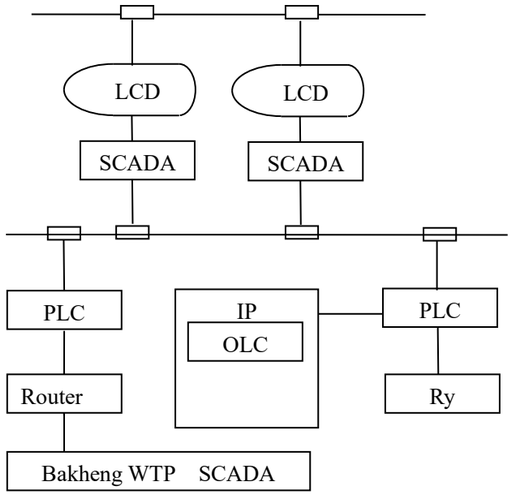
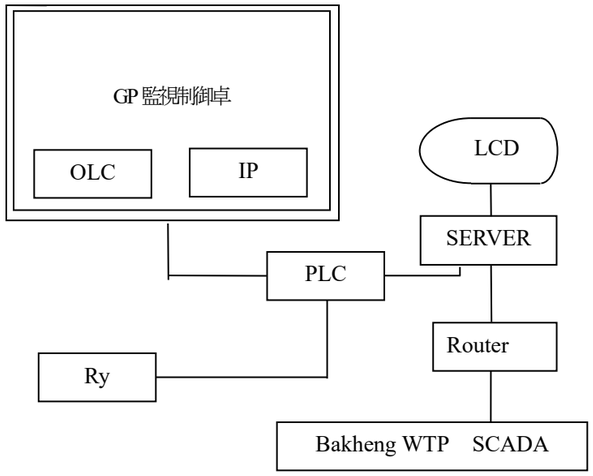
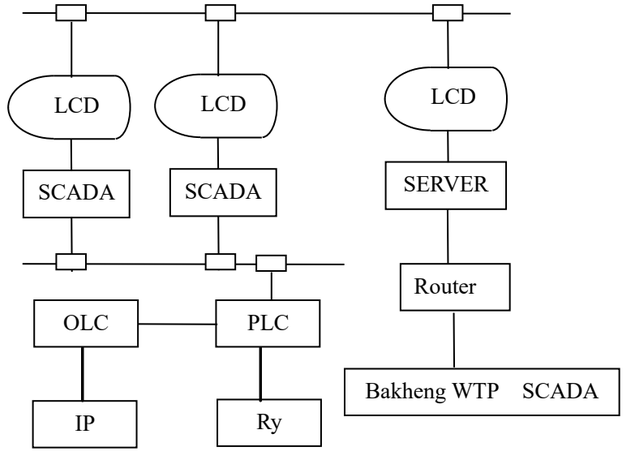
システム構成としては、現場からの各状態信号（DI）及びアナログ信号をコントロール室リレーパネルおよび GP 監視制御卓に入力し、表示および記録（レコーダー）、監視操作卓では取水ポンプ及び配水ポンプの運転操作を主に行っている。また、一部信号は GP 監視操作卓を経由して既存の SCADA（監視記録装置）に伝送されている。主な監視制御する項目を**表 3-2.12** に示す。配水管網用 SCADA は、Head Office 及びプンプレック浄水場 Control Room に端末が配置されている。

表 3-2.12　監視制御項目

監視制御項目	監　視	制　御	計　装
機器の運転状況に係る項目			
取水ポンプ	○	○	
取水ポンプ送水流量計	○		
急速攪拌池・フロキュレータ・ろ過設備	○		
空気洗浄ブロワ・逆洗ポンプ・空気源装置	○		
配水ポンプ	○	○	
薬品注入設備	○		
サンプリング水ポンプ	○		
受変電設備	○	○	
配電設備	○		
ポンプ可変速装置（VFD）	○	○	
浄水処理に係る項目			
トンレサップ川水位（na			○
取水流量			○
配水池水位			○
凝集剤注入量			○
配水流量			○
配水圧力			○
薬品貯留タンク液位			○

出典：調査団

表 3-2.13　監視制御システム形態比較

	A 案　LCD 監視制御装置	B 案 GP 監視デスク＋Server 案	C 案 LCD 監視制御装置＋Server 案
概略構成図			
監視・操作性	・プロセスの全体監視は、LCD 画面画素数制限により困難である。ただし、LCD 監視制御装置は多種多様な画面構成が可能であり、複数画面表示も可能で監視上特に問題とならない。 ・操作は、専用キーボード又はマウス等で行う。SCADA は PC1 台構成だと故障時に全く監視できなくなるため二重化する。 ・バッケーン浄水場への情報伝送は PLC により SCADA を経由せず直接伝送する。情報の伝送遅れは最小となるが、伝送路の支障時にはデータは欠損となる。	・GP を使った全体監視が容易である。データの記録装置をほとんど持たないため、Server によるロギングを行うとともに、バッケーン浄水場 SCADA への情報伝送機能を実現する。 ・GP 監視制御卓は全体が停止することはほとんど考えられないため、二重化は不要である。Server 装置は故障時の浄水場運転への影響はないためシングル構成とする。 ・バッケーン浄水場へのデータ伝送は Server を経由して行うため、伝送路の支障時にもデータ欠損は避けられるが、構成上データ伝送の時間遅れは発生する。	・プロセスの全体監視は、LCD 画面画素数制限により困難である。ただし、LCD 監視制御装置は多種多様な画面構成が可能であり、複数画面表示も可能で監視上特に問題とならない。 ・操作は、専用キーボード又はマウス等で行う。SCADA は PC1 台構成だと故障時に全く監視できなくなるため二重化する。 ・バッケーン浄水場への情報伝送と情報表示は専用の Server を設置して機能を分離する。伝送路の支障時にもデータの欠損は避けられが、構成上データ伝送の時間遅れは発生する。
保　守　性	・LCD 監視制御装置を複数台設置することにより、一方の LCD 監視制御装置保守時においても他方の LCD 監視制御装置より詳細監視操作が可能である。	・GP の保守はディスクリート構成のため比較的容易である。 ・Server はシングル構成のため保守時にはデータ欠損となる・	・LCD 監視制御装置を複数台設置することにより、一方の LCD 監視制御装置保守時においても他方の LCD 監視制御装置より詳細監視操作が可能である。
配置スペース	・既存 GP の撤去場所に SCADA を配置可能である	・既存 GP を拡張する必要がある。また Server の配置スペースが必要となり、既存のコントロール室では配置が困難である	・既存 GP の撤去場所に SCADA および Server を配置可能である
拡　張　性	・LCD 監視制御装置の機能増設時は、ソフトウェアのみ増設でよい。	・Server の機能増設時は、ソフトウェアのみ増設でよい。・GP は表示スペースの余地がある場合のみ改造可能である	・LCD 監視制御装置および Server の機能増設時は、ソフトウェアのみ増設でよい。
安全性	・LCD 監視制御装置を複数台設置することにより、一方の LCD 監視制御装置異常においても他方の LCD より監視操作が継続できるため、運転障害にはならない。	・GP による監視制御操作は、全体同時故障は考えにくいため運転の障害が発生しても一部のみに限定される。	・LCD 監視制御装置を複数台設置することにより、一方の LCD 監視制御装置異常においても他方の LCD より監視操作が継続できるため、運転障害にはならない。
経済性	安　価	高　価	やや高価
評　価	◎	△	○

出典：調査団

(2) 監視制御装置の検討

1) 監視制御システムの形態

各種システム形態の比較の結果、今回の更新にあたり LCD 監視制御装置案を採用する。既存の監視制御デスクについてはすでに更新時期を迎えており、これを別途工事で更新する場合も本案と同じ LCD 監視制御装置として更新されると考えられるが、既存の監視制御機能を今回の装置に取り込んで、1 体として更新することが最も安価で合理的であることから、本整備において既設機能と新設監視制御機能を統合した監視制御装置として設置するものとする。なお本設備機器は既存の中央監視室に再配置可能であることから、既設監視室を再利用するものとする。

2) LCD 監視制御装置台数

LCD 監視制御では、多彩な表示が可能であるが、画面サイズに限りがあるため関連する表示が全て表示できない。本施設は、浄水場として 3 系統あり、また場外に取水ポンプ場があり監視する項目も非常に多くなる。よって LCD 監視制御装置は、故障対策・操作性・監視員の人数等を考慮して複数台設置するものとする。LCD 監視制御装置は、同一機能を有した装置であるが、常時の監視体制は下記設備ごとの監視操作とし装置台数を最低限 2 台設置することとする。非常時等の情報共有のため、監視操作画面を同時表示する大画面モニターを監視制御装置毎に 1 台設置し、表示情報を共有する。

表 3-2.14 監視制御装置配置計画

設置場所	用　　途	台数	備　　考
管理棟 3 階中央操作室	全施設監視操作	1 台	新設
	全施設監視操作	1 台	新設
	配水管網監視	1 台	既設 SCADA
事務所棟	配水管網監視	1 式	既設 SCADA
合　　計		4 台	

出典：調査団

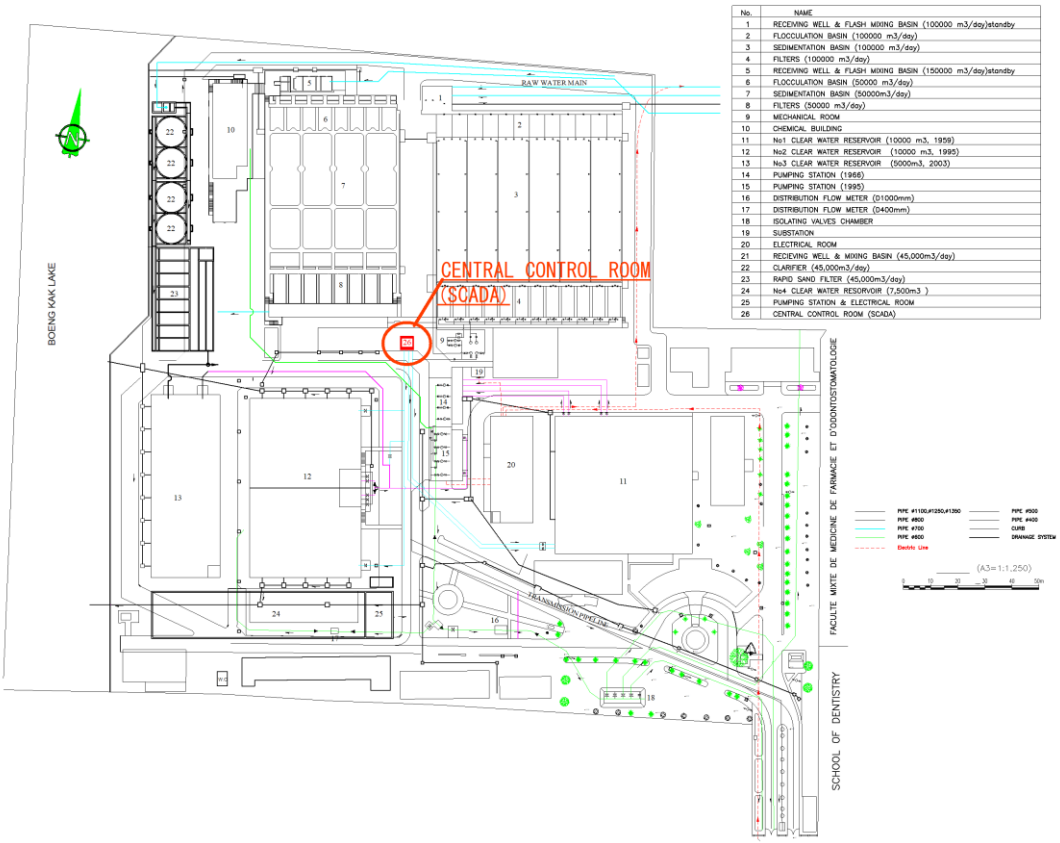


図 3-2.18　中央監視室配置案（SCADA 設備）

出典：調査団

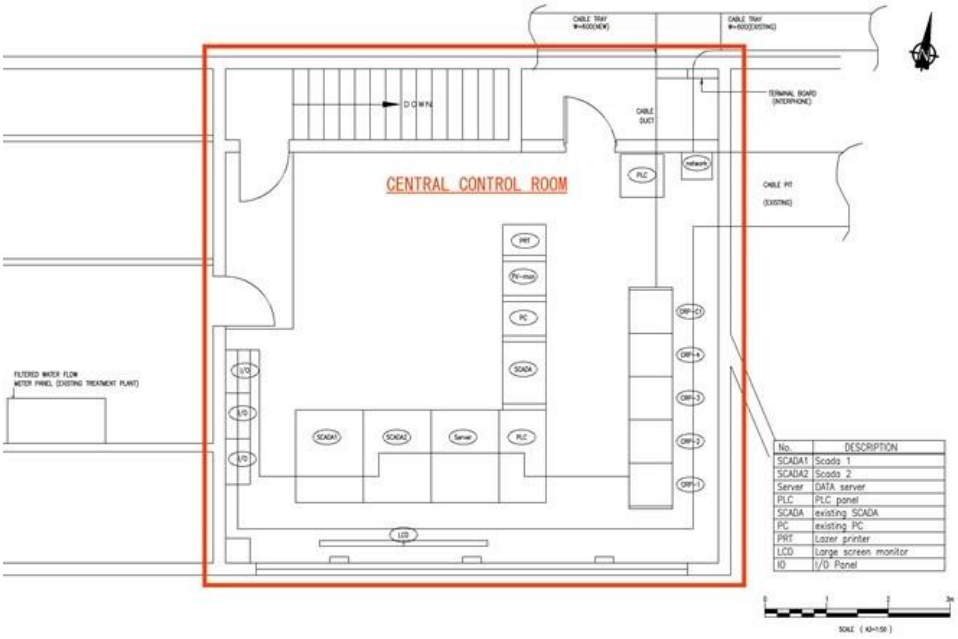


図 3-2.19　浄水場監視制御装置（SCADA）の配置案

出典：調査団

3)　LCD 監視制御装置機能

LCD 監視制御装置のハードウェアでは、24 時間連続運転が可能であり、OA パソコンに比べ信頼性に優れる FA パソコンとする。また、機器の操作方法はタッチスクリーン方式とマウス及びキーボード方式が考えられるが、下記理由よりマウス及びキーボード方式によるものとする。

タッチスクリーンは、モニターの交換に際してもシステムを停止する必要がある。これに対して、マウスによる方式では汎用モニター価格も安価であり、USB 接続によればマウス交換もシステムの停止なしに容易に行うことが出来るようになる。よって、LCD 監視制御装置での操作方式は、マウス・キーボードによるものとする。大画面表示装置を監視制御装置毎に設け、監視画面を多人数で共有可能とする。

4)　ＬＡＮの検討

現在、最も一般的な伝送路は Ethernet であり、IEEE802.3 により標準化され、各メーカも汎用性が高く、オープン化を図る目的で伝送路に Ethernet を採用するメーカがほとんどである。今回、伝送路には汎用性・オープン化という観点から Ethernet を採用するものとする。

5)　監視制御項目

主な監視制御する項目を**表 3-2.12** に示す。新設する水処理設備の運転操作方法は、既存の水処理設備の運転操作方法に準じたものとするが、配水ポンプについては今回 3 台の可変速ポンプを新設することからポンプ運転パターンを見直し、運転パターンの集約と半自動化を導入する。

3-2-2-7-5　設備計画

電気設備は、基本的に高効率、長寿命で故障が少なく、且つ初期投資額並びに維持管理費が安価なものとする。コンパラター施設の主要電気設備を**表 3-2.15** に示す。

表 3-2.15　主要電気設備

電気設備名	設置個所
1.受変電設備 －　変圧器（常用回線） －　変圧器（予備回線） －　配電盤	 屋外 屋外 屋内
2.運転操作設備 －　モーターコントロールセンタ（VFD 盤含む） －　補助継電器盤 －　現場操作盤	 電気室 電気室 各電力駆動機械の現場
3.計測設備 －　流量計 －　水位計	 各計測場所 各計測場所
4.監視制御設備 －　監視制御装置（SCADA） －　PLC 盤	 監視室 監視室

出典：調査団

3-2-3　コンパラター施設の概略設計図

本準備調査で作成したコンパラター施設の図面のリストを**表 3-2.16** に示す。コンパラター施設の概略設計図を資料に示す。

表 3-2.16　概要設計図面リスト

DRAWING No.	DESCRIPTION
PPWTP-001	Hydraulic Profile
PPWTP-010	Block Flow Diagram
PPWTP-111	3rd Stage Intake Facility
PPWTP-201	Raw Water Pipe
PPWTP-301	Water Treatment Facility Layout
PPWTP-311	Receiving Well & Mixing Channel
PPWTP-321	Clarifier
PPWTP-331	Rapid Sand Filter
PPWTP-341	No.4 Clear Water Reservoir & Distribution Pumping Station

出典：調査団

3-2-4　施工計画／調達計画

3-2-4-1　施工方針／調達方針

3-2-4-1-1　事業実施体制

本プロジェクトは、事業権無償（**図 2-1.1**）に基づいて実施され、プロジェクトの実施決定後、カンボジア政府は日本国法人のコンサルタントおよび事業者を選定し、事業を実施する。事業実施体制は、以下を想定している。D&B 契約、O&M 契約、トレーニング契約及びこれらの 3 契約を連結させる包括合意書を契約する（**図 3-2.20**）。

無償資金を活用した D&B 契約に基づき施設を整備し、その試運転段階で O&M 契約を締結した事業者がカンボジア国内で設立した特別目的会社 (SPC)と当事者交代契約（Novation Contract）を締結し、O&M 契約を引き継ぐことを想定している。なお、トレーニング契約は、本邦法人が実施しても、SPC が実施しても構わないが、事業提案時に提示した考え方に基づいて事前に合意した金額でのトレーニングの実施を想定している。なお、O&M 契約とトレーニング契約は PPWSA の原資によって支払われるものである。

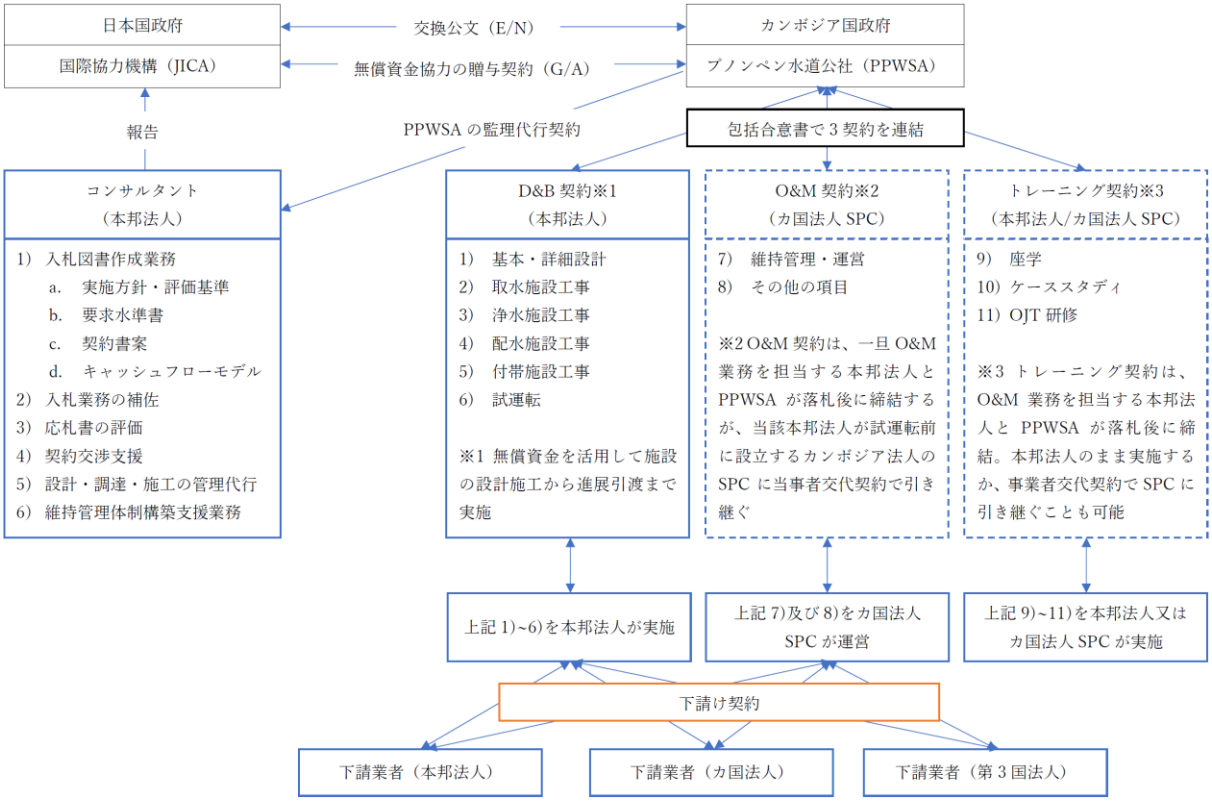


図 3-2.20　事業実施体制の概念図

出典：調査団

3-2-4-1-2　事業実施機関

本プロジェクトの実施機関及び事業実施機関は共に、プノンペン水道公社（PPWSA）である。

3-2-4-1-3　コンサルタント

日本国側が事業権無償を行う取水・導水管接続工事、浄水施設工事、附帯施設工事、送配水施設工事、及び運営・維持管理契約・トレーニング契約に係る入札補助、設計確認、施工監理、契約締結支援、及び財務モデル策定を含めた維持管理体制等構築支援は、日本国法人で水道施設の設計・施工監理及び事業権無償に精通し経験のあるコンサルタントを選定し実施する。

3-2-4-1-4　工事施工業者

日本国側が事業権無償を行う設計及び建設工事は、SPC を構成する日本国法人の設計・施工業者によって行われる。本施設整備の内訳は取水施設、浄水施設、配水施設及び付帯施設である。よって本件のような都市部における土木工事かつ水密構造物の品質を確保し、且つ水処理プラントを設計・建設することができる業者を選定する。

3-2-4-1-5　技術者派遣の必要性

日本法人の設計・施工業者によって設計・施工され、所長、主任施工管理技術者、土木取水施設施工管理技術者、浄水施設施工管理技術者、機械設備施工管理技術者、電気設備施工管理技術者、事務管理者を本邦より派遣する必要がある。

3-2-4-1-6　調達事情調査

(1)　一般資材

建設に関連する主要資材のうち、セメントはカンボジア国で生産している。コンクリートプラントはプノンペンに各所に存在している。構造物鋼材及び鉄筋は、ベトナム、タイなどからの輸入品がプノンペンで入手可能である。本プロジェクトの建設では調達数量、サイズ、規格によってカンボジア国内での調達、ベトナム、タイなどの近隣国からの調達となる。

(2)　機械電気設備

機械電気設備は、カンボジア国で制作ができないため、基本的に ASEAN もしくは OECD 諸国を想定した第三国調達となる。

(3)　カンボジア国内輸送

日本調達及び第三国調達の機材の海上輸送はシアヌークビル港に陸揚げされる。シアヌークビル港はカンボジア国で最大の商業港であり大規模のコンテナ基地があり、輸送上の問題はない。

内陸輸送に関して、シアヌークビルからプノンペンへの輸送経路は、国道 4 号を経由して陸路でプノンペンに運搬され、その国道 4 号の道路状況は良好である。ベトナム調達の場合、陸上輸送は主にベトナムから 1 号線を経由してプノンペンまで運搬される。1 号線の道路状況も良好で特に問題は無い。

3-2-4-2　施工上／調達上の留意事項

各施設の設計及び建設工事における留意事項は下記の通りである。

- カンボジア側、設計・施工業者、コンサルタント間の連携強化を図り、定期的な工程会議等、組織間の情報共有手段を明確にする。
- コンサルタントは、設計施工監理技術者を 1 名配置し、事業関係者との日々の情報共有を図るとともに、設計・施工監理業務に支障がないように留意する。
- 建設業者は、コンサルタントと同様に、現場代理人 1 名と主任技術者並びに、設計・施工に必要な技術者を配置し、責任を持って事業を実施する体制を整える。
- コンサルタント及び設計・施工業者の事務所は、事業実施に適切な場所に配置する。
- 取水施設工事は河川水位に大きく依存しており、水位が低下する 12 月から 6 月の間に工事を実施する事が望ましい。水位が上昇する 7 月から 11 月は、基本的に河川内での作業は行

わない。

- 工事期間中も住民は給水を受けているため、工事にあたっては断水にならないように配慮する。もし、どうしても断水して工事をしなければならない場合は、断水期間や場合によっては給水が濁ることについて、事前に住民への広報を行い、理解協力を得る。
- 建設工事の着工前にプロジェクトサイトの不発弾等の探査について、カンボジア関係者と協議し、不発弾等確認調査等が未完了で、埋設の可能性のある部分についてはカンボジア側が責任をもって探査・除去を実施する。また、建設時の安全対策を講じる。

3-2-4-3　施工区分／調達・据付区分

施設建設工事は、日本側が実施する。なお、カンボジア側の負担事業については、「3.相手国側分担事業の概要」にて詳細を述べる。

3-2-4-4　施工監理計画／調達監理計画

(1)　入札関連業務

入札関連業務では、入札図書の作成段階で並行して事前審査を行い、入札図書作成が終了し、PPWSA による承認後は直ちに入札公示及び入札図書配布を行う。

コンサルタントによる入札関連業務は、主に次のような業務を実施する。

- 入札手順、入札評価方法・項目・評点設定の検討
- 入札図書作成（D&B 契約書案の本邦弁護士事務所レビュー、O&M 契約書案の現地弁護士事務所レビューを含む）
- 現地調査
- P/Q 公示、P/Q 審査、図渡し
- 入札期間中の質問対応取りまとめ及び同意取り付け
- 入札評価
- 入札評価結果協議
- 契約交渉
- JICA・先方関連機関への説明・協議
- 先方政府関係機関からの承認取り付け
- 入札評価結果報告書作成

これらの全ての入札図書完成後に、PPWSA の承認を得る。

入札関連業務のフローを**図 3-2.21** に示す。コンサルタントは、カンボジア側の代理人として入札関連業務を補佐する。入札公示から業者契約まで 10 ヶ月を見込む。

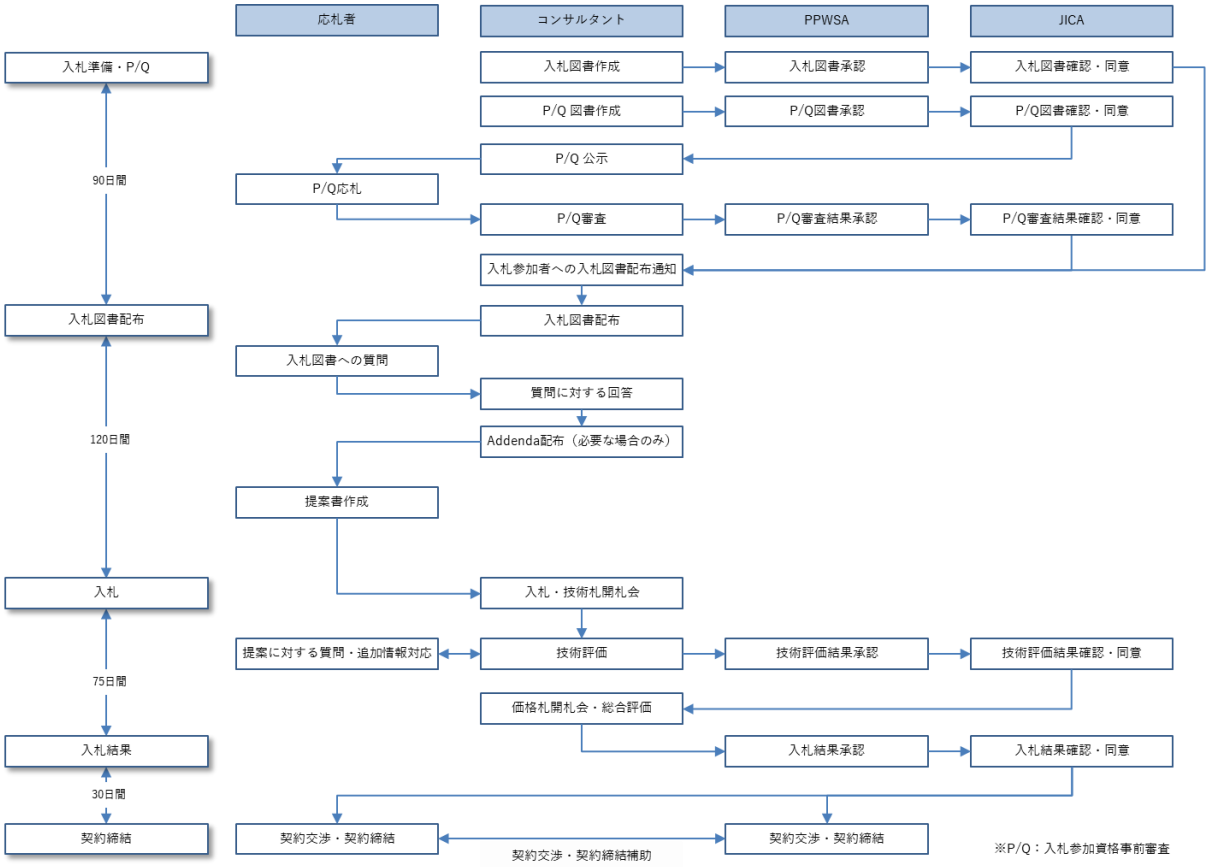


図 3-2.21　入札関連業務の流れ

出典：調査団

(2)　設計確認計画

コンサルタントによる設計確認では、主に次のような業務を実施する。

- 基本・詳細設計の設計確認及び PPWSA への説明・協議
- 基本・詳細設計の提案内容・確認結果に関する協議・承認取付け

(3)　施工・調達監理

コンサルタントによる施工・調達監理では、主に次のような業務を実施する。

- 建設工事に係る書類・材料・機材・図面・施工スケジュール、施工方法、施工手順、安全対策、品質確保、環境社会影響対策等の確認
- 建設工事現場における安全監理及び環境社会影響対策監理
- 工事品質管理会議事務局
- 検査記録、工事記録等確認
- 試運転の立会い、助言・指導
- JICA への報告
- 瑕疵検査の実施

本プロジェクトには､取水・導水施設工事、浄水施設工事、送配水施設工事及び附帯施設工事が含まれており、土木・機械・電気の各種工事を伴う一連の浄水施設の工事となっている。施工期間中、相互に関連したこれらの工事について一貫した設計確認・施工監理を行うため、工事着工から試運転・竣工まで各種分野の工事内容に対応するための技術者を短期的に派遣する。

(4) 維持管理体制構築支援

設計・施工業者による設計・施工業務の内容により、維持管理内容や維持管理方法が異なるものになるため、O&M 契約の詳細について、作成、修正・変更が必要である。また、維持管理をモニタリングするための体制構築を支援する必要がある。

コンサルタントによる維持管理体制構築支援では、主に次のような業務を実施する。

- 運営維持管理契約の締結及び受注者による当該業務への円滑な移行の支援
- 維持管理における O&M モニタリング体制構築支援
- 詳細設計前のモニタリング概要および緊急時対応計画対象項目の確認
- 詳細設計内容に基づいたモニタリング指標の検討及び、PPWSA との協議
- 途中段階でのモニタリングの指標及びその確認の方法・頻度の決定についての進捗確認
- 引渡し前の配員計画、SPC 事業計画、および収益目標の確認
- SPC に求める最低資本金の検討と、PPWSA との協議による決定
- モニタリングフロー、業務報告フロー、不具合発生時の対応方法、緊急時対応計画の確認等
- 業務運営マニュアルの内容確認および策定支援等
- その他の項目についての PPWSA との協議
- O&M 契約の詳細条件等に係る契約変更等
- O&M 完了後引き渡し条件検討・修正・変更
- O&M 契約変更・修正等に係る法的妥当性確認

3-2-4-5 品質管理計画

SPC は、品質管理計画を作成する。品質管理計画は、管理項目、内容、方法、適用規格等について、設計図書や仕様書と照らし合わせ実施することなる。原則として、品質規格は JIS あるいは ISO もしくは同等の国際規格を適用することを前提とする。

3-2-4-6 資機材等調達計画

3-2-4-6-1 資機材等調達先の選定

本プロジェクトに必要な資機材の調達は、原則として現地調達もしくは日本調達とするが、第三国調達の可能性についても検討を行い、資機材調達先に関しては、以下の事項を考慮して決定する。

・ 資機材の品質が要求事項を満たすものであること
・ 品質や供給量に関してカンボジア市場での可能性があること
・ スペアパーツ供給を考慮した修理・保守の容易性をもつこと
・ 価格の妥当性
・ アフターケアの確約

工事用資機材の調達については、原則、現地調達または本邦調達とするが、現地調達または本邦調達が困難な場合は、第三国調達も可能とする。

主要資機材調達先区分表を**表 3-2.17** に示す。

表 3-2.17　主要資機材調達先区分表

資　機　材　名	調　達　先			備考
	現地	日本	第三国	
1. 工事材料				
生コン、砂、砂利、セメント、鉄筋	○			
型枠合板、木材	○			
H 形鋼等鋼材	○			
塗料類、潤滑油、燃料	○			
足場材、支保工材等	○			
2. 機械設備				
取水ポンプ・配水ポンプ			○	
その他ポンプ			○	第三国は ASEAN（タイやベトナム）、OECD 国を想定
天井クレーン			○	
水処理機器			○	
薬品注入設備			○	
換気ファン			○	
配管材料、バルブ類			○	
3.電気設備				
変圧器			○	
受電盤			○	
配電盤			○	
コントロールセンタ（VFD を含む）			○	
補助継電器盤			○	
現場操作盤			○	
流量計			○	
水位計			○	
監視制御設備			○	
ＰＬＣ盤			○	
分電盤			○	
照明器具、配線器具			○	
電線管、ケーブル、その他配線材料			○	

出典：調査団

3-2-4-6-2　建設機械調達先の選定

カンボジア国内の建設業者等が多数保有しており、リースが可能であり、現地調達とする。

3-2-4-7　初期操作指導・運用指導等計画

本案件にて新設される浄水場は、建設後引き続き SPC が雇用する人員により維持管理が行われる。SPC 自身が設計・施工する施設であり、基本的には SPC 自身で維持管理指標や維持管理方法等をまとめた維持管理マニュアルを整備し、職員の技術指導並びに能力開発も自らが行うことになるが、コンサルタントは維持管理マニュアルの整備や試運転並びにトレーニングに係る助言を行う。

3-2-4-8　ソフトコンポーネント計画

本プロジェクトにおいてソフトコンポーネントは含まれない。

3-2-4-9　実施工程

本プロジェクトの実施工程は、工事内容・工期の関係から、複数年度案件として実施計画を策定した。最初の年度に入札を行い、翌年度から工事（設計・調達・施工・維持管理準備）を実施するものとする。工期は、入札期間が 10 ヶ月（**図 3-2.22**）、設計・調達・施工が 39 ヶ月（**図 3-2.23**）である。

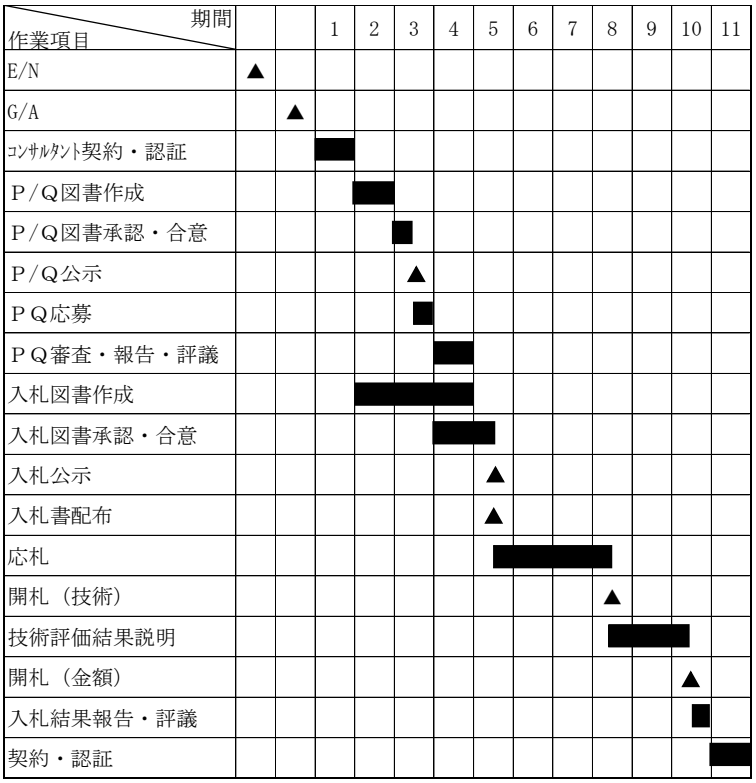


図 3-2.22　入札関連業務のスケジュール

出典：調査団

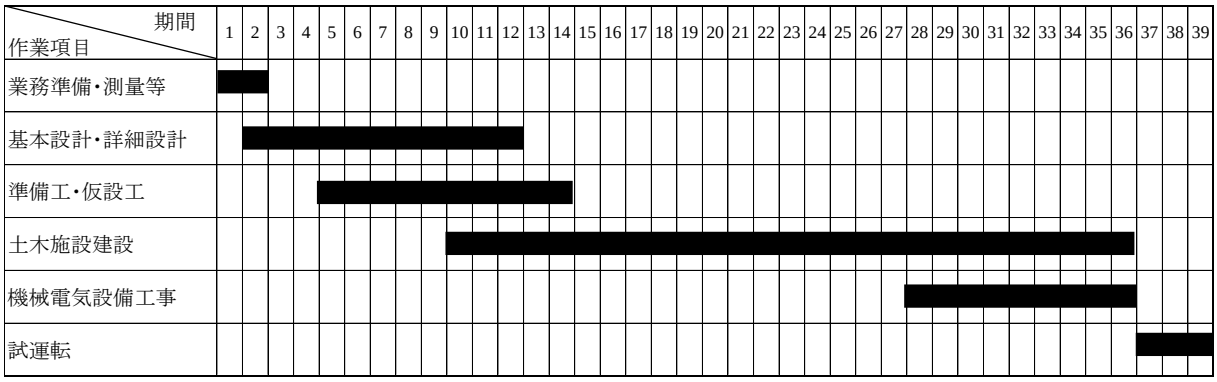


図 3-2.23　実施工程計画（設計・調達・施工）

特記：実施工程計画（設計・調達・施工）は、コンパラター施設の想定であり、入札時において、事業者により提案された実施工程計画を評価する。

出典：調査団

カンボジア国の首都プノンペンの気候は熱帯モンスーンであり、5 月から 10 月が雨期、11 月から 4 月が乾期である。

トンレサップ川は、年間の水位変動が大きく、取水施設の建設は、河川流量、水位によって大きく影響を受けるので、11 月から 4 月の乾期に主要工事を行うことが必要である。

3-2-5　安全計画

カンボジアは日本国外務省危険情報レベル 1 に位置付けられており、プノンペン周辺では治安の懸念は少ない。しかし、盗難等を含む軽犯罪は多く発生しており、工事期間中および据え付けられた機材等については常に盗難対策を施すことに留意する必要がある。
また、施工の安全対策について、請負事業者は「ODA 建設工事等安全管理ガイダンス」および現地の工事安全および労働安全衛生に関する法律基準を順守し、必要な安全対策を取る必要がある。
労働者の疾病や事故を防ぐため、請負事業者はカンボジア国内法や国際基準（OHSAS）に基づき労働安全計画を策定し、建設労働者に対して、労働安全に関するトレーニングを実施すると共にマスクや手袋など防護用具を必ず配布するようにする必要がある。

なお、本事業では取水施設の築造を行うことから、工事境界における仮囲い、労働者の教育、重機の管理、高所作業における安全具の整備とその使い方の指導などは特に重点的に配慮する必要がある。また、特に、過去の無償資金協力における事故事例や（転落事故・人身事故等）の状況も事前に調査し、週例会議・月例会議および品質管理会議で重要な議題として取り扱い、充分な配慮を行う。

3-3　契約形態／入札

3-3-1　契約形態

3-3-1-1　概要

本プロジェクトは、事業・運営権対応型無償資金協力の適用を前提として、無償資金の対象となる設計施工契約（D&B 契約）と、PPWSA の予算で実施される運営期間における運営・維持管理契約（O&M 契約）及びトレーニング契約、及び上記 3 契約の一体性を規定する包括合意書を、総合評価落札方式による競争入札によって単一の事業者（単独企業或いは共同事業体）に発注することを想定する。

(1)　設計施工契約（D&B 契約）:

無償資金を原資とする施設の設計施工と施設の引き渡しを行う業務を設計施工業者と規定する。

(2)　運営・維持管理契約（O&M 契約）:

無償資金で整備した施設に対する PPWSA 予算を原資とする運営・維持管理業務を規定する。運営・維持管理を行う事業主体は、落札時に O&M 契約を締結した事業者がカンボジア国内で設立した特別目的会社(Special Purpose Company: SPC)が行うものとする。SPC の資本金は 12 億リエル以上とし、入札に参加した日本企業が最低 51%を有することとする。O&M 契約を締結した事業者と当該 SPC が当事者交代契約（Novation Contract）を締結し、O&M 契約を引き継ぐことを想定する。SPC の設立は、D&B 契約で整備した施設の試運転実施前とする。

(3)　トレーニング契約：

PPWSA 予算を原資とする PPWSA に対するトレーニングサービスの提供をトレーニングサービス提供業者と規定する

(4)　包括合意書

以下の通り契約者、特性および事業期間が異なる上記の 3 契約の一体性を規定する包括合意書を作成する。

表 3-3.1　包括合意書で一体性を規定する対象となる契約

契約名	契約者	特性	事業期間
D&B 契約	設計施工事業者	日本政府の無償資金による無償資金事業	施設の引渡し後 1 年間の瑕疵担保期間を含む継続的な無償資金の対象期間
O&M 契約	運営維持管理事業者	PPWSA 予算による維持管理契約	施設整備の最終段階における試運転前に SPC に引き継ぎ、施設引き渡し後 10 年間の継続的な期間
トレーニング契約	トレーニング事業者	PPWSA 予算によるトレーニング契約	O&M 契約の 10 年間の運営期間中に実施されるスポット的なサービス実施

出典：調査団

3-3-1-2　D&B 契約

D&B 契約書案は、FIDIC Yellow Book 及び JICA の標準契約雛形に準じて作成する。なお、タクマウ・プロジェクトで活用した結果をフィードバックする。

3-3-1-3　O&M 契約

3-3-1-3-1　概要

O&M 契約書案は、事業権無償の趣旨を反映して適切な業務分担・支払条件・リスク分担を規定する。契約条件は現地法に基づいて作成し、現地弁護士事務所によるリーガルチェックを受ける。

3-3-1-3-2　主要契約条件

O&M 契約書案の主要契約条件の項目及びその内容は、**表 3-3.2** の通り。

表 3-3.2　主要契約条件の項目及び内容

項目	内容
O&M 期間	施設整備完了から 10 年間とする。PPWSA からの要望がある場合には、協議の上延長も可能とする。
浄水の生産	規定の水質基準を満たす浄水の生産・供給は基本的に SPC の責任とする。
VAT	PPWSA から事業者に支払う業務対価については、現地法に基づいて免税となることが想定されているが、税当局の判断により課税となった場合には PPWSA の負担とする。
水質テスト	原水については事業者の責任で実施する。浄水の水質は PPWSA が検査する。
施設維持及び修繕	O&M 契約期間における修繕及び必要な部品交換等に要する費用は契約額に含み、事業者のコストと責任で実施する。事業者は要求水準に定められた運営基準に従って施設を運営・維持管理する。
施設の引き渡し条件	O&M 契約の終了時において、事業者は契約時に定めたパフォーマンス基準に準じた状態で施設を返還する。また、事業者の運営のために変更した箇所については、PPWSA の要望がある場合には原状回復義務を有する。薬剤等の在庫については正味簿価で PPWSA が引き取ること権利を有する。
民間所有の機材等	O&M 期間の終了時において、事業者が所有する付随施設、ソフトウェア、または、その他運営に必要な機材等について、PPWSA は正味簿価で引き取る権利を有する。
セルフモニタリング	事業者は運営・維持管理業務について、要求水準の規定に基づいて事前に PPWSA と合意した方法と頻度でモニタリングを行い、結果を PPWSA に報告する。
運営データと財務情報	事業者は運営に関するデータ及び財務情報を規定のフォーマットで記録・報告し、データを共有する。PPWSA は施設の返還後に当該データを活用して運営を継続する。
早期契約解除・清算事象	・任意終了（PPWSA からの一方的な終了） PPWSA は公益のために契約を早期に終了する権利を有する。ただし、PPWSA は当該業務のために事業者が調達した機材等、契約の終了によって発生した追加費用、および契約の機会費用について全額補償する。契約の機会費用は、当初事業計画で合意した利益の残存期間分とする。 ・PPWSA のデフォルトによる終了 終了条件は前述した任意終了の場合と同等とする。 ・SPC のデフォルトによる終了 PPWSA は、事業者の資産等の権利および利益の全てを PPWSA へ譲渡することを要求でき

項目	内容
	るものとする。資産の価値は、資産の正味簿価から、契約の終了により PPWSA が被った損害および損失の費用を差し引いたものとする。 ・不可抗力による解除 予測不可能かつ対応不可能な外部要因であり、プロジェクトに重大な悪影響を及ぼす事象を不可抗力とし、不可抗力が発生し契約の遂行が困難となった場合、その対応に伴う費用は双方の負担とする。またその状況が 180 日以上継続した場合、双方は契約を解除することができる。その場合 PPWSA は事業者に対して民間資産を正味簿価で譲渡することを要求できる。
支払条件	事業者は当月に供給した水量に基づき翌月の 10 日までに請求書を提出する。 PPWSA は請求書を受領日から 1 か月以内に支払いを行う。支払通貨はカンボジアリエルとする。
従業員の雇用	O&M 契約の終了時において、PPWSA と事業者は双方合意の下事業者の雇用を PPWSA が引き継ぐことができる。
保険の付与	現地法による規定がない限り、事業者は運営期間中において第三者賠償責任保険等を付与する責務を負わない。ただし、事業者の判断とコスト負担で当該保険を付与することができる。
紛争解決	契約上の紛争解決のプロセスは英語によって行われることとし、裁判はシンガポールに所在する the International Court of Arbitration (ICC) 或いは the Singapore International Arbitration Centre (SIAC)にて実施することとする。

出典：調査団

3-3-1-3-3 リスク分担

本プロジェクトにおけるリスク分担は、最もリスクを適切に管理できる主体が当該リスクを負担することで事業価値を最大化することを基本的な考え方とする。主なリスクと分担は以下の通りである。

表 3-3.3 リスク分担表

リスク	PPWSA	SPC	内容
瑕疵・故障リスク		O	不可抗力を除いて、施設の瑕疵や故障に関するリスクは事業者の負担とする。
需要リスク	O		PPWSA は最終需要の低迷や配水網のトラブル等により、45,000 ㎥/日の浄水を受け入れることができなかった場合においても、事業者が 45,000 ㎥/日の浄水を供給可能であれば、当該水量に対する支払いを補償する（Take or Pay）。
運営リスク		O	事業者の運営の瑕疵によって水質基準を満たさない水が供給された場合（機械の故障や薬品の扱いの不備等）、PPWSA の支払い義務は生じない。さらに、PPWSA の定める飲料水質基準を満たさない浄水を給水して PPWSA に損害が生じた場合には、事業者には損失の補償義務が生じる。事業者による保険（賠償責任保険等）は事業者の任意とする。
原水供給リスク	O		PPWSA の瑕疵によって原水が供給されなかった場合、事業者は当該損失を PPWSA に請求できる。
原水水質リスク	O		長期的に原水の水質が悪化した場合、事業者は追加の浄水コストを PPWSA に請求することができる。
電力価格リスク		O	電力価格の変動は事業者の負担とする。
電力供給リスク		O	電力の確保は基本的に事業者の責任とする。停電等事業者の責に帰さない事由により電力が供給されなかった場合、PPWSA は事業者の営業補償や固定費の負担を含め、当該期間中事業者に対する支払い責任はない。一方、事業者も浄水の供給責任を免除される。
薬剤調達リスク		O	薬剤の調達は事業者の責任とする。

リスク	PPWSA	SPC	内容
物価上昇リスク	O		物価変動が生じた場合は、支払メカニズム（価格算定式）により自動的にバルク水単価に反映する。物価変動の基準は、National Bank of Cambodia の公表する ECONOMIC AND MONETARY STATISTICS に記載された Consumer Price Index and Inflation Rate の CPI（All items）を適用する。
許認可リスク	O		IEIA 及びその他運営に必要な許認可は PPWSA が取得する。
法令変更リスク (水道セクター)	O		水道セクター特有の法令変更（飲料水の水質規準強化等）によって追加コストが生じた場合、SPC は PPWSA に対して当該コストを請求できる。
法令変更リスク (経済全般)		O	国或いは経済全体に影響する法令変更による追加コストについて SPC は PPWSA に対して当該コストを請求できない。(VAT 率の変更、法人税率の変更等)。
不可抗力リスク	O	O	予測不可能かつ対応不可能な外部要因であり、プロジェクトに重大な悪影響を及ぼす事象を不可抗力とし、不可抗力が発生し契約の遂行が困難となった場合、その対応に伴う費用は双方の負担とする。またその状況が 180 日以上継続した場合、双方は契約を解除することができる。民間資産がある場合は、PPWSA は SPC に対して、正味簿価にて民間資産の受け渡しを要求できる。

出典：調査団

3-3-1-3-4 支払メカニズム

上記の契約条件及びリスク分担を踏まえて、SPC の運営・維持管理業務に対する対価をバルク水の供給量を基準とした業務委託費として以下のように規定する。

SPC の収入＝バルク水供給量に応じた業務委託費
＝ バルク水供給量 × バルク水販売単価
バルク水販売単価 ＝ 基準バルク単価×インフレ指数

バルク水供給量は事業者の O&M 業務の最下流であるフィルターに設置した流量計によって計測する。

運営期間の初年度から 3 年間のバルク水価格は PPWSA の定める上限価格の範囲内で事業者が入札において提案した単価と D&B 期間中の累積インフレ率に応じて算定する。バルク水価格は運営期間の 4 年目、7 年目、10 年目の開始日において、過去 3 年間の累積インフレ率を参照して改定する。尚、運営期間の初年度から 3 年間における上限バルク水価格はコンパラター計画の積算を参考に PPWSA と KHR350/ m^3 で暫定合意している。

インフレ指数は National Bank of Cambodia の公表する ECONOMIC AND MONETARY STATISTICS に記載された Consumer Price Index and Inflation Rate の CPI（All items）を適用する。

3-3-1-4 トレーニング契約

規定のトレーニングサービスに対する対価を Lump-sum で支払う契約条件とする。本邦法人が直接実施する、或いは SPC が実施することとし、事業主体に応じた契約主体とする。トレーニング契約の対価は O&M 契約と同様に PPWSA の原資によって支払われるものとする。

トレーニングサービスの契約額は、暫定的に$30,000/年を上限として合意している。トレーニングの実施期間については暫定で 10 年間毎年実施する想定であるが、PPWSA の要望により入札の段階で調整が行われる可能性がある。

表 2-4.4　トレーニング予算内訳

費用内訳	単価	量	金額
報酬	$1,000/日・人	3 人 ＊7 日/回 ＊1 回/年	$21,000
渡航費	$2,000/渡航	3 人 ＊1 回/年	$6,000
宿泊費	$150/泊	3 人 ＊6 泊/回 ＊1 回/年	$2,700
その他	--	--	$300
		合計	**$30,000**

出典：調査団

なお、トレーニングの内容は、マネージャー以上を対象に以下のトレーニングを実施することを想定している。

１．　データ分析（基礎＆専門）
２．　水質分析＆管理
３．　監視制御電気設備の維持管理
４．　予防保全

3-3-2　入札

3-3-2-1　概要

本プロジェクトの入札は、JICA の無償資金協力調達ガイドライン及び標準入札図書（入札指示書スタンダード・(施設・建設案件）に基づいて実施する。事前資格審査及び、入札評価の 2 段階方式とし、入札評価は総合評価落札方式を採用する。

尚、標準入札指示書は総合評価落札方式に対応していないため、Bid Data Sheet にて必要な修正を行うことを想定する。

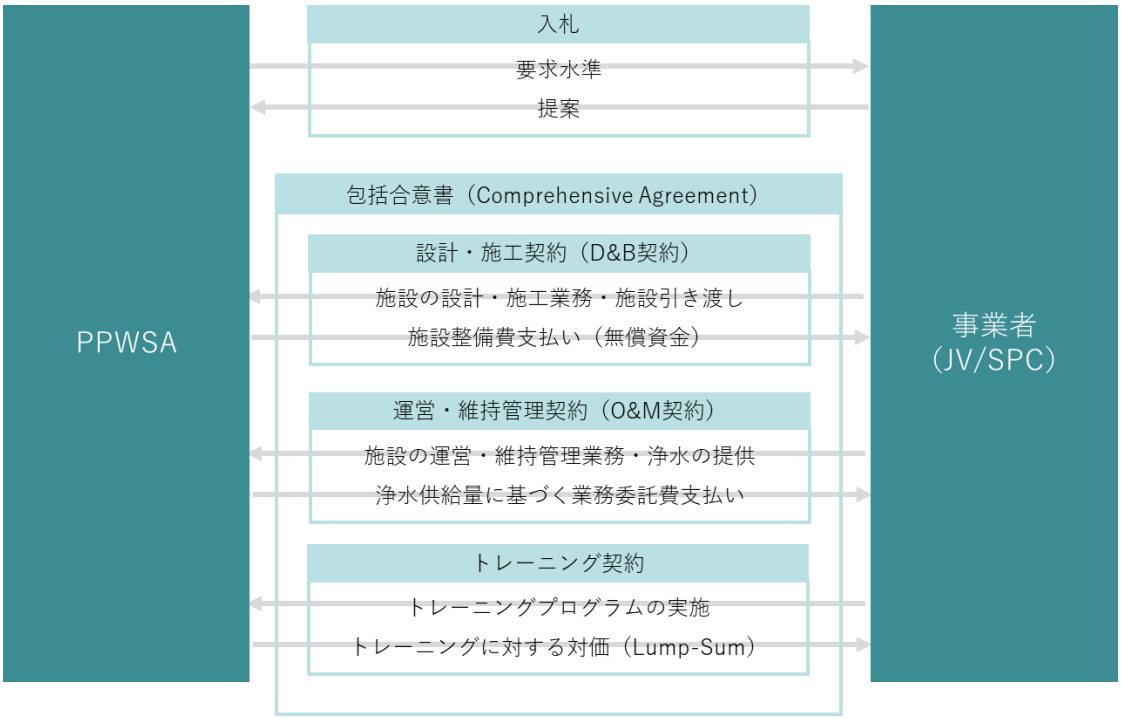


図 3-3.1　入札、契約及び事業の実施形態

出典：調査団

3-3-2-2　現地法との整合性

本プロジェクトは維持管理運営サービスおよびトレーニングサービスも含めた無償資金協力として、カンボジア公共調達法の例外規定に基づき、維持管理運営サービスおよびトレーニングサービスについても JICA の無償資金協力調達ガイドラインの適用を受けられることを M/D において PPWSA と合意している。ただし、下記のように公共調達法第 3 条では、ファイナンス合意書（G/A であると想定される）で記載された活用原則と手続きに則って履行されるという記載があるだけであり、JICA の無償資金協力調達ガイドラインの適用を確約したものではない。また、PPWSA は上場企業であり、前述した合意内容は取締役会での承認を得たうえで、調達手続きが進められるが、株主が公共調達法の例外規定を適用することを違法として訴訟する可能性もある。このような無償資金の適用原則と手続きが変動するリスクを軽減するため、G/A においても、本プロジェクトは、カンボジア公共調達法に基づく調達(同法 3 条の例外規定適用)であり、JICA の無償資金協力調達ガイドラインが適用される具体的な活用原則と手続き内容であることを記載しておくことが望ましいと考える。

3-3-2-3　入札参加資格事前審査

入札参加資格事前審査においては、入札資格のない者を明確化したうえで、事前資格申請書の提示を求める。入札資格の無いものとは、法律に基づく処分を受けている者や、反社会勢力の疑いや反社会勢力との関わりがある者もしくは、資本関係や組織体制等により応札が認められない

者であり、このような者が事前資格申請書を提出した場合には、申請書を無効とする。入札参加資格事前審査は、事業権無償の特性を考慮し、無償資金協力事業で採用される標準的な P/Q 項目を踏まえて以下のように設定する。

- 応札者は、設計、施工及び運営・維持管理のすべての実績・ノウハウを有する単体企業或いは共同事業体として入札する。
- 共同事業体の場合、応募時点で共同企業体の各企業の役割分担及び最低出資比率を記載した JV 合意書を提示する。
- 応札者は E/N 等で定める Japanese Nationals とする（共同事業体の場合、すべての企業は Japanese Nationals とする）。
- 応札者に求められる類似案件の実績については、以下の通りとする。ただし、G/A 締結後の JICA の確認同意プロセスによって最終的に確定する。
  - 過去 10 年以内に 15 億円以上の建設案件を 3 件以上海外において実施していること
  - 過去 10 年以内に 10,000 m^3 以上の飲料用水の浄水場を国内外において 2 件以上実施していること

3-3-2-4 総合評価

入札において PPWSA は事業の実施方針、要求水準及び契約条件を提示し、応札者は施設の基本設計、建設計画、運営・維持管理計画及びトレーニング計画と以下に示す価格を提案する。各提案の総合得点は以下の数式に基づいて決定し、最高得点を獲得した応札者が最優先交渉者となる。

総合得点= 技術点 × α + 価格点 × (1-α)

α：技術評価と価格評価の比重：50%を想定

3-3-2-4-1　技術評価

表 3-3.3　技術点の評価内容

	評価項目	配点
1	組織の経験と実績	TBD
2	概略設計・プロセスデザイン	TBD
3	施工計画	TBD
4	品質管理計画	TBD
5	安全・環境配慮	TBD
6	運営維持管理に係る計画と体制	TBD
7	トレーニングプログラム	TBD
	合計	100

出典：調査団

3-3-2-4-2　価格評価

価格は 10 年間総調達コスト（D&B 価格と O&M 価格：10 年間の O&M 対価の総額）を対象とし、以下の式で算定する。トレーニング契約の金額は固定として価格評価対象外とする。

価格点 ＝ 最低価格 / 入札者の価格 * 100

尚、O&M 価格の前提となるバルク水については、運営期間の初年度から 3 年間に適用されるバルク水価格の基準として上限価格を設定する。上限価格については、コンパラター計画の積算を参考に設計施工期間における予想インフレ率を前提として KHR350/ m^3 で暫定合意している。

3-4　相手国側分担事業の概要

3-4-1　導水管の整備

既存導水管（φ1200 mm、φ700 mm、φ700 mm）のうち現在使用されていない 2 系統の φ700 mm 管路は老朽化が進んでいることから、運営期間中のリスク軽減と消費電力削減を目的として新規に φ800 mm の導水管を G/A 上の先方負担事項として PPWSA が新設する。PPWSA による導水管敷設の遅延による損害（試運転開始の遅れによる人件費の増加等）が生じた場合、D&B 契約或いは O&M 契約において PPWSA が当該追加コストを負担する。

新規に増設する浄水施設の試運転を 2026 年 12 月から開始予定であるため、新規導水管は事業者による接続作業準備期間等を考慮し、試運転開始 3 ヵ月前の 2026 年 9 月までに敷設が完了する予定として設定する。

本整備の電力削減効果の経済性は以下の通りで、現状の電力代を前提とした IRR は約 3.4%、投資回収期間は 25 年程度となる。投資収益性は限定的だが、運営期間中の浄水の安定供給に寄与することから PPWSA は実施することを合意している。

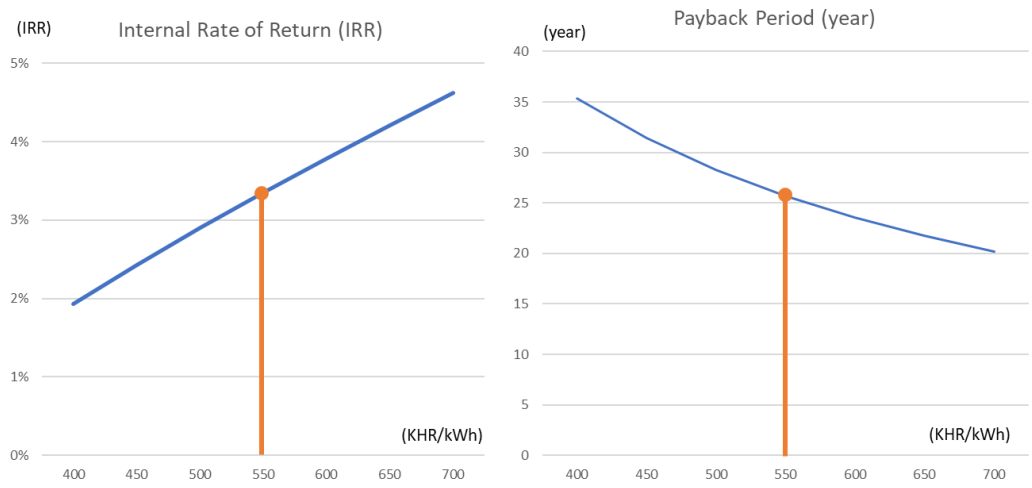


図 3-4.1　導水管整備の経済性

出典：調査団

尚、協力準備調査の一環で、事業者の創意工夫と民間資金で事業価値を最大化する観点から、民間資金活用案を検討し、PPWSA と協議した。PPWSA が本プロジェクトの事業者に対して導水管の設計及び資材調達を委託し、その対価を O&M 期間に合わせて 10 年間の分割払いとする民間資金活用案として**表 3-4.1** の通り事業採算性の試算をしたが、事業者の負担するリスク（信用リスク、為替リスク）への対価を含めた支払条件では PPWSA にとっての事業採算がとれないこと等を理由に、導入を断念した。

表 3-4.1　民間資金による導水管整備の事業採算性

(thousand USD)

Assumptions	
Forex rate	JPY110/USD
Engineering (Design) Cost	100
Procurement Cost	3,636
Total Contract Price	3,736

	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Total
Payment by PPWSA	0	560	560	560	560	560	560	560	560	560	560	5,605
Cashflow of the Contractor	-3,736	560	560	560	560	560	560	560	560	560	560	1,868

IRR to the Contractor

8%

出典：調査団

3-4-2　浄水場用地のサイトクリアランス

沈殿ろ過池、配水池いずれの施工用地においても、**図 3-4.2** に示す通り、空きスペースや場内道路は資材置き場として仮の利用がされている。施工前にこれら資材の搬出が必須である。これら

はPPWSAの所有物であることから、既存の仮置きされている資材（**図 3-4.2** 参照）の搬出、並びに搬出先の用地の確保はカンボジア国負担とする。

図 3-4.2　浄水場内の仮置き資材

出典：調査団

プンプレック浄水場内でのStage3関連施設の施工において、既存構造物の撤去・移設・切り廻しが必要な施設は**表 3-4.2**、**図 3-4.3** の通りである。表には負担についての案を示しており、詳細については事業者による設計段階でPPWSAとの協議により確認する。舗装の撤去は工事の一環であるためコントラクター負担となる。

表 3-4.2　既存浄水場内の撤去・移設・切廻しが必要な施設

施設	種類	概要	負担（案）
場内全般	管路資材	場内道路に仮置きされている管路資機材＜搬出＞	PPWSA
沈殿・ろ過池周辺	地中配管	場内配管（ろ過池～配水池）φ700 mm＜切廻し＞ 場内配管（薬品注入棟～配水ポンプ室）φ150 mm＜切廻し＞ 場内配管（排水管）φ700 mm＜切廻し＞	コントラクター
配水池周辺	仮設	管路資材ストックヤード＜資材搬出・ヤード撤去＞	PPWSA
	土木 RC	流量計室 φ400 mm 用＜移設＞	コントラクター
	地中配管	場内配管（配水管）φ400 mm＜切廻し＞ 場内配管（排水管）φ700 mm＜切廻し＞	コントラクター

出典：調査団

＜管路資材ストックヤード＞　　＜流量計室 φ400mm 用＞

図 3-4.3　浄水場内の撤去が必要な施設

出典：調査団

3-4-3　河川からの取水許可等

PPWSA により CNMC 及び MOWRAM に許可申請手続きを行っており、入札図書の公表までに CNMC 及び MOWRAM から許可取得予定。

3-4-4　電気工事

新規の取水施設および浄水場用地内に設置する変電設備までは、事業権無償資金協力に含まれ、受電に関する手続き及び 2 回線受電の申請手続きは、カンボジア側負担である。

3-4-5　地雷・不発弾（UXO）の探査・処理

Cambodian Mine Action Centre (CMAC)との協議において、プンプレック浄水場の取水場の南部に隣接する他案件（The Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City）の建設用地内において、不発弾（以下、UXO）が発見され、CMAC による撤去作業が行われた（2020 年 8 月）ことが判明した。下はその時の様子を示す写真である。

図 3-4.4　取水場隣接地における UXO 撤去作業（撮影：CMAC）

出典：調査団

また、新規取水場建設に際しては河川中の調査も必要となり、さらに新設導水管の敷設ルート付近（ナイトマーケット近傍）の道路下からも UXO が発見されていることから、計画段階における PPWSA と CMAC による協議が必要である。また、事前調査や撤去作業にかかるカンボジア側の費用負担などについては合意済みである。

なお、通常、UXO はボーリング機器や重機等による衝撃により爆発することはあるが、ケガ人が出ることはまれとのことである。

地雷・UXO の事前の探査の実施、および建設中に地雷・UXO に遭遇した場合の処置はカンボジア側の負担となる。

3-4-6　環境社会配慮への対応

本プロジェクトにおいては、環境関連法に規定される EIA/IEIA/EPC の内、最も手続きが簡易な

EPC (Environmental Protection Contract) のみが要求され、既に 2021 年 8 月に MoE から承認を受けた。今後は工事に当たってコントラクターが遵守すべき EMP (Environmental Management Plan) およびモニタリングに関して PPWSA が監督を行う必要がある。

3-4-7　その他

上記以外に本プロジェクト実施に当たり、カンボジア側負担事項と想定されるものは下記の通りである。

- カンボジア負担事項に係る予算措置
- 先方負担事項には、PPWSA の予算措置およびカンボジア政府の予算措置として講じられる項目がある。政府の予算措置は PPWSA によって予算申請がなされるものであるが、このような手続きは PPWSA として無償事業毎に実施する定型業務であることから、予算措置上のリスクは小さい。PPWSA 自体の財務状況も 4-1-1 に記載の通り比較的良好であり、先方負担事項の実施は十分に負担可能であると考えられる。
- 銀行取決め手続き
- 免税措置の支援

3-5　プロジェクトの運営・維持管理計画

3-5-1　PPWSA の財務分析及び損益収支の将来予測

3-5-1-1　PPWSA の財政状況

PPWSA はカンボジア証券取引所に登録している上場企業であり、2012 年の上場以降堅調な業績で推移している。PPWSA の売上高・営業利益・純利益・総給水量の推移を**図 3-5.1** に、財務諸表を**表 3-5.1** に、財務指標を**表 3-5.2** に示す。PPWSA の売上高は需要の拡大に伴い長期的な成長が続いており、効率的な運営管理により営業利益も同様に増加している。2020 年の流動比率、自己資本比率、DSCR はそれぞれ 127%、53%、153%と健全な財務体質となっている。フリーキャッシュフロー（営業キャッシュフローと投資キャッシュフローの合計）がマイナスとなっている年度（2018 年、2020 年）もあるが、投資活動が極めて活発であることが主因であり営業キャッシュフローは安定的にプラスとなっている。本プロジェクトの事業者の視点では、PPWSA の財務リスク・信用リスクは極めて限定的である。ただし、需要の拡大に伴う更なる追加投資、大規模修繕の実施、有償プロジェクトの償還等により長期的な財務リスクには留意が必要である。

尚、**図 3-5.1** で 2019 年の売上高が落ち込んでいるが、これはカンボジア国際財務報告基準（CIFRS）の適用にあたり、会計処理上の変更が一部生じたことが主因となっている。これまで、カンボジアでは、長い間旧フランス式（General Accounting）、旧カンボジア会計基準（Cambodia Accounting Standard : CAS）、カンボジア国際財務報告基準（CIFRS）が混在して使用されてきたが、これを 2018 年、2019 年に渡って CIFRS として見直す作業がおこなわれた。この会計基準の変更による売上の減少であり、PPWSA の本業における要因ではない。

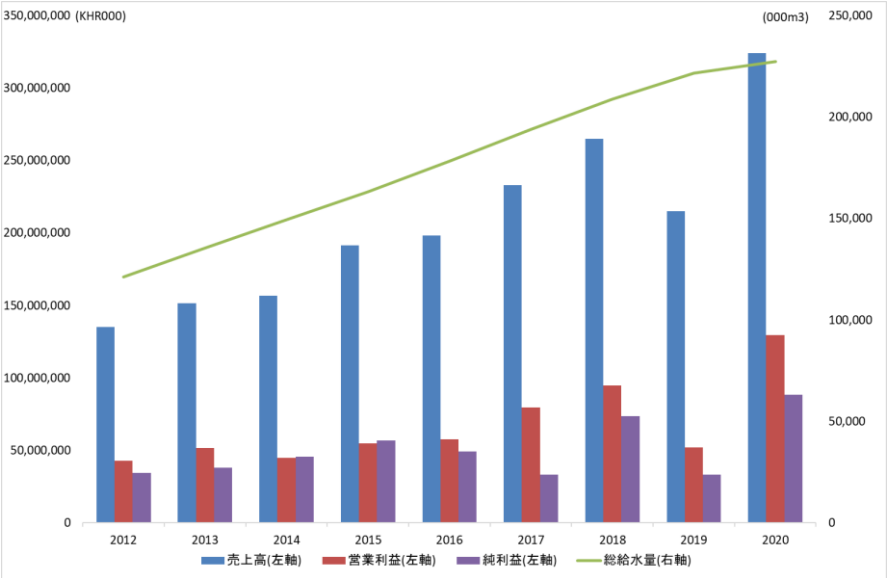


図 3-5.1　PPWSA の売上高・営業利益・純利益・総給水量の推移

出典：PPWSA 提供資料を基に調査団作成

表 3-5.1　PPWSA の財務諸表

	2016	2017	2018	2019	2020
Statement of Comprehensive Income					
Revenues	198,179,874	232,893,089	265,093,293	215,035,579	324,367,856
Operating profit	57,469,473	79,486,598	94,871,231	51,974,444	129,586,672
Net profit	49,273,104	33,067,826	73,607,168	33,291,913	88,351,845
Statement of Financial Position					
Assets	1,297,729,600	1,362,011,777	1,449,408,815	1,604,343,922	1,864,618,140
(Cash and back accounts)	16,386,849	15,992,527	13,353,758	55,212,070	50,215,505
Liabilities	477,757,804	522,886,991	550,070,729	690,639,283	882,565,483
Equity	819,971,796	839,124,786	899,338,086	913,704,639	982,052,657
Statement of Cash Flows					
Cash from operating activities	100,564,035	83,383,404	83,110,841	224,718,620	73,817,414
Cash used in investing activities	-74,697,592	-60,123,881	-98,812,949	-185,971,647	-253,888,131
Cash (used in)/from financing activities	-22,035,029	-23,653,845	13,063,339	3,111,339	175,074,152
Net change in cash and cash equivalents	3,831,414	-394,322	-2,638,769	41,858,312	-4,996,565
	2016	2017	2018	2019	2020

出典：PPWSA 提供資料を基に調査団作成

表 3-5.2　PPWSA の財務指標

	2016	2017	2018	2019	2020
Profitability					
Operating margin	29.0%	34.1%	35.8%	24.2%	40.0%
Net profit margin	24.9%	14.2%	27.8%	15.5%	27.2%
Solvency					
Current ratio	331%	204%	158%	90%	127%
Capital ratio	63%	62%	62%	57%	53%
Debt service coverage ratio (DSCR)	238%	143%	134%	467%	153%

出典：PPWSA 提供資料を基に調査団作成

3-5-1-2　水道料金体系及び改定履歴

2020 年 8 月時点での PPWSA の水道料金体系は**表 3-5.3** の通りである。

表 3-5.3　PPWSA の料金体系

	2001~April 2017		May 2017~ Dec. 2019		Jan. 2020 to present	
Type of Customer	Q'ty of water consumed (m^3/month)	Tariff (KMR/m^3)	Q'ty of water consumed (m^3/month)	Tariff (KMR/m^3)	Q'ty of water consumed (m^3/month)	Tariff (KMR/m^3)
Domestic	0 m^3 ~ 7 m^3	550	0 m^3 ~ 3 m^3	400	0 m^3 ~ 7 m^3	400
			4 m^3 ~ 7 m^3	500		
	8 m^3 ~ 15 m^3	770	8 m^3 ~ 15 m^3	770	8 m^3 ~ 15 m^3	720
	16 m^3 ~ 50 m^3	1,010	16 m^3 ~ 50 m^3	1,010	16 m^3 ~ 25 m^3	960
					26 m^3 ~ 50 m^3	1,250
	Over 50 m^3	1,270	Over 50 m^3	1,270	51 m^3 ~ 100 m^3	1,900
					Over 100 m^3	2,200
Public Administration Institution and Embassy	Flat rate	1,030	Flat rate	1,030	Flat rate	2,500
Commercial, Autonomous	0 m^3 ~ 100 m^3	950	0 m^3 ~ 100 m^3	950	0 m^3 ~ 15 m^3	950
					16 m^3 ~ 45 m^3	1,100

	2001~April 2017		May 2017~ Dec. 2019		Jan. 2020 to present	
Type of Customer	Q'ty of water consumed (m^3/month)	Tariff (KMR/m^3)	Q'ty of water consumed (m^3/month)	Tariff (KMR/m^3)	Q'ty of water consumed (m^3/month)	Tariff (KMR/m^3)
State Authorities and Wholesalers					46 m³ ~ 100 m³	1,400
	101 m³ ~ 200 m³	1,150	101 m³ ~ 200 m³	1,150	101 m³ ~ 200 m³	1,700
	201 m³ ~ 500 m³	1,350	201 m³ ~ 500 m³	1,350	201 m³ ~ 500 m³	2,100
	Over 500 m³	1,450	Over 500 m³	1,450	Over 500 m³	2,400

出典：PPWSA 提供資料を基に調査団作成

2020 年 3 月改定時に、使用水量が小さいセグメントの料金単価を据え置き、大口の料金単価を引き上げたことで全体として水道料金単価は 20%程度上昇し、PPWSA の収益性及び長期的な投資余力が向上している。

3-5-1-3 水道接続状況

PPWSA の給水接続数は一貫して増加傾向にあり、2020 年には 408,500 戸となっている。今後も年間 20,000 戸以上の新規接続を計画しており、従来のマスタープランに記載されている 2030 年の 550,000 戸は達成可能であると考えられる。給水接続数及び給水網の拡張に伴い無収水率は若干の増加傾向にあるが、概ね想定の範囲内に抑制されている。

表 3-5.4 水道接続情報等

	2014	2015	2016	2017	2018	2019	2020
Business data							
Water production	149,552	163,149	178,234	194,038	208,915	221,657	227,409
Number of metered connections	270,812	289,024	310,835	333,288	367,032	388,883	408,500
Number of annual connections	18,497	18,212	21,811	22,453	33,744	0	0
NRW ratio	7.76%	5.99%	7.19%	8.30%	7.94%	8.94%	9.78%
Average tariff	1,020	1,028	1,039	1,030	1,002	0	0

出典：PPWSA 提供資料を基に調査団作成

3-5-2 運営・維持管理計画

3-5-2-1 SPC の運営・維持管理体制

本プロジェクトでは事業権無償の適用により、無償資金で整備する施設の一部を完工後 10 年間に渡り SPC が運営・維持管理する計画である。本邦企業の技術・ノウハウを活かして設計施工と運営・維持管理を一体的に実施することで、ライフサイクルでのコスト低減と技術移転効果が期待される。特に予防保全、在庫管理、文書管理、人材管理や、能力開発・評価については本邦の実績・ノウハウを最大限活用するように入札を行う。

3-5-2-2 SPC の運営・維持管理業務内容

SPC が新設される 45,000 m^3/日施設の運転維持管理を行う事業スキームの場合、コンパラター施設の日常的なコンパラター運転維持管理は WTP の施設規模から必要スタッフ人数を考慮する

と、Phum Prek WTP（150,000 m³/日）、Chruoy Changwar WTP（130,000 m³/日）や Nirotdh WTP（260,000 m³/日）に比べて施設規模が小さく、また Chamkar Mon 浄水場は同様の規模だが、SPC が維持管理を行う施設では、取水とコントロールパネルの人員は必要ではなく、緊急時には PPWSA に助力を求めることもできると考えるため、最低限二人一組のオペレーターが 3 シフト（8 時間毎）で行うことで可能である。場長やマネージャー等を合わせれば水質検査要員を除き日中には 5 人が常駐しているので、日常的な運転や、定期的な掃除等は 5 人で行うことは十分に可能である。配管や機械電気設備の故障などに対しては、SPC が技師や作業員の派遣や、必要に応じた PPWSA への支援要請にて対応を行う事を想定する。プンプレック浄水場増設施設の運営及び運転維持管理体制（案）を**表 3-5.5** に示す。

表 3-5.5　SPC が運転維持管理を行う場合の運営維持管理体制（案）

Plant O&M

Position	Origin	Duty	Number	Shift	Total Number	Note
Plant Manager (PM)	Japanese	Control of WTP O&M Work and Instruction of O&M Works	1	Periodical	1	Full deployment for first 1 year, and spot deplpyment 2 weeks a half year from seoond year
Plant Operation Manager (POM)	Japanese	Management of Entire WTP Work	1	1	1	Including Quality & Safety Control
Deputy Operation Manage (DOM)	Japanese	Support of POM to Control Daily Regular Work	1	1	1	
Plant Operator	Local	Plant O&M	2	3	6	Valve and Pump Operation, Filter Backwashing, Cleaning, Chemical Works, etc.
Laboratory Staff	Local	Water Quality Analysis of Daily Monitoring Items	1	1	1	Including Management of Environmental Monitoring
M&E Engineer	Foreign / Local	Maintenance and Repair of M&E Equipment	As required	-	Depends	As required dispatch from SPC or PPWSA
				Total	**10**	

Administration

Position	Origin	Duty	Number	Shift	Total Number	Note
Securetary	Local	Documentaion, Office Management	1	1	1	
Accountant	Local	Accounting	1	1	1	
Stock and Procurement Manager	Local	Management of Stock and Procurement	1	1	1	
Office Keeper	Local	Office Keeping	1	1	1	Cleaning, Maintenance of Office Equipment and Furnitures
				Total	**4**	

出典：調査団

3-5-2-3　本プロジェクトの実施による PPWSA の損益収支

本プロジェクトの実施において、PPWSA は SPC から浄水を購入し利用者に供給することで収入が増加する。PPWSA の平均的な水道料金及び配水・運営費を前提とした PPWSA の損益収支は以下の通りである。

表 3-5.6　PPWSA の損益収支への将来予測

(1,000,000KHR)	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Purchase volume (1,000m3)	16,425	16,425	16,425	16,425	16,425	16,425	16,425	16,425	16,425	16,425
Average tariff (KHR)	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350
Revenue	22,174	22,174	22,174	22,174	22,174	22,174	22,174	22,174	22,174	22,174
Unit cost of bulk water (KHR)	337	337	337	369	369	369	403	403	403	440
Cost of bulk water purchase	5,535	5,535	5,535	6,061	6,061	6,061	6,619	6,619	6,619	7,227
Electricity for distribution	2,522	2,522	2,522	2,522	2,522	2,522	2,522	2,522	2,522	2,522
Other operating costs	9,034	9,305	9,584	9,871	10,168	10,473	10,787	11,110	11,444	11,787
Total operating cost	17,428	17,699	17,978	18,824	19,120	19,425	20,331	20,655	20,988	21,976
Operating profit	4,745	4,474	4,195	3,350	3,054	2,749	1,842	1,519	1,186	197
Operating margin	21%	20%	19%	15%	14%	12%	8%	7%	5%	1%

出典：PPWSA 提供資料を基に調査団作成

水道料金は一定で、バルク水単価及びその他の運営費がインフレに応じて増加することから、収益は減衰することが見込まれるが、10 年間の運営期間を通して営業利益は正となる。SPC に支払う業務委託費には日本人の人件費やマージンが含まれていることから、PPWSA の既存の浄水場運営よりは収益率は低いものの、平均で 12%前後の営業利益率となる。結論として、本プロジェクトは財務的に持続可能であり、PPWSA の収益に一定の貢献が期待できる。

尚、PPWSA は国際会計基準（IAS20）に則って、無償資金で取得した資産を貸借対照表上の資産と負債に両建てで計上している。期間損益の計算においては、当該資産の減価償却費と同額の繰延収益を償却することで損益への影響は相殺されている。

3-5-2-4　SPC の財務計画

SPC の財務計画は、「**3-6-2-3 SPC の財務計画案**」に示す。

3-5-3　SPC 設立に係る留意事項

外国企業が、カンボジア現地法人登録するにおいては、これまでは、商業省への商業登記に加え、経済財政省租税総局への税務登録、労働職業訓練省への事業所開設申告、国家社会保障基金（NSSF）への登録が必要であったが、2020 年 6 月 10 日付政令 84 号（Sub Decree No.84 on the New Online Business Registration Procedures）が施行され、商業登録手続きが簡素化された。

なお、本案件は、免税対象の案件であることから、免税での請求書を受け取れる状態になるためには、上記の商業登記、税務登録に加えて、免税のマスターリストの承認が必要となる。

マスターリストの承認申請に先立ち、税務登録に合わせて、事業内容に応じて変動する登録税（Patent Tax）[13]の納付と、付加価値税（VAT）の納税者登録を行う必要がある。

これらの登録手続き終了後に、契約に基づいて免税対象となる品目のマスターリストを租税総局に提出し承認が得られれば、免税での取引が可能となる。

また、JETRO のカンボジア会社設立マニュアル 2021 年 2 月（改訂版）によると、①特に租税総局において、新制度での登録完了後に追加で従前同様の手続を求めるなど、新プラットフォーム導入の効果を大きく減殺するような運用を企図する動きがある、②登録事項を後に変更する場合（現地法人の取締役の交代など）については新プラットフォームでは対応しておらず、従前どおりの時間を要する手続が必要であるなど、課題も多く残されているようである。

カンボジアの制度は頻繁に改訂が行われる傾向にあり、コンサルタント及び応札者においては最新の情報に留意する必要がある。

[13] 本事業に係る SPC の年間売り上げは 20 億リエル(約 500,000USD)以上 100 億リエル(約 2,500,000USD)以下であることから、SPC は大規模納税者（Large Taxpayers）に分類され、Patent Tax は 3 百万リエル(約 750USD)になるものと考えられる。

3-6　プロジェクトの概略事業費

3-6-1　協力対象事業の概略事業費

3-6-1-1　日本側負担費用

事業者契約認証まで非公表とする。

3-6-1-2　カンボジア側負担費用

カンボジア側負担費用は約 9.8 億円（施設建設完了の 2026 年末までにかかる経費合計）で、**表 3-6.1** にその内訳を示す。

表 3-6.1　カンボジア側負担費用内訳

No	負担事項	内容	USD	百万円
1	用地準備	取水場、浄水場、資材置場の用地準備費用	100,000	11.1
2	不発弾・地雷調査	プロジェクト対象用地に不発弾及び地雷等がないか事前に調査を行う費用	40,000	4.4
3	PPWSA 職員の配置	D&B 業務のマネジメント費用	120,000	13.3
4	受電に係る費用	建設用の受電及びプラント運転用受電の手続き、工事等の負担費用（取水・浄水施設への一次側受電設備の工事負担費用）	10,000	1.1
5	導水管の整備	新規取水施設から浄水施設（今回増設分）までの導水管 φ800 mm、L=1.9 km (非開削の場合)	8,500,000	942.7
6	銀行手数料	銀行取決めに係る手数料	41,000	4.5
		合　計	8,811,000	**977.2**

出典：調査団

3-6-1-3　積算条件

① 積算時点：　令和 3 年 8 月
② 為替交換レート：　1 US$＝110.91 円
　1 HR＝0.02742 円
③ 施工期間：　全体：49 ヶ月
　入札図書作成期間：3 ヶ月
　入札契約期間：7 ヶ月
　設計施工調達期間：39 ヶ月
④ その他：　本計画は、日本国政府の無償資金協力の制度に従い、実施されるものとする。なお、本事業は予備的経費を想定した案件となっている。但し、予備的経費の適用及び経費率については外務省によって別途決定される。

出典：調査団

3-6-2　運営・維持管理費

3-6-2-1　運営・維持管理費

本プロジェクトは事業権無償の適用により SPC が運営・維持管理を行うことから、入札における価格評価対象の一部として運営・維持管理費の提案を求めることを想定している。実現可能性のある上限価格を PPWSA と合意し、応札者への参考情報として提供するために運営・維持管理

費を**表 3-6.2** の通り算出した。（算出にあたっての前提条件は**表 3-6.3** のとおり。）

表 3-6.2　コンパラター施設の運営・維持管理費

Period start	[Date]	1-Jan-26	1-Jan-27	1-Jan-28	1-Jan-29	1-Jan-30	1-Jan-31	1-Jan-32	1-Jan-33	1-Jan-34	1-Jan-35		
Annual production	[000m3]	16,425	16,425	16,425	16,425	16,425	16,425	16,425	16,425	16,425	16,425	164,250	...(1)
Inflation index	[Index]	1.09	1.13	1.16	1.19	1.23	1.27	1.30	1.34	1.38	1.43		
Electricity price	[KHR/kWh]	584	584	584	584	584	584	584	584	584	584		
Discount rate	[%]												
FX rate	[KHR/JPY]												

Production inputs (excluding inflation effect)												Total	
Electricity cost	[000KHR]	81,640	81,640	81,640	81,640	81,640	81,640	81,640	81,640	81,640	81,640	816,403	
Labor cost	[000KHR]	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	23,591,040	
Raw materials cost	[000KHR]	621,260	621,260	621,260	621,260	621,260	621,260	621,260	621,260	621,260	621,260	6,212,598	
Repair and maintenance cost	[000KHR]	-	547,600	547,600	547,600	547,600	547,600	547,600	547,600	547,600	980,032	5,360,832	
Other operating expenses cost	[000KHR]	114,907	169,667	169,667	169,667	169,667	169,667	169,667	169,667	169,667	212,910	1,685,155	
Total	[000KHR]	3,176,911	3,779,271	3,779,271	3,779,271	3,779,271	3,779,271	3,779,271	3,779,271	3,779,271	4,254,947	37,666,029	...(2)

10 year total O&M cost	[000KHR]	37,666,029	=(2)
10 year total production	[000m3]	164,250	=(1)
10 year average O&M cost	**[KHR/m3]**	**229**	=(2)/(1)
Marginal Profit rate	**[%]**	35%	

Marginal profit, Unit Price of bulk water and O&M Price												
Escalation flag		1	-	-	1	-	-	1	-	-	1	
Average O&M cost with escalation		250	250	250	273	273	273	299	299	299	326	
Margin	[000KHR]	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	
Unit Price of bulk water	[000KHR]	**337**	**337**	**337**	**369**	**369**	**369**	**403**	**403**	**403**	**440**	
Payment to SPC	[000KHR]	5,535,225	5,535,225	5,535,225	6,060,825	6,060,825	6,060,825	6,619,275	6,619,275	6,619,275	7,227,000		...(3)

O&M Price: Net present value	**[000KHR]**	**50,616,511**	...(4)	=sum(3) discounted with 4.5%
of Payment to SPC	**[000JPY]**	**1,368,013**	...(5)	=(4)/FX rate

出典：調査団

上記試算では、SPC の利益を含む初年度のバルク水単価は KHR337/m^3 となることから、入札における上限価格は初年度を基準として KHR350/m^3 とすることを PPWSA と合意している。

3-6-2-2　試算前提

試算における前提条件は以下の通りである。

表 3-6.3　運営・維持管理費の前提条件

Electricity		
Consumption		
Intake	[kWh]	-
Treatment	[kWh]	-
Chemical	[kWh]	110,595
Distribution	[kWh]	-
Others	[kWh]	29,200

# of employees		
Plant Manager (PM)	[persons]	1
Plant Operation Manager (POM)	[persons]	1
Deputy Operation Manager (DOM)	[persons]	1
Quality manager	[persons]	1
Admin/business staff	[persons]	3
M&E Engineer	[persons]	1
Operating staff	[persons]	6

Salaries (Annual)		
Plant Manager (PM)	[000KHR]	740,000
Plant Operation Manager (POM)	[000KHR]	666,000
Deputy Operation Manager (DOM)	[000KHR]	555,000
Quality manager	[000KHR]	47,634
Admin/business staff	[000KHR]	35,047
M&E Engineer	[000KHR]	35,047
Operating staff	[000KHR]	35,047

Raw material unit price		
PAC	KHR/kg	2,137
Salt for sodium hypochlorite	KHR/kg	2,531

Raw materials Consumption		
PAC	[g/m3]	10.0
Sodium hypochlorite	[g/m3]	6.5

Repair and maintenance		
Machinery	[000KHR]	436,600
Electrical equipment	[000KHR]	111,000

Repair and maintenance at hand-back		
Machinery	[000KHR]	436,600
Electrical equipment	[000KHR]	111,000
Civil works and others	[000KHR]	432,432

Other operating expenses		
Employee social security	[KHR/person/month]	40,000
Transportation	[000KHR/month]	1,850
Office keeping	[000KHR/month]	3,700
Accounting audit / legal services	[000KHR/month]	1,850
Other operating costs (as % of other op. expenses)	[%]	10%
Marginal Profit rate	[%]	35.0%

出典：調査団

- 人件費：運営維持管理体制（**表 3-5.5**）に基づき、日本人 3 人（PM、POM、DOM）を含む 14 人を想定する。大半を占める日本人スタッフの人件費は、諸手当等を含めて PM ：2,000 万円、POM : 1,800 万円、DOM : 1,500 万円とする。日本人以外の現地スタッフについては、現在の PPWSA の単価を採用している。（2021 年 6 月時点での為替レート KHR37/JPY）
- 電力費：施設全体の電力使用量の大半を占める取水・配水は PPWSA が運営・維持管理するため、SPC の電力負担は限定的である。薬剤生成と逆洗に要する電力量として、電力価格は現状と同水準の 584 リエル/kWh とする。（現時点で薬剤に入れている分を切り出す想定）
- 薬剤費： PAC と Chlorine について、PPWSA の既存のオペレーションを参考に**表 3-6.3** の使用量を前提とした。単価については現在の PPWSA の購入価格と同水準とした。
- 修繕費：施設整備費の内、次亜生成装置は 1 千万円/年、その他機械設備と電気設備については年間 2%の修繕費を織り込んだ。ただし、初年度は D&B 契約における瑕疵担保期間で O&M 費用としては修繕費が発生しないこととし、最終年度は O&M 契約で要求される引き渡し条件を満たすための整備が発生するため上記の倍額を計上している。
- その他運営費：その他の運営費用として、雇用に係る社会保険を 4 万リエル/月/人、交通費を 5 万円/月、オフィス関連費を 10 万円/月、会計監査・顧問弁護士の費用を 5 万円/月とする。また、上記の総額の 10%を予備費として計上し、上記運営費に係る 10%の VAT を計上した。
- 火災保険・損害保険等については既存の浄水場と同様に付保しないことを想定している。

3-6-2-3　SPC の財務計画案

上記試算に基づく SPC の財務計画は以下の通りである。

表 3-6.4　コンパラター施設に基づく SPC の財務計画

(Unit: KHR 000)

0. Assumptions										
Period start	1-Jan-26	1-Jan-27	1-Jan-28	1-Jan-29	1-Jan-30	1-Jan-31	1-Jan-32	1-Jan-33	1-Jan-34	1-Jan-35
Period End	31-Dec-26	31-Dec-27	31-Dec-28	31-Dec-29	31-Dec-30	31-Dec-31	31-Dec-32	31-Dec-33	31-Dec-34	31-Dec-35
Calender Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual Period Counter	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Inflation index	1.09	1.13	1.16	1.19	1.23	1.27	1.30	1.34	1.38	1.43
1. Profit and Loss Statement										
Operating Revenue										
O&M revenue	5,535,225	5,535,225	5,535,225	6,060,825	6,060,825	6,060,825	6,619,275	6,619,275	6,619,275	7,227,000
Total Operating Revenue	**5,535,225**	**5,535,225**	**5,535,225**	**6,060,825**	**6,060,825**	**6,060,825**	**6,619,275**	**6,619,275**	**6,619,275**	**7,227,000**
Operating Cost										
Electricity costs	81,640	81,640	81,640	81,640	81,640	81,640	81,640	81,640	81,640	81,640
Salaries, wages and related expenses	2,577,857	2,655,192	2,734,848	2,816,894	2,901,400	2,988,442	3,078,096	3,170,439	3,265,552	3,363,518
Raw materials for water treatment	678,867	699,233	720,210	741,817	764,071	786,993	810,603	834,921	859,969	885,768
Repairs and maintenance	-	616,329	634,818	653,863	673,479	693,683	714,494	735,929	758,006	1,397,292
Depreciation										
Other operating expense	125,562	190,962	196,691	202,592	208,669	214,929	221,377	228,019	234,859	303,559
Total Operating Cost	3,463,926	4,243,357	4,368,208	4,496,805	4,629,260	4,765,689	4,906,210	5,050,947	5,200,026	6,031,778
Gross Operating Profit	**2,071,299**	**1,291,868**	**1,167,017**	**1,564,020**	**1,431,565**	**1,295,136**	**1,713,065**	**1,568,328**	**1,419,249**	**1,195,222**
Non Operating Cost										
Interest expense										
Others										
Total Non Operating Cost	-	-	-	-	-	-	-	-	-	-
Net Profit before Tax	**2,071,299**	**1,291,868**	**1,167,017**	**1,564,020**	**1,431,565**	**1,295,136**	**1,713,065**	**1,568,328**	**1,419,249**	**1,195,222**
Tax on Profit	414,260	258,374	233,403	312,804	286,313	259,027	342,613	313,666	283,850	239,044
Net Profit after Tax	**1,657,039**	**1,033,495**	**933,614**	**1,251,216**	**1,145,252**	**1,036,109**	**1,370,452**	**1,254,662**	**1,135,399**	**956,178**
2. Cashflow	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Cashflow from Operating Cashflow										
Net Profit after Tax	1,657,039	1,033,495	933,614	1,251,216	1,145,252	1,036,109	1,370,452	1,254,662	1,135,399	956,178
Depreciation										
Change in working capital	(172,608)	64,953	10,404	(33,084)	11,038	11,369	(34,827)	12,061	12,423	118,271
Cash Flows from Investment Activity										
Capital Investment										
Cashflow from Financial Activities										
Equity Injection	-	-	-	-	-	-	-	-	-	(1,200,000)
Dividend	-	-	-	-	-	-	-	-	-	(11,773,415)
Net Cashflow	**1,484,431**	**1,098,447**	**944,018**	**1,218,132**	**1,156,290**	**1,047,478**	**1,335,625**	**1,266,724**	**1,147,822**	**(11,898,966)**
Opening Cash	1,200,000	2,684,431	3,782,878	4,726,896	5,945,028	7,101,318	8,148,796	9,484,421	10,751,144	11,898,966
Closing Cash	2,684,431	3,782,878	4,726,896	5,945,028	7,101,318	8,148,796	9,484,421	10,751,144	11,898,966	-
3. Balance Sheet										
Assets										
Cash	2,684,431	3,782,878	4,726,896	5,945,028	7,101,318	8,148,796	9,484,421	10,751,144	11,898,966	-
Account receivable	461,269	461,269	461,269	505,069	505,069	505,069	551,606	551,606	551,606	
Other current assets										
Propery, plant and equipment										
Other long-term assets										
Total Assets	3,145,699	4,244,147	5,188,164	6,450,097	7,606,387	8,653,865	10,036,027	11,302,751	12,450,573	-
Liabilities										
Account payable	288,661	353,613	364,017	374,734	385,772	397,141	408,851	420,912	433,336	
Short-term Borrowings										
Other current liabilities										
Long-term Borrowings										
Other long-term liabilities										
Total Liabilities	288,661	353,613	364,017	374,734	385,772	397,141	408,851	420,912	433,336	-
Equity										
Share capital	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000	-
Retained earnings	1,657,039	2,690,534	3,624,147	4,875,363	6,020,615	7,056,724	8,427,176	9,681,838	10,817,237	-
Total Equity	2,857,039	3,890,534	4,824,147	6,075,363	7,220,615	8,256,724	9,627,176	10,881,838	12,017,237	-

出典：調査団

3-6-3　本プロジェクト実施に当たっての留意事項の整理

入札公示前までに以下のカンボジア側負担事項について完了しておく必要がある。

① EPC の取得（取得済み）
② 水利権の取得
③ 河岸及び河床の UXO 調査
④ 新設導水管 φ800 mm の建設の予算確保および、完成遅延時の事業者保証
⑤ 新設浄水施設拡張用地のサイトのクリアランス
⑥ ストックヤードの受け入れ準備
⑦ 建設用地およびストックヤード用地への建設工事用水道、電力及び通信回線供給準備
⑧ 建設に係る、関連機関との調整
⑨ 浄水場運転用電力供給及び通信回線供給手続き
⑩ 環境社会配慮に係るモニタリングフォームの確認
⑪ 免税措置の確認

その他の留意事項：

⑫ 公共調達法の第 3 条の例外規定は、プロジェクト全体に対して適応されるものであり、D&B 契約、O&M 契約およびトレーニング契約は連動したものであることを G/A に規定する
⑬ 電力価格及びインフレ指標、および価格調整の頻度についての定義の詳細は、合意され、契約に記載されなければならない。
⑭ モニタリングシステム、報告義務と様式および詳細な緊急時対応計画は、建設期間に運営マニュアルと整合性の取れる形で決定されなければならない。
⑮ 技術評価の詳細な評価基準は事業者（SPC を含む）に対しての PPWSA の要望と JICA の無償資金協力調達ガイドラインを考慮しなければならない。
⑯ SPC に対する財務的な要求（最低資本金、DSCR 等）は、PPWSA の要求および民間企業にとってのプロジェクトの魅力を反映させる形で決定されなければならない。
⑰ 契約ストラクチャーと入札プロセス（SPC 設立のタイミング、契約主体等）は決定の上 PPWSA の確認を取らなければならない。

第4章 プロジェクトの評価

4-1 事業実施のための前提条件

事業実施のための前提条件、相手国側による負担項目等については、「3. 相手国側分担事業の概要」に詳述した通りである。

4-2 プロジェクト全体計画達成のための必要な相手方投入（負担）事項

事業権無償によって整備された浄水場で造水された水は、PPWSA にバルク売りされ、PPWSA はその全量（45,000 m^3/日）を購入しなければならない。

4-3 外部条件

プロジェクト効果を発現、持続するための外部条件として以下が挙げられる。

- 大規模な天候不順や自然災害が発生しないこと
- 社会・経済状況が著しく悪化しないこと
- 対象地域の人口動態が予測外の動きを示さないこと
- 原水水質が極端に悪化しないこと

4-4 プロジェクトの評価

4-4-1 妥当性

4-4-1-1 プロジェクトの裨益対象

本プロジェクトによりプノンペン都への給水能力が改善され、プノンペン都の裨益人口が増加する。浄水場の増水能力の拡張に加え、現状の給水サービスの向上が図られるため、増加する給水人口に対する裨益のみならず、現在給水を受けている住民に対しても給水サービスが改善することとなる。

4-4-1-2 プロジェクトの緊急性

PPWSA は既存の水道システムを有してはいるが、現在の浄水能力では 2030 年時点でのプノンペン都における水需要の 35%程度しかない[14]。上水道施設の拡張による給水量の増加なしでは水不足が予測され、上水道施設の拡張が急務となっている。

[14] 既存浄水能力 592 千 m^3／2030 年日最大需要 1,714 千 m^3＝0.35

4-4-1-3　プロジェクトの上位計画との整合性

カンボジア政府は、国家戦略開発計画（NSDP）により、2025 年までに都市部人口の 100%に対して安全な水へのアクセスを確保するという目標を掲げており、本プロジェクトはプノンペン都において、その実現に寄与するものである。

4-4-1-4　我が国の援助政策との整合性

カンボジアに対する我が国の援助方針の事業展開計画（2016 年 9 月）では、カンボジアの開発目標達成を支援し、「社会開発の促進」を援助の重点分野の一つとし、「上下水道インフラの整備」を開発課題としており、本プロジェクトの実施は、我が国の援助政策と整合している。

4-4-2　有効性

本プロジェクトの有効性に関しては、以下の定量的効果及び定性的効果が見込まれる。

4-4-2-1　定量的効果

プンプレック浄水場の増水能力を拡張することにより、**表 4-4.1** に示すような効果が期待できる。

表 4-4.1　定量的効果

No.	指標	基準値(2021 年)	目標値(2030 年) （供用開始後 3 年）
1	給水能力 （日平均）	150,000 m^3/日	195,000 m^3/日*

出典：調査団

4-4-2-2　定性的効果

定性的効果は以下の通りである。

- 給水栓からの水量・水圧不足の改善
- 浄水場の運営・維持管理に関する技術移転による運営・維持管理能力の向上
- 公衆衛生の向上

以上の内容により、本プロジェクトの妥当性は高く、また有効性が見込まれると判断される。

添付資料

資　料 1　調査団員・氏名

官団員/JICA Officials

氏名	担当	所属
井上　陽一 Mr. Yoichi INOUE	団長 Leader	JICA 地球環境部水資源グループ水資源第一チーム課長 Director, Water Resources Group, Global Environment Department, JICA
横田義昭 Mr. Yoshiaki YOKOTA	上水技術 Water Supply Advisor	JICA 地球環境部 国際協力専門員 Senior Advisor (Water Supply) Global Environment Department, JICA
中井　一孝 Mr. Kazunori NAKAI	協力企画 Cooperation Planning （2021 年 3 月まで）	JICA 地球環境部水資源グループ水資源第一チーム Senior Engineering Officer, Water Resources Group, Global Environment Department, JICA
掛川　恵梨子 Ms. Eriko KAKEGAWA	協力企画 Cooperation Planning （2021 年 4 月から）	JICA 地球環境部水資源グループ水資源第一チーム Senior Engineering Officer, Water Resources Group, Global Environment Department, JICA

コンサルタント団員/Consultant Team

氏名	担当	所属
岡崎　浩一 Mr. Koichi OKAZAKI	業務主任者／上水道施設計画・設計 Chief Consultant /Water Supply Facility Planning	株式会社日水コン Nihon Suido Consultants Co., Ltd.
中嶋　宜信 Mr. Yoshinobu NAKAJIMA	副業務主任者/上水道施設設計③/施工計画・積算 Deputy Chief Consultant / Water Supply Facility Design 3 / Construction Planning & Cost Estimate 1	株式会社日水コン Nihon Suido Consultants Co., Ltd.
熊谷　弘志 Mr. Hiroshi KUMAGAE	事業権無償ビジネスモデル Japanese Grant Aid with O&M Business Model	ｸﾗｳﾝｴｲｼﾞｪﾝﾂ･ｼﾞｬﾊﾟﾝ株式会社 Crown Agents Japan Limited
松本　直秀 Mr. Naohide MATSUMOTO	上水道施設設計① Water Supply Facility Design 1	株式会社 TEC インターナショナル TEC International Co., Ltd.
藤沼　晋也 Mr. Shinya FUJINUMA	上水道施設設計② Water Supply Facility Design 2	株式会社 TEC インターナショナル
鈴木　辰造 Mr. Tatsuzo SUZUKI	機械・電気設備計画① Mechanical and Electrical Equipment Planning 1	TEC International Co., Ltd.
齋藤　周一 Mr. Shuichi SAITO	機械・電気設備計画②／監視制御システム Mechanical and Electrical Equipment Planning 2 / SCADA System	株式会社日水コン Nihon Suido Consultants Co., Ltd.
斗ケ澤　海 Mr. Umi TOGASAWA	入札図書参考資料作成 Referenced Bidding Documents Preparation	ｸﾗｳﾝｴｲｼﾞｪﾝﾂ･ｼﾞｬﾊﾟﾝ株式会社 Crown Agents Japan Limited
木村　光志 Mr. Koji KIMURA	環境社会配慮／UXO 確認 Environmental and Social Consideration / UXO Survey	株式会社日水コン Nihon Suido Consultants Co., Ltd.
金田 誠 Mr. Makoto KANEDA	機械・電気設備計画③／積算施工計画② Mechanical and Electrical Equipment Planning 3 / Construction Planning & Cost Estimate 2	株式会社日水コン Nihon Suido Consultants Co., Ltd.

資　料 2　調査行程

調査行程は次のとおり。

第 1 次現地調査：　　2021 年 1 月 9 日～同年 3 月 14 日

		コンサルタント団員								
		岡崎　浩一	中嶋　宜信	熊谷　弘志	松本　直秀	藤沼　晋也	鈴木　辰造	斎藤　周一	木村　光志	男鹿　剛彦
		業務主任者／上水道施設計画	副業務主任者／上水道施設設計③／施工計画・積算	事業権無償ビジネスモデル	上水道施設設計①	上水道施設設計②	機械・電気設備計画①	機械・電気設備計画②／監視制御システム	環境社会配慮／UXO確認	上水道計画アドバイザー
2021/1/9	土		出発日		出発日					
2021/1/10	日		コロナ隔離		コロナ隔離					
2021/1/11	月	情報収集、インセプション協議準備	コロナ隔離	情報収集、インセプション協議準備	コロナ隔離					
2021/1/12	火	情報収集、インセプション協議準備	コロナ隔離	情報収集、インセプション協議準備	コロナ隔離					
2021/1/13	水	情報収集、インセプション協議準備	コロナ隔離	情報収集、インセプション協議準備	コロナ隔離					
2021/1/14	木	情報収集、インセプション協議準備	コロナ隔離	情報収集、インセプション協議準備	コロナ隔離					
2021/1/15	金	情報収集、対処方針会議資料作成	コロナ隔離、情報収集、対処方針会議資料作成		コロナ隔離、情報収集、対処方針会議資料作成					
2021/1/16	土	情報収集、対処方針会議資料作成	コロナ隔離、対処方針会議資料作成		コロナ隔離、対処方針会議資料作成					
2021/1/17	日	情報収集、対処方針会議資料作成	コロナ隔離、対処方針会議資料作成		コロナ隔離、対処方針会議資料作成					
2021/1/18	月	情報収集、対処方針会議資料作成	コロナ隔離、対処方針会議資料作成		コロナ隔離、対処方針会議資料作成					
2021/1/19	火	対処方針会議								
2021/1/20	水	情報収集、インセプション協議準備	コロナ隔離、情報収集、インセプション協議準備	情報収集、インセプション協議準備	コロナ隔離、情報収集、インセプション協議準備					
2021/1/21	木	情報収集、インセプション協議準備	コロナ隔離、情報収集、インセプション協議準備	情報収集、インセプション協議準備	コロナ隔離、情報収集、インセプション協議準備					
2021/1/22	金	情報収集、インセプション協議準備	コロナ隔離、情報収集、インセプション協議準備	情報収集、インセプション協議準備	コロナ隔離、情報収集、インセプション協議準備					
2021/1/23	土	情報収集、インセプション協議準備	コロナ隔離、情報収集、インセプション協議準備	情報収集、インセプション協議準備	コロナ隔離、情報収集、インセプション協議準備					
2021/1/24	日	情報収集、インセプション協議準備	コロナ隔離、情報収集、インセプション協議準備	情報収集、インセプション協議準備	コロナ隔離、情報収集、インセプション協議準備					
2021/1/25	月	インセプション協議								
2021/1/26	火	MEF協議、MISTI表敬訪問				情報収集、現場調査、調査結果整理				
2021/1/27	水	M/D協議				情報収集、現場調査、調査結果整理		M/D協議		
2021/1/28	木	情報収集、現場調査、調査結果整理								
2021/1/29	金	情報収集、現場調査、調査結果整理								
2021/1/30	土	調査結果整理								
2021/1/31	日	調査結果整理								
2021/2/1	月		情報収集、現場調査、調査結果整理							
2021/2/2	火		情報収集、現場調査、調査結果整理							
2021/2/3	水		相手側(PPWSA)との中間協議							
2021/2/4	木		情報収集、現場調査、調査結果整理							
2021/2/5	金		情報収集、現場調査、調査結果整理							
2021/2/6	土		調査結果整理							
2021/2/7	日		調査結果整理							
2021/2/8	月		情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理	帰国日	帰国日	情報収集、現場調査、調査結果整理		
2021/2/9	火		情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理			情報収集、現場調査、調査結果整理		
2021/2/10	水		情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理			情報収集、現場調査、調査結果整理		
2021/2/11	木		情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理			情報収集、現場調査、調査結果整理		
2021/2/12	金		情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理			情報収集、現場調査、調査結果整理		
2021/2/13	土		調査結果整理					調査結果整理		
2021/2/14	日		調査結果整理					調査結果整理		
2021/2/15	月		情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理			情報収集、現場調査、調査結果整理		
2021/2/16	火		情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理			情報収集、現場調査、調査結果整理		
2021/2/17	水		情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理			情報収集、現場調査、調査結果整理		
2021/2/18	木		情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理			情報収集、現場調査、調査結果整理		
2021/2/19	金		情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理			情報収集、現場調査、調査結果整理		
2021/2/20	土		調査結果整理					調査結果整理		
2021/2/21	日		調査結果整理					調査結果整理		
2021/2/22	月	情報収集、報告書準備	情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理			情報収集、現場調査、調査結果整理	帰国日	
2021/2/23	火	情報収集、報告書準備	情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理			情報収集、現場調査、調査結果整理		
2021/2/24	水	情報収集、報告書準備	情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理			情報収集、現場調査、調査結果整理		
2021/2/25	木	情報収集、報告書準備	情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理			情報収集、現場調査、調査結果整理		
2021/2/26	金	情報収集、報告書準備	情報収集、現場調査、調査結果整理	情報収集、報告書準備	情報収集、現場調査、調査結果整理			情報収集、現場調査、調査結果整理		
2021/2/27	土	調査結果整理	帰国日	調査結果整理				帰国日		
2021/2/28	日	調査結果整理		調査結果整理						
2021/3/1	月			情報収集、報告書準備	情報収集、現場調査、調査結果整理					
2021/3/2	火			情報収集、報告書準備	情報収集、現場調査、調査結果整理					
2021/3/3	水	情報収集、報告書準備		帰国日	情報収集、現場調査、調査結果整理					
2021/3/4	木				情報収集、現場調査、調査結果整理					
2021/3/5	金				情報収集、現場調査、調査結果整理					
2021/3/6	土				情報収集、現場調査、調査結果整理					
2021/3/7	日				調査結果整理					
2021/3/8	月				調査結果整理					
2021/3/9	火				情報収集、現場調査、調査結果整理					
2021/3/10	水				情報収集、現場調査、調査結果整理					
2021/3/11	木				情報収集、現場調査、調査結果整理					
2021/3/12	金				情報収集、現場調査、調査結果整理					
2021/3/13	土				調査結果整理					
2021/3/14	日				帰国日					

第 2 次現地調査：　　2021 年 7 月 19 日～同年 7 月 30 日

		コンサルタント団員
		岡﨑　浩一
		業務主任者／上水道施設計画・設計
2021/7/19	月	情報確認、公式協議の事前準備
2021/7/20	火	情報確認、公式協議の事前準備
2021/7/21	水	内部協議、情報収集、公式協議の事前準備
2021/7/22	木	情報確認、公式協議の事前準備
2021/7/23	金	情報確認、公式協議の事前準備
2021/7/24	土	
2021/7/25	日	
2021/7/26	月	相手側（PPWSA)との公式協議（中間成果について）
2021/7/27	火	議事録準備
2021/7/28	水	議事録準備
2021/7/29	木	相手側（PPWSA)との公式協議（議事録について）
2021/7/30	金	情報収集、協議結果整理、報告書準備

第 3 次現地調査：　　2022 年 8 月 14 日～同年 8 月 20 日

		コンサルタント団員	
		岡﨑　浩一	斗ケ澤　海
		業務主任者／上水道施設計画・設計	入札図書参考資料作成
2022/8/14	日		移動日
2022/8/15	月	DF/R説明協議 （PPWSA）	
2022/8/16	火	協議結果整理 M/D作成	
2022/8/17	水	M/D協議 （PPWSA）	
2022/8/18	木	M/D協議 （PPWSA）	
2022/8/19	金	協議結果整理	
2022/8/20	土	協議結果整理	帰国日

資　料 3　関係者（面会者）リスト

Phnom Penh Water Supply Authority

-	H.E. Dr. SIM Sitha (PhD)	Director General (Retired)
-	H.E. LONG Naro	Director General
-	Dr. CHEA Visoth (PhD)	Deputy Director General, in charge of Corporate Secretary (Retired)
-	Mr. SAMRETH Sovithiea	Deputy General Director, in charge of Plan and Investment Project
-	Mr. MA Noravin	Deputy Director General, in charge of Production and Distribution Department
-	Mr. ROS Kimleang	Deputy Director General, in charge of Finance and Securities Exchange Department (Retired)
-	Mr. DENG Polyden	Deputy Director General, in charge of Finance
-	Mr. CHEA Satephoat	Director of Planning and Project Department
	Mr. Ou Kunavath	Director of Planning and Project Department
	Mr. SOK Nareth	Director of Accounting & Finance Department
	Mr. KEM Kanvicheth	Director of Water Production Management Department
	Mr. REANG Chanphirum	Deputy Director of Department of Planning and Project
	Mr. KHEM Vchinin	Deputy Director of Department of Planning and Project
	Mr. LUN Ramy	Vice Chief Office of Project Design

Ministry of Industry, Science, Technology and Innovation (MISTI)

Dr. SRENG Sokvung (PhD)	Director of Department of Technics and Project Management
Ms. CHHAY Vuchnea	Vice-chief office of Department of Technics and Project Management

資　料 4　討議議事録（M/D）

- Minutes of Discussions on the Preparatory Survey for the Project for Expansion of Phum Prek Water Treatment System (Explanation on Inception Report) (27th January 2021)

- Minutes of Discussions on the Preparatory Survey for the Project for Expansion of Phum Prek Water Treatment System (Interim Result) (05th August 2021)

- Minutes of Discussions on the Preparatory Survey for the Project for Expansion of Phum Prek Water Treatment System (Explanation on Draft Preparatory Survey Report) (18th August 2022)

Minutes of Discussions
on the Preparatory Survey for the Project for
Rehabilitation and Expansion of Phum Prek Water Treatment System

In response to the request from the Government of the Kingdom of Cambodia (hereinafter referred to as "Cambodia"), Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Team for the Outline Design (hereinafter referred to as "the Team") of the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System (hereinafter referred to as "the Project") to the Government of Cambodia. The Team held a series of discussions with the officials of the Government of Cambodia and conducted a field survey. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

Phnom Penh, 27th January, 2021

Mr. Yoichi Inoue
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

H.E. Dr. Sim Sitha
Director General
Phnom Penh Water Supply Authority (PPWSA)
Kingdom of Cambodia

Witness

H.E.Mr Chhuon Samrith
Director General
General Department of International Cooperation
and Debt Management,
Ministry of Economy and Finance (MEF)
Kingdom of Cambodia

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve the sustainable water supply in Phnom Penh through the rehabilitation and expansion of water supply system including operation and maintenance (hereinafter referred to as "O&M") of the Phum Prek water treatment plant (hereinafter referred to as "WTP").

2. Title of the Preparatory Survey

Both sides confirmed the title of the Preparatory Survey as "the Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System".

3. Relevancy of additional production capacity

The Team pointed out that it would be necessary to clarify planning basis of additional production capacity 45,000m^3/day for the project appraisal. Both sides agreed to further discuss the planning basis to set and justify the requirements for the project.

4. Responsible authority for the Project

Both sides confirmed the authorities responsible for the Project are as follows:

4-1. PPWSA will be the executing agency and the implementing agency for the Project. The organization chart is shown in Annex 2.

4-2. PPWSA is autonomously able to agree with the O&M contract and outsourcing fee/off -take price subject to the Board of Directors if such agreement does not affect the current water tariff system.

5. Items requested for Japanese Grant Aid by the Government of Cambodia.

5-1. As a result of discussion, both sides confirmed that the items requested by the Government of Cambodia are as follows:

Facility

- Rehabilitation and Expansion of the Intake Tower
- Augmentation of Raw Water Intake Pumps
- Water Treatment Plant: Additional facilities for 45,000m^3/day and rehabilitation of the existing facilities with 100,000 m^3/day capacity part
- Augmentation of Distribution Pump

- Rehabilitation and Expansion of Clear reservoir
- Improvement of SCADA

Consulting Service

- Tender Assistance, Construction and Procurement Supervision

The Team explained that the entire project cost may not be covered by grant aid due to constraints of the grant budget, and items and/or scale of the Project may be adjusted to the possible budget.

5-2. JICA will assess the feasibility of the above requested items through the survey and will report the findings to the Government of Japan. The final scope of the Project will be decided by the Government of Japan.

6. Procedures and Basic Principles of Japanese Grant

6-1. The Cambodian side agreed that the procedures and basic principles of Japanese Grant as described in Annex 3 shall be applied to the Project.

As for the monitoring of the implementation of the Project, JICA requires the Cambodian side to submit the Project Monitoring Report that the form is attached as Annex 4.

6-2. The Cambodian side agreed to take the necessary measures, as described in Annex 5, for smooth implementation of the Project. The contents of the Annex 5 will be elaborated and refined during the Preparatory Survey and be agreed in the mission dispatched for explanation of the Draft Preparatory Survey Report.

The contents of Annex 5 will be updated as the Preparatory Survey progresses, and eventually, will be used as an attachment to the Grant Agreement.

7. Schedule of the Survey

7-1. The Team will proceed with further survey in Cambodia until March 2021.

7-2. JICA will dispatch a mission to Cambodia in order to discuss draft project outline, draft requirements and draft term sheet of the contracts around June 2021.

7-3. JICA will hold a project briefing session for Japanese companies to give information in terms of project outline, draft requirements to be stipulated in the bidding documents, and draft term sheet of the contracts around July, 2021.

7-4. JICA will prepare a draft Preparatory Survey Report in English, and dispatch a mission to Cambodia in order to explain its contents around November, 2021.

7-5. If the contents of the draft Preparatory Survey Report are accepted and the

undertakings for the Project are fully agreed by the Cambodian side, JICA will finalize the Preparatory Survey Report and send it to the Cambodian side around March, 2022.

7-6. The above schedule is tentative and subject to change.

8. Environmental and Social Considerations

8-1. The Cambodian side confirmed to give due environmental and social considerations during implementation, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April, 2010).

8-2. The Project is categorized as "B" from the following considerations:

The project is not located in a sensitive area, nor has sensitive characteristics, nor falls into sensitive sectors under the JICA guidelines for environmental and social considerations (April 2010), and its potential adverse impacts on the environment are not likely to be significant.

PPWSA confirmed to conduct the necessary procedures concerning the environmental assessment (including stakeholder meetings, Environmental Impact Assessment (EIA) / Initial Environmental Examination (IEE) and information disclosure, etc.). Both sides agreed that the Team would make Environmental Protection Contract (EPC) report of the Project and support for approval. The EPC approval shall be received from the responsible authorities and submitted to JICA by January 2022.

9. Other Relevant Issues

9-1. Application of the Japanese Grant Aid with O&M

The Team explained that the Project would be implemented by applying the Japanese Grant Aid with O&M, whose outline is explained in Annex 3. The Team also explained important matters as follows and the Cambodian side understood them:

1) The Japanese Grant Aid shall be used for construction of the facilities and procurement of equipment necessary for the Project, and the consulting service for procurement and supervision of the above-mentioned facilities and equipment,
2) The prime contractor(s) and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle,
3) The single entity(SE) or the joint venture(JV) shall be responsible for design

and construction,

4) The local special purpose company(SPC) comprised of SE or major JV members shall be responsible for O&M,
5) Quality and Cost Based Selection (QCBS) that includes technical, financial and legal evaluation will be applied for the bidding process,
6) Contracts consist (a) comprehensive contract which consolidates both contracts for the purchase of the products and/or services and for O&M, (b) contract(s) for the purchase of products and/or services and (c) contract(s) for O&M, and
7) The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the products and/or the services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

9-2. Tax exemption

The Cambodian side confirmed that it gives necessary support to collect the information of tax exemption.

The Team explained the precondition that the tax such as corporate tax, personal income tax, value added tax and customs to be imposed for the construction work and the service which will be covered by the Japanese Grant Aid shall be exempted or reimbursed, and the Cambodian side understood it.

The Team will also study the possibility for tax exemption during the period of O&M and the Cambodian side agreed to offer necessary cooperation to the Team. The Cambodian side also explained that tax exemption for the O&M phase should be discussed further with PPWSA and GDT.

9-3. Water right for additional withdrawal amount

The Team requested PPWSA to apply a permit of additional raw water amount from Sap River to Ministry of Water Resources and Meteorology (MOWRAM) by January 2022.

9-4. Facility design policy for comparator facilities (to be confirmed)

The Team explained the facility design policy for comparator facilities as bellow.

Both sides confirmed that comparator facilities would be used only for project cost estimation, and the actual design of the facilities would be proposed by a contractor after contact in the implementation stage.

- The speed-up of filtration would be an option to increase production capacity due to the limitation of available space

Both sides agreed that further discussion on the operation policy during construction would be held based on the field survey conducted by the Team and reach an agreement at the end of the first field survey.
PPWSA mentioned there would be multiple options after the completion of construction of Bakheng WTP.

9-5. Responsibilities of PPWSA and SPC during O&M period

The Team explained the possible responsibilities of PPWSA and SPC during O&M period.
PPWSA showed its interest for the option PP Model 2 and 3 in the inception report other than PP Model 1 which is the same scheme as stated in the Grant application form submitted by Cambodia.
Both sides agreed that responsibilities of O&M should be discussed further on a priority basis to reach consensus by the beginning of June, 2021, before the project briefing session for Japanese companies.

9-6. Unexploded ordnance (UXO)

PPWSA explained that the site had been already cleared from UXO during the implementation of the project for the expansion of Phum Prek water treatment plant. Both sides agreed that in case that UXO be found during the survey and the Project, the Cambodian side should take necessary measures to secure the safety of the site.

9-7. Outsourcing fee/Off-take price

Both sides agreed that outsourcing fee/off-take price should be affordable for PPWSA and acceptable for SPC.

PPWSA explained that the outsourcing fee/off-take price should be approved by the Board of Directors of PPWSA and no other approval would be necessary, if

such approval does not affect the current water tariff system.

Both sides agreed that this topic should be discussed further on a priority basis to reach consensus by the beginning of June, 2021, before the project briefing session for Japanese companies.

9-8. Application of Procurement Guidelines for the Japanese Grant

The Team explained that the bidding for Japanese Grant Aid with O&M should be Japan-tied in accordance with Procurement Guidelines for the Japanese Grant based on the Article 3 of the Public Procurement Law in Cambodia.

The Cambodian side understood it.

9-9. Duration of O&M phase

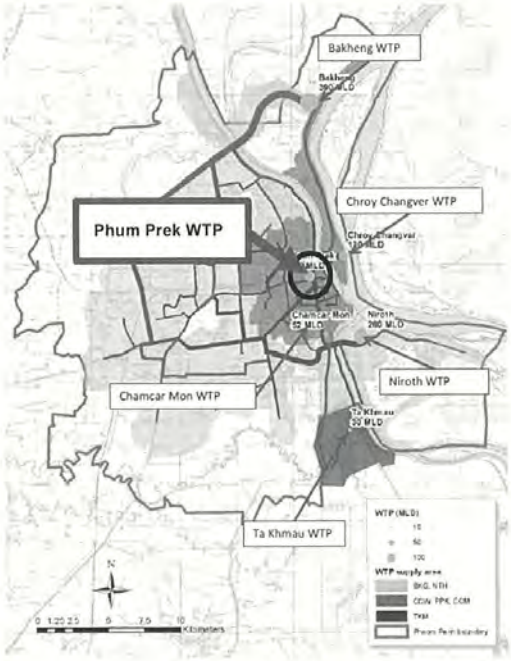
PPWSA explained that the duration of O&M which was requested for 10 years in the Grant Application should be internally confirmed first.

JICA requested that the duration of O&M would be decided at the early stage of the preparatory survey because it affected the financial feasibility study.

Annex 1 Project Site
Annex 2 Organization Chart
Annex 3 Japanese Grant Aid Scheme
Annex 4 Project Monitoring Report (template)
Annex 5 Major Undertakings to be taken by the Government of Cambodia

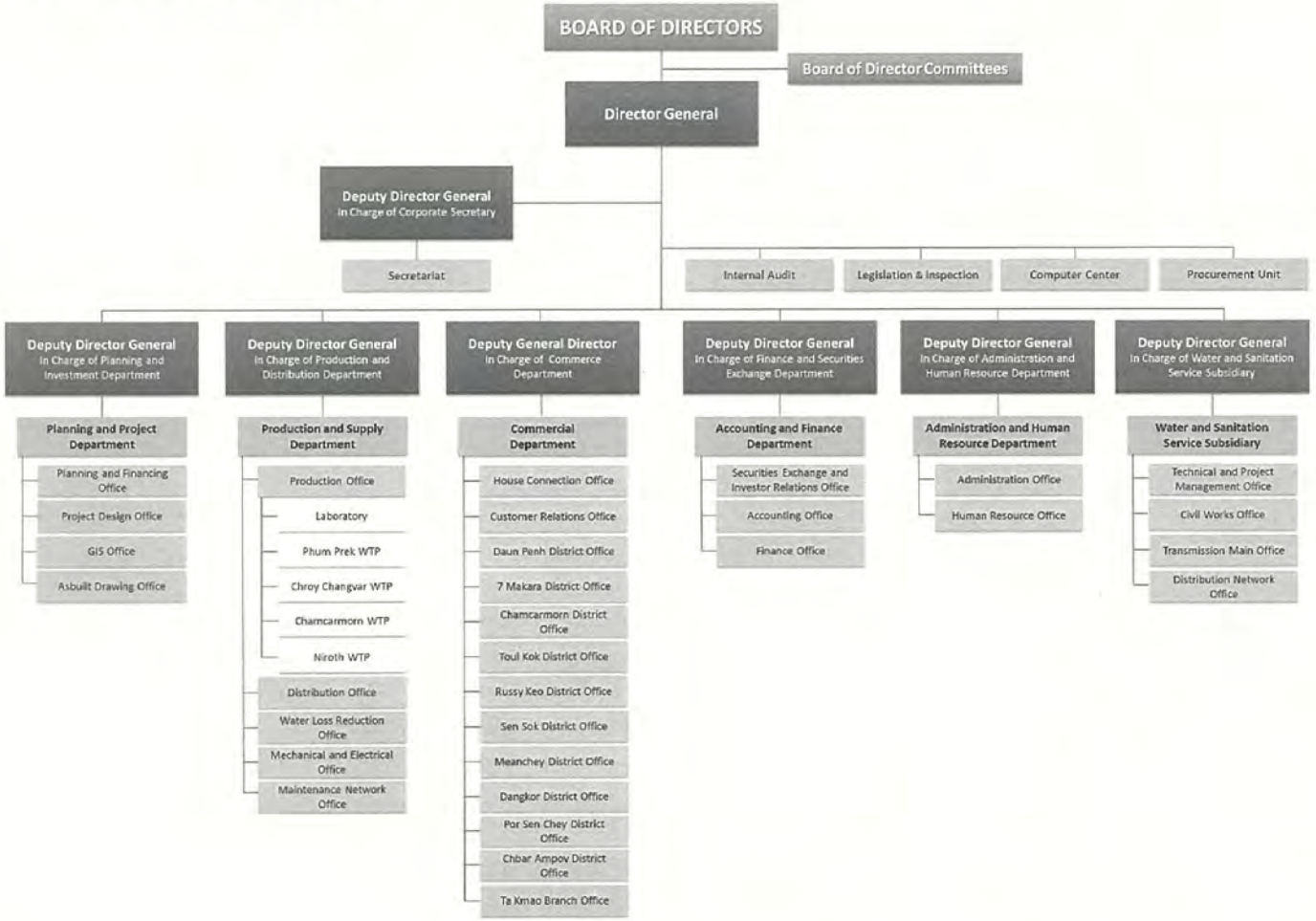
Annex1 Project Site Map

Cambodian Map



Site location Map

Annex2 Organization Chart of PPWSA



JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as "the Recipient") to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as "Project Grants"). The Project Grants in the present understanding here means a public project which private company (ies) with the technologies and know-how of Japanese Nationals for the development in the Recipient is (are) participated in and is (are) comprehensively implemented including construction of facilities, procurement of equipment, and operation and management.

1. Procedures of Project Grants

Project Grants are conducted through following procedures. (See "PROCEDURES OF JAPANESE GRANT" for details):

(1) Preparation

- The Preparatory Survey (hereinafter referred to as "the Survey") conducted by JICA

(2) Appraisal

-Appraisal by the government of Japan (hereinafter referred to as "GOJ") and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes

-The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as "the G/A")

-Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as "the B/A")

-Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant

Construction works/procurement

-Implementation of the project (hereinafter referred to as "the Project", the term "the Project" means that the Recipient concludes contract(s) to construct facilities and/or procure equipment by using the Japanese Grant.) on the basis of the G/A

(4) Operation and Management (without using the Japanese Grant)

-Operation and management of the facilities and equipment

(5) Ex-post Monitoring and Evaluation

-Monitoring and evaluation of the Project at post-implementation stage

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the Project Grants made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project Grants and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.
- Evaluation of the feasibility of the Project Grants to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project Grants.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project Grants.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project Grants are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project Grants.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."

2) Banking Arrangements (B/A) (See "Financial Flow of Japanese Grant (A/P Type)" for details)

a) The Recipient shall open an account or shall cause its designated authority to open an account in the Bank. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.

b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be provided for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractor(s), namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals".

6) Contracts and Concurrence by JICA

1) Contracts consist (a) a comprehensive contract which consolidates both contracts for the purchase of the products and/or services and for the operation and maintenance, (b) contract(s) for the purchase of products and/or services and (c) contract(s) for the operation and maintenance.

2) The Recipient will conclude (b) contract(s) for the purchase of products and/or services denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.

b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Operation and Management Stage

The Contractor operates and manages the facilities and equipment based on the contract(s) for operation and maintenance with the Recipient.

(3) Ex-post Monitoring and Evaluation Stage

1) After the project completion of all construction and procurement works by using the Japanese Grant, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.

2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion of all construction and procurement works by using the Japanese Grant. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

(4) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the products and/or the services be exempted or be borne by its designated authority without using the Grant and its accrued interest.

3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient country.

Attachment 1

PROCEDURES OF JAPANESE GRANT

Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		x		x	x		
2. Appraisal	(2)Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
	(3)Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Preparation of bidding documents	Concurrence by JICA is required	x			x		
	(10) Bidding	Concurrence by JICA is required	x			x	x	
	(11) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
	(12) Design/Construction works/procurement	Concurrence by JICA is required for amendment of contracts.	x			x	x	
	(13) Completion certificate		x			x	x	
4. Operation & Management	(14) Operation and management of the facilities and equipment		x			x	x	
5. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

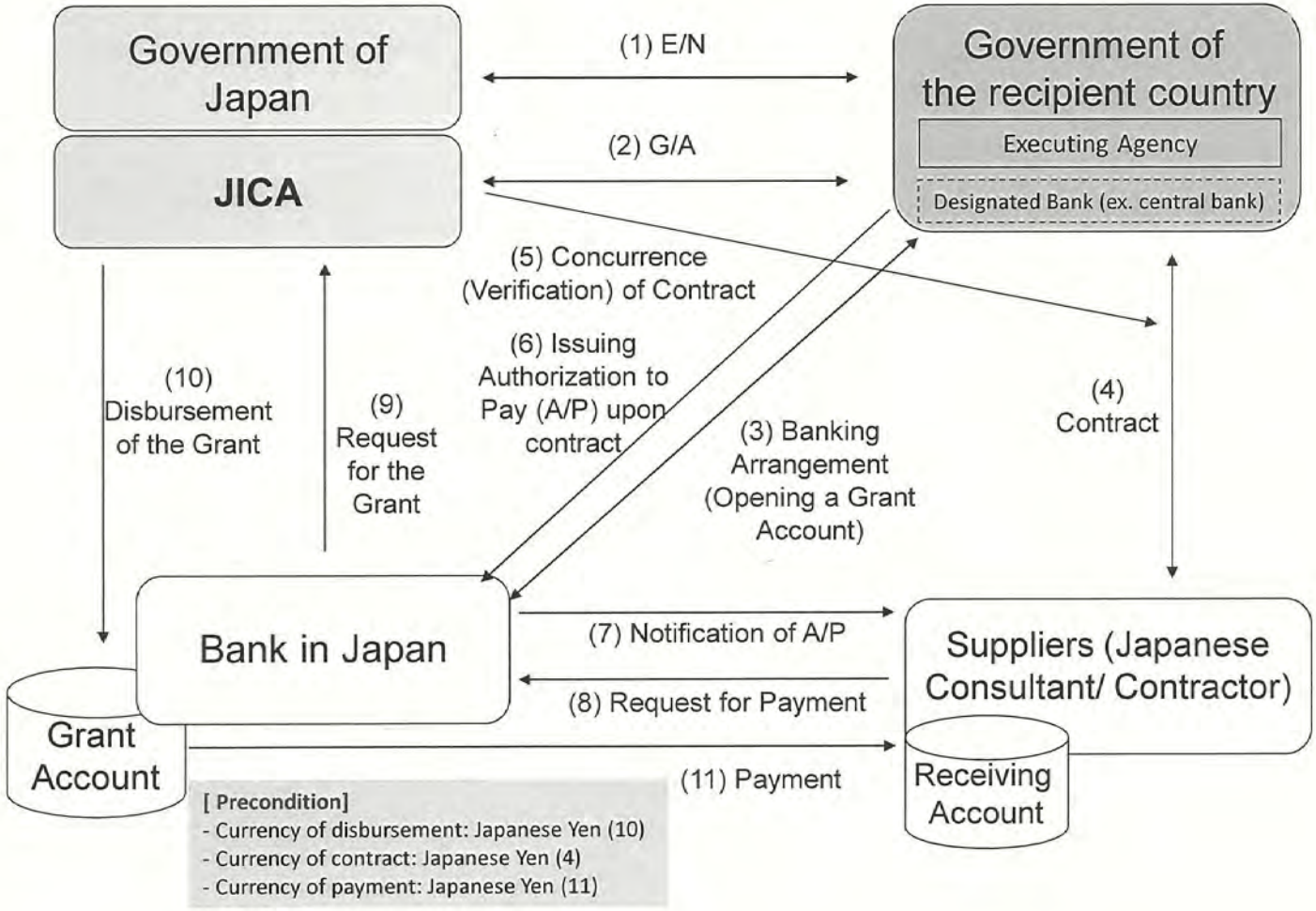
notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.

2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

Attachment 2

Financial Flow of Japanese Grant (A/P Type)



Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXX
20XX, Month

Organizational Information

Signer of the G/A (Recipient)	Person in Charge	(Designation)
	Contacts	Address: Phone/FAX: Email:
Executing Agency	Person in Charge	(Designation)
	Contacts	Address: Phone/FAX: Email:
Line Ministry	Person in Charge	(Designation)
	Contacts	Address: Phone/FAX: Email:

General Information:

Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____

1: Project Description

1-1 Project Objective

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr)	Target (Yr)
Qualitative indicators to measure the attainment of project objectives		

2: Details of the Project

2-1 Location

Components	Original *(proposed in the outline design)*	Actual
1.		

2-2 Scope of the work

Components	Original* *(proposed in the outline design)*	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)

2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	*(at the time of signing the Grant Agreement)*	

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant(Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components			Cost (1,000 Taka)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original *(at the time of outline design)* name: role: financial situation: institutional and organizational arrangement (organogram): human resources (number and ability of staff):
Actual *(PMR)*

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original *(at the time of outline design)*
Actual *(PMR)*

3-2 Budgetary Arrangement

- Required O&M cost and actual budget allocation for O&M

Original *(at the time of outline design)*

Actual *(PMR)*

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks *(at the time of outline design)*

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:

	Contingency Plan (if applicable):
Actual Situation and Countermeasures	
(PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant

Appendix - Photocopy of Contractor's Progress Report (if any)
- Consultant Member List
- Contractor's Main Staff List

4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final)only)
8. Pictures (by JPEG style by CD-R) (PMR (final)only)
9. Equipment List (PMR (final)only)
10. Drawing (PMR (final)only)
11. Report on RD (After project)

Attachment 6

Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

	Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C−D	Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

	Items of Specified Materials	1st ●month, 2015	2nd ●month, 2015	3rd ●month, 2015	4th	5th	6th
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

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Attachment 7

Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
(Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	

Annex 5

Major Undertakings to be taken by the Royal Government of Cambodia

1. Specific obligations of the Royal Government of Cambodia which will not be funded with the Grant

(1) Before the Bidding

No	Items	Deadline	In charge	Estimated Cost (USD)	Ref.
1	To open bank account (B/A)	within 1 month after the signing of the G/A	PPWSA	-	
2	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the consultant	within 1 month after the signing of the contract(s)	PPWSA	-	
3	To bear the following commissions to the Agent Bank for the banking services based upon B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	PPWSA/ NBC		
	2) Payment commission for A/P	every payment	PPWSA/ NBC		
4	To approve Environmental Protection Contract (Conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation.	within 1 month after the signing of the G/A	PPWSA	-	
5	To notice the construction of the intake facility in the Tonle Sap River to local authorities.	before notice of the bidding document(s)	PPWSA	-	
6	To secure and clear the following lands/sites * 1) Site for Phum Prek WTP	before notice of the bidding document(s)	PPWSA	-	
7	To explore landmines and UXO at construction site	before notice of the bidding document(s)	PPWSA		
8	To obtain water right for intake from the Tonle Sap River from MOWRAM	before notice of the bidding document(s)	PPWSA	-	

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

NBC: National Bank of Cambodia

(2) During the Project Implementation (during EPC)

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Supplier(s)	within 1 month after the signing of the contract(s)	PPWSA	-	
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	PPWSA/ NBC		
	2) Payment commission for A/P	every payment	PPWSA/ NBC		
3	to ensure prompt unloading and customs clearance at ports of disembarkation in the country of the Recipient and to assist the Supplier(s) with internal transportation therein	during the Project	PPWSA	-	
4	To accord Japanese physical persons and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into Cambodia and stay therein for the performance of their work	during the Project	PPWSA	-	
5	To ensure that customs duties, VAT, internal taxes and other fiscal levies which may be imposed on prime contractors and subcontractors in Cambodia with respect to the purchase of the products and/or the services be exempted by its designated authority without using the Grant;	during the Project	MEF	-	
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	PPWSA	-	
7	To notify JICA promptly of any incident or accident, which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers.	during the construction	PPWSA		
8	1) To submit Project Monitoring Report	every month	PPWSA	-	
	2) To submit Project Monitoring Report (final)	within one month after signing of Certificate of Completion for the works under the contract(s)	PPWSA	-	
9	To submit a report concerning completion of the Project	within six months after completion of the Project	PPWSA	-	
10	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the site(s)		PPWSA	-	
	1) Electricity Construction of utility poles and wiring work including conduit from the power receiving point to the transformer, procedures for receiving power, and procedures for receiving two lines.	before start of the construction			
	2) Drainage The city drainage main (for storm, sewer and others) to the site	before start of the construction			
11	To relocate buried objects such as pipeline at construction site of additional facilities if necessary	before start of the construction	PPWSA		

12	To take necessary measure for safety of construction - Coordination with the police for traffic control - Coordination with relevant authority to ensure the safety of boats and ships in relation to the construction of intake facility	during the construction	PPWSA	-	
13	To implement EMP and EMoP	during the construction	PPWSA		
14	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction	PPWSA	-	
15	To provide sufficient space in Phum Prek site and others as a stockyard and office space for free of charge	during the construction	PPWSA	-	

(3) During O&M

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To implement EMP and EMoP	for a period based on EMP and EMoP	PPWSA		
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between PPWSA and JICA.	for three years after the commissioning	PPWSA		
3	To extend distribution network and facilitate the service connections.	for the O&M period	PPWSA		
4	To comply strictly with the O&M contract	for the O&M period	PPWSA		

Minutes of Discussions
on the Preparatory Survey for the Project for
Rehabilitation and Expansion of Phum Prek Water Treatment System

In response to the request from the Government of the Kingdom of Cambodia (hereinafter referred to as "Cambodia"), Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Team for the Outline Design (hereinafter referred to as "the Team") of the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System (hereinafter referred to as "the Project") to the Government of Cambodia. The Team held a series of discussions with the officials of the Government of Cambodia. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

Phnom Penh, 5th August, 2021
Tokyo, 5th August, 2021

Mr. Yoichi Inoue	H.E. Dr. Sim Sitha
Leader	Director General
Preparatory Survey Team	Phnom Penh Water Supply Authority
Japan International Cooperation Agency	Kingdom of Cambodia
Japan	

Minutes of Discussions
on the Preparatory Survey for the Project for
Rehabilitation and Expansion of Phum Prek Water Treatment System

ATTACHMENT

Project Outline and Implementation Policy

1. Scope of the facilities/services to be funded by the Grant

   The team explained the scope of the facilities/services to be funded by the Grant and both sides agreed as follows:

   Facility:

   - Construction of Intake Facility
   - Installation of Intake Pumps
   - Water Treatment Facility: Additional facilities for 45,000 m^3/day, including power receiving unit and chemical generation and dozing system (See 6 below regarding power receiving unit and chemical generation and dozing system)
   - Service Reservoir: 6,000 m^3
   - Pumping station
   - Installation of Distribution Pumps
   - Improvement of SCADA System

   Consulting Service:

   - Tender Assistance, Monitoring of Design and Construction and Procurement

2. Project Contracts

   Both sides agreed Contracts shall be as follows.

   Contract between PPWSA and the Consultant

   a) Contract for Consulting Services for:
      - Support of Tendering, Monitoring of Design and Construction and Procurement

   Contracts between PWPSA and the Contractor

   a) Design and Build (D&B) Contract for:
      - Construction of Intake Facility
      - Installation of Intake Pumps
      - Water Treatment Facility: Additional facilities for 45,000 m^3/day, including power receiving unit and chemical generation and dozing system
      - Service Reservoir: 6,000 m^3
      - Pumping station
      - Installation of Distribution Pumps
      - Improvement of SCADA System

A1

b) Operation and Maintenance (O&M) Contract for:
   - Operation and maintenance of water treatment facilities for 10 years and sales of bulk water

c) Training Service Contract for:
   - Operation and maintenance of the water treatment facilities
   - Development of PPWSA's capacity on the management of water treatment plant

d) Comprehensive Agreement which consolidates all the contracts above.

3. Reinforcement of structure 100,000 m^3/day Sedimentation & Filter and 10,000 m^3 Reservoir

   The team explained that the existing two facilities, 100,000 m^3/day Sedimentation & Filters and 10,000 m^3 Reservoir, require reconstruction rather than reinforcement due to their conditions found in the survey as Annex 2. Therefore, both sides agreed that requested reinforcement of structure 100,000 m^3/day Sedimentation & Filters and 10,000 m^3 Reservoir are excluded from the Project.

4. Private financing to new Transmission Pipeline

   The Team studied private financing to new Transmission Pipeline under the Grant Aid, however it was found not feasible due to the following reasons as Annex 2.

   1) While PPWSA does not have to finance at its own, total cost of procurement (total amount of payment by PPWSA) may be higher due to higher interest (compared to government loans) and payment risk / forex risk borne by the Contractor.
   2) Based on the cash flow analysis, the development of new transmission pipeline has negative net present value and is not worth implementing from financial perspectives.
   3) There is a concern that Japanese companies may not be willing to implement the project with private finance and it would limit competitiveness of the Grant project.
   4) It may also impose a risk on the implementation schedule of the Grant project.

5. Installation of new Transmission Pipeline

   The team explained that the new transmission pipeline cannot be included in the scope of the grant due to budget constraint as Annex 2 and both sides agreed new transmission Pipeline which may cost about 3.9 mil. USD should be designed,

procured, and constructed by PPWSA as one of the undertakings of the Project by January 2026. PPWSA explained PPWSA will utilize counterpart fund for the Project and the Team agreed to submit further technical and budget information on new transmission Pipeline.

6. Power receiving unit and chemical generation system
PPWSA requested the Team to install new power receiving unit and chemical generation system under the Grant Aid to avoid defect risk of the existing facilities. The Team will further study and consult with GOJ.

7. Summary of Implementation plan
Both sides confirmed as follows:

Components	**Funded by**	**Constructed by**	**Operated by**
Intake facilities, including power receiving unit	Grant	Contractor	PPWSA
Transmission pipeline	Out of scope of the Grant (PPWSA will develop the transmission pipeline as undertakings of the Project)		
Water treatment facilities, including power receiving unit and chemical generation and dozing system*	Grant	Contractor	Contractor
Distribution facilities	Grant	Contractor	PPWSA
SCADA	Grant	Contractor	PPWSA and Contractor
Existing Sedimentation/Filters and Reservoir (rehabilitation/reconstruction)	Out of scope of the Project		

* See 6 above regarding power receiving unit and chemical generation and dozing system

8. Project schedule
The Team explained the tentative project schedule based on the comparator facilities described in Section 1. Implementation Policy of Annex 1, which includes installation of transmission pipeline by PPWSA by January 2026 as one of the

undertakings of the Project by PPWSA, and both sides agreed upon it.
The Team also explained that the tentative schedule might be reconsidered reflecting opinions given by Japanese companies in a project briefing session to be held by JICA in August, 2021.

9. Basic framework of evaluation of Quality and Cost Based Selection (QCBS)
The Team explained the basic framework of evaluation of QCBS described in Section 1. Implementation Policy of Annex 1, and both sides agreed with it.

10. Tax exemption
PPWSA has an agreement with MEF mentioning that PPWSA will issue a letter to confirm with the Tax Department for the exemption under the contracts with the Contractor as follows.
   a) Tax exemption for Consulting Services and D&B Works
   PPWSA ensures that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the Products and/or the Services under the Grant are exempted under the Exchange of Notes.
   b) Tax exemption for O&M Services
   The Services of the supply of clean water by the Contractor most likely falls within a non-taxable supply according to the local Prakas. However, in the event the Cambodian tax authority deems the Services by the Contractor a taxable supply for the purpose of VAT, PPWSA shall pay the invoiced amount which shall include VAT (in the same manner as Ta Khmau Project).

<u>Client's Requirements and Comparator Facility</u>

11. Requirements for the Facility
PPWSA required that the power system and chemical generation and dozing system shall be constructed in a way that the new water treatment facility does not depend on the existing facilities to avoid defect risks.

12. Production amount
The Contractor shall make best efforts to produce water 45,000 m^3/day. The Contractor shall also request a meeting to PPWSA in case the actual production amount is varied from the production plan which shall be submitted to PPWSA in

advance.

13. Water quality standards

Both sides confirmed the water quality standards which the Contractor should meet as Section 2. Client's Requirements of Annex 1. PPWSA also explained that it would not require the Contractor to treat trihalomethane precursors and odor substances.

14. Work Allocation

- Water Quality Testing in Laboratory

Testing of raw water quality shall be carried out by the Contractor as its own responsibility. Testing of treated water quality shall be carried out by PPWSA in the existing laboratory of PPWSA in Phum Prek WTP.

- Chemical Generation and Solutions

The Contractor shall have responsibility to procure raw materials necessary for its operation.

- Operation and Maintenance of Distribution Pumps

PPWSA shall have responsibility to operate and maintain the whole distribution system including the existing and new pumps.

15. Training Service

Tentative general requirements for the training services are following.

a. Classroom lecture
- Strategic planning of operation and maintenance
- Preventive maintenance
- Asset management

b. Case study (in Phum Prek)
- Strategic planning and reporting
- Stock and procurement management
- Updating SOP and other manuals

c. On the Job Training
- Training on improvement of system operation
- Operation of both existing and new water treatment facilities

16. Outline of comparator facility
    The Team explained the outline of comparator facilities as Section 3. Comparator Facility Design of Annex 1. Both sides confirmed that comparator facilities were used only for estimating project cost, and the actual design of the facilities would be proposed by the Contractor in the later stage.

Contract Terms

17. Contract Terms
    The Team explained the contract terms including the conditions for hand-back after the termination of O&M contract described in Section 4. Contract Terms of Annex 1, and both sides agreed with them.

18. Responsibilities of PPWSA and the Contractor during O&M period
    The Team explained the possible responsibilities of PPWSA and the Contractor during O&M period described in Section 4. Contract Terms of Annex 1, and both sides agreed with them.

19. Risk allocation during the O&M period
    The Team explained the risk allocations described in Section 4. Contract Terms of Annex 1, and both sides agreed with them.

20. Payment Terms for Water Treatment
    PPWSA is obligated to take or pay for 45,000 m^3/day of treated water measured at the handover point (after the filter). Daily fluctuation in volume is accepted as far as the supply exceeds 45,000 m^3/day averaged over two (2) consecutive months.

21. Method for Bulk Water Price Determination
    The Team explained that through the bidding process, the proposals from the Contractor to reduce bulk water price would be encouraged. Both sides also understood bulk water price is subject to a proposal by the Contractor.

    The Team explained the following three steps to decide the bulk water price:
    (1) Ceiling prices based on the comparator facility to be agreed in the Preparatory Survey, which will be written in the Minutes of Discussions at the explanation of the draft report which is scheduled around November to December, 2021, and the

schedule of Grant Agreement (G/A),

(2) Requirement to be written in the bidding document, which should be the same as the assumption above in principle, and

(3) Final decision to be fixed based on the proposal from the Contractor and the contract negotiation between the Contractor and PPWSA, which will be written in the contract.

22. Ceiling Prices for Bulk Water and Training Services

The Team explained the method for ceiling price calculation described in Section 4. Contract Terms of Annex 1. PPWSA understood the composition of the price formula and agreed to set the ceiling prices for the bulk water and training services at KHR350/m^3 and $35,000/year respectively. These ceiling prices are tentative and subject to revision after the private sector sounding.

The Team requested PPWSA to report to the Board of Directors about the progress of examination of the prices before the middle of September 2021 and inform the Team of the result.

Both sides reconfirmed that the prices should be approved by the Board of Directors of PPWSA and no other approval from related authorities would be necessary.

23. Trading currency

The Team explained that the trading currency of the O&M contract between PPWSA and the Contractor will be in Cambodian Riel, and both sides agreed.

Others

24. Stockyard and office for the consultant and the Contractor during the construction stage

The Team requested PPWSA to prepare possible space for the stockyard and office necessary for the construction stage.

25. Staff of operation and maintenance for new 45,000 m^3/day facility by the Contractor and staff assignment from PPWSA for training services

The team explained the new 45,000 m^3/day facility will be operated and maintained by the staff of the Contractor and both sides agreed that PPWSA will assign staffs for training services.

26. Other issues
    a) Both sides agreed that Sludge Collection, Treatment and Disposal shall be done by PPWSA.
    b) PPWSA submitted the draft Environmental Protection Contract to the Ministry of Environment in the early August and both sides agreed that PPWSA shall inform the team of its approval.
    c) Both sides confirmed the situation of Permission for the Construction of Intake.
    d) Both sides agreed that Coordination with the Developer for the Construction of Raw Water Intake shall be confirmed in further discussions.

27. Title of the Preparatory Survey
    Both sides confirmed the title of the preparatory survey as "the Preparatory Survey for the Project for Expansion of Phum Prek Water Treatment System".

Annex 1 Project Information Memorandum
Annex 2 Explanation materials on the components to be out of scope of the Grant-scheme
Annex 3 Major undertakings

Project Information Sheet

THE PROJECT FOR REHABILITATION AND EXPANSION OF PHUM PREK WATER TREATMENT SYSTEM IN THE KINGDOM OF CAMBODIA

1. Implementation Policy

1.1 Project Background

- The water demand in the area supplied by PPWSA is projected to be double in 2030 and capacity of existing water treatment plants (WTP/WTPs) in Phnom Penh will be insufficient to meet the demand in 2030.
- The Phum Prek WTP shall be expanded to meet the raised demand in the Phnom Penh Capital central area.
- The Government of Cambodia requested to the Government of Japan for the funds to implement the project for expansion of Phum Prek water treatment system.

1.2 Project Objectives

The objective of the Project is to supply sufficient drinking water through the expansion of Phum Prek water treatment system including raw water intake facility, and water treatment facilities, service reservoir and distribution pumping station.

1.3 Project Scope and Structure

The Project would be implemented by applying the Japanese Grant Aid with Operation and Maintenance (O&M), whose outline is explained in Annex 3 of Minutes of Discussions on the Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System dated 27th January 2021 in particular:

- PPWSA will be the executing agency and the implementing agency for the Project.
- The Japanese Grant Aid shall be used for construction of the facilities and procurement of equipment necessary for the Project, and the consulting service to be assigned to consultants.
- A Japanese company or a joint venture of Japanese companies (the Contractor) that shall be responsible for the design, construction, O&M of the new water treatment facilities in the Phum Prek WTP, and training services will be selected through a competitive tender.
- The Contractor shall establish a Special Purpose Company (SPC) in Cambodia before the commencement of the O&M Services.
- Contracts shall consist of (a) contract for the purchase of products and/or services, (b) contract for the operation and maintenance services, (c) contract for training services, and (d) comprehensive agreement which

consolidates all the contracts above.

- The Government of Cambodia shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Government of Cambodia with respect to the purchase of the products and/or the services be exempted or be borne by its designated authority without using the Grant and its accrued interest.

The facilities/services to be funded by the grant are as follows:

Facility: Construction of Intake Facility

Installation of Intake Pumps

Water Treatment Facility: Additional facilities for 45,000m^3/day, including power receiving unit and chemical generation and dozing system

Service Reservoir: 6,000m^3

Pumping station

Installation of Distribution Pumps

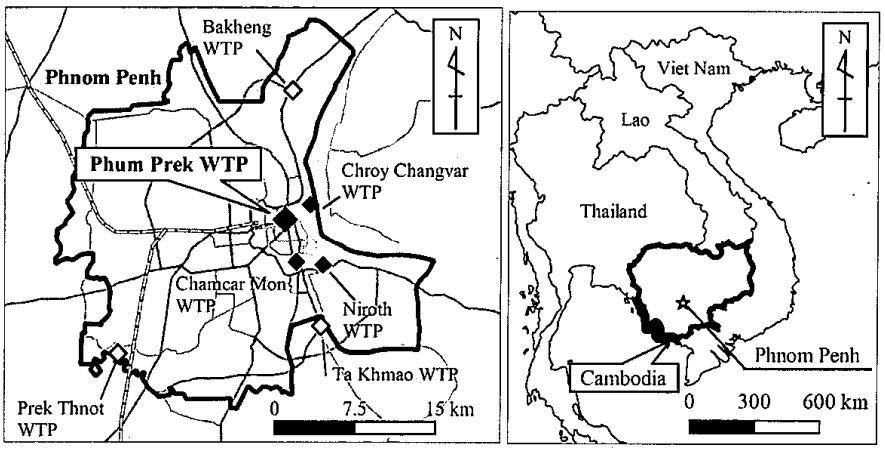
Improvement of SCADA System

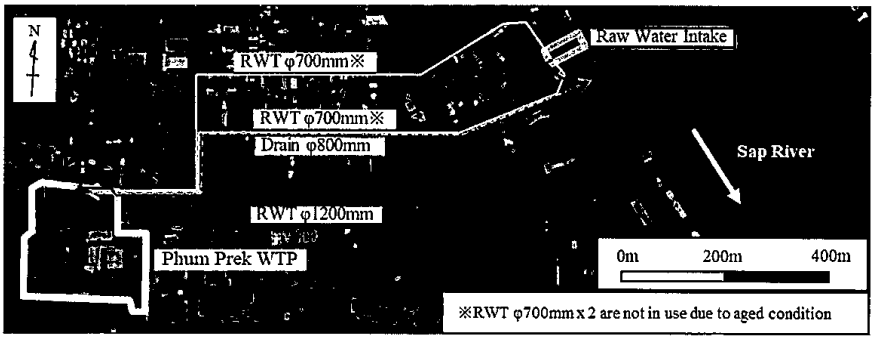
Consulting Service: Tender Assistance, Monitoring of Design and Construction and Procurement

Among the facilities to be funded by the grant, only the Water Treatment Facility would be subject to the O&M Services by the Contractor. Payment for the O&M Contract and Training Contract shall be funded by PPWSA at its own responsibility.

1.4 Project Site

The project sites are existing Phum Prek raw water intake site and the existing Phum Prek Water Treatment Plant site as shown in the Figure below.



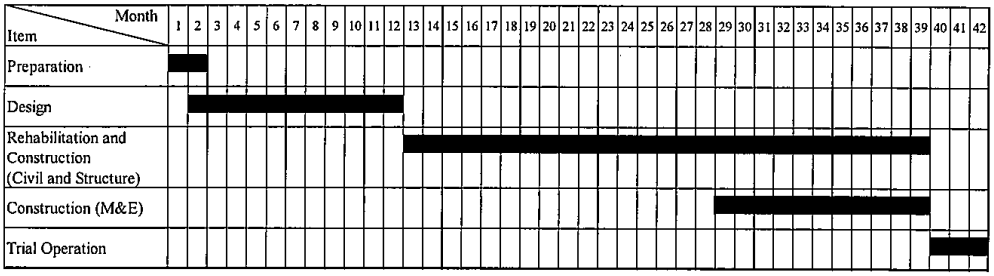


1.5 Project Schedule

Bidding Schedule

Item \ Month					1	2	3	4	5	6	7	8	9	10	11	12	
Cabinet Meeting (Japan)	▼																
E/N		▼															
G/A			▼														
Contract for the Consultant				■	■												
PQ Documents Preparation					■												
P/Q Documents Approval						■											
P/Q Announcement						▼											
P/Q						■											
P/Q Evaluation and Reporting							■										
Bidding Documents Preparation					■	■	■										
Bidding Documents Approval							■	■									
Bid Announcement								▼									
Bidding Document Distribution								▼									
Bidding Period								■	■	■	■	■					
Bid Open (Technical)												▼					
Technical Bid Evaluation												■	■	■			
Technical Bid Approval															■		
Bid Open (Price)															▼		
Approval of Bid Result															■	■	
Contract Negotiation																■	
Contract																	▼

Construction Schedule



1.6 Bidding Procedure

- The bidders must be "Japanese nationals", in principle.
- Quality and Cost Based Selection (QCBS) that includes technical and financial evaluation will be applied for the bidding.
- Scope of evaluation includes D&B works, O&M services, and training program.
- Comprehensive evaluation would be carried out such that:

Comprehensive Evaluation Score = Technical Score * X + Price Score * (1-X)
where X is a weight factor 1>X>0 (In this stage the Consultants propose 0.5 as used in the preceding Ta Khmau Project.)

Technical Score (example)

No.	Category	Score
1	Organization and Management	TBD
2	Conceptual Design/Process Design	TBD
3	Construction Plan	TBD
4	Quality Control and Assurance	TBD
5	Health and Safety / Environmental Management	TBD
6	O&M Plan	TBD
7	Training Plan	TBD
Total		100

Price Score (example)

The tenderer bids on total cost of the Project to PPWSA such that:

Bid Price = D&B price + Net present value of bulk water payment

Price score = Lowest Price / Price of the Tenderer * 100

Subject to:

(1) D&B price shall be below the Grant budget applicable to the D&B contract.

(2) Bulk water price shall be below the ceiling prices set by PPWSA.

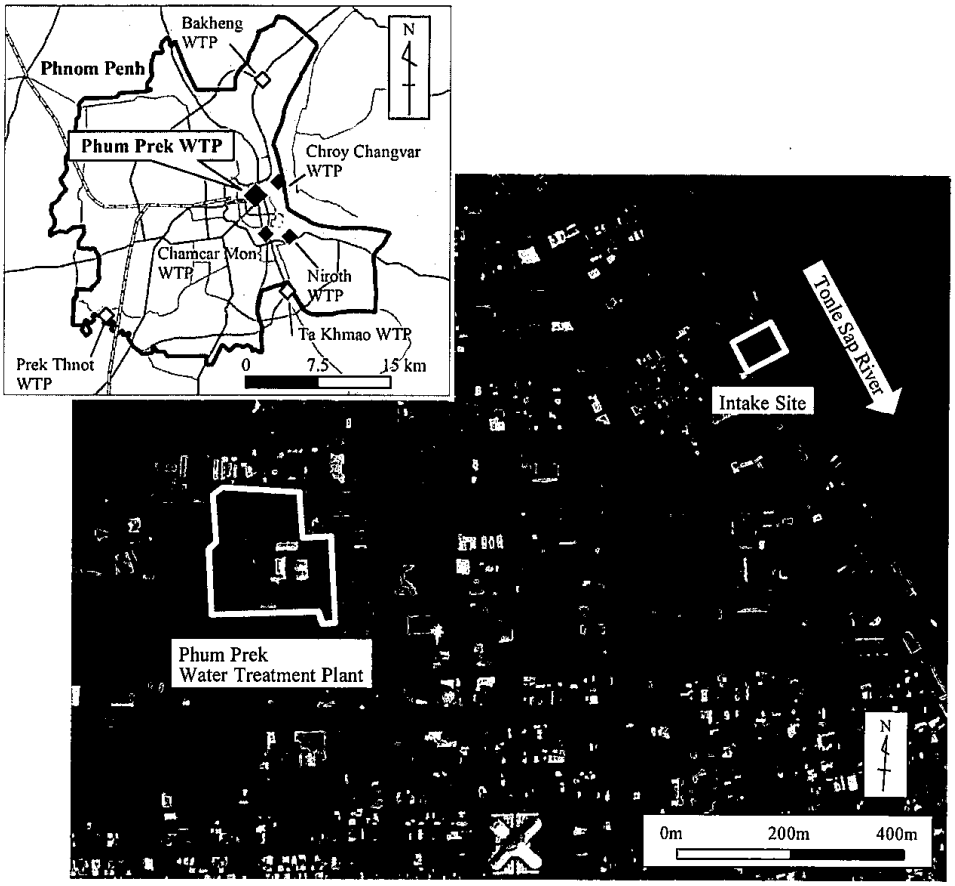
For the training services, PPWSA shall describe its requirements and fixed price for the Contractor's proposal for which the Contractor shall propose the detailed training program. The price of the training program consequently would not be subject to price evaluation.

2. Client's Requirements

2.1. Preconditions

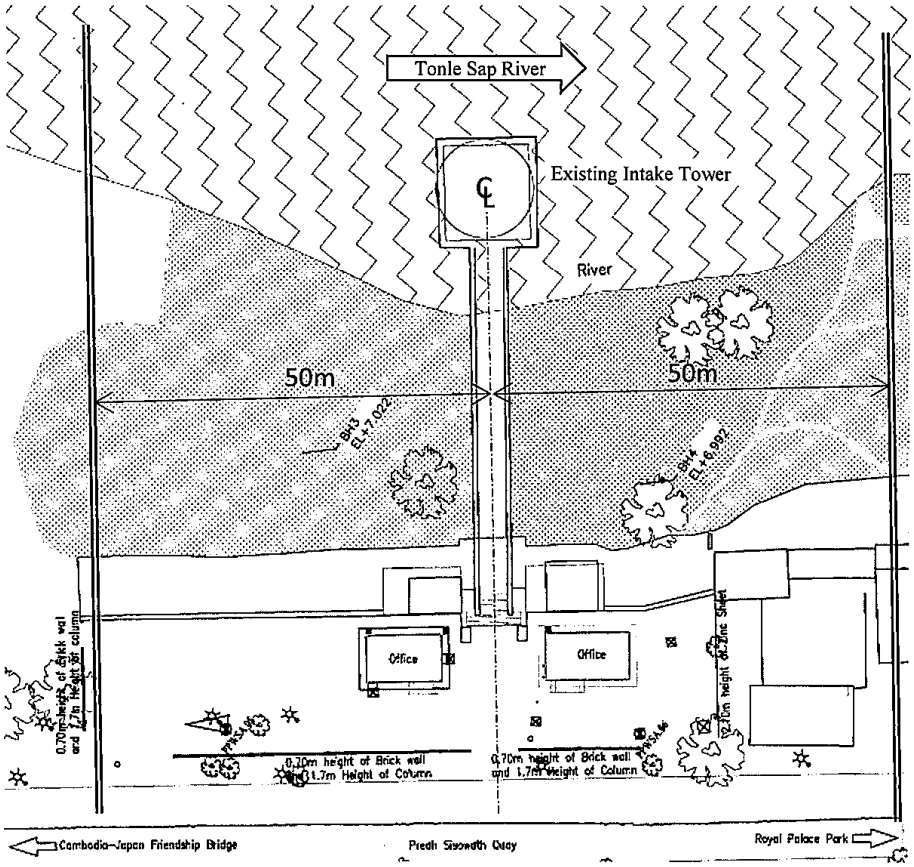
2.1.1. Construction Area

The construction sites are existing Phum Prek raw water intake site and the existing Phum Prek Water Treatment Plant site as shown in the Figure below.



2.1.1.1. Intake Site

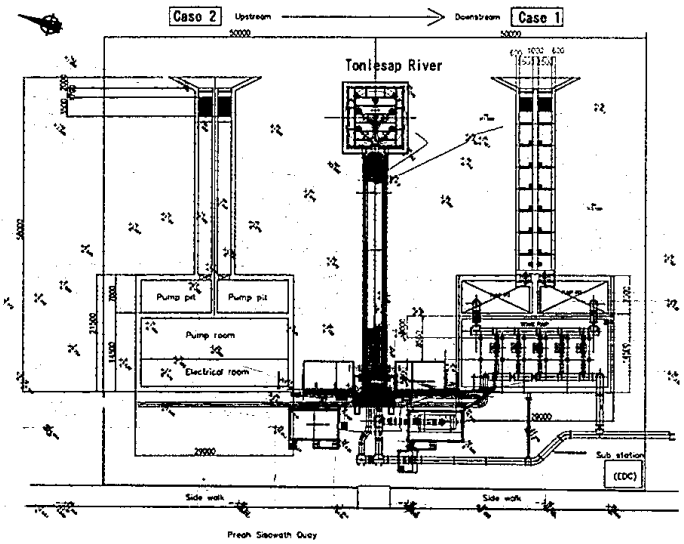
The construction site of raw water intake is approx. 100 m wide facing and along the Sap River as shown on the Figure below.



The existing raw water intake facility will be abandoned after the construction of new intake facility under this Project.

Riverbank neighboring the construction site will be developed by Private Developer.

The available construction area shall be both sides of existing facility as shown on the Figure below.



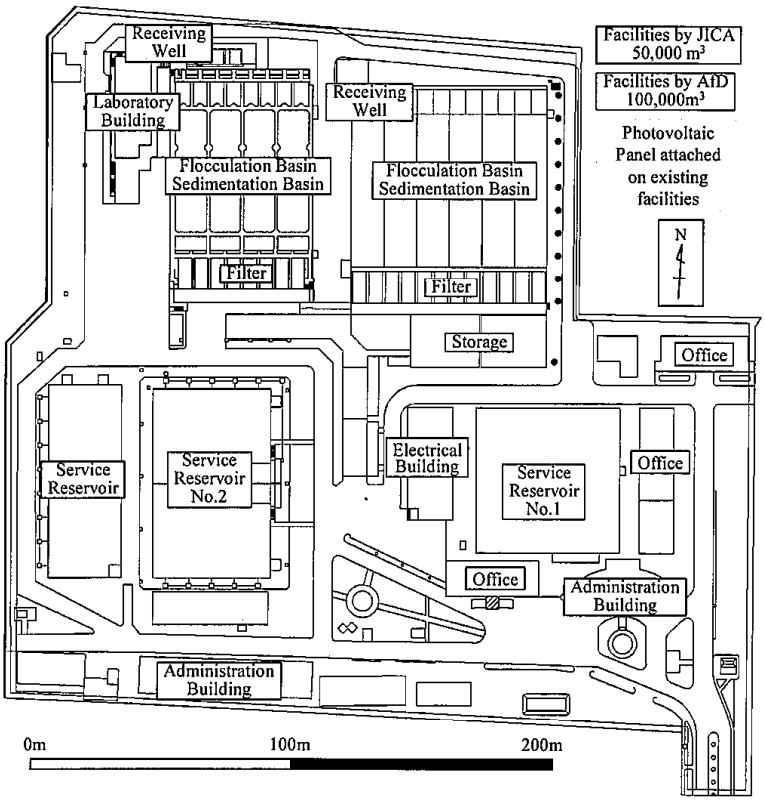
A New Raw Water Intake Facility will be located on the bank of the Sap River. Since the existing facility cannot be reused, a new facility will be constructed downstream adjacent to it.

The existing φ1200mm raw water pipeline will continue to be used for supplying to the Existing WTP of 150,000m^3/day. The new φ800mm raw water pipeline (to be constructed by PPWSA) will supply the 45000m^3/d to new water treatment facilities to be constructed under this Project.

2.1.1.2. Water Treatment Site

The construction site of water treatment plant is within the existing Phum Prek Water Treatment Plant.

The existing facilities in the Phum Prek Water Treatment Plan is shown on the Figure below.



There are existing facilities of 2 phases listed as below.

A. Phase 1 Facilities of 100MLD (1959)

a) Receiving Well
b) Mixing well
c) Sedimentation basin
d) Rapid sand filter
e) Service Reservoir No.1 (10 ML)
f) Service Reservoir No.2 (10 ML)

B. Phase 2 Facilities of 50 MLD (2003)

a) Receiving Well
b) Mixing well
c) Sedimentation basin

d) Rapid sand filter

e) Service Reservoir No.3 (5 ML)

f) Pumping Station

C. Other Facilities

a) Administration Building

b) Chemical Building

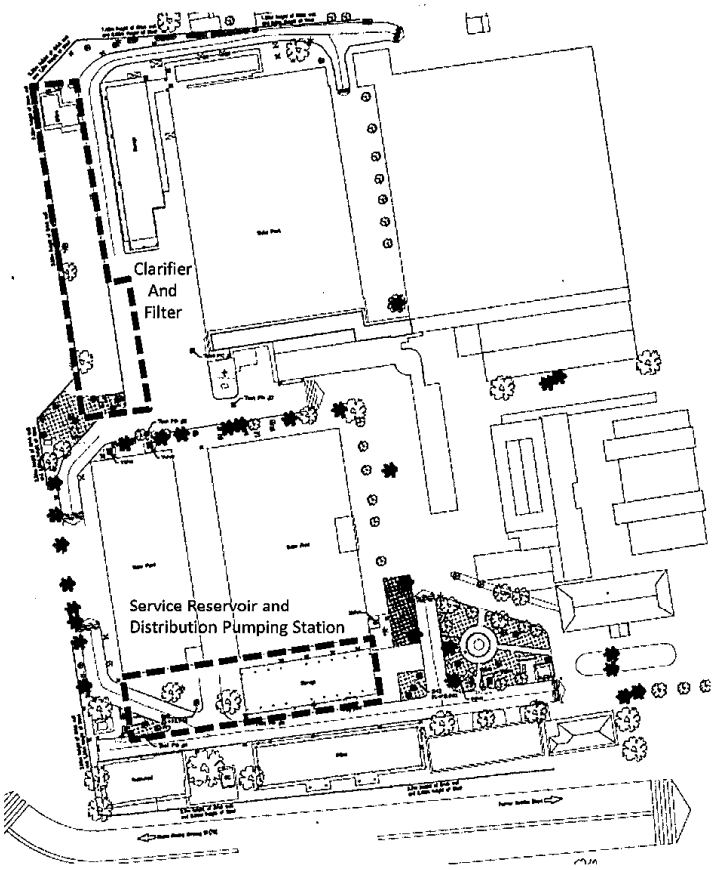
c) Storage

d) Canteen

e) Work Offices

f) Others

The room for the construction of new facilities of 45 MLD are as shown on the Figure below.



The existing Water Treatment facilities (Phase 1 100 MLD and Phase 2 50 MLD facilities) will be used as it is. The New facilities will be constructed in the empty space of the Phum Prek WTP.

New 800mm transmission pipeline shall be constructed by PPWSA for the new water treatment facilities by the time the Contractor completes the construction before commencement of trial operation (January 2026).

2.1.2. Raw Water Quality

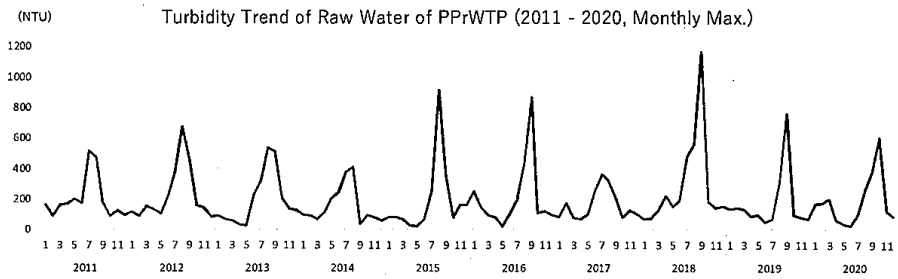
Raw water source shall be Tonle Sap River.

The raw water quality recorded at Phum Prek WTP during 2017-2020 shows following characteristics.

- pH is relatively high with the lowest values continuously over 7.0. On the other hand, highest values are slightly over 8.0 even in the late dry seasons (Dec.-Apr.) when sunshine duration is longer and the photosynthesis by phytoplankton is actively carried out.
- Turbidity lowers in the dry seasons with the values from 20 to 100NTU. It increases in the wet seasons with the values over 200NTU in many cases and over 1,000NTU in some cases. Since the turbidity values shifts in a wide range, it is required to adjust the dosage rate of the coagulant accordingly.
- Alkalinity shifts in a high range and does not lower than 20mg/L even in the lowest months. Thus, no problems for water quality management are expected as long as PAC (which does not consume much alkalinity) is used as coagulant.
- Ammonium nitrogen (NH4-N) shifts from <0.1 to 1.2mg/L with various trends in different months. This shift makes the forecast so difficult that the attention should be kept because the concentration of NH4-N affects the chlorination operation.

Followings are summary of raw water turbidity of Phum Prek WTP during 2011-2020.

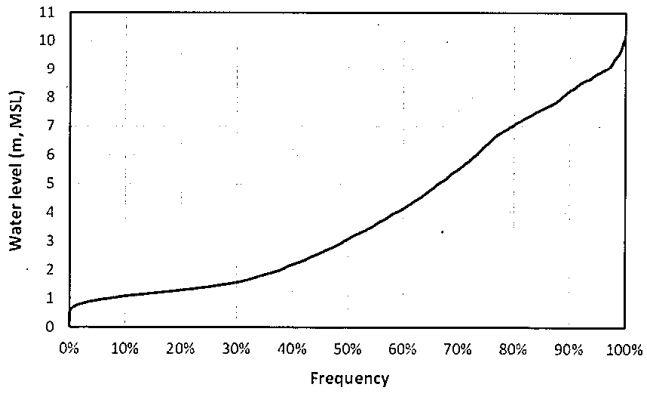
- Average Turbidity in Dry Season: 70NTU
- Average Turbidity in Wet Season: 122NTU
- Average Turbidity over 10 years: 100NTU
- Maximum Turbidity over 10 years: 1163NTU
- Minimum Turbidity over 10 years: 7NTU



The monthly raw water quality analysis of February-July 2021 at intake location of Phum Prek WTP is being carried out under the Survey and the result will be provided soon.

2.1.3. Water Level of Tonle Sap River

In Tonle Sap River, the minimum, the average and the maximum water level are 0.52, 3.93 and 10.16 (m AMSL) respectively. And the frequency is shown below.



2.2. Client's Requirements

2.2.1. Requirement for the D&B Works

2.2.1.1. Requirement of Water Treated Water Quantity and Service Reservoir Capacity

Treated Water Quantity: 45,000 m^3/day.
Service Reservoir Capacity: 6,000 m^3

2.2.1.2. Treatment Loss

Treatment Loss is less than 5%.
Intake Quantity = Treated Water Quantity (for entire production capacity of 195,000 m^3/day) x 1.05 =204,750 m^3/day

2.2.1.3. Laboratory for water quality test in WTP

Water quality tests shall be carried out in the existing laboratory of PPWSA in Phum Prek WTP. The results of the water quality test and jar tests shall be shared among PPWSA and the Contractor.

2.2.1.4. Intake Facility

The requirements for the new raw water intake facility are:

1. Raw water intake facility of 204,750 m^3/day
2. 3 VFD Pumps to supply for existing 157,500m^3/day facilities, 1 VFD Pump to supply for 47,250m^3/day new facilities, 1 VFD Pump is standby for all facilities.
3. Pump Type is Double Suction horizontal centrifugal type.
4. The discharge facility for sedimented sand is installed.

2.2.1.5. Water Treatment Facility

New Water Treatment Facilities of 45 MLD comprising:

a) Mixing well;
b) High-rate sedimentation basin; and
c) Rapid sand filter

2.2.1.6. Service Reservoir and Distribution Pumping Station

New Service Reservoir of 6 ML and Distribution Pumping Station

2.2.1.7. Distribution Pumps

3 VFD pumps ($29m^3$/min, Head 42m, 280kW) for new service reservoir

2.2.1.8. Chemical

a) Coagulant : PAC is dissolved in the solution tanks at new facilities.
PAC is injected by feeding pump.
Injection point : Mixing well

b) Disinfectant : Sodium hypochlorite (NaClO) is generated by On-Site generator.
NaClO is injected at Mixing well by feeding pump.
Injection point : Receiving well, Outlet of Clarifier, Outlet of Filter

2.2.2. Requirement for the O&M Services

2.2.2.1. Requirement of Treated Water Quantity

The Contractor shall make best efforts to produce water 45,000m3/day. The Contractor shall also request a meeting to PPWSA in case the actual production amount is varied from the production plan which shall be submitted to PPWSA in advance.

2.2.2.2. Requirement of Treated Water Quality

The water quality standards which the Contractor should meet the Cambodia National Drinking Water Quality Standard. The daily test items shall be analyzed by PPWSA in the laboratory in the Phum Prek WTP, and quarterly and yearly test items shall be analyzed by PPWSA too. Turbidity of treated water should be 1NTU or less. The Contractor would not be required to treat trihalomethane precursors and odor substances.

Annex 1

Items to be Analyzed and Recorded in Phm Prek WTP	Parameter	Parameter			Exception	Formal Monitoring Examination level		
		Unit	Permissible limite			A	B	C
			National Drinking water Standard	Requirement for New Facilities		Daily	Quarterly	Annually
	Microbial							
	E.Coli or thermoteloerant	CFU or MPN / 100 ml	0	0			B	
	Chemical							
	Aluminium (Al)	mg/l	0.2	0.2	in the case that alum is used		B	
	Ammonia (NH_3)	mg/l	1.5	1.5			B	
	Arsenic (As)	mg/l	0.05	0.05	for the case of groundwater source			C
	Barium (Ba)	mg/l	0.7	0.7				C
	Cadmium (Cd)	mg/l	0.003	0.003				C
	Chloride (Cl^-)	mg/l	250	250			B	
●	Chlorine Cl_2 * (free residual)	mg/l	0.1-1.0	1.5	for the case of using chlorine for disinfectant	A		
	Chromium (Cr)	mg/l	0.05	0.05				C

Annex 1

Items to be Analyzed and Recorded in Phm Prek WTP	Parameter	Parameter			Exception	Formal Monitoring Examination level		
		Unit	Permissible limite			A	B	C
			National Drinking water Standard	Requirement for New Facilities		Daily	Quarterly	Annually
	Copper (Cu)	mg/l	1	1	for the case that household plumbing uses copper pipes			C
	Fluoride (F)	mg/l	1.5	1.5	for the case of groundwater source			C
	Total hardness as $CaCO_3$	mg/l	300	300	for the case of groundwater source		B	
	Iron (Fe)	mg/l	0.3	0.3	case of groundwater		B	
	Lead (Pb)	mg/l	0.01	0.01				C
	Manganese (Mn)	mg/l	0.1	0.1	case of groundwater		B	
	Mercury (Hg)	mg/l	0.001	0.001				C
	Nitrate (NO_3^-)	mg/l	50	50			B	
	Nitrite (NO_2^-)	mg/l	3	3			B	
	Sodium (Na)	mg/l	250	250	case at coastal areas			C
	Sulfate ion (SO_4^{2-})	mg/l	250	250			B	
	Zinc (Zn)	mg/l	3	3				C

Items to be Analyzed and Recorded in Phm Prek WTP	Parameter	Parameter			Exception	Formal Monitoring Examination level		
		Unit	Permissible limite			A	B	C
			National Drinking water Standard	Requirement for New Facilities		Daily	Quarterly	Annually
			Physical					
●	Colour	TCU	5	5		A		
●	pH	n/a	6.5-8.5	6.5-8.5		A		
●	TDS or Conductivity	mg/l or µS/cm	800 or 1600	800 or 1600		A		
●	Turbidity	NTU	5	1		A		
●	Taste and Odour	-	Acceptable	Acceptable		A		

*Residual chlorine must be daily analysed in production system and fortnightly (two weeks) at end points of networks (water supply system with more than 3001 connections). The number of samples is dependent on situations of end points of networks of each unit or service provider. We can analyse thermoteloerant coliform bacteria for E Coli.

**Conductivity is an acceptable alternative to TDS. The above limits assume that Conductivity is twice TDS, but this relationship should be confirmed at each site if conductivity is used.

*** Whether the analysis of taste and odour by operators is acceptable depends on users.

Source: National Drinking Water Quality Standard (MIH)

2.2.2.3. Work to be done by the Contractor

The works to be done by the Contractor shall include the following.

1. Design of New 45 MLD Water Treatment Facilities and 6 ML Service Reservoir and Distribution Pumping

Station

(a) Basic Design

(b) Detailed Design

(c) Application Work for Design

(d) Laws and Regulations to be complied.

2. Construction of New Facilities

(a) Civil and Equipment Works

(b) Plant Mechanical Work

(c) Plant Electrical Work

(d) Application Work for Construction

3. Operation and Maintenance of New Facilities

(a) Water Quality Control

(b) Treated Water Volume Control in case required by PPWSA

(c) Monitoring and Control of New Facilities

(d) Maintenance and Repair

(e) Management of Power Receiving, Water Use and Fuel / Chemical Storage and Safety

(f) Cleaning

(g) Security and Safety

(h) Emergency Action

4. Hand-Over Work at the End of the O&M period

(a) Performance Test of WTP

(b) Asset Check and Evaluation

2.2.2.4. Reporting Obligations

Following submittals shall be provided by the Contractor. Detail shall be provided in later stage

(a) At the time of work commencement

(i) Work commencement application

(ii) Design, Construction and Operation Plan

(iii) Organization structure for the operation

(b) Design and Build period

(i) Report related to construction works including progress record

(ii) Draft of Operation and Maintenance Manual

(iii) Draft of Self-monitoring Report

(iv) Modification and additional work confirmation report

(v) Commissioning reports

(c) At the time of hand-over

(i) Completion report or substantial completion certificate and list of outstanding works

(ii) Final operation and maintenance manual

(iii) Final self-monitoring reports template

(d) During operation period

(i) Monthly report including self-monitoring report

(e) At the time of hand-back

(i) Performance check list of the facilities.

(ii) Remaining book value calculation and confirmation sheet.

(iii) Purchase agreement of the Contractor's facilities, if any.

(iv) Letter of Waiver of claims and liens and release of rights relating this project from PPWSA to the Contractor.

(f) At the time of Expiration of warranty against defect period

(i) Report on Expiration of Warranty against Defect Period

2.2.3. Requirement for the Training Services

The detailed program shall be proposed by the Contractor within the annual budget set by PPWSA. The following are the examples for the Contractor's proposal:

A. Classroom lecture

- Strategic planning of operation and maintenance
- Preventive maintenance
- Asset management

B. Case study (in Phum Prek)

- Strategic planning and reporting
- Stock and procurement management
- Updating SOP and other manuals

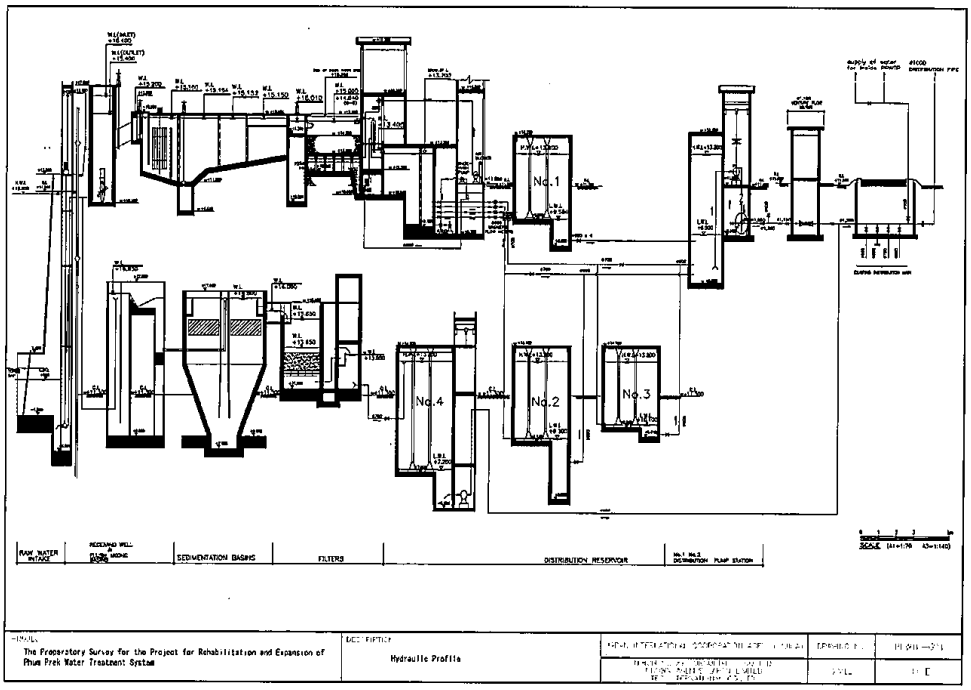
C. On the Job Training

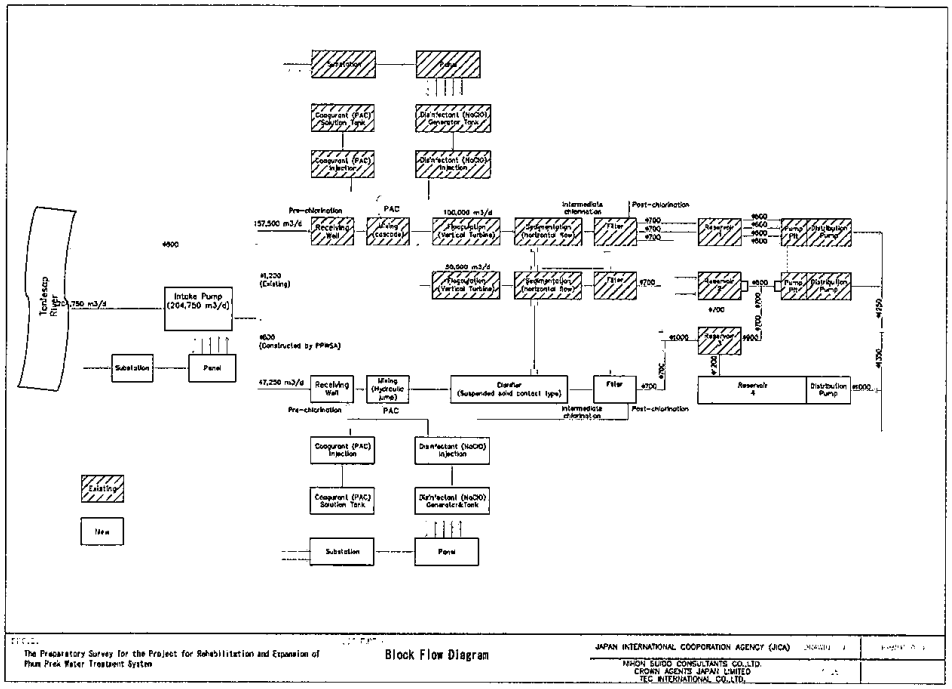
- Training on improvement of system operation
- Operation of high-speed coagulation sedimentation basin

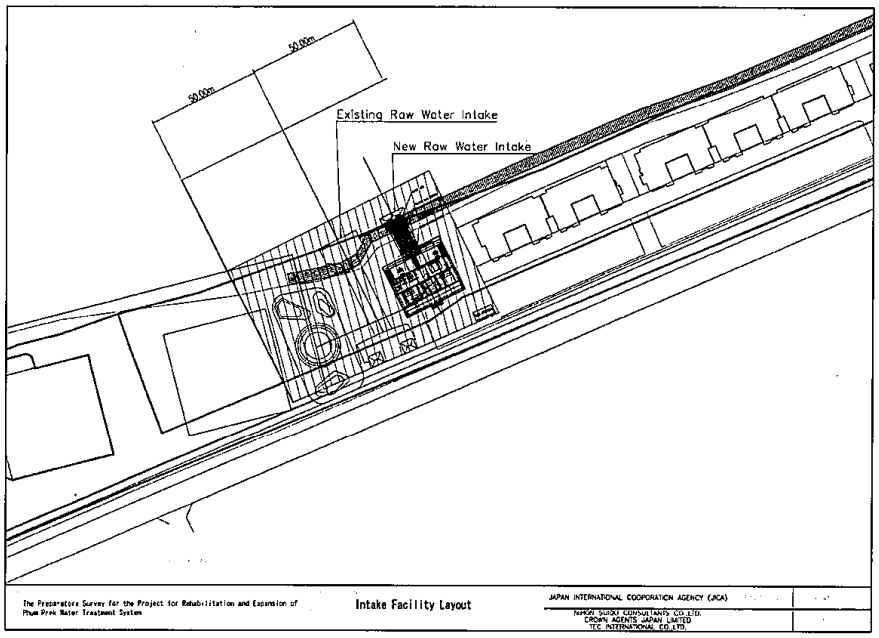
3. Comparator Facility Design

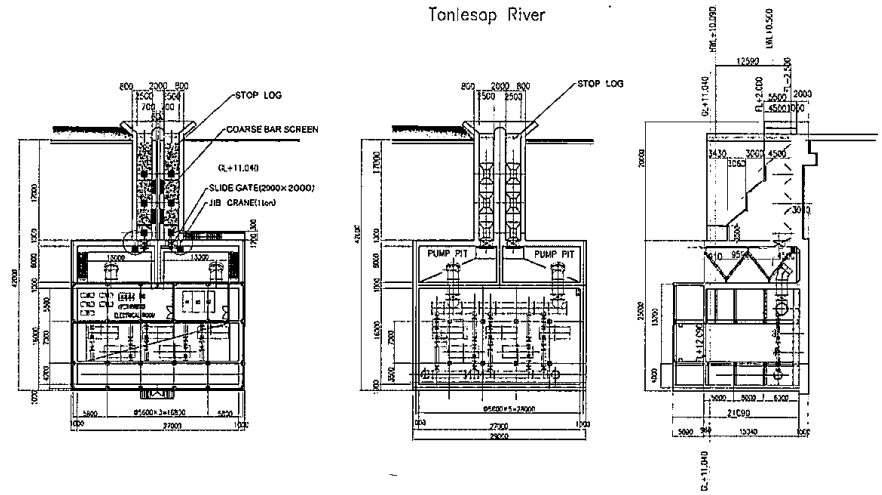
The Comparator Facility Design has been prepared by the Consultant only for the purposes of 1) cost estimates for the Grant and 2) reference documents to the potential bidders. Design works shall be done by the Contractor in accordance with the Client's Requirements during implementation phase.

Drawing List	Drawing No,
- Hydraulic Profile	PPWTP-001
- Block Flow Diagram	PPWTP-010
- Intake Facility Plot plan	PPWTP-101
- Intake Facility	PPWTP-102
- Facility Layout	PPWTP-301
- Receiving Well & Mixing Channel	PPWTP-311
- Clarifier	PPWTP-321
- Rapid Sand Filter	PPWTP-331
- No.4 Reservoir	PPWTP-341

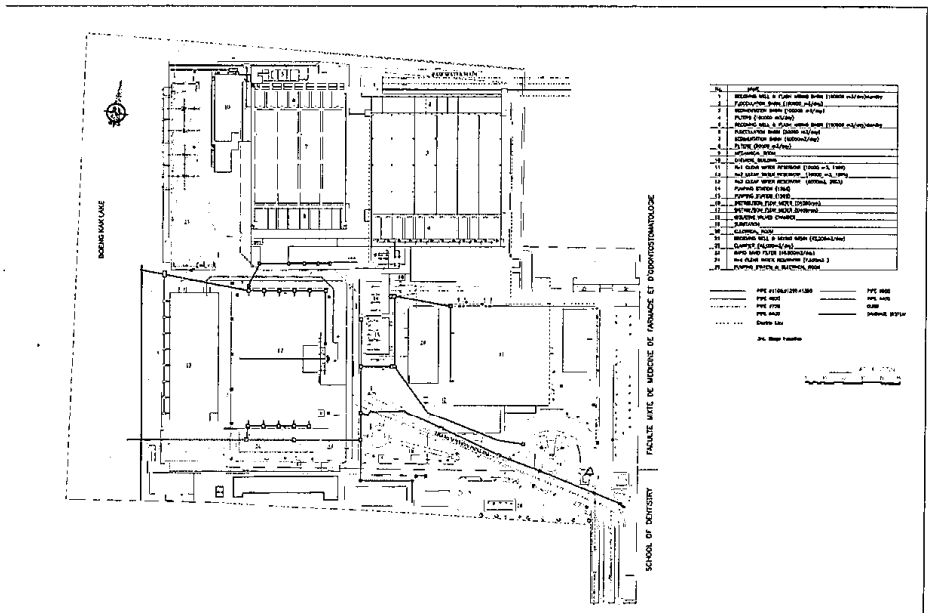



Existing
New
Coagulant (PAC) Solution Tank
Disinfectant (NaClO) Generator Tank
Coagulant (PAC) Injector
Disinfectant (NaClO) Injection
Pre-chlorination
PAC
Intermediate chlorination
Post-chlorination
157,500 m3/d
Receiving Well
Mixing (Cascade)
100,000 m3/d
Sedimentation (Vertical Turbine)
Sedimentation (Horizontal flow)
Filter
Reservoir
Pump (FT)
Distribution Pump
Tonlesap River
Intake Pump (204,750 m3/d)
Substation
Panel
47,250 m3/d
Mixing (Hydraulic jump)
Clarifier (Suspended solid contact type)
Reservoir 4
Coagulant (PAC) Injection
Disinfectant (NaClO) Injection
Coagulant (PAC) Solution Tank
Disinfectant (NaClO) Generator&Tank
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System
Block Flow Diagram
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
NIHON SUIDO CONSULTANTS CO.,LTD.
CROWN AGENTS JAPAN LIMITED
TEC INTERNATIONAL CO.,LTD.

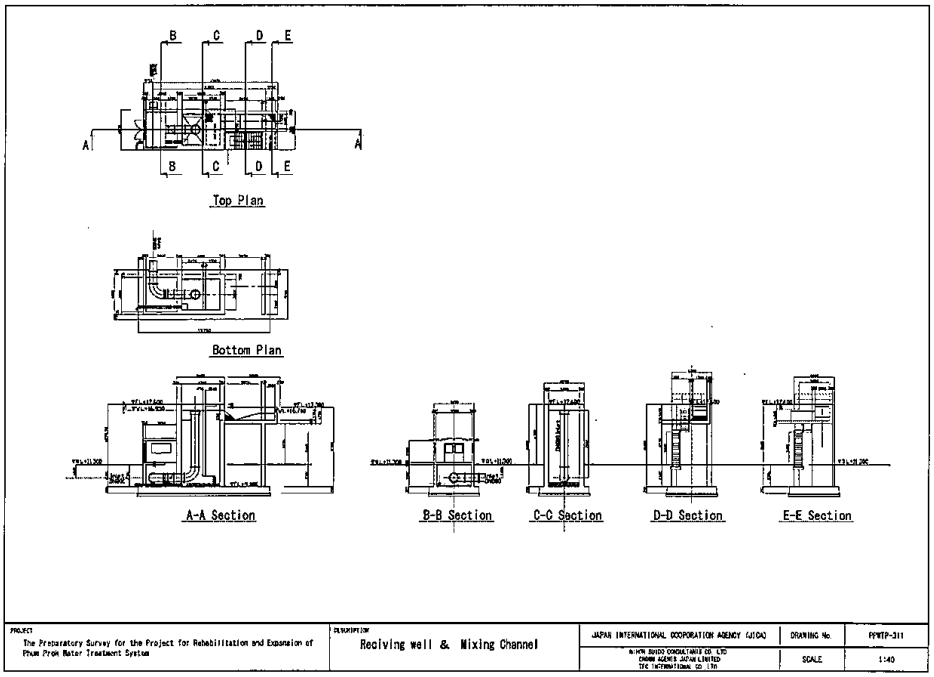

50.00m
50.00m
Existing Raw Water Intake
New Raw Water Intake
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System
Intake Facility Layout
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
NIHON SUIDO CONSULTANTS CO.,LTD.
CROWN AGENTS JAPAN LIMITED
TEC INTERNATIONAL CO.,LTD.

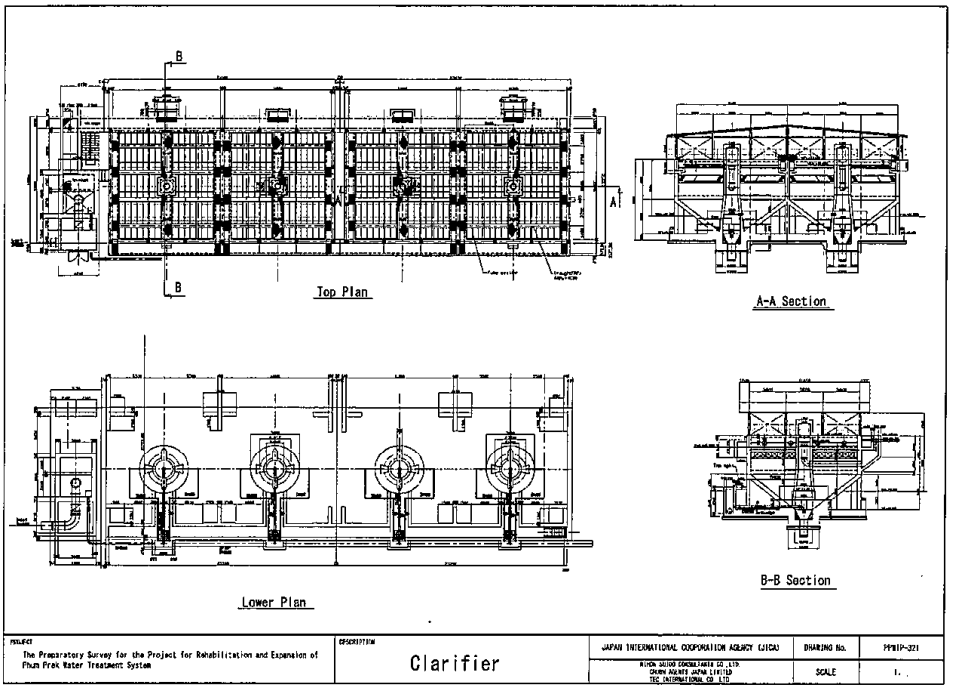


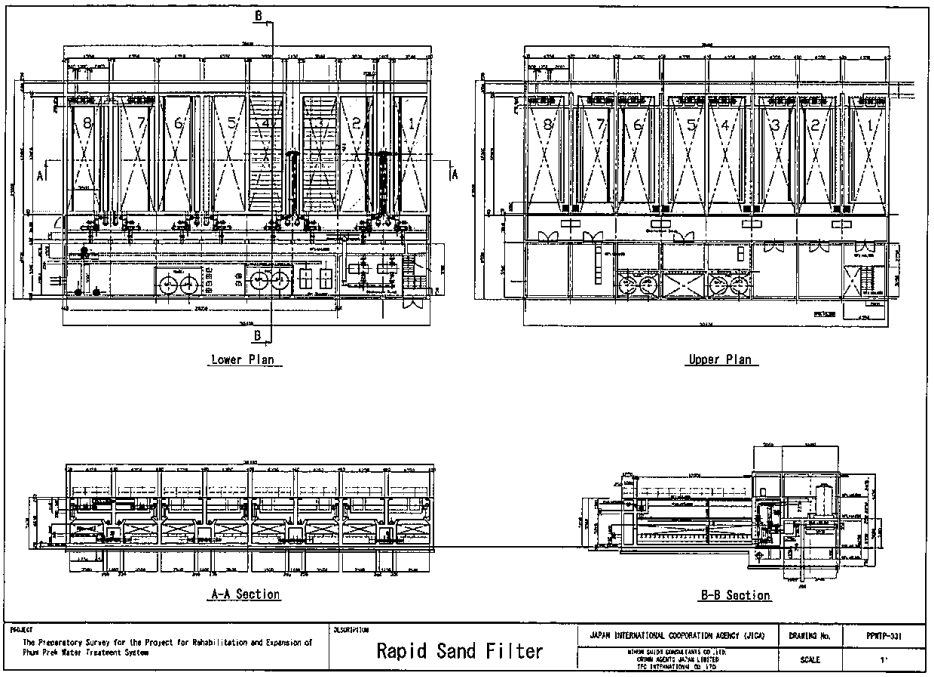
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System | PPWTP Intake facility rev01.dwg. | JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.

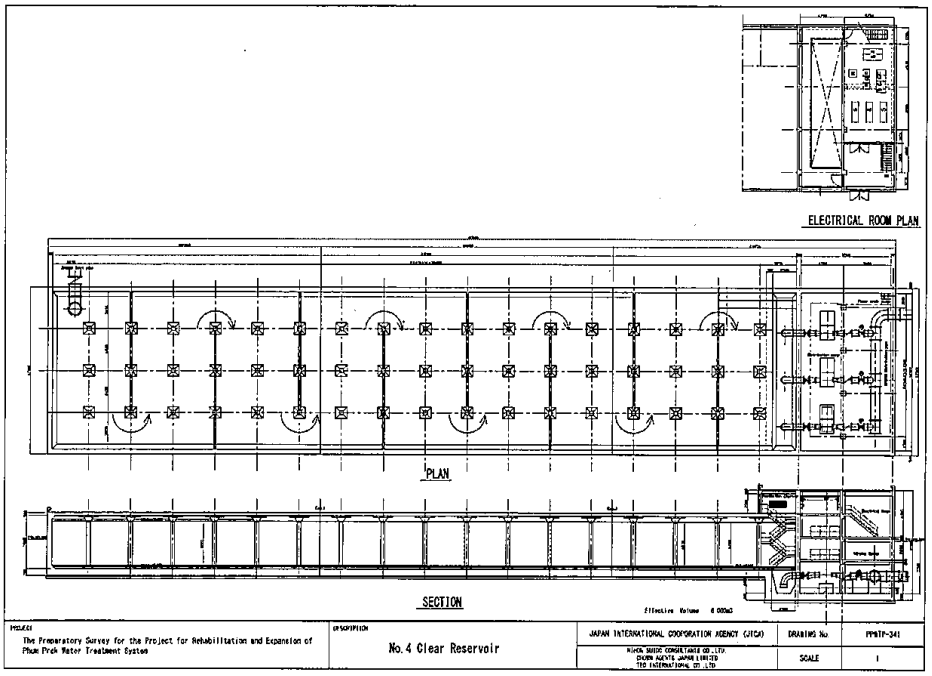


The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System | Facility Layout & Yard Piping | JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | CROWN AGENTS JAPAN LIMITED | PPWTP-301


Top Plan
Bottom Plan
A-A Section
B-B Section
C-C Section
D-D Section
E-E Section
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System
Reciving well & Mixing Channel
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
DRAWING No.
SCALE
1:40


Top Plan
A-A Section
Lower Plan
B-B Section
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System
Clarifier
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
DRAWING No.
SCALE


Lower Plan
Upper Plan
A-A Section
B-B Section
PROJECT
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System
DESCRIPTION
Rapid Sand Filter
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
DRAWING No.
PPWTP-331
SCALE
1'


ELECTRICAL ROOM PLAN
PLAN
SECTION
PROJECT
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System
DESCRIPTION
No.4 Clear Reservoir
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
DRAWING No.
PPWTP-341
SCALE
1

Summary of Outline Design of Comparator Facility

3.1. Intake Facility

Type:	Gravity inflow by two (2) sets of open channels
Water source;	Sap river
Water level:	L.W.L +0.500m (aMSL)
	H.W.L +10.200m (aMSL)
Total intake volume:	207,450 m3/day
Channel opening dimensions:	width 2.5m x depth 4.5m
Intake pump Type:	Horizontal double suction volute pump with flywheel
	Volume 36.5m^3/min.
	Head 23m
Number:	5sets (4 duty+1stand by)
Equipment:	Fixed coarse bar screen
Power Receiving:	2 feeder line (3phase, 3wire, 22kV)
	Transformers (2nos, 22/0.38kV, 50Hz)

3.2. Water Treatment Facility

Inlet water:	Q= 47,250m^3/day
Product water:	Q= 45,000m^3/day

3.2.1. Receiving Well

Dimension:	width 3.2m x length 3.8m x depth 7.65m
Detention time:	0.62min.
Water level:	W.L +16.950m (aMSL)

3.2.2. Mixing Basin

Method:	Hydraulic jump

3.2.3. High-rate Sedimentation

Type:	Sludge contact type with tube settler
Number:	4 basins
Upflow velocity:	75mm/min.
Detention time:	61min

3.2.4. Rapid Sand filter

Type:	Natural balancing gravity type rapid sand filter
Dimensions:	Width 3.5mx Length 12m

Number:	8 basins
Filtration rate:	148m/day (8 on duty)
	170m/day (7 on duty ,1 back wash or at rest)
Filter layer:	Sillica Sand (e.s Φ1.0mm U.C less than 1.7)
Underdrain system:	Plastic block with lateral type
Wash system:	Combine with air scouring and backwash
Air scouring velocity:	0.9m/min.
Back wash velocity:	In weak stage 0.1-0.15m/min.
	In strong stage 0.2-0.3m/min.

3.2.5. Clear Water Reservoir

Effective Volume:	6,000m^3
Number:	1 basin
Water level:	L.W.L +8.400m (aMSL)
	H.W.L +13.200m (aMSL)
Effective depth:	H= 4.8m
Distribution pump:	Type Horizontal double suction volute pump
	Volume 28.0m^3/min.
	Head 41m
Number:	3sets (3 duty)

3.2.6. Chemical Facility

Chemical:	Poly aluminum chlorite (effective Al_2O_3:10% liquid)	
	Dosing point:	Receiving well
	Generated hypochlorite (effective CL2:1%)	
	Dosing point:	Pre. Receiving well
		Mid. Sedimentation treated water channel
		Post Filtration treated water channel
Chemical supply method:	From new chemical production facilities of SPC	
Dosing method:	Diaphragm metering pump	

3.2.7. Power Receiving and Distribution

Power Receiving:	2 feeder line (3phase, 3wire, 22kV)
	Transformers (2nos, 22/0.38kV, 50Hz)

3.2.8. SCADA System

Component equipment:	Industrial personal computer 3set
	SCADA software
	PLC
	MODEM
	Router/L2/L3
Number of I/O point:	around 3000
Automatic control target:	pump speed (Distribution pressure) PID

Major Monitoring Items

1) River water level
2) Pump pit water level
3) Intake pump flow rate control settings
4) Intake water flow rate
5) Chemical injection amount
6) Filtering head
7) Filtration water flow rate
8) No.4 Reservoir water Level
9) Distribution pump pressure control settings
10) Distribution pressure
11) Distribution flow rate
12) Water quality measurement data

4. Contract Terms

4.1 Scope of Contracts

Contract	Scope of works/services
D&B Contract	Intake Facility, Water Treatment Facility, Service Reservoir, and Distribution Pumping Station, SCADA
O&M Contract	Water Treatment Facility
Training Contract	Training

The D&B Contract shall be prepared by the Consultant in accordance with FIDIC yellow book and JICA's standard form of contract and guidelines.

4.2 O&M Contract

4.2.1 Contract Terms

The O&M Contact terms are stipulated below:

	Contract Terms	Conditions
1	**O&M period**	Upon the completion, the ownership of the facility will be transferred from the Contractor to PPWSA, then PPWSA and the Contractor will agree the O&M contract for 10 years after commencement O&M on the facilities owned by PPWSA.
2	**Production of bulk water**	Production of treated bulk water is fundamentally a responsibility of the Contractor.
3	**Payment mechanism and price of bulk water**	As stipulated on a separate sheet
4	**VAT on the payment**	The Services, which consists, among others, of the supply of clean water, to be discharged by the Contractor most likely falls within the purview of the relevant Cambodian tax laws, including the Prakas No. 690 MEF.P dated 25 June 2015 on the Implementation of Value-Added Tax on Clean Water Production and Supplies to People, and the Prakas No. 559 dated 25 May 2017 on the Implementation for VAT on Non-Taxable Supplies, including its amendment or replacement, as a non-taxable supply and the Contractor shall not collect value added tax ("VAT") in its provision of the Services to PPWSA. Notwithstanding application of These Prakas, in the event the Cambodian tax authority deems the Services a taxable supply for the purpose of VAT, and the Contractor is required to issue invoices with the applicable VAT, PPWSA shall promptly pay the invoiced amount which shall include VAT.
5	**Water Quality Testing**	Testing of raw water quality shall be carried out by the Contractor at its own responsibility. Testing of treated water quality shall be carried out by PPWSA in the existing laboratory of PPWSA in Phum Prek WTP.
6	**Repairment**	During O&M period, the Contractor may use the facility free of charge, however, the Contractor shall be responsible for any repairment of the facilities at its own cost. the Contractor shall keep good conditions of the facility and equipment in accordance with the requirements set by PPWSA.
7	**Conditions for the hand-back**	- After the end of O&M period, PPWSA has the right to be handed back the facility from the Contractor under certain requirements.

		- The Contractor shall remove any additional facilities or equipment installed for its operation and restore the WTP to its initial condition at its own cost, if required by PPWSA. - PPWSA has the right to purchase any remaining inventories (e.g. parts and/or raw materials) at their book value.
8	**Private investment**	The Contractor may invest in some additional facilities, software, or any other equipment necessary for the operations. PPWSA has the right to purchase the private investments from the Contractor at their residual value (net book value) at the end of O&M period.
9	**Self-monitoring**	The Contractor shall monitor and report to PPWSA its operation in accordance with the requirements set by PPWSA.
10	**Operation data and financial information**	The Contractor shall record and report all the operation data and financial information in a required format. PPWSA may utilize the data to continue operation of the facility after hand-back.
11	**Early termination / compensation events**	- Termination for convenience (Unilateral termination) PPWSA has the right to terminate the contract early for public interest. In this case the Contractor shall be compensated in full, for all the private investments, inventories and additional costs incurred by the termination of the contract, and opportunity costs for the equity. Opportunity costs for the equity shall be a sum of net profit for the remaining contract period based on the Contractor's initial financial plan initially agreed in the contract. - Termination for default by PPWSA The termination condition shall be in line with the case of the termination for convenience. - Termination for default by the Contractor PPWSA shall have the option to require the Contractor to transfer to PPWSA all of its right, title and interest in and to the assets and inventories. The value of the assets and inventories shall be net book value of the assets minus cost of damages and losses suffered by PPWSA due to the termination of the contract. - Termination for Force Majeure A Force Majeure is an event that is external, unpredictable, and irresistible and has a significant impact on the project. Both parties may terminate the contract if the impact of a Force Majeure lasts for 180 days. Neither party has any obligation to each other for the cost of mitigation measures to prevent increasing loss caused by Force Majeure. PPWSA shall have the option to require the Contractor to transfer to PPWSA all of

		its right, title and interest in and to the assets and inventories. The value of the assets and inventories shall be net book value of the assets.
12	**Invoice settlement**	The Contractor shall report and charge to PPWSA by the 10 days of each month for the bulk water produced in the previous month. PPWSA shall in return review the invoice and make payment within one month after the invoice receiving date. Currency to be used for the invoice settlement shall be Cambodian Riel.
13	**Staff Employment**	1) PPWSA may take over the employment contracts from the Contractor at the end of O&M period.

4.2.2 Payment Terms

The payment which the Client shall make to the Contractor in return for the Contractor's provision of the Services shall be calculated as follows:

Service Fee = volume of water delivered * unit price of bulk water

Volume of water delivered shall be confirmed by a volume meter just after the filter.

The unit price of the bulk water shall be the one proposed by the Contractor in the bidding and subject to periodic revision upon the following dates:
(a) at the beginning of the fourth anniversary of the Starting Date;
(b) at the beginning of the seventh anniversary of the Starting Date; and
(c) at the beginning of the tenth anniversary of the Starting Date.

The inflation index for the purpose of this Contract shall be the latest available Consumer Price Index and Inflation Rate published by the National Bank of Cambodia.

4.2.3 Ceiling Price of Bulk Water

Based on the estimated by the Consultant, the ceiling price of bulk water shall be KHR **350/m^3**.

Assumptions

Electricity		
Consumption		
Intake	[kWh]	-
Treatment	[kWh]	-
Chemical	[kWh]	110,595
Distribution	[kWh]	-
Others	[kWh]	29,200

# of employees		
Plant Manager (PM)	[persons]	1
Plant Operation Manager (POM)	[persons]	1
Deputy Operation Manager (DOM)	[persons]	1
Quality manager	[persons]	1
Admin/business staff	[persons]	3
M&E Engineer	[persons]	1
Operating staff	[persons]	6

Salaries (Annual)		
Plant Manager (PM)	[000KHR]	740,000
Plant Operation Manager (POM)	[000KHR]	666,000
Deputy Operation Manager (DOM)	[000KHR]	555,000
Quality manager	[000KHR]	47,634
Admin/business staff	[000KHR]	35,047
M&E Engineer	[000KHR]	35,047
Operating staff	[000KHR]	35,047

Raw material unit price		
PAC		2,137
Salt for sodium hypochlorite		2,531

Raw materials Consumption		
PAC	[g/m3]	10.0
Sodium hypochlorite	[g/m3]	6.5

Repair and maintenance		
Machinery	[000KHR]	436,600
Electrical equipment	[000KHR]	111,000

Repair and maintenance at hand-back		
Machinery	[000KHR]	436,600
Electrical equipment	[000KHR]	111,000
Civil works and others	[000KHR]	432,432

Other operating expenses		
Employee social security	[KHR/person/month]	40,000
Transportation	[000KHR/month]	1,850
Office keeping	[000KHR/month]	3,700
Accounting audit / legal services	[000KHR/month]	1,850
Other operating costs (as % of other op. expenses)	[%]	10%
Marginal Profit rate	[%]	35.0%

Period start	[Date]	1-Jan-26	1-Jan-27	1-Jan-28	1-Jan-29	1-Jan-30	1-Jan-31	1-Jan-32	1-Jan-33	1-Jan-34	1-Jan-35		
Annual production	[000m3]	16,425	16,425	16,425	16,425	16,425	16,425	16,425	16,425	16,425	16,425	164,250	...(1)
Inflation index	[Index]	1.09	1.13	1.16	1.19	1.23	1.27	1.30	1.34	1.38	1.43		
Electricity price	[KHR/kWh]	584	584	584	584	584	584	584	584	584	584		
Discount rate	[%]												
FX rate	[KHR/JPY]												

Production inputs (excluding inflation effect)												Total	
Electricity cost	[000KHR]	81,640	81,640	81,640	81,640	81,640	81,640	81,640	81,640	81,640	81,640	816,403	
Labor cost	[000KHR]	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	23,591,040	
Raw materials cost	[000KHR]	621,260	621,260	621,260	621,260	621,260	621,260	621,260	621,260	621,260	621,260	6,212,598	
Repair and maintenance cost	[000KHR]	-	547,600	547,600	547,600	547,600	547,600	547,600	547,600	547,600	980,032	5,360,832	
Other operating expenses cost	[000KHR]	114,907	169,667	169,667	169,667	169,667	169,667	169,667	169,667	169,667	212,910	1,685,155	
Total	[000KHR]	3,176,911	3,779,271	3,779,271	3,779,271	3,779,271	3,779,271	3,779,271	3,779,271	3,779,271	4,254,947	37,666,029	...(2)

10 year total O&M cost	[000KHR]	37,666,029	=(2)
10 year total production	[000m3]	164,250	=(1)
10 year average O&M cost	[KHR/m3]	229	=(2)/(1)
Marginal Profit rate	[%]	35%	

Marginal profit, Unit Price of bulk water and O&M Price												
Escalation tag		1	-	-	1	-	-	1	-	-	1	
Average O&M cost with escalation		250	250	250	273	273	273	299	299	299	326	
Margin	[000KHR]	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	
Unit Price of bulk water	[000KHR]	**337**	**337**	**337**	**369**	**369**	**369**	**403**	**403**	**403**	**440**	
Payment to SPC	[000KHR]	5,535,225	5,535,225	5,535,225	6,060,825	6,060,825	6,060,825	6,619,275	6,619,275	6,619,275	7,227,000		...(3)

O&M Price: Net present value	[000KHR]	50,616,511	...(4)	=sum(3) discounted with 4.5%
of Payment to SPC	[000JPY]	1,368,013	...(5)	=(4)/FX rate

4.2.4 Risk Allocation

Risk allocation between PPWSA and the Contractor in regard to the D&B Contract shall be in accordance with the concept of FIDIC yellow book and JICA's standard form of contract.

Risk allocation between PPWSA and the Contractor in regard to the O&M Contract is stipulated below:

Risks	PPWSA	Contractor	Remarks/Examples
Facility risk		O	Unless caused by Force Majeure, any defects, deterioration, damage, or failure to the WTP operation shall be immediately fixed, repaired, patched, and/or replaced under the full responsibility of the Contractor at

Risks	PPWSA	Contractor	Remarks/Examples
			no additional cost on PPWSA.
Demand risk	O		PPWSA shall pay for 45,000m^3/day of treated water if the Contractor provides or is ready to provide 45,000m^3/day of treated water that satisfies the required water quality on a monthly average, regardless of any reason on PPWSA side (e.g. demand stays low or distribution pipes get damaged).
Operation risk		O	No payment shall be made if the delivered water does not satisfy the water quality requirement due to poor operation by the Contractor (e.g. facility malfunction, inappropriate usage of water treatment chemicals). In case the water delivered by the Contractor does not comply with the Client's requirements, the Contractor shall compensate for any damage (e.g. compensation to end-customers) suffered by PPWSA as a result of such poor operation by the Contractor. Unless required by the law, the Contractor shall have no obligation to obtain or subscribed to any kind of insurance policies during the term of the contract and in relation with the Services and the Water Treatment Facility. However, at its sole discretion and its own cost, the Contractor may obtain relevant insurance policies such as Third-party liability insurance, Professional liability insurance, Insurance against loss of or damage to the Contractor's property and other insurances.
Raw water supply risk	O		PPWSA has the obligation to supply raw water to the facility to be operated by the Contractor. The Contractor has a right to claim operating loss caused by the incident where the raw water is not supplied to the facility.
Raw water quality risk	O		Additional cost of production due to change in quality of raw water shall be covered by PPWSA and compensated to the Contractor.
Electricity price risk		O	Any fluctuations in electricity price shall be covered by the Contractor.
Electricity availability risk		O	The Contractor shall have responsibility to procure electricity necessary for its operation. In case the electricity is not supplied to the facility due to blackout or other force majeure events, neither the

Risks	PPWSA	Contractor	Remarks/Examples
			Contractor has obligation to supply water to PPWSA, nor PPWSA must pay the Contractor for the period. The Contractor does not have a right to claim operating loss caused by such blackout to PPWSA.
Raw material supply risk		O	The Contractor shall have responsibility to procure raw materials necessary for its operation.
Inflation risk (during O&M period)	O		Increase in production costs caused by inflation (e.g. wages or raw materials) shall be covered by PPWSA according to the Price Formula for Bulk Water Supply.
Licensing risk	O		IEIA/EIA or any other permit/authorization necessary for the Contractor to operate the facility shall be obtained by PPWSA.
Legal risk (change of project specific law)	O		Additional cost caused by a change in law that specifically affects the project (e.g. upgrade of national quality standard for drinking water) shall be covered by PPWSA and compensated to the Contractor.
Legal risk (change of general law)		O	Additional cost caused by a change in general law that would affect the whole economy (e.g. VAT) shall be covered by the Contractor.
Force Majeure risk	O	O	A Force Majeure is an event that is external, unpredictable, and irresistible and has a significant impact on the project. Both parties may terminate the contract if the impact of a Force Majeure lasts for a certain period (based on practice of water utilities). Neither party has any obligation to each other for the cost of mitigation measures to prevent increasing loss caused by Force Majeure. PPWSA shall have the option to require the Contractor to transfer to PPWSA all of its right, title and interest in and to the Contractor's assets. The value of the Contractor's assets shall be net book value of the assets.

4.3 Training Contract

Training Contract shall be drafted after the Contractor proposes and PPWSA accept the detailed training program. Payment for the Training Contract shall be a lump-sum basis and the Consultant proposes the ceiling price at $35,000 per year based on the cost estimates below.

Annex 1

Cost Items	Unit Price	Unit	Amount
Renumeration	$1,000/day/person	3 persons * 7 days/time * 1 times/year	$21,000
Flights	$2,000/flight	3 persons * 1 times/year	$6,000
Accommodation	$150/night	3 persons * 6 nights/time * 1 times/year	$2,700
Others	--	--	$5,300
Total			**$35,000**

Reinforcement of structure 100,000 m^3/day Sedimentation and Filter
Reinforcement of structure 10,000 m^3 Reservoir

1. Application of PPWSA
2. Concrete Structure Survey
3. Study
4. Conclusion
5. Implementation Plan

1

1. Application of PPWSA

Reinforcement of structure 100,000 m^3/day Sedimentation and Filters

Reinforcement of structure 10,000 m^3 Reservoir

2

2. Concrete Structure Survey

2.1 Survey of design documents
2.2 Visual inspection
2.3 Concrete tapping sound survey
2.4 Schmidt hammer test(to measure strength of concrete)
2.5 Judgment of deterioration status of reinforced concrete structures

2. Concrete Structure Survey

2.1 Survey of design documents

100,000 m^3/day Sedimentation and Filters & 10,000 m^3 Reservoir

- Details for design materials such as structural calculations, bar arrangement drawings, and pile arrangement drawings are not available.

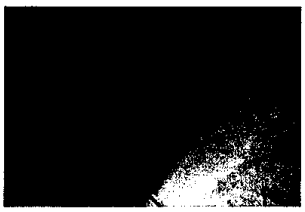
Annex 2

2. Concrete Structure Survey

2.2 Visual inspection

2.2.1 100,000 m^3/day Sedimentation and Filters

➢Covered concrete peeled off, Reinforcing bars are exposed, Cracks in concrete



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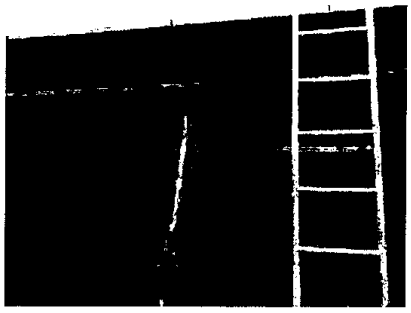
Annex 2

2. Concrete Structure Survey

2.2 Visual inspection

2.2.1 100,000 m^3/day Sedimentation and Filters

➢There is a crack in the wall and water is leaking.



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Annex 2

2. Concrete Structure Survey

2.2 Visual inspection

2.2.2 10,000 m^3 Reservoir

➢Precipitates such as efflorescence, moss and dirt

7

Annex 2

2. Concrete Structure Survey

• 2.3 Concrete tapping sound survey

•100,000 m^3/day Sedimentation and Filters

•10,000 m^3 Reservoir

➢Abnormal tapping sound

➢There are cracks and cavities on the wall

8

Annex 2

2. Concrete Structure Survey

• 2.4 Schmidt hammer test (to measure strength of concrete)

➢Criteria: 21N / mm^2 or more

➢Result: Insufficient strength

14.4, 15.9 < 21

No.	100,000m3/d Sedimentation and Filters	10,000m3 Reservoir
No.1	15.5	15.8
No.2	14.3	14.8
No.3	9.6	11.1
No.4	17.1	19.7
No.5	10.6	15.5
No.6	14.9	15.7
No.7	15.3	14.4
No.8	16.7	15.4
No.9	16.7	17.8
No.10	16.5	16.5
No.11	11.6	17.7
No.12	13.8	16.5
Average estimated strength	**14.4**	**15.9**

9

Annex 2

2. Concrete Structure Survey

2.5 Judgment of deterioration status of reinforced concrete structures
100,000m3/d Sedimentation and Filters 1965
10,000m3 Reservoir 1959

➢Deterioration process can be divided into four phases as below.

Phase	Deterioration Process	Condition
First Ph.	Incubation Period	No crack or other deformation on concrete surface.
Second Ph.	Developed Period	No crack or other deformation on concrete surface. Rebar starts to be rusted.
Third Ph. First Half	Acceleration Period First Half	Crack appears on the concrete surface due to rebar's rust.
Third Ph. Second Half	**Acceleration Period Second Half**	**Crack increases and some parts of concrete are peeled off.**
Fourth Ph.	**Deterioration Period**	**Crack increases and some parts of concrete are peeled off. Rebar has partial loss of its area due to the rust.**

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2. Concrete Structure Survey

2.5 Judgment of deterioration status of reinforced concrete structures

➢Deterioration phase of the facilities is in third phase(second half) or fourth phase

Facility	Construction year	Deterioration Phase	Deterioration Process	Condition
Flocculation Sedimentation and Filters	1965	Third Phase (Second Half) to Fourth Phase	Acceleration Period (Second Half Phase) to Deterioration Period	Rebar's rust Crack Peeling off Precipitate Leakage
Reservoir	1959	Third Phase (Second Half) to Fourth Phase	Acceleration Period (Second Half Phase) to Deterioration Period	Rebar's rust Crack Peeling off Precipitate Moss and Dirt

3. Study

100,000 m^3/day Sedimentation and Filters (1965)
10,000 m^3 Reservoir (1959)

➢It has been 60 years since it was built and structural condition is seriously deteriorated, therefore rebuilt of structures are required.

➢Reinforcement can be considered as temporary measure, but it is necessary to add more reinforced concrete due to insufficient strength of concrete and corrosion of reinforcing bars. However, since this temporary measure increases the load, there is a risk of subsidence because the foundation structure is unknown. For this reason, it cannot be reinforced.

➢In addition to being unable to reinforce, it is unpredictable whether life can be extended in a way that is commensurate with the cost even if repair work is carried out as a life-prolonging measure.

➢life-prolonging method: The method is to scrape old concrete to expose the reinforcing bars, protect the reinforcing bars from corrosion, and finish the surface with concrete.

Annex 2

4. Conclusion

- Reinforcement of structure 100,000m3/d Sedimentation & Filters and 10,000m3 Reservoir are excluded from this grant aid.

  - ***Reason***
  - It has been 60 years since it was built and structural condition is seriously deteriorated, therefore rebuilt of structures are required.
  - Since it cannot be reinforced technically, it will be a life-prolonging measure (the period is unknown).
  - However, taking life-prolonging measures with an unknown warranty period does not meet the purpose of grant aid.

  - ***Recommendations from the Consultants : excluded from this grant aid***
  - Repair each time a water leak occurs
  - Demolition and reconstruction of existing facilities

13

Annex 2

5. Implementation Plan

- Step 1: Japanese Grant Aid with O&M Scheme for expansion of 45 MLD (new facilities) and Construction of New Intake Facility (205 MLD), and installation of new raw transmission pipe (ND800) by PPWSA himself (if willing by PPWSA), 2023-2026

- Step 2: Re-construction of old 100 MLD sedimentation and filtration facilities, 3 years *(by demolish of half portion (50%, 50 MLD) of 100 MLD sedimentation and filtration facilities (remaining 50 MLD will continue operation during construction) and construction of 100 MLD sedimentation and filtration facilities)*

- Step 3; Reconstruction of old 10 ML Service Reservoir, 1 year *(by Demolition of remaining half portion (50%, 50 MLD) of old 100 MLD sedimentation and filtration facilities and construction of new service reservoir of 10 ML)*

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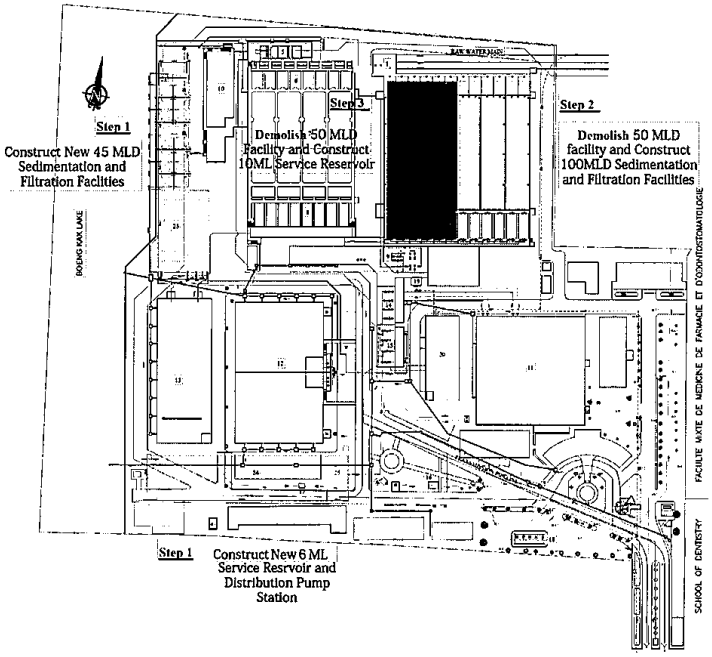
Annex 2



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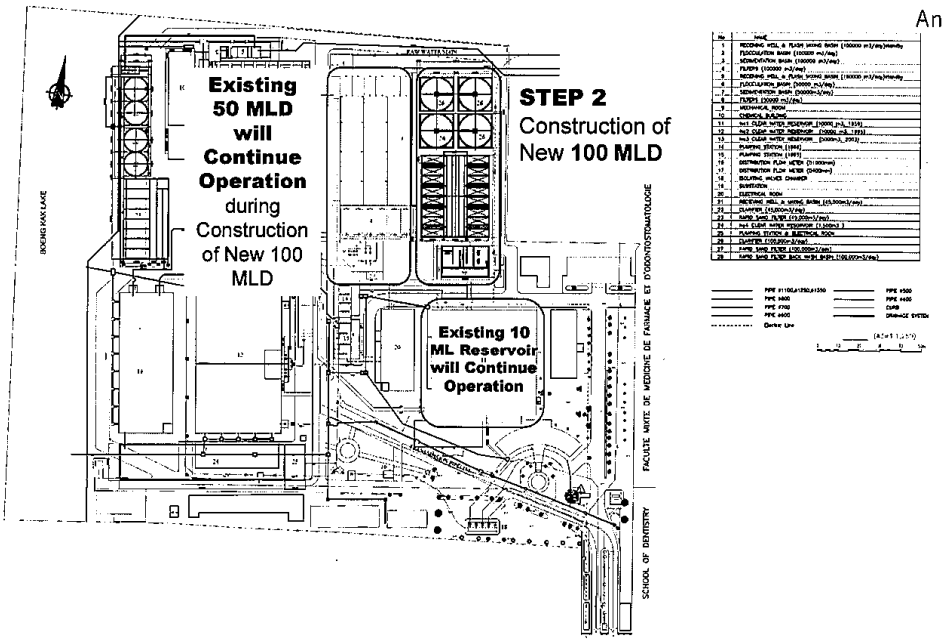
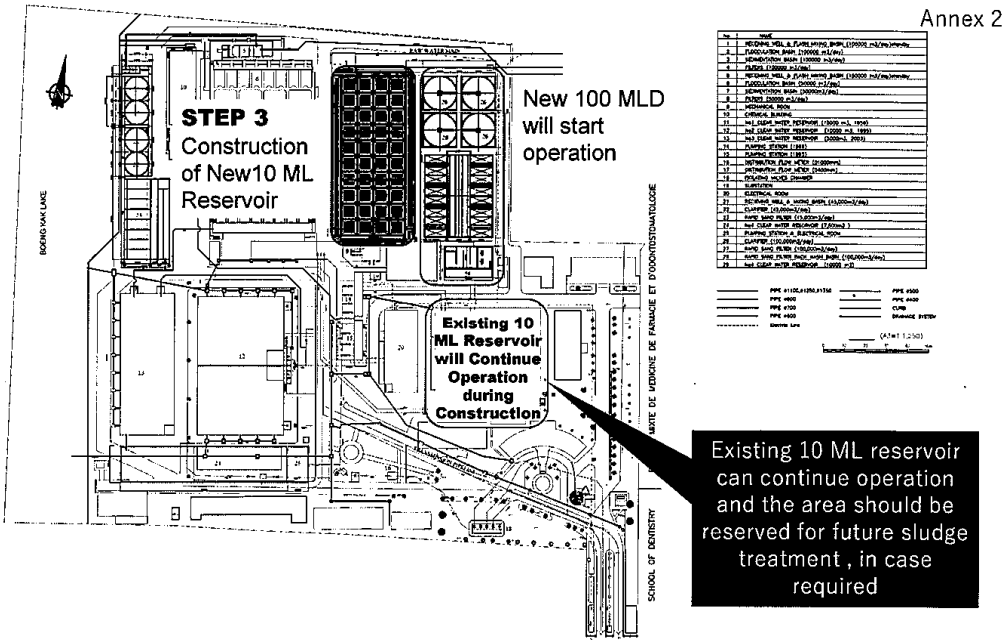
Annex 2



Annex 2


STEP 3
Construction of New10 ML Reservoir
New 100 MLD will start operation
Existing 10 ML Reservoir will Continue Operation during Construction
Existing 10 ML reservoir can continue operation and the area should be reserved for future sludge treatment , in case required
BOENG YAK LANE
SCHOOL OF DENTISTRY

Annex 2

THE PREPARATORY SURVEY FOR REHABILITATION AND EXPANSION OF PHUM PREK WATER SUPPLY SYSTEM IN THE KINGDOM OF CAMBODIA

Agenda of Meeting / Discussion Points
14th July 2021

1. Results of Sedimentation/Filters and Reservoir Survey
2. Reconstruction plan for Sedimentation/Filters and Reservoir
3. Discussion on new transmission pipelines
4. Summary of Implementation Plan by Component

Annex 2

Discussion on New Transmission Pipelines

We explained in our previous meeting (9th June) about technical and financial benefits of new transmission pipelines for the new facility and suggested that PPWSA may construct the transmission pipelines at its own finance:

We noted PPWSA' comments in the previous meeting as follows:

1. PPWSA is positive about considering the suggestion.
2. PPWSA requests for a scheme to minimize initial cash outlay.
3. PPWSA requests for tax exemption for VAT/custom duties for the equipment in a way that the construction of the transmission pipelines would be implemented comprehensively with the grant project.
4. PPWSA wants the Contractor to design the transmission pipelines and procure necessary materials/equipment but is willing to do the construction/installation works by itself.

Considering the comments by PPWSA the Consultant has examined an implementation plan to utilize private finance to implement the project.

-> However, as a conclusion JICA and the Consultant deem it not feasible. Please see the next slides for the details.

Analysis for Private Finance for New Transmission Pipelines

The Consultant examined an implementation plan in which:

1. PPWSA should award an Engineering and Procurement (E&P Contract) of the new transmission pipelines to the winning Contractor along with D&B and O&M Contracts of the Grant components under one comprehensive competitive bidding.
2. Payment condition of the E&P Contract should be such that PPWSA pays to the Contractor by 10-year installment payment (currency supposed to be US dollar) to minimize initial cash outlay.

For example, required rate of return is set at 8%, then payment schedule would be:

(thousand USD)

Assumptions	
Forex rate	JPY110/USD
Engineering (Design) Cost	100
Procurement Cost	3,636
Total Contract Price	3,736

	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Total
Payment by PPWSA	0	560	560	560	560	560	560	560	560	560	560	5,605
Cashflow of the Contractor	-3,736	560	560	560	560	560	560	560	560	560	560	1,868

IRR to the Contractor

8%

Annex 2

Analysis for Private Finance for New Transmission Pipelines

Conclusion:

1. While PPWSA does not have to finance at its own, total cost of procurement (total amount of payment by PPWSA) may be higher due to higher interest (compared to government loans) and payment risk / forex risk borne by the Contractor.
2. Based on the cashflow analysis below, the development of new transmission pipelines has negative net present value and is not worth implementing from financial perspectives.

Cashflow of PPWSA (million KHR)

Assumptions	
Construction cost by PPWSA	3,700
Electricity price	KHR550/kWh
Forex rate	KHR37/JPY - JPY110/USD
Discount rate	5%

Cashflow of PPWSA	Y0	Y1	Y2		Y10	Y11		Y59	Y60
Construction cost by PPWSA	-3,700	0	0		0	0		0	0
Payment to the Contractor	0	-2,281	-2,281	~~~	-2,281	0	~~~	0	0
Benefits of electricity reduction	0	693	693		693	693		693	693
Total	-3,700	-1,588	-1,588		-1,588	693		693	693

NPV to PPWSA

-7,805

Analysis for Private Finance for New Transmission Pipelines

Conclusion (continued):

3. There is a concern that Japanese companies may not be willing to implement the project with private finance and it would limit competitiveness of the Grant project.
4. It may also impose a risk on the implementation schedule of the Grant project.

Therefore, as a conclusion, the development of the new transmission pipelines shall be out of the scope of the Project. If PPWSA is willing to develop the new transmission pipelines, it shall be financed and implemented by PPWSA at its own responsibility, by January 2026 (subject to schedule adjustment).

As it will be a precondition of the design-build works by the Contractor, please notify whether to develop the new transmission pipelines by itself, <u>by 2nd Official Site Survey scheduled in late July</u>.

For reference: Cost estimates for PPWSA to develop the pipelines

111 USD/JPY

			(USD/m)			
Direct cost (USD/m)	Material	Straight Pipe	1,067			
		fitting	320			
	Instalation(labour & machine)		375		Length	
	sub-total		1,763	×	2130m =	3.8 mil. USD
Design cost						0.1 mil. USD
Total						**3.9 mil. USD**

Summary of Implementation Plan by Component

Annex 2

Components	Funded by	Constructed by	Operated by	Remark
Intake facilities	Grant	Contractor	PPWSA	Raw water will be taken and supplied to both existing and new facilities through existing and new transmission pipelines maintained by PPWSA, therefore to simplify the project scheme and risk allocation, the operation of intake facilities shall be done by PPWSA
*Transmission pipelines (optional)	Out of scope of this Project			The implementation of the facility will be a component to be undertaken by Cambodian Side.
Water treatment facilities	Grant	Contractor	Contractor	The Contractor shall operate and maintain new 45MLD treatment facilities because advanced technology will be applied for the treatment process and the O&M, and PPWSA will learn this particular technology through O&M by the Contractor.
Chemical Facilities for New treatment facilities	Existing facilities to be utilized		PPWSA	The Contractor will procure generated chemicals provided by PPWSA.
Distribution facilities	Grant	Contractor	PPWSA	Clear water from both existing and new facilities shall be distributed as one comprehensive system of WTP therefore the distribution facilities shall be operated and maintained by PPWSA.
SCADA	Grant	Contractor	TBD	The monitoring and controlling system for the new facilities shall be consolidated with other facilities operated by PPWSA. Allocation of SCADA operation works should be discussed with new SCADA system to be installed.
*Existing Sedimentation/Filters and Reservoir (rehabilitation/reconstruction)	Out of scope of this Project (The Consultant provides an alternative reconstruction plan)			As the result of survey and study by the Consultant, Reconstruction is recommended. However, because of budget limitation and Grant-scheme, the reconstruction shall be out of scope of this Project

Major Undertakings to be taken by the Royal Government of Cambodia

1. Specific obligations of the Royal Government of Cambodia which will not be funded with the Grant

(1) Before the Bidding

No	Items	Deadline	In charge	Estimated Cost (USD)	Ref.
1	To open bank account (B/A)	within 1 month after the signing of the G/A	PPWSA	-	
2	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the consultant	within 1 month after the signing of the contract(s)	PPWSA	-	
3	To bear the following commissions to the Agent Bank for the banking services based upon B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	PPWSA/ NBC	50	
	2) Payment commission for A/P	every payment	PPWSA/ NBC	1,500	
4	To approve Environmental Protection Contract (Conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation.	within 1 month after the signing of the G/A	PPWSA	-	
5	To notice the construction of the intake facility in the Sap River to local authorities and other relations.	before notice of the bidding document(s)	PPWSA	-	
6	To secure, clear, level and reclaim the following lands/sites * 1) Sites for Phum Prek Intake and WTP	before notice of the bidding document(s)	PPWSA	-	
7	To explore landmines and UXO at construction site	before notice of the bidding document(s)	PPWSA	35,000	
8	To obtain water right for intake from the Sap River from MOWRAM	before notice of the bidding document(s)	PPWSA	-	

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

NBC: National Bank of Cambodia

(2) During the Project Implementation (during D&B period)

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Supplier(s)	within 1 month after the signing of the contract(s)	PPWSA	-	
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	PPWSA/ NBC	600(in total)	
	2) Payment commission for A/P	every payment	PPWSA/ NBC	30,000(in total)	
3	to ensure prompt unloading and customs clearance at ports of disembarkation in the country of the Recipient and to assist the Supplier(s) with internal transportation therein	during the Project	PPWSA	-	
4	To accord Japanese physical persons and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into Cambodia and stay therein for the performance of their work	during the Project	PPWSA	-	
5	To ensure that customs duties, VAT, internal taxes and other fiscal levies which may be imposed on prime contractors and subcontractors in Cambodia with respect to the purchase of the products and/or the services be exempted by its designated authority without using the Grant;	during the Project	MEF	-	
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	PPWSA	-	
7	To notify JICA promptly of any incident or accident, which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers.	during the construction	PPWSA		
8	1) To submit Project Monitoring Report	every month	PPWSA	-	
	2) To submit Project Monitoring Report (final)	within one month after signing of Certificate of Completion for the works under the contract(s)	PPWSA	-	
9	To submit a report concerning completion of the Project	within six months after completion of the Project	PPWSA	-	
10	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the site(s)		PPWSA	-	
	1) Electricity Construction of utility poles and wiring work including conduit from the power receiving point to the transformer, procedures for receiving power, and procedures for receiving two lines.	before start of the construction		5,000	
	2) Drainage The city drainage main (for storm, sewer and others) to the site	before start of the construction			

11	To take necessary measure for safety of construction - Coordination with the police for traffic control - Coordination with relevant authority to ensure the safety of boats and ships in relation to the construction of intake facility	during the construction	PPWSA	-	
12	To implement EMP/EMoP	during the construction	PPWSA	31,250	
13	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction	PPWSA	-	
14	To provide sufficient space in Phum Prek WTP for office space, and Niroth WTP and/or other PPWSA's land as a stockyard for free of charge	during the construction	PPWSA	-	
15.	New 800 mm transmission pipeline shall be constructed by PPWSA for the new water treatment facilities by the time the Contractor completes the construction before commencement of trial operation (by January 2026).	before trial operation	PPWSA	3,900,000	

(3) During O&M

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To implement EMP/EMoP	for a period based on EMP/EMoP	PPWSA		
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between PPWSA and JICA.	for three years after the commissioning	PPWSA		
3	To comply strictly with the O&M contract	for the O&M period	PPWSA		
4	To extract sludge from WTP and dispose it	for the O&M period	PPWSA		

Minutes of Discussions
on the Preparatory Survey for the Project for
Expansion of Phum Prek Water Treatment System
(Explanation on Draft Preparatory Survey Report)

With reference to the minutes of discussions signed between Phnom Penh Water Supply Authority (hereinafter referred to as "PPWSA") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") on 5th August 2021, and in response to the request from the Government of the Kingdom of Cambodia (hereinafter referred to as " Cambodia ") dated 24th October 2019, JICA dispatched the Preparatory Survey Team (hereinafter referred to as "the Team") for the explanation of Draft Preparatory Survey Report (hereinafter referred to as "the Draft Report") for the Project for Expansion of Phum Prek Water Treatment System (hereinafter referred to as "the Project").

As a result of the discussions, both sides agreed on the main items described in the attached sheets.

Phnom Penh, 18th August 2022

Mr. Yoichi Inoue	H.E. Long Naro
Leader of Preparatory Survey Team	Director General
Japan International Cooperation Agency	Phnom Penh Water Supply Authority
Japan	Kingdom of Cambodia

ATTACHEMENT

1. **Objective of the Project**

The objective of the Project is to improve the sustainable water supply in Phnom Penh through the expansion of water supply system: raw water intake facility, and water treatment facilities, service reservoir and distribution pumping station, including operation and maintenance (hereinafter referred to as "O&M") of Phum Prek water treatment plant (hereinafter referred to as "WTP"), thereby contributing to improvement of living environment of the people in Phnom Penh.

2. **Title of the Preparatory Survey**

Both sides confirmed the title of the Preparatory Survey as "the Preparatory Survey for the Project for Expansion of Phum Prek Water Treatment System".

3. **Project Site**

Both sides confirmed that the sites of the Project are in Phnom Penh, which is shown in **Annex 1**.

4. **Responsible Authority for the Project**

Both sides confirmed the authorities responsible for the Project are as follows:

4-1. The PPWSA will be the executing agency (hereinafter referred to as "the Executing Agency") and the implementing agency for the Project. The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be taken care by relevant authorities properly and on time. The organizational structure of PPWSA is shown in **Annex 2**.

4-2. PPWSA is autonomously able to agree with O&M Contract and outsourcing fee/ off-take price and Training Contract and Comprehensive Agreement subject to the Board of Directors and/or Board Committee if such agreement does not affect the current water system.

5. **Contents of the Draft Report**

After the explanation of the contents of the Draft Report by the Team, the Cambodian side agreed to its contents. JICA will finalize the Final Preparatory Survey Report based on the confirmed items. The report will be sent to the Cambodian side after E/N.

6. **Cost Estimate**

Both sides confirmed that the cost estimate including the contingency explained by the Team is provisional and will be examined further by the Government of Japan for its approval. The contingency would cover the additional cost against natural disaster, unexpected natural conditions, etc.

7. **Confidentiality of the Cost Estimate and Technical Specifications**

Both sides confirmed that the cost estimate and technical specifications of the Project should never be disclosed to any third parties until all the contracts under the Project are concluded.

8. **Procedures and Basic Principles of Japanese Grant**

The Cambodian side agreed that the procedures and basic principles of Japanese Grant (hereinafter referred to as "the Grant") as described in **Annex 3** should be applied to the Project. In addition, the Cambodian side agreed to take necessary measures according to the procedures. The Grant shall cover only for D&B Works, and the Grant shall not cover O&M Services and Training Services.

9. **Timeline for the Project Implementation**

The Team explained to the Cambodian side that the expected timeline for the project implementation is as attached in **Annex 4**.

10. **Expected Outcomes and Indicators**

Both sides agreed that key indicators for expected outcomes are as follows. The Cambodian side will be responsible for the achievement of agreed key indicators targeted in year 2030 and shall monitor the progress for Ex-Post Evaluation based on those indicators.

[Quantitative indicators]

No.	Indicator	Baseline Data (Year 2021)	Target (Year 2030) (3 years after completion of the new facilities)
1	Water Supply Capacity (daily average basis)	150,000 m^3/day	195,000 m^3/day

*Rehabilitation or reconstruction of Phase 1 of Phum Prek WTP as specified in the 3rd master plan updated may affect to the total capacity of the WTP.

[Qualitative indicators]

- Maintaining appropriate residual water pressure and increasing water supply

capacity will improve water supply services.

- Improving of operation and maintenance capacity through technology transfer for operation and maintenance of WTPs.
- Improving public health. More people will have access to safe water supply and water shortage will be eliminated.

11. Ex-Post Evaluation

JICA will conduct ex-post evaluation after three (3) years from the project completion, in principle, with respect to five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact and Sustainability). The result of the evaluation will be publicized. The Cambodian side is required to provide necessary support for the data collection.

12. Undertakings of the Project

Both sides confirmed the undertakings of the Project as described in **Annex 5**. With regard to exemption of customs duties, internal taxes and other fiscal levies as stipulated in (2)-6 of **Annex 5**, both sides confirmed that such customs duties, internal taxes and other fiscal levies, which shall be clarified in the bid documents by PPWSA during the implementation stage of the Project.

The Cambodian side assured to take the necessary measures and coordination including allocation of the necessary budget, which are preconditions of implementation of the Project. It is further agreed that the costs are indicative, i.e. at Outline Design level. Costs that are more accurate will be estimated during the implementation.

The costs for the provision for power receiving borne by PPWSA will confirmed by PPWSA by the end of September.

Both sides also confirmed that the **Annex 5**, which will be adjusted by the end of October, will be used as an attachment of G/A.

As shown in **Annex 5**, both sides confirmed that PPWSA shall take necessary measures to ensure and maintain the security of the Project site and the persons related to the implementation of the Project, in cooperation with relevant authorities such as MEF, MOE, MOI, MPWT, CNMC, CMAC, PPCA, DOT, EDC and police.

13. Monitoring During the Implementation

The Project will be monitored by the Executing Agency and reported to JICA by using the form of Project Monitoring Report (PMR) attached as **Annex 6**. The timing of submission of the PMR is described in **Annex 5**.

14. Project Completion

Both sides confirmed that the project completes when all the facilities constructed, and equipment procured by the Grant are in operation. The completion of the Project will be reported to JICA promptly by the Executing Agency, but in any event not later than six months after completion of the Project.

15. Items and Measures to Be Considered for the Smooth Implementation of The Project

Both sides confirmed the items and measures to be considered for the smooth implementation of the Project as described in **Annex 7**.

16. Environmental and Social Considerations

16-1 General Issues

16-1-1 Environmental Guidelines and Environmental Category

The Team explained that 'JICA Guidelines for Environmental and Social Considerations (April 2010)' (hereinafter referred to as "the Guidelines") is applicable for the Project. The Project is categorized as "B" because the Project is not located in a sensitive area, nor has sensitive characteristics, nor falls into sensitive sectors under the Guidelines, and its potential adverse impacts on the environment are not likely to be significant.

16-1-2 Environmental Checklist

The environmental and social considerations including major impacts and mitigation measures for the Project are summarized in the Environmental Checklist attached as **Annex 8**. Both sides confirmed that in case of major modification of the content of the Environmental Checklist, the Cambodian side shall submit the modified version to JICA in a timely manner.

16-2 Environmental Issues

16-2-1 Initial Environmental Impact Assessment (IEIA)

Both sides confirmed the Environmental Protection Contract (EPC) necessary for the

Project has been approved by the Ministry of Environment (MOE) in August 2021 as attached in **Annex 12**, and the Initial Environmental Examination (IEE) survey required for the project categorized as "B" in the Guidelines was completed in September 2021. The EIA report is not required for the Project in the country's legal system.

16-2-2 Environmental Management Plan and Environmental Monitoring Plan

Both sides confirmed Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) of the Project is as **Annex 9**, respectively. Both sides agreed that environmental mitigation measures and monitoring shall be conducted based on the EMP and EMoP, which may be updated during the implementation stage of D&B Works.

16-3 Environmental and Social Monitoring

16-3-1 Environmental Monitoring

Both sides agreed that the Cambodian side will submit results of environmental monitoring to JICA with PMR by using the monitoring form attached as **Annex 9**.

The timing of submission of the monitoring form described in **Annex 5** will be determined during implementation stage of D&B Works based on the frequency of environmental and social monitoring set in **Annex 9**.

16-3-2 Information Disclosure of Monitoring Results

Both sides confirmed that the Cambodian side will disclose results of environmental and social monitoring to local stakeholders through their website / in their field offices.

The Cambodian side agreed JICA will disclose results of environmental and social monitoring submitted by the Cambodian side as the monitoring forms attached as **Annex 9** on its website.

17. Other Relevant Issues

17-1. Disclosure of Information

Both sides confirmed that the Preparatory Survey Report from which project cost is excluded will be disclosed to the public after completion of the Preparatory Survey.

The comprehensive report including the project cost will be disclosed to the public after all the contracts under the Project are concluded.

17-2. Updated Outline of Comparator Facility

The Team explained the updated outline of comparator facilities as Comparator Facility Design of **Annex 10**. Both sides confirmed that comparator facilities were used only for estimating project cost, and the actual design of the facilities would be proposed by the Contractor in the later stage.

17-3. Change in Intake

Both sides confirmed that the new raw water intake tower (capacity: 204,750 m^3/day) of the comparator facility explained in the Annex 1 of Minutes of Discussions (MD) signed on 5th August 2021 (see **Annex 13**), will not be constructed under the Project due to the budgetary constraint of the Japanese Government, and the existing intake tower will continue withdrawing water for the existing WTP with a design production capacity of 150,000 m^3/day. Instead, pontoon type (design treatment capacity: 47,250 m^3/day) is specified for the intake of comparator facility to supply the new WTP with a design production capacity of 45,000 m^3/day as explained in **17-2**.

17-4. Site Clearance at WTP

The Team explained that all the assets in the temporary storage locations, which are marked for the construction of the new sedimentation basins, filter and service reservoir & distribution pumping station, and in nearby pathways must be removed before the materials for construction start to arrive.

PPWSA explained that the temporary stockyard location will be selected and secured by PPWSA before bid announcement, and both sides agreed on who would be responsible for each item in the following table.

Assets to Be Moved or Removed for Construction

Assets	Type	Description	Responsible Party
Generally, on the property	Pipe materials	✓ Pipes being temporarily stored on pathways on the premises. <Move>	PPWSA
Near sedimentation basin/ filter	Buried pipes	✓ Facility piping (Filtration basin to reservoir) dia. 700 mm. <Divert> ✓ Facility piping (Chemical dosing building to distribution pump facility) Dia. 150 mm. <Divert> ✓ Facility piping (Drainage pipes) dia. 700 mm <Divert>	Contractor
Near reservoir	Temp Storage	✓ Pipe stockyard. <Move pipes, remove stockyard>	PPWSA

Assets	Type	Description	Responsible Party
	RC structures	✓ Flow meter room Dia. 400 mm. <Move>	Contractor
	Buried pipes	✓ Facility piping (Distribution lines) Dia. 400 mm. <Divert> ✓ Facility piping (Drainage pipes) Dia. 700 mm. <Divert>	Contractor

17-5. Office for the Consultant and the Contractor during the D&B Works Stage

PPWSA explained that areas for temporary office(s) for the consultants and the contractor during the construction stage could be provided in Phum Prek WTP, if required. The team agreed to it.

17-6. Water Right for Intake

Both sides confirmed that PPWSA will obtain additional water right for intake from Sap River, from Ministry of Water Resources and Meteorology (MOWRAM) will be done before bid announcement.

17-7. Exploration and Disposal of landmines and Unexploded Ordinance (UXO)

Both sides confirmed that PPWSA will discuss with Cambodian Mine Action Centre (CMAC) and explore and dispose landmines and UXOs around intake construction site, before bid announcement.

17-8. Installation of Transmission Pipeline

Both sides agreed new raw water transmission pipeline of D800mm from intake to Phum Prek WTP should be designed, procured, and constructed by PPWSA as one of the undertakings of the Project before start of the trial operation of new facilities.

PPWSA shall confirm the budget and implementation schedule for the new raw water conveyance system (D800) and report to JICA by the end of April 2023 (before bidding).

PPWSA shall report the status of design and procurement of pipes and fittings and other materials and equipment for the new raw water conveyance system (D800) to JICA by the end of September 2023 (before the Contract for the D&B Works).

PPWSA shall complete the installation and construction of equipment for the new raw water conveyance system (D800) and report to JICA, the Consultants and the Contractor by the end of August 2026.

PPWSA agreed to compensate for any additional cost caused by the delay in implementation of new transmission pipes (e.g. additional labor / operating cost caused by delay of trial operation and/or completion of construction) to the Contractor in the D&B Contract or O&M Contract.

17-9. Items of Requirements

Both sides confirmed the following items shall be included for requirements in the bidding documents at this time and requirements would be finalized in the later stage.

- Intake for design capacity of 47,250 m^3/day
- WTP for design production capacity of 45,000 m^3/day
- 10 years O&M period
- Power receiving facilities for both intake and WTP
- PAC dissolution and dozing system
- On-site Sodium hypochlorite generation and dozing system
- Volume of service reservoir of 6,000 m^3 or more
- Distribution pumping station
- 24 hours supply
- Water quality standards described in **Annex 10**
- Raw water pumps
- Distribution pumps
- O&M manual in both Khmer Language and English
- Prevention against adhesion of shell inside raw water transmission pipe
- 5 % of production loss ratio from receiving well to the bulk meter after the filter
- Payment currency shall be Khmer Riel
- Prevention of oil inflow into the WTP

17-10. Client's Requirements for the Facilities

Both sides agreed to set the Client's Requirements for the facilities as follow:

1. Intake facility shall be a floating type only and alternative is not allowed
2. Sedimentation method is up to the bidder's proposal
3. Sand filtration is preferred for filtration method, but a bidder may propose alternative technology for evaluation in the bid.

Detailed requirements and specifications for each component shall be stipulated in

the bid preparation after E/N and G/A.

17-11. Water quality test During O&M

The Contractor may outsource to PPWSA and pay for water quality test for treated water to confirm compliance with water quality standard stipulated in the contracts or install its own facility or laboratory to conduct their own water quality test.

17-12. Sludge Discharge and Disposal

Both sides confirmed the waste-wash water and sludge discharge shall be received by the existing drainage system of Phum Prek WTP and PPWSA shall take all responsibility for the disposal of waste-wash water and sludge in entire Phum Prek WTP.

The Client's requirements shall stipulate the Contractor will discuss with PPWSA about scheduling of backwashing to optimize discharge of waste-wash water.

17-13. By-pass to the Existing Transmission Pipelines

Both sides agreed that by-pass to the existing transmission pipes will be installed at Intake site by PPWSA as a contingency measurement.

17-14. Ceiling Price for Bulk Water

PPWSA confirmed that Board of Director agreed the ceiling price for the bulk water at KHR350/m^3 in October 2021 as shown in **Annex 11**.

17-15. P/Q Criteria

Both sides agreed to minimize the qualification criteria to encourage bid participation. A bidder shall be qualified if it has at least three (3) construction works with each contract price not less than 1.5 billion Japanese Yen during the last ten years, executed overseas, and at least two (2) experiences of construction work of water treatment facilities for drinking water with a capacity of 10,000 m3/day or more, either in domestic or overseas. P/Q Criteria will be reconfirmed by JICA before bid announcement.

The Team suggested to add water treatment facilities for industrial water as eligible experiences to allow more bidders, but PPWSA considers it has different nature of technical requirements and it shall be excluded to ensure the Contractor to comply with Cambodian national drinking water quality standard requirements.

17-16. Training Contract

Both sides agreed to have a separate training contract in relation to the Project to develop PPWSA's overall capacity and management with fixed price of $30,000/year, for 10 years. Training program shall be proposed by the Contractor in the bidding to include the following:

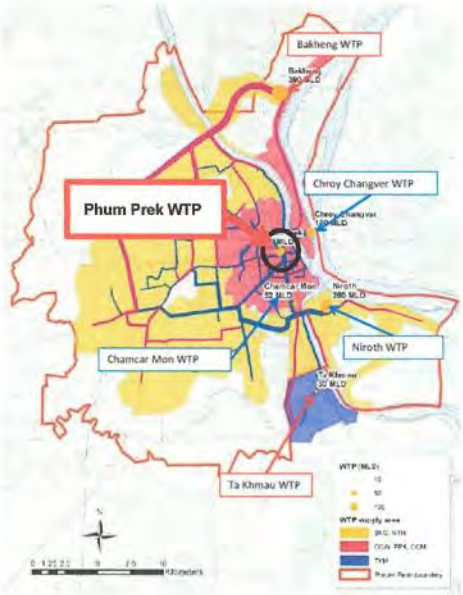
1. Data Analysis (Basic and Advanced)
2. Water Quality Analysis and Management
3. Operation and Maintenance of Electrical Equipment for Monitoring and Control
4. Preventive Maintenance

Annexes

Annex 1 Project Site
Annex 2 Organization Chart
Annex 3 Japanese Grant Procedures and Basic Principles of Japanese Grant
Annex 3-1 Attachment (1) Procedures
Annex 3-2 Attachment (2) Financial Flow of Grant
Annex 4 Project Implementation Schedule
Annex 5 Major Undertakings to be taken by the Government of Cambodia
Annex 6-1 Project Monitoring Report (PMR) -Cover Page
Annex 6-2 Project Monitoring Report (PMR) -Form
Annex 7 Issues to be considered for Smooth Implementation of the Project
Annex 8 Environmental Check List
Annex 9 Environmental Management Plan/Environmental Monitoring Plan/ Environmental Monitoring Form
Annex 10 Project Data Sheet
Annex 11 Approval Letter of the Ceiling Prices for the Bulk Water
Annex 12 EPC Approval Letter issued by MOE
Annex 13 Minutes of Discussions (MD) signed on 5th August 2021

Annex 1 Project Site

Cambodian Map



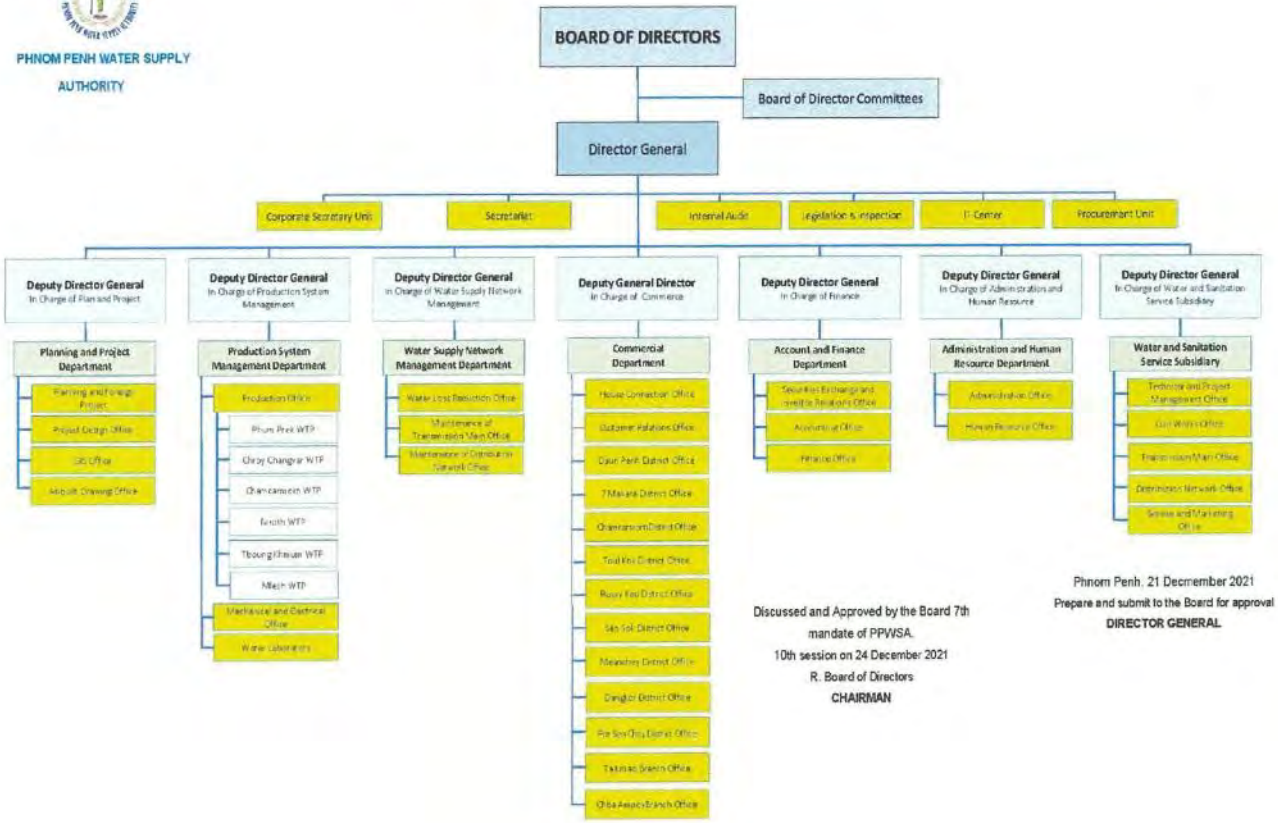
Site location Map

Annex 2 Organizational Structure of PPWSA

KINGDOM OF CAMBODIA
NATION RELIGION KING

PHNOM PENH WATER SUPPLY AUTHORITY

ORGANIZATIONAL CHART OF PHNOM PENH WATER SUPPLY AUTHORITY



Discussed and Approved by the Board 7th mandate of PPWSA.
10th session on 24 December 2021
R. Board of Directors
CHAIRMAN

Phnom Penh, 21 December 2021
Prepare and submit to the Board for approval
DIRECTOR GENERAL

Annex 3 Japanese Grant

JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as "the Recipient") to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as "Project Grants"). The Project Grants in the present understanding here means a public project which private company (ies) with the technologies and know-how of Japanese Nationals for the development in the Recipient is (are) participated in and is (are) comprehensively implemented including construction of facilities, procurement of equipment, and operation and maintenance

1. Procedures of Project Grants

Project Grants are conducted through following procedures. (See "PROCEDURES OF JAPANESE GRANT" for details):

(1) Preparation

- The Preparatory Survey (hereinafter referred to as "the Survey") conducted by JICA

(2) Appraisal

-Appraisal by the government of Japan (hereinafter referred to as "GOJ") and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes

-The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as "the G/A")

-Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as "the B/A")

-Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant

Construction works/procurement

-Implementation of the project (hereinafter referred to as "the Project", the term "the Project" means that the Recipient concludes contract(s) to construct facilities and/or procure equipment by using the Japanese Grant.) on the basis of the G/A

(4) Operation and Maintenance (without using the Japanese Grant)

-Operation and maintenance of the facilities and equipment

(5) Ex-post Monitoring and Evaluation (without using the Japanese Grant)

-Monitoring and evaluation of the Project at post-implementation stage

Annex 3 Japanese Grant

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the Project Grants made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project Grants and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.
- Evaluation of the feasibility of the Project Grants to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project Grants.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project Grants.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project Grants are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project Grants.

3. Basic Principles of Project Grants

(1) Implementation Stage

Annex 3 Japanese Grant

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."

2) Banking Arrangements (B/A) (See "Financial Flow of Japanese Grant (A/P Type)" for details)

a) The Recipient shall open an account or shall cause its designated authority to open an account in the Bank. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.

b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractor(s), namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

a) Contracts consist of (i) a comprehensive contract which consolidates both contracts for the purchase of the products and/or services and for the operation and maintenance, (ii) contract(s) for the purchase of products and/or services and (iii) contract(s) for the operation and maintenance.

b) The Recipient will conclude (ii) contract(s) for the purchase of products and/or services denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

Annex 3 Japanese Grant

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.

b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Operation and Maintenance Stage

The Contractor operates and manages the facilities and equipment based on the contract(s) for operation and maintenance with the Recipient.

(3) Ex-post Monitoring and Evaluation Stage

1) After the project completion of all construction and procurement works by using the Japanese Grant, JICA will continue to keep in close contact with the Recipient in order to monitor that the output of the Project is used and maintained properly to attain its expected outcomes.

2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion of all construction and procurement works by using the Japanese Grant. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

Annex 3 Japanese Grant

(4) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the products and/or the services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Measures to ensure more efficient implementation of the Grant

a) In the event that the E/N and the G/A concerning a project cannot be signed by the end of the following Japanese fiscal year of the cabinet decision concerned by the GOJ, the authorities concerned of the two Governments will discuss the cancellation of the project.

b) In the event that the period, specified in the G/A, during which the grant is available expires before the completion of the disbursement, the authorities concerned of the GOJ will thoroughly review the status, situation and perspective of the implementation of the project concerned before extending the said period. The authorities concerned of the two Governments will discuss the termination of the project including a refund, unless there are concrete prospects for its completion.

c) Regardless of the period mentioned in b) above, the authorities concerned of the two Governments will, in the event that five years have passed since the cabinet decision concerned by the GOJ before the completion of the disbursement, except as otherwise confirmed between them, discuss the termination of a project including a refund, unless there are concrete prospects for its completion.

4) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

5) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient country.

PROCEDURES OF JAPANESE GRANT

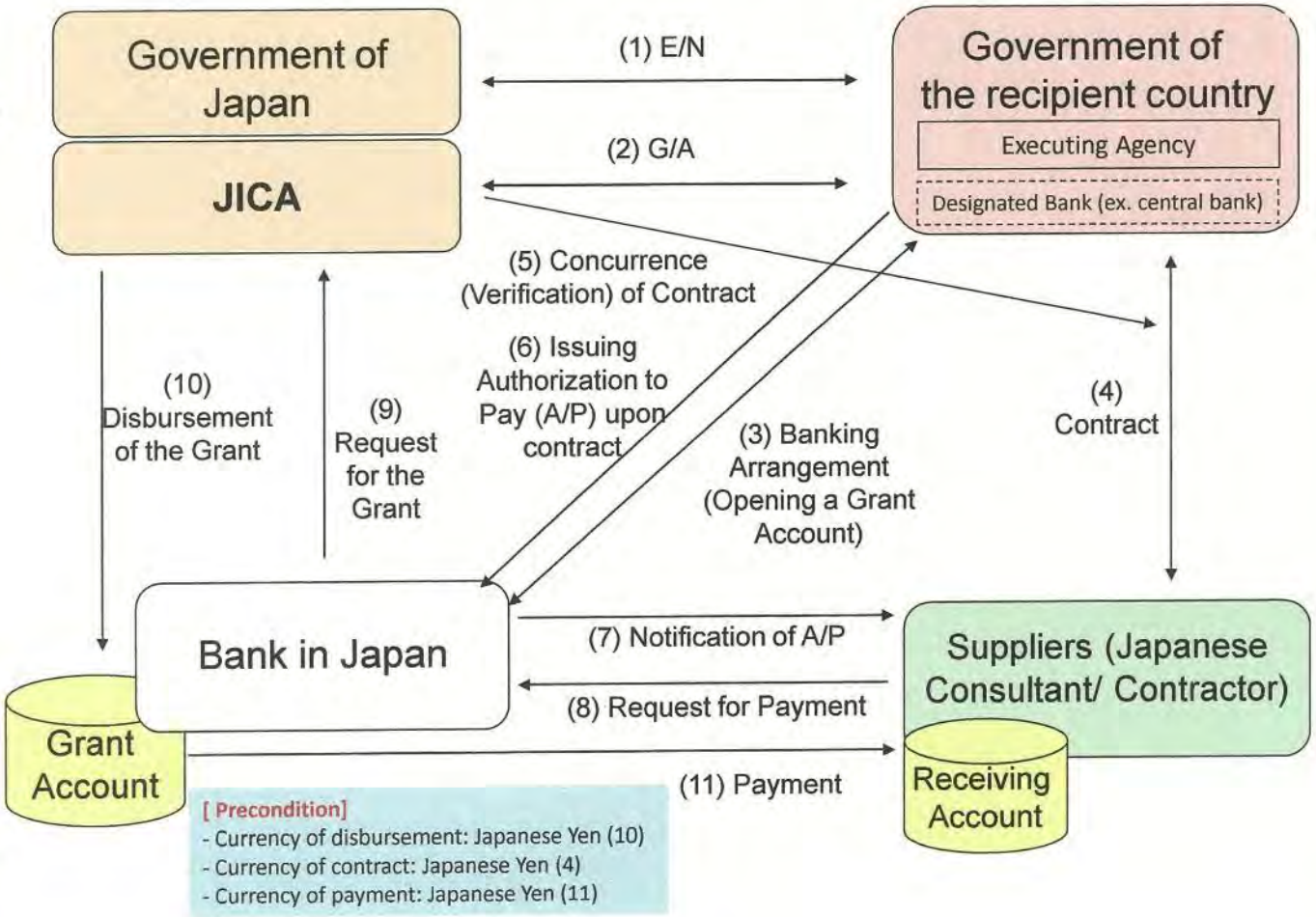
Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		x		x	x		
2. Appraisal	(2)Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
	(3)Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Preparation of bidding documents	Concurrence by JICA is required	x			x		
	(10) Bidding	Concurrence by JICA is required	x			x	x	
	(11) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
	(12) Design/Construction works/procurement	Concurrence by JICA is required for amendment of contracts.	x			x	x	
	(13) Completion certificate		x			x	x	
4. Operation & Management	(14) Operation and management of the facilities and equipment		x			x	x	
5. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.

2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

Financial Flow of Japanese Grant (A/P Type)

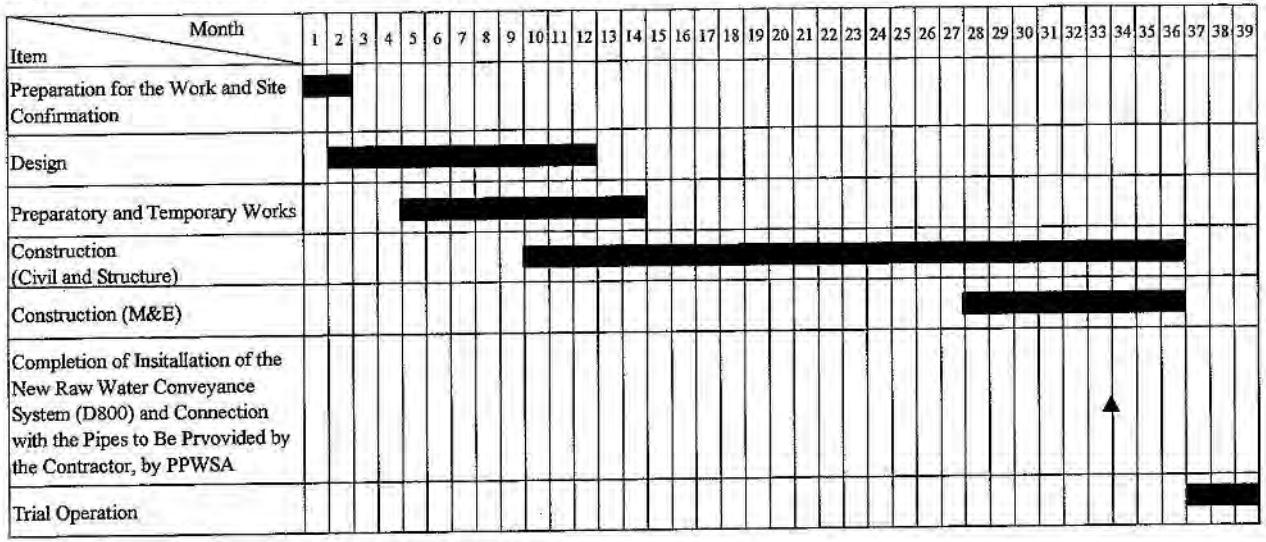


Annex 4 Project Implementation Schedule

Implementation Schedule (Tender)

Item \ Month			1	2	3	4	5	6	7	8	9	10	11
E/N	▲												
G/A		▲											
Contract for the Consultant			■										
PQ Documents Preparation				■									
P/Q Documents Approval					■								
P/Q Announcement					▲								
P/Q					■								
P/Q Evaluation and Reporting						■							
Bidding Documents Preparation				■	■	■							
Bidding Documents Approval						■	■						
Confirmation of Budgeting and Implementation Schedule for the New Raw Water Conveyance System (D800) to Be Installed by PPWSA							▲						
Bid Announcement							▲						
Bidding Document Distribution							▲						
Bidding Period							■	■	■				
Bid Open (Technical)										▲			
Technical Bid Evaluation, Approval										■	■		
Bid Open (Price)												▲	
Approval of Bid Result												■	
Confirmation of Status of Design and Procurement of Pipes and Fittings and Other Materials and Equipment for the New Raw Water Conveyance System (D800) to Be Installed by PPWSA												▲	
Contract for the Contractor													■

Implementation Schedule (Design & Build)



Annex 5 Major Undertakings to be taken by the Royal Government of Cambodia

1. Specific obligations of the Royal Government of Cambodia which will not be funded with the Grant

(1) Before the Bidding

No	Items	Deadline	In charge	Estimated Cost (USD)	Ref.
1	To sign the banking arrangement (B/A) with a bank in Japan (the Agent Bank) to open bank account for the Grant.	within 1 month after the signing of the G/A	PPWSA	-	
2	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the consultant.	within 1 month after the signing of the contract(s)	PPWSA	-	
3	To bear the following commissions to the Agent Bank for the banking services based upon B/A.				
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	PPWSA/ NBC	1,000	
	2) Payment commission for A/P	every payment	PPWSA/ NBC	21,000 (in total)	
4	To obtain the approval of EPC (Environmental Protection Contract) and secure the necessary budget for implementation.	within 1 month after the signing of the G/A (Already approved)	PPWSA	-	
5	To report the status of budgeting and implementation schedule for the new Raw Water Transmission Pipe to Be Installed by PPWSA to JICA	within 5 months after the signing of the G/A but before bid announcement	PPWSA		
6	To notice the construction of the intake facility in the Sap River to local authorities.	before bid announcement	PPWSA	-	
7	To secure and clear the following lands. 1) Site for raw water intake 2) Site for Phum Prek WTP (Including office area) 3) Site for stock yards	before bid announcement	PPWSA	100,000	
8	To explore landmines and UXO at intake construction sites.	before bid announcement	PPWSA	40,000	
9	To obtain water right for intake from the Sap River from MOWRAM.	before bid announcement	PPWSA	-	
10	To submit Project Monitoring Report.	At preparation of bidding documents	PPWSA		
11	To report the status of design and procurement of pipes and fittings and Other Materials and Equipment for the new raw water conveyance system (D800)	within 10 months after the signing of the G/A but before the contract for the Contractor	PPWSA		

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

NBC: National Bank of Cambodia

(2) During the Project Implementation (during D&B)

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Supplier(s).	within 1 month after the signing of the contract(s)	PPWSA	-	
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A.				
	1) Advising commission of A/P.	within 1 month after the signing of the contract(s)	PPWSA/ NBC	1,000 (in total)	
	2) Payment commission for A/P.	every payment	PPWSA/ NBC	18,000 (in total)	
3	To assign Client's Engineer(s) for the management of D&B Works	during the D&B Works	PPWSA	120,000 (in total)	
4	To ensure prompt unloading and customs clearance at ports of disembarkation in the country of the Recipient and to assist the Supplier(s) with internal transportation therein.	during the Project	PPWSA	-	
5	To accord Japanese physical persons and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work.	during the Project	PPWSA	-	
6	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted.	during the Project	MEF	-	
7	To ensure budgeting, design, procurement of materials and equipment, installation of the new raw water conveyance system (D800) from the intake to Phum Prek water treatment plant. The Contractor shall connect their installed pipes with the new raw water transmission pipes installed by PPWSA at intake and WTP sites.	by August 2026 or 3 months before start of the trial operation of new facilities	PPWSA	8,500,000	
8	Compensate for any additional cost caused by the delay of installation of the new raw water conveyance system (e.g. additional labor / operating cost caused by delay of trial operation and/or completion of construction)	during the Project	PPWSA	-	
9	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project.	during the Project	PPWSA	-	
10	To notify JICA promptly of any incident or accident, which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers	during the construction	PPWSA		
11	1) To submit Project Monitoring Report.	every three (3) months	PPWSA	-	
	2) To submit Project Monitoring Report (final).	within one month after signing of Certificate of Completion for the works under the contract(s)	PPWSA	-	
12	To submit a report concerning completion of the Project.	within six months after completion of the Project	PPWSA	-	
13	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the site(s)		PPWSA	-	

	1) Water To provide facilities for distribution of water supply for intake. (Connection fee and cost for water supply arrangement within the construction site shall be borne by the Contractor)	before start of the construction	PPWSA	-	
	2) Water To provide facilities for distribution of water supply for water treatment plant. (Connection fee and cost for water supply arrangement within the construction site shall be borne by the Contractor)	before start of the construction	PPWSA	-	
	3) Water To provide facilities for distribution of water supply for stock yards.	before start of the construction	PPWSA	-	
	4) Temporary Electricity for Intake Cost for all the application forms for the provision of power receiving. (All the cost for power receiving such as utility poles and wiring work including conduit from the connection points from the EDC to the transformer for receiving two lines for construction shall be borne by the Contractor.)	before start of the construction	PPWSA	-	
	5) Temporary Electricity for water treatment plant Cost for all the application forms for the provision of power receiving. (All the cost for power receiving such as utility poles and wiring work including conduit from the connection points from the EDC to the transformer for receiving two lines for construction shall be borne by the Contractor.)	before start of the construction	PPWSA	-	
	6) Temporary Electricity for stock yard Cost for all the application forms for the provision of power receiving. (All the cost for power receiving such as utility poles and wiring work including conduit from the connection points from the EDC to the transformer for receiving two lines for construction shall be borne by the Contractor.)	before start of the construction	PPWSA	-	
	7) Permanent Electricity for intake Cost for all the application forms for the provision of power receiving. (All the cost for power receiving such as utility poles and wiring work including conduit from the connection points from the EDC to the transformer for receiving two lines for commissioning and operation shall be borne by the Contractor.)	before start of the trial operation	PPWSA	5,000	
	8) Permanent Electricity for water treatment plant Cost for all the application forms for the provision of power receiving. (All the cost for power receiving such as utility poles and wiring work including conduit from the connection points from the EDC to the transformer for receiving two lines for commissioning and operation shall be borne by the Contractor.)	before start of the trial operation	PPWSA	5,000	
	9) Drainage The city drainage main (for storm, sewer and others) to the sites. Cost for drainage arrangement within all the construction sites and stock yard(s) shall be borne by the Contractor. However, PPWSA will arrange the connection to the city drainage of the municipality.	before start of the construction	PPWSA		
14	To ensure the safety of persons engaged in the implementation of the Project during the Project	during the Project	PPWSA		
15	To take necessary measure for safety of construction - Coordination with the police for traffic control - Coordination with relevant authority to ensure the safety of boats and ships in relation to the construction of intake facility.	during the construction	PPWSA	-	

16	To implement EMP and EMoP.	during the construction	PPWSA	-	
17	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report.	during the construction	PPWSA	-	
18	To provide sufficient space at the intake and water treatment plant sites for stockyard and office space for free of charge.	during the construction	PPWSA	-	

(3) During O&M

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To implement EMP and EMoP.	for a period based on EMP and EMoP	PPWSA	-	
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between PPWSA and JICA.	for three years after the commissioning	PPWSA		
3	PPWSA have to ensure utilization of additional production of 45,000 m^3/day to the distribution network system.	for the O&M period	PPWSA		
4	To comply strictly with the O&M Services contract.	for the O&M period	PPWSA		
5	To comply strictly with the Training Services contract.	for the training contract period	PPWSA		

2. Other obligations of the Government of Cambodia funded with the Grant

事業者契約認証まで非公表とする。

Annex 6 Project Monitoring Report (Cover)

Date:
Ref. No.

JAPAN INTERNATIONAL COOPERATION AGENCY
JICA CAMBODIA OFFICE
6th, 7th, 8th Floors, Building #61-64, Preah Norodom Blvd, Corner of St. 306, Phnom Penh, CAMBODIA
Attention: Chief Representative

Ladies and Gentlemen:

NOTICE CONCERNING PROGRESS OF PROJECT

Reference : Grant Agreement, dated XXX XX, 2022, for Expansion of Phum Prek Water Treatment System

In accordance to the Article 6 (3) of the Grant Agreement, we would like to report on the progress of the Project up to the following stages:

[Common]
- ☐ Preparation of bidding documents
- ☐ Completion of final works under construction/procurement contract

[Construction]
- ☐ Monthly progress [Month/Year]

[Procurement of Equipment]
- ☐ Shipping/delivery, hand-over (take over) of equipment
- ☐ Installation works
- ☐ Operational training

- ☐ Other _____

Please see the details as per attached Project Monitoring Report (PMR).

Very truly yours,

_____
H.E. LONG Naro
Director General
Phnom Penh Water Supply Authority

cc:
Director General
Financial Cooperation Implementation Department
Japan International Cooperation Agency
5-25, Niban-cho, Chiyoda-ku, Tokyo 102-8012, JAPAN

Annex 6 Project Monitoring Report

G/A NO. XXXXXX
PMR prepared on 07/June/2022

Project Monitoring Report
on
the Project for Expansion of Phum Prek Water Treatment System
Grant Agreement No. XXXXX
2022, June

Organizational Information

Signer of the G/A (Recipient)	**Ministry of Economy and Finance** Person in Charge Deputy Prime Minister Contacts Address: St.92, Sangkat, Wat Phnom, Khan Daun Penh, Phnom Penh, Cambodia Phone: +855 (0)23 724 664 Fax: +855 (0)23 427 798 Email: admin@mef.gov.kh
Executing Agency	**Phnom Penh Water Supply Authority** Person in Charge (Designation) Director General Contacts Address: Office 45 st.106, Sangkat Srah Chork, Khan Daun, Penh, Phnom Penh, Cambodia Phone: +855 (0)23 724 046/(0)23 635 8080 Fax: +855 (0)23 427 657 Email: admin@ppwsa.com.kh
Line Ministry	_____ Person in Charge (Designation) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____

General Information:

Project Title	***Expansion of Phum Prek Water Treatment System***
E/N	Signed date: XXX XX, 202X Duration: XXX XX, 202X - XXX XX, 202X
G/A	Signed date: XXX XX, 202X Duration: XXX XX, 202X - XXXX XX, 202X
Source of Finance	Government of Japan: Not exceeding JPY X,XXX mil. Government of (_____): _____

1: Project Description	

1-1 Project Objective

The project aims to achieve the objectives as follows; 1) Construct a water treatment plant (45,000 m³/day) and intake (47,250 m³/day) for water distribution to Phnom Penh central area; 2) Improving water supply services, and 3)Contribute to improving the living environment in Phnom Penh.

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

Full-scale renovation and expansion of the water supply sector of Cambodia began after the civil war ended in the 1990s, with activities centered mainly in the capital Phnom Penh and other major cities. Nationwide, there are two water boards and eight public water utilities. In addition, there are roughly 300 private water supply enterprises.

In 1993, JICA conducted the "Study on Phnom Penh Water Supply System". Based on the conclusions of the study and with the support of the Government of Japan (hereinafter referred to as "GOJ") and other donor agencies, water supply capacity in Phnom Penh was increased through the construction and rehabilitation of facilities and operation and maintenance (hereinafter referred to as "O&M") capacity building of staff. Currently, the 24-hour water supply service ratio in Phnom Penh is over 90%. JICA has assisted in the implementation of four (4) grant aid projects, one (1) Japanese Yen loan project, two (2) water supply master plan formulation projects, and technical assistance by dispatching the Japanese public water supply experts from Kitakyushu for capacity building activities. However, water supply in the Phnom Penh Water Supply Authority (hereinafter referred to as "PPWSA") service area, mainly in the Phnom Penh Capital, has become inadequate because production capacity has not been able to keep up with the rapid increases in domestic and commercial demand. A water demand of more than 642,000 m³/day is expected by 2022 in the PPWSA service area, already exceeding the total production capacity of 592,000 m³/day. It is projected to increase to 1,578,000 m³/day by 2030. This rapid increase in demand has caused water pressures to fall in some areas, and other urgent issues. In addition, deterioration and inefficiency of aged facilities and equipment has been identified and improvement of energy efficiency and energy saving are required for the sustainable operation of water supply facilities and provision of services.

Against this backdrop, PPWSA is currently implementing "Third Phnom Penh Water Supply Master Plan" (hereinafter referred to as the "M/P") that was prepared in 2017 to increase water supply capacity through financial support of ODA partners. JICA is currently assisting the implementation of "The Project for the Expansion of Water Supply System in Ta Khmau" for PPWSA to construct water treatment plant (hereinafter referred to as "WTP") with a capacity of

30,000 m³/day under the Japanese Grant Aid with O&M (grant limit: 3.4 billion JPY) and has assisted the implementation of "The Data Collection Survey on Water Supply Development in Phnom Penh Capital" to review and update the M/P to include the recent rapid increases in water demand.

Phum Prek WTP (hereinafter referred to as "P.Prek") commenced operation with a production capacity of 100,000 m³/day in 1966. It underwent rehabilitation with grant aid from the French and Japanese governments in 1995, and added 50,000 m³/day of capacity under the Japanese Grant Aid. Its current production capacity is 150,000 m³/day. It is one of the principal water treatment plants (hereinafter referred to as "WTP") operated by PPWSA. It takes in water from the Sap River, and supplies it to the public after a flocculation, coagulation, and rapid sand filtration treatment process. P.Prek is an important WTP, supplying potable water to the central area of Phnom Penh Capital. Therefore, increasing production capacity here will contribute greatly to the improvement of water supply conditions in the Phnom Penh Capital. In addition, rehabilitation of aged facilities and equipment initially constructed under French aid are necessary to increase operational efficiency and ensure sustainability of water supply.

Based on the above, the Royal Government of Cambodia (hereinafter referred to as "RGC") requested Japanese Grant Aid with O&M for the "Rehabilitation and Expansion of Phum Prek Water Treatment System" from the GOJ to rehabilitate, expand, operate, and maintain P.Prek efficiently utilizing technology, knowledge, and funds of the Japanese private sector. The objective of this Survey is to study and evaluate the project scope, carry out outline design of comparator facilities, create project implementation plan, and estimate project cost within the scope of a Japanese Grand Aid with O&M Project.

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr 2021)	Target (Yr 2027)
Daily Average Water Supply Volume	150,000 m³/day	195,000 m³/day
Qualitative indicators to measure the attainment of project objectives		
1. *Increase of Water Supply Volume*		
2. *Increase of Water Pressure*		
3. *Technology Transfer*		

2: Details of the Project

2-1 Location

Components	Original *(proposed in the outline design)*	Actual
1.	Attachment 1: Map	

2-2 Scope of the work

Components	Original* *(proposed in the outline design)*	Actual*
1. Intake Facility	- Intake Capacity : 47,250m³/day - Raw Water Intake Facility - 2 Nos. of Raw Water Pumps - Power Receiving and Distribution Facilities	
2. Water Treatment Facility	- Water Treatment Capacity : 45,000 m³/day - Water Treatment Facilities - Service Reservoir of 6,000 m³ - Distribution Pumping Station - 3 Nos. of Distribution Pumps - Power Receiving and Distribution Facilities - On-site Sodium Hypo Chloride Generation Facility - Chemical Mixing and Dosing Facilities	
3. SCADA	- Central Supervisory System in the WTP	
4. Consulting Service	- Tender Assistance - D&B Works Supervision - Support for O&M, and monitoring system	

Reasons for modification of scope (if any).

(PMR)

2-3 Implementation Schedule

Items	Original *(proposed in the outline design)*	Original *(at the time of signing the Grant Agreement)*	Actual
E/N	Dec 2022		
G/A	Jan 2023		
PQ Announcement	Apr 2023		
Tender Announcement	Jun 2023		
Signing of Contract	Dec 2023		
Completion of D&B Works	Feb 2027		
Defect Liability Date	Feb 2028		
Completion of O&M	Feb 2038		

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant (Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
D&B Works	D&B Works			
Consulting Service	D&B Works Supervision			
Contingencies				
Total				

Note: 1) Date of estimation: June/2022
2) Exchange rate: 1 US Dollar = 127.389 Yen

2-5-2 Cost borne by the Recipient

Components			Cost (USD)		Cost (Million JPY)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual	Original[1),2)] *(proposed in the outline design)*	Actual
Banking Arrangement for the Consulting Services	Advising commission of A/P		1,000			
	Payment commission for A/P at every payment		21,000 (in total)			
Banking Arrangement for the D&B	Advising commission of A/P		1,000			

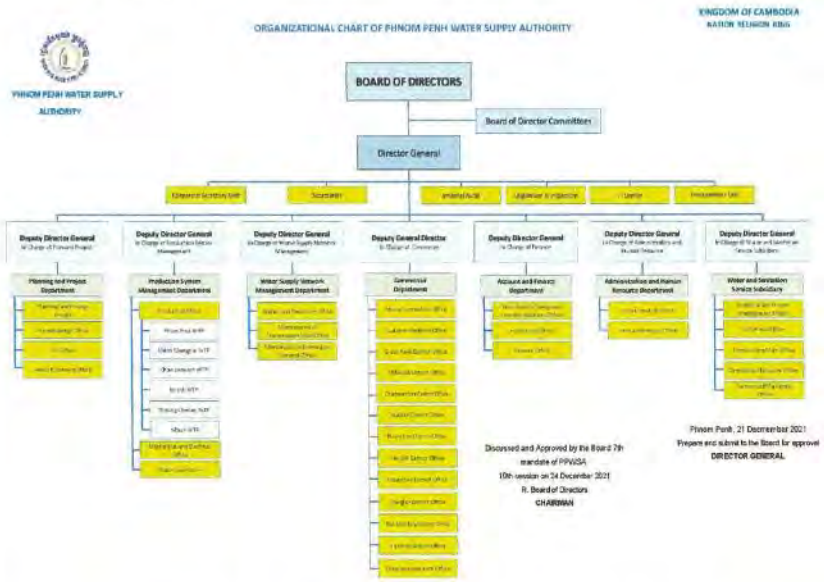
Works						
	Payment commission for A/P at every payment		18,000 (in total)			
Land preparation	Land preparation and clearance of raw water intake, water treatment and stockyard sites		100,000			
Unexploded or mine survey	To explore landmines and UXO at construction raw water intake and water treatment plant sites		40,000			
Client's Engineer(s)	Cost for assignment of Client's Engineer(s) for the management of D&B Works		120,000			
Raw water conveyance system installation	Cost for installation of new D800 mm raw water transmission conveyance system		8,500,000			
Power receiving arrangement	Cost for permanent electricity for intake		5,000			
	Cost for permanent electricity for water treatment plan		5,000			
Total			**8,811,000**			

Note: 1) Date of estimation: June/2022
2) Exchange rate: 1 US Dollar = 127.389 Yen

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

institutional and organizational arrangement (organogram):



human resources (number and ability of staff): 1,153 (in 2021) and good ability

Actual *(PMR)*

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original *(at the time of outline design)*

Actual *(PMR)*

3-2 Budgetary Arrangement
- Required O&M cost and actual budget allocation for O&M

Original *(at the time of outline design)*
Actual *(PMR)*

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks *(at the time of outline design)*

Potential Risks	Assessment
1. Long wet period and high river water level	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	It shall be unforeseen case. If construction of intake is delayed, completion of overall construction will be delayed.
	Mitigation Measures:
	Extension of construction period
	Action required during the implementation stage:
	Weather monitoring
	Contingency Plan (if applicable):
	This risk shall be taken by the Contractor upon the Contract.
2. Deterioration of raw water quality	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Unforeseen contents may be contained in raw water which effect to treatment process.
	Mitigation Measures:
	N/A
	Action required during the implementation stage:
	Carry-out periodical/continuous raw water monitoring
	Contingency Plan (if applicable):
	For the design modification and extension of D&B period, if necessary.
3. Cheap Japanese Yen rate	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:

	It is very difficult to forecast, however it is currently happened that actual payment amount increases because payment is made in foreign currency against the deposit in yen for the procurement of material and equipment.
	Mitigation Measures: N/A
	N/A
	Action required during the implementation stage:
	Monitoring of exchange rates.
	Contingency Plan (if applicable):
	This risk shall be taken by the Contractor upon the Contract.
4. Cheap Japanese Yen rate	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	It is very difficult to forecast, however it is currently happened that large foreign exchange losses when remitting funds locally.
	Mitigation Measures:
	The Contractor should make effort to reduce losses by reducing the amount of remittances and adjusting the frequency of remittances
	Action required during the implementation stage:
	Monitoring of exchange rates.
	Contingency Plan (if applicable):
	This risk shall be taken by the Contractor upon the Contract.
5. Price escalation due to the unforeseen global situation	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	It is very difficult to forecast, however it is currently happened that procurement and transportation costs are high.
	Mitigation Measures:
	N/A
	Action required during the implementation stage:
	Monitoring of market prices.
	Contingency Plan (if applicable):
	This risk shall be taken by the Contractor upon the Contract.
6. Long delivery time	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	It is very difficult to forecast, however it is currently happened that the time for procurement takes long time or unclear.
	Mitigation Measures:
	The Contractor should make effort to determine the specification and start arrangement for the procurement as fast as possible. Extension of the construction period can be considered
	Action required during the implementation stage:

	Monitoring of market condition.
	Contingency Plan (if applicable):
	Cost for the extension of construction period may be applied, if necessary.
Actual Situation and Countermeasures	
(PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant
   Appendix - Photocopy of Contractor's Progress Report (if any)
   - Consultant Member List
   - Contractor's Main Staff List
4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Pictures (by JPEG style by CD-R) (PMR (final)only)
7. Equipment List (PMR (final)only)
10. Drawing (PMR (final)only)
11. Report on RD (After project)

Issues to be Considered for Smooth Implementation of the Project

1. **The Raw Water Transmission Pipe from the new Raw Water Intake to the New Receiving Well for the new water treatment facility with a production capacity of 45,000 m^3/day shall be financed, designed, and constructed solely by PPWSA 3 months before the commencement of trial operation (by the end of August 2026).**

   KEY POINTS FOR SMOOTH IMPLEMENTATION OF THE PROJECT

   - **PPWSA shall confirm the budget and implementation schedule for the new raw water conveyance system (D800) and report to JICA by the end of April 2023 (before bidding).**
   - **PPWSA shall report the status of design and procurement of pipes and fittings and other materials and equipment for the new raw water conveyance system (D800) to JICA by the end of September 2023 (before the Contract for the D&B Works).**
   - **PPWSA shall complete the installation and construction of equipment for the new raw water conveyance system (D800) and report to JICA, the Consultants and the Contractor by the end of August 2026.**
   - **The Contractor shall connect their pipes with the new raw water transmission pipe installed by PPWSA at intake site and the new receiving well in the Phum Prek WTP. For the connection, both parties shall discuss and determine the final connection method. Backfilling of connection points shall be done by the Contractor.**

2. **PPWSA shall coordinate with the Developer around the new intake site for the construction of Raw Water Intake facility.**

   KEY POINTS FOR SMOOTH IMPLEMENTATION OF THE PROJECT

   - **PPWSA shall obtain the project development details such as project design and schedule from the Developer.**
   - **In case of any accident caused by the Developer, PPWSA will support the Contractor to solve the issues.**

Annex 8

Environmental Check List

Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1. Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process?	N/A	(a) EIA or Initial Environmental Impact Assessment (IEIA) reports are not required for the Project. On the other hand, IEE study in accordance with JICA "Guidelines for Environmental and Social Considerations" was conducted for the approval of EPC during this preparatory survey.
		(b) Have EIA reports been approved by authorities of the host country's government?	N/A	(b) EIA or Initial Environmental Impact Assessment (IEIA) reports are not required for the Project.
		(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?	N/A	(c) EIA or Initial Environmental Impact Assessment (IEIA) reports are not required for the Project. On the other hand, EPC is required to be approved and EPC was already approved on 16th August 2021 by MOE.
		(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	Y	(d) In this project, among the EIA / IEIA / EPC stipulated in the environment-related law, only the EPC (Environmental Protection Contract), which has the simplest procedure, is required. The EPC was approved by MoE in August 2021.
	(2) Explanation to the Public	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the local stakeholders?	Y	(a) Stakeholder meetings with local authorities were held 4 times from 19 to 20-May, 2021 on-line. Public Consultation meeting with Related Department of Phnom Penh was held on 25-May, 2021 on-line. In the meetings, contents of the project and the potential impacts been adequately explained appropriately.
		(b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	Y	(b) The Project is an expansion, not a new construction project. Thus, opinions concerning serious environmental impacts were not stated. In other hand, social concerns such as traffic / noise / air quality (dust) issues were raised. PPWSA responded that the impacts would be limited and minimized. And they also stated that they will reflect the opinions to the construction methods and the design.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	Y	(a) The alternative studies (without project ⇔ with project) have been examined. In order to meet the water demand, "with project" option was is selected.
2. Mitigation Measures	(1) Air Quality	(a) Is there a possibility that chlorine from chlorine storage facilities and chlorine injection facilities will cause air pollution?	N	(a) On-site sodium hypochlorite generation system with high safety will be applied. Therefore, chlorine gas will not be used in the Project and leakage of chlorine is not expected.
		(b) Do chlorine concentrations within the working environments comply with the country's occupational health and safety standards?	Y	(b) In the on-site sodium hypochlorite generation system, the disinfectant is produced and stored in liquid form. Therefore, no danger of gas leaks is expected. (in Cambodia there are no regulations on chlorine concentrations within working environments)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Water Quality	(a) Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards?	Y	(a) During construction phase, the amount of wastewater generated from the construction site is estimated to be very limited and treated. While during operation phase, backwash water will be treated before discharging applying the standard.
	(3) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed in accordance with the country's regulations?	Y (N)	(a) In Cambodia, there are no laws or regulations on WTP sludge disposal. During construction phase: part of construction waste soil will be reused for backfilling at construction site. The remaining waste soil will be reused for backfilling of various kinds of other constructions. During operation period: WTP sludge will be collected and transported to soil users or landfill sites.
	(4) Noise and Vibration	(a) Do noise and vibrations generated from the facilities, such as pumping stations comply with the country's standards?	Y	(a) All pumps will be installed within pump stations, therefore, the noise and vibration level in outside of pump stations is considered to be almost the same as the background level of the site.
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	N	(a) During construction period and operation period, no groundwater will be extracted. Therefore, the impacts of subsidence are not expected.
3. Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	N	(a) The project sites are not located in protected area or environmentally sensitive areas designated by Cambodia laws or international treaties. Therefore, there is no possibility that the project will affect the protected areas.
	(2) Ecosystem and Biota	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?	N	(a) The project site doesn't encompass primeval forests, tropical rain forests, and ecologically valuable habitats.
		(b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?	N	(b) Within the project site, there are no protected habitats of endangered species designated by Cambodia laws or international treaties and conventions.
		(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?	N	(c) It is not anticipated to cause significant ecological impacts because there are no protected habitats in and around the Project area, and no significant pollution caused by the Project is expected.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(d) Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	N	(d) Additional intake of 0.16% of monthly minimum flowrate of the River will not have significant impacts on ecosystem and biota.
	(3) Hydrology	a) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect surface water and groundwater flows?	N	(a) Additional intake of 0.16% of monthly minimum flowrate of the River will not have significant impacts on hydrology
4. Social Environment	(1) Resettlement	a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	N/A	(a) No resettlement or land acquisition are planned.
		(b) Is adequate explanation on compensation and resettlement given to affected people prior to resettlement?	N/A	(b) No resettlement or land acquisition are planned.
		(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	N/A	(c) No resettlement or land acquisition are planned.
		(d) Is the compensations going to be paid prior to the resettlement?	N/A	(d) No resettlement or land acquisition are planned.
		(e) Is the compensation policies prepared in document?	N/A	(e) No resettlement or land acquisition are planned.
		(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?	N/A	(f) No resettlement or land acquisition are planned.
		(g) Are agreements with the affected people obtained prior to resettlement?	N/A	(g) No resettlement or land acquisition are planned.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	N/A	(h) No resettlement or land acquisition are planned.
		(i) Are any plans developed to monitor the impacts of resettlement?	N/A	(i) No resettlement or land acquisition are planned.
		(j) Is the grievance redress mechanism established?	N/A	(j) No resettlement or land acquisition are planned.
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	N	(a) All proposed facilities will be located within the existing PPWSA owned sites and will not affect the living environment of the surrounding inhabitants. The project is expected to improve the living environment as the water supply rate increases.
		(b) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect the existing water uses and water area uses?	N	(a) Additional intake of 0.16% of monthly minimum flowrate of the River will not have significant impacts on the existing water uses and water area uses.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	N	(a) There will be no negative impact since pagodas are not in and around the Project component sites. No cultural heritages exist in the Project area as well.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	N	(a) Facilities in the WTP premises will be out of the public view. The intake facility will alternate the existing intake facility as a newer building. Thus, deterioration of landscape is not expected.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	N/A	(a) There is no ethnic minority or indigenous group in the project area (Sangkat Srah Chak and Sangkat Wat Phnom).
		(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	N/A	(b) Ditto
	(6) Working Conditions	(a) Is the project proponent (not) violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?	N	(a) Cambodian laws and ordinances (such as Labor Law 1997 and amendment Law 2018, the Law on Social Security, Sub-Decree 11/16, on Health Care Scheme etc.) associated with working conditions (such as wage and hours of work etc.) will be followed by the project proponent during construction works and operation of the project based on Environmental Management Plan (EMP).

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?	Y	(b) Safety considerations will be taken during construction works and operation of the project based on the EMP. In addition, inspections of PPWSA and other authorities on safety will be conducted.
		(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?	Y	(c) Safety and health program and safety training for workers will be planned and implemented during construction works and operation of the project based on the EMP. (such as wearing safety shoes and clements during construction, following Standard Operation Procedures for the works during operation)
		(d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	Y	(d) Appropriate measures will be taken based on the EMP. (e.g., specific security guards will be assigned by contractor and PPWSA will conduct regular inspection during construction and operation)
5. Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	Y	(a) Mitigation measures on utilization of local resources (fishing), water usage/water right, traffic control, poor households, accidents (such as safety plan preparation, O/M manual etc.), air pollution (such as preventing dust by covering trucks and spraying exposed areas with water etc.), water pollution, wastes (sludge reuse methods etc.), noise and vibrations (such as application of reasonable construction schedule and methods etc.) have been proposed.
		(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?	Y	(b) The construction activities which could give adverse impacts to the natural environment (Tonle Sap River) will be at Intake site. The possible impacts were considered to be short term and very limited, however, still countermeasures for prevention (of, such as high turbidity, oil leakage and so forth) were considered.
		(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	Y	(c) Before construction starts, information will be delivered to residents and users around the Intake site. Proper construction schedule and methods to reduce traffic disruption and traffic accident will be prepared. Education of staff/workers on the safety and fire will also be conducted to reduce impacts.
		(d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?	Y	(d) Proper construction schedule and methods to reduce traffic disruption and traffic accident will be prepared.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	Y	(a) Environmental monitoring plan has been prepared and shown in the main report.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(b) What are the items, methods and frequencies of the monitoring program?	-	(b) The items, methods and frequencies of the monitoring plan is shown below. **Monitoring Parameter** / **Monitoring Parameter (method)** / **Monitoring Frequency** **During Construction Phase** Traffic: Visual observation: During working hours of every day Air quality: CO, NO_2, SO_2, O_3, Pb, TSP, PM10 and PM2.5: Once, preconstruction: Once/6 months during construction Waste: Volume of wastes: Once/week Noise: Equivalent continuous A sound level ($L_{Aeq,1h}$): Once, preconstruction: Once/6 months during construction Water pollution: pH, DO, SS, turbidity, COD, NH_4-N, Coliform: Once, preconstruction: Once/6 months during construction **During Operation Phase** Waste: Volume of wastes and disposal method: Once/month Water pollution: pH, DO, SS, turbidity, COD, NH_4-N, Coliform: Once/3 months
		(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?	Y	(c) Monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework) has been prepared and shown in the main report.
		(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	Y	(d) Monitoring format has been proposed and shown in the Annex of the main report.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Dam and River Projects checklist should also be checked.	N/A	(a) Additional intake of 0.16% of monthly minimum flowrate of the River will not have significant impacts.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	N/A	(a) The Project does not include factors in terms of transboundary or global issues.

Annex 9

ENVIRONMENTAL MANAGEMENT PLAN / ENVRIONMENTAL MONITORING PLAN / ENVIRONMENTAL AND SOCIAL MONITORING FORM

ENVIRONMENTAL MANAGEMENT PLAN

Table Mitigation Measures for Environmental and Social Impacts (During Construction)

No.	Item	Proposed Mitigation Measures	Implementing & (Inspection) Organization	Estimated Cost (USD/year)
Social/natural Environment				
1	Land use and utilization of local resources (fishing) / Biota and ecosystem	1) Design riverbank protection to prevent land erosion 2) If worker camp is needed, locate accommodation of construction workers with distance of at least 20m from Tonle Sap River. 3) Prepare temporary toilets or a septic tank for staff-worker for daily use. 4) Prepare location for fuel and fuel residue storage tanks. 5) Waste from construction activities, such as rubble from excavations, will be cleared immediately after construction 6) Educate staff-workers on the implementation of sanitary measures in the construction field.	Contractor (PPWSA & communes)	Included in construction costs
2	Existing social infrastructures and services (such as traffic etc.)	The construction of the WTP may create traffic disruption. 1) Prepare a detailed traffic control plan and to coordinate with local government. 2) Prepare proper construction schedule and methods to reduce traffic disruption and traffic accident. 3) Assign traffic control person at the entrance of the sites while construction is taking place. 4) Cooperate with the Traffic Police to facilitate traffic.	Contractor (PPWSA, Traffic Police Office, communes)	Included in construction costs
3	Infectious diseases such as HIV/AIDS	1) Prepare appropriate manning plan. 2) Educate staff/workers on the sanitation safety. 3) Set up regularly inspection etc.	Contractor (MIH/PPWSA)	Included in construction costs
4	Accidents (risk etc.)	1) Prepare appropriate construction plan. 2) Educate staff/workers on the safety. 3) Set up regularly inspection etc.	Contractor (MIH/PPWSA)	Included in construction costs
5	Biota and ecosystem			
Pollution				
1	Air pollution	1) Cover stored materials with plastic or other materials. 2) Cover trucks, and to spray exposed areas with water. 3) Wash vehicles before going out the construction site. 4) Minimize traffic over freshly exposed surfaces. 5) Install barrier walls for limiting wind dispersing if necessary. 6) Prepare air quality monitoring plan and carry it out during construction. (for details, see Environmental Monitoring Plan)	Contractor (MoE/PDE, PPWSA)	Included in construction costs
2	Water pollution	1) Steel sheet pile will be installed to prevent scouring on the bottom of the main body. 2) Carry out water quality monitoring. 3) Temporary toilets will be placed to store domestic wastewater during construction.	Contractor (MoE/PDE, PPWSA)	Included in construction costs
3	Waste	1) Prepare reasonable plan for solid waste disposal, especially for excavated soil. 2) Install temporary toilets at the construction site for workers, and set sanitary bins for domestic wastes. 3) Dispose solid wastes appropriately.	Contractor (MoE/PDE, PPWSA)	PPWSA may benefit from it (selling the wastes to buyer)
4	Noise and vibration	1) Prepare a detailed plan for noise control and coordinate with local government. 2) Prepare proper construction schedule and methods. 3) Set speed limits for vehicles and train workers on mitigation measures for environmental impacts. 4) Use low noise level equipment, if necessary.	Contractor (MoE/PDE, PPWSA)	Included in construction costs

No.	Item	Proposed Mitigation Measures	Implementing & (Inspection) Organization	Estimated Cost (USD/year)
		5) Prepare noise monitoring plan and carrying out monitoring during construction.		

Table Mitigation Measures for Environmental and Social Impacts (During O&M)

No.	Item	Proposed Mitigation Measures	Implementing & (Inspection) Organization	Estimated Cost (USD/year)
Social/natural Environment				
1	Land use and utilization of local resources (fishing) / Biota and ecosystem	1) Monitor the sources that could lead to the leakage of oil into the water body. 2) Prohibit the disposal of fuel residue into Tonle Sap River that affects both the quality of water to be used and the water quality of downstream Tonle Sap River.	Operator (MIH/PPWSA)	Included in OM costs
2	Water usage/water right	1) Monitor the water level (flowrate) of Tonle Sap River. 2) Monitor the water usage around the Intake facility.	Operator (MIH/PPWSA)	Included in OM costs
3	Accidents (risk etc.)	1) Prepare appropriate O/M plan. 2) Educate staff/workers on the safety. 3) Set up regularly inspection etc.	Operator (MIH/PPWSA)	Included in OM costs
Pollution				
1	Water pollution	1) Keep the facilities and equipment in good condition. 2) Carry out water quality monitoring for raw water and discharged water.	Operator (MoE/PDE, PPWSA)	Included in OM costs of the WTP
2	Soil pollution / Waste	1) Prepare reasonable plan for solid waste disposal, especially for sludge. 2) Thickened sludge will be transported to the landfill site by PPWSA or sold to local construction company as backfilling materials. Thus, check the volume of sludge transported.	Operator (MoE/PDE, PPWSA)	PPWSA may benefit from it (selling the wastes to buyer)

ENVIRONMENTAL MONITORING PLAN

Table Environmental Monitoring Plan

Monitoring Parameter	Monitoring Location	Monitoring Parameter	Compliance Standards	Monitoring Frequency	Implementing & (Inspection) Organization	Estimated Cost (USD/year)
Pre & During Construction Phase						
Traffic	(1) at the entrance of the WTP (2) at the entrance of the Intake facility	Visual observation	-	During working hours of each day	Contractor (PPWSA, Traffic Police Office)	Included in construction costs
Accidents	(1) at the WTP (2) at the Intake facility	Items on the checklist	-	Each day during construction	Contractor (PPWSA)	Included in construction costs
Air quality	(1) at the WTP boundary (2) at the Intake facility boundary	CO, NO_2, SO_2, O_3, TSP, PM10 and PM2.5	Sub-Decree No. 42 on Air Pollution Control and Noise Disturbance (MOE)	Once, preconstruction: Once/6 months during construction	Contractor (MoE/PDE, PPWSA)	1,500 USD / time x 2 places x (1+2) times = 9,000 USD / year
Water pollution	(1) at downstream of the Intake	pH, DO, SS, turbidity, COD, NH_4-N, Coliform	Sub-Decree No. 103 on Water Pollution Control (MOE)	Once, preconstruction: Once/6 months during construction	Contractor (MoE/PDE, PPWSA)	500 USD / time x (1+2) times = 1,500 USD / year
Waste	(1) at the WTP (2) at the Intake facility	Volume of wastes	-	Once/week	Contractor (MoE/PDE, PPWSA)	Included in construction costs
Noise	(1) at the WTP boundary (2) at the Intake facility boundary	Equivalent continuous A sound level ($L_{eq,10}$)	Sub-Decree No. 42 on Air Pollution Control and Noise Disturbance (MOE)	Once, preconstruction: Once/6 months during construction	Contractor (MoE/PDE, PPWSA)	1,500 USD / time x 2 places x (1+2) times = 9,000 USD / year
During Operation Phase						
Water usage	(1) at the Intake facility	Water level	-	Each day during operation	Operator (PPWSA)	Included in operation costs
Accidents	(1) at the WTP (2) at the Intake facility	Items on the O/M manual	-	Each day during operation	Operator (PPWSA)	Included in operation costs
Water pollution	(1) WTP discharged water	pH, DO, SS, turbidity, COD, NH_4-N, Coliform	Sub-Decree No. 103 on Water Pollution Control (MOE)	Once/3 months	Operator (MoE/PDE, PPWSA)	500 USD / time x 4 times = 2,000 USD / year
Waste	(1) at the gate of the WTP	Volume of wastes	-	In each case of disposal	Operator (MoE/PDE, PPWSA)	Included in OM costs of the WTP

ENVIRONMENTAL MONITORING FORM

M-1: [Pre-Construction Phase]

M-1-1 Air Quality

Monitoring Frequency: Once / **Implementation Schedule:** Before construction activities

Time and Date of the measurement (WTP) :_____

Time and Date of the measurement (Intake) :_____

No	Parameter	Unit	Result		Cambodian Standard (MoE)	International Std (WHO Guideline)
			WTP	Intake		
1	Carbon monoxide (CO)	mg /m^3			20 (8h ave.)	-
2	Nitrogen dioxide (NO_2)	mg /m^3			0.1 (24h ave.)	0.2 (1h ave.)
3	Sulphur dioxide (SO_2)	mg /m^3			0.3 (24h ave.)	0.02 (24h ave.)
4	Ozone (O_3)	mg /m^3			0.2 (1h ave.)	0.1 (8h max.)
5	Dust (TSP)	mg /m^3			0.33 (24h ave.)	-
6	Dust (PM10)	mg /m^3			-	0.05 (24h ave.)
7	Dust (PM2.5)	mg /m^3			-	0.025 (24h ave.)

M-1-2 Noise

Monitoring Frequency: Once / **Implementation Schedule:** Before construction activities

Time and Date of the measurement (WTP) :_____

Survey Period		Noise Level dB(A)			
		Standard (Leq)	LAeq	Lmax	Lmin
Day	6:00 - 7:00	75 (MOE, Cambodia) Int'l Std*(55-70)			
	7:00 - 8:00				
	8:00 - 9:00				
	9:00 - 10:00				
	10:00 - 11:00				
	11:00 - 12:00				
	12:00 - 13:00				
	13:00 - 14:00				
	14:00 - 15:00				
	15:00 - 16:00				
	16:00 - 17:00				
	17:00 - 18:00				
Average					
Evening	18:00 - 19:00	70 (MOE, Cambodia) Int'l Std*(55-70)			
	19:00 - 20:00				
	20:00 - 21:00				
	21:00 - 22:00				
Average					

*:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines (values are ranged because the conditions cannot be applied)

Time and Date of the measurement (Intake) :_____

Survey Period		Noise Level dB(A)			
		Standard (Leq)	LAeq	Lmax	Lmin
Day	6:00 - 7:00	75 (MOE, Cambodia) Int'l Std*(55-70)			
	7:00 - 8:00				
	8:00 - 9:00				
	9:00 - 10:00				
	10:00 - 11:00				

Survey Period		Noise Level dB(A)			
		Standard (Leq)	LAeq	Lmax	Lmin
	11:00 - 12:00				
	12:00 - 13:00				
	13:00 - 14:00				
	14:00 - 15:00				
	15:00 - 16:00				
	16:00 - 17:00				
	17:00 - 18:00				
Average					
Evening	18:00 - 19:00	70 (MOE, Cambodia) Int'l Std*(55-70)			
	19:00 - 20:00				
	20:00 - 21:00				
	21:00 - 22:00				
Average					

*:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines (values are ranged because the conditions cannot be applied)

M-1-3 Water Quality

Monitoring Frequency: Once / **Implementation Schedule:** Before construction activities

Time and Date of the measurement (Intake) :_____

No.	Parameters	Units	Downstream of Intake Site	Cambodia Std*1	International Std*2
1	pH	-		5.5-9	6-9
2	Dissolved Oxygen	mg/L		-	-
3	Suspended Solids	mg/L		100	50
4	Turbidity	NTU		-	-
5	COD	mg/L		120	125
6	Ammonia	mg/L		10	-
7	Total coliform	cfu/100mL		-	-

*1:Sub decree 103 on Water Pollution Control (MOE)

*2:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines

M-2: [Construction Phase]

M-2-1 Traffic

Monitoring Frequency: During working hours of each day / **Implementation Schedule:** During construction activities

Time and Date of the measurement (WTP) :_____

Monitoring Item	Descriptive details	Measures to be Taken
Traffic disruption		1) Arranging specific person for control the flow of traffic, 2) completing the construction works at the sections with high traffic flow as short time.

Time and Date of the measurement (Intake) :_____

M-2-1 Traffic

Monitoring Item	Descriptive details	Measures to be Taken
Traffic disruption		3) Arranging specific person for control the flow of traffic, 4) completing the construction works at the sections with high traffic flow as short time.

A9-5

M-2-2 Accidents

Monitoring Frequency: Each day / **Implementation Schedule:** During construction activities

Safety Check Sheet

Project: Project for Expansion of Phum Prek Water Treatment System	
Site:	Operator:
Date:	Time:

No.	Item	Eval	No.	Item	Eval
1	Site Security/Safety		5	Earthwork	
1-1	Perimeter fencing		5-1	Earthwork arrangement/planning	
1-2	Signage		5-2	Shoring	
1-3	Lighting		5-3	Site security/signage	
1-4	Other		5-4	Other	
2	Site cleaning/hygiene		6	Scaffold	
2-1	Site		6-1	Condition of scaffolds	
2-2	Office		6-2	Condition of foundation	
2-3	Road		6-3	Condition of supports	
2-4	Latrines		6-4	Site security/signage	
2-5	Other		6-5	Other	
3	Environment		7	Heavy equipment	
3-1	Erosion prevention		7-1	Equipment condition	
3-2	Dust prevention		7-2	Wire condition	
3-3	Dust bins/waste collection		7-3	Hoist work procedure condition	
3-4	Other		7-4	Site security/signage	
4	Protective Equipment		7-5	Other	
4-1	Helmet		8	Other Items	
4-2	Protective eyewear				
4-3	Mask				
4-4	Protective wear				
4-5	Safety harness				
4-6	Protective footwear				
4-7	Work gloves				
4-8	Other				

EVAL:	Good	o	To be improved	△	NA	/

Notes:

A9-6

M-2-3 Air Quality

Monitoring Frequency: Once/6 months / **Implementation Schedule:** During construction activities

Time and Date of the measurement (WTP) :_____

Time and Date of the measurement (Intake) :_____

No.	Parameter	Unit	Result		Cambodian Standard (MoE)	International Std*
			WTP	Intake		
1	Carbon monoxide (CO)	mg /m³			20 (8h ave.)	-
2	Nitrogen dioxide (NO_2)	mg /m³			0.1 (24h ave.)	0.2 (1h ave.)
3	Sulphur dioxide (SO_2)	mg /m³			0.3 (24h ave.)	0.02 (24h ave.)
4	Ozone (O_3)	mg /m³			0.2 (1h ave.)	0.1 (8h max.)
5	Dust (TSP)	mg /m³			0.33 (24h ave.)	-
6	Dust (PM10)	mg /m³			-	0.05 (24h ave.)
7	Dust (PM2.5)	mg /m³			-	0.025 (24h ave.)

*:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines

M-2-4 Water Quality

Monitoring Frequency: Once/6 months / **Implementation Schedule:** During construction activities

Time and Date of the measurement (Intake) :_____

No.	Parameters	Units	Downstream of Intake Site	Cambodia Std*1	International Std*2
1	pH	-		5.5-9	6-9
2	Dissolved Oxygen	mg/L		-	-
3	Suspended Solids	mg/L		100	50
4	Turbidity	NTU		-	-
5	COD	mg/L		120	125
6	Ammonia	mg/L		10	-
7	Total coliform	cfu/100mL		-	-

*1:Sub decree 103 on Water Pollution Control

*2:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines

M-2-5 Waste

Monitoring Frequency: Weekly / **Implementation Schedule:** During construction activities

Time and Date of the measurement (WTP) :_____

Monitoring item	Measurement point	Monitoring period & estimated volume	Monitoring result during report period	Countermeasure (for improvement)
(Domestic waste) Designate temporary locations for garbage collection service	a-1		Good / To be improved	
	a-2		Good / To be improved	
			Good / To be improved	
(Construction waste) Designate waste disposal point			Good / To be improved	

Time and Date of the measurement (Intake) :_____

Monitoring item	Measurement point	Monitoring period & estimated volume	Monitoring result during report period	Countermeasure (for improvement)
(Domestic waste) Designate temporary locations for garbage collection service	a-1		Good / To be improved	
	a-2		Good / To be improved	

Monitoring item	Measurement point	Monitoring period & estimated volume	Monitoring result during report period	Countermeasure (for improvement)
			Good / To be improved	
(Construction waste) Designate waste disposal point			Good / To be improved	

M-2-6 Noise

Monitoring Frequency: Once/6 months / **Implementation Schedule:** During construction activities

Time and Date of the measurement (WTP) :_____

Survey Period		Noise Level dB(A)			
		Standard (Leq)	LAeq	Lmax	Lmin
Day	6:00 - 7:00	75 (MOE, Cambodia) Int'l Std*(55-70)			
	7:00 - 8:00				
	8:00 - 9:00				
	9:00 - 10:00				
	10:00 - 11:00				
	11:00 - 12:00				
	12:00 - 13:00				
	13:00 - 14:00				
	14:00 - 15:00				
	15:00 - 16:00				
	16:00 - 17:00				
	17:00 - 18:00				
Average					
Evening	18:00 - 19:00	70 (MOE, Cambodia) Int'l Std*(55-70)			
	19:00 - 20:00				
	20:00 - 21:00				
	21:00 - 22:00				
Average					

*:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines (values are ranged because the conditions cannot be applied)

Time and Date of the measurement (Intake) :_____

Survey Period		Noise Level dB(A)			
		Standard (Leq)	LAeq	Lmax	Lmin
Day	6:00 - 7:00	75 (MOE, Cambodia) Int'l Std*(55-70)			
	7:00 - 8:00				
	8:00 - 9:00				
	9:00 - 10:00				
	10:00 - 11:00				
	11:00 - 12:00				
	12:00 - 13:00				
	13:00 - 14:00				
	14:00 - 15:00				
	15:00 - 16:00				
	16:00 - 17:00				
	17:00 - 18:00				
Average					
Evening	18:00 - 19:00	70 (MOE, Cambodia) Int'l Std*(55-70)			
	19:00 - 20:00				
	20:00 - 21:00				
	21:00 - 22:00				
Average					

*:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines (values are ranged because the conditions cannot be applied)

M-3: [Operation Phase]

M-3-1 Water level

Monitoring Frequency: Each day / **Implementation Schedule:** Throughout operation stage

Monitoring item	Time and Date	Water level	Report (In case of abnormality)
Water level at the Intake			

M-3-2 Water Quality

Monitoring Frequency: Once/3 months / **Implementation Schedule:** Throughout operation stage

Time and Date of the measurement (WTP discharged water) :_____

No.	Parameters	Units	Downstream of Intake Site	Cambodia Std*1	International Std*2
1	pH	-		5.5-9	6-9
2	Dissolved Oxygen	mg/L		-	-
3	Suspended Solids	mg/L		100	50
4	Turbidity	NTU		-	-
5	COD	mg/L		120	125
6	Ammonia	mg/L		10	-
7	Total coliform	cfu/100mL		-	-

*1:Sub decree 103 on Water Pollution Control (MOE)

*2:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines

M-3-3 Waste

Monitoring Frequency: In each case of disposal / **Implementation Schedule:** Throughout operation stage

Monitoring item	Measurement point	Date & estimated volume	Monitoring result during report period	Countermeasure (for improvement)
Designate waste disposal point	PPrWTP		Good / To be improved	

M-4: [Any Phase]

M-4-1 Complain resulting from the Project

Monitoring Frequency: As needed / **Implementation Schedule:** Throughout the Project

Subject of Complain	Content of Complain	Action Taken and Result
Component _____ Date/Period _____ By Mr./Ms._____ Contact information _____		

Annex 10 Project Data Sheet

Project Data Sheet

THE PROJECT FOR EXPANSION OF PHUM PREK WATER TREATMENT SYSTEM

1. Implementation Policy

1.1 Project Background

- The water demand in the area supplied by PPWSA is projected to be double in 2030 and capacity of existing water treatment plants (WTP/WTPs) in Phnom Penh will be insufficient to meet the demand in 2030.
- The Phum Prek WTP shall be expanded to meet the raised demand in the Phnom Penh Capital central area.
- The Government of Cambodia requested to the Government of Japan for the funds to implement the project for expansion of Phum Prek water treatment system.

1.2 Project Objectives

The objective of the Project is to supply sufficient drinking water through the expansion of Phum Prek water treatment system including raw water intake facility, and water treatment facilities, service reservoir and distribution pumping station. New raw water transmission pipes shall be installed by PPWSA.

1.3 Project Scope and Structure

The Project would be implemented by applying the Japanese Grant Aid with Operation and Maintenance (O&M), whose outline is explained in Annex 3 of Minutes of Discussions on the Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System dated 27th January 2021 in particular:

- PPWSA will be the executing agency and the implementing agency for the Project.
- The Japanese Grant Aid shall be used for construction of the facilities and procurement of equipment necessary for the Project, and the consulting service to be assigned to consultants.
- A Japanese company or a joint venture of Japanese companies (the Contractor) that shall be responsible for the design, construction, O&M of the new water treatment facilities in the Phum Prek WTP, and training services will be selected through a competitive tender.
- The Contractor shall establish a Special Purpose Company (SPC) in Cambodia before the commencement of the O&M Services.
- Contracts shall consist of (a) contract for the D&B Works, (b) contract for the operation and maintenance services, (c) contract for training services, and (d) comprehensive agreement which consolidates all the contracts above.

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- The Government of Cambodia shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Government of Cambodia with respect to the purchase of the products and/or the services be exempted or be borne by its designated authority without using the Grant and its accrued interest.

The facilities/services to be funded by the grant are as follows:

Facility: Construction of Intake Facility (47,250 m^3/day) including Power Receiving and Distribution System

Installation of Intake Pumps (2 pumps)

Water Treatment Facility: Additional facilities for 45,000 m^3/day, including power receiving and distribution facilities and chemical generation, dissolution and dozing system

Service Reservoir: 6,000 m^3

Distribution Pumping Station

Installation of Distribution Pumps (3 pumps)

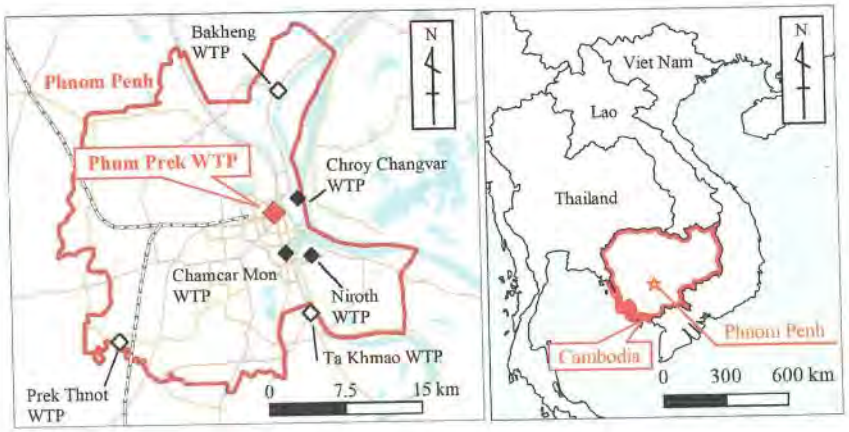
Improvement of SCADA System

Consulting Service: Tender Assistance, D&B works supervision

Among the facilities to be funded by the grant, only the Water Treatment Facility would be subject to the O&M Services by the Contractor. Payment for the O&M Contract and Training Contract shall be funded by PPWSA at its own responsibility.

1.4 Project Site

The project sites are existing Phum Prek raw water intake site and the existing Phum Prek Water Treatment Plant site as shown in the Figure below.



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1.5 Project Schedule

Bidding Schedule

Item \ Month			1	2	3	4	5	6	7	8	9	10	11
E/N	▲												
G/A		▲											
Contract for the Consultant			■										
PQ Documents Preparation				■									
P/Q Documents Approval					■								
P/Q Announcement					▲								
P/Q					■								
P/Q Evaluation and Reporting						■							
Bidding Documents Preparation				■	■	■							
Bidding Documents Approval						■	■						
Bid Announcement							▲						
Bidding Document Distribution							▲						
Bidding Period							■	■	■				
Bid Open (Technical)										▲			
Technical Bid Evaluation, Approval										■	■		
Bid Open (Price)												▲	
Approval of Bid Result												■	
Contract for the Contractor													■

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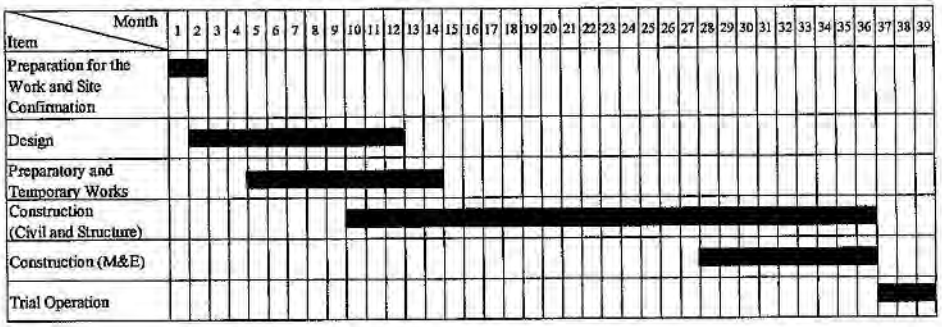
Construction Schedule



1.6 Bidding Procedure

- The bidders must be "Japanese nationals", in principle.
- Quality and Cost Based Selection (QCBS) that includes technical and financial evaluation will be applied for the bidding.
- Scope of evaluation includes D&B works, O&M services, and training program.
- Comprehensive evaluation would be carried out such that:

Comprehensive Evaluation Score = Technical Score * X + Price Score * (1-X)
where X is a weight factor 1>X>0 (In this stage the Consultants propose 0.5 as used in the preceding Ta Khmau Project.)

Technical Score (example)

No.	Category	Score
1	Organization and Management	TBD
2	Conceptual Design (Process, Facilities and SCADA System)	TBD
3	Construction Plan and Schedule	TBD
4	Quality Control and Assurance	TBD
5	Health and Safety / Environmental Management	TBD
6	O&M Plan	TBD
7	Training Plan	TBD
Total		100

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Price Score (example)

The tenderer bids on total cost of the Project to PPWSA such that:

Bid Price = D&B price + Net present value of bulk water payment

Price score = Lowest Price / Price of the Tenderer * 100

Subject to:

(1) D&B price shall be below the Grant budget applicable to the D&B contract.

(2) Bulk water price shall be below the ceiling prices set by PPWSA.

For the training services, PPWSA shall describe its requirements and fixed price for the Contractor's proposal for which the Contractor shall propose the detailed training program. The price of the training program consequently would not be subject to price evaluation.

1.7 Prequalification

Prequalification will be conducted as part of bidding process. Qualification criteria and requirements will include the following.

- A bidder (in case of Joint Venture, all the members combined) shall have track record of at least three (3) construction works with each contract price not less than 1.5 billion Japanese Yen during the last ten years, executed overseas.
- It shall also have track record of at least two (2) experiences of construction work of water treatment facilities for drinking water with a capacity of 10,000 m^3/day or more, either in domestic or overseas.
- A SPC shall be 51% or more owned by Japanese companies which participate in the bidding and have at least KHR1,200,000,000 paid capital.

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2. Client's Requirements

2.1. Preconditions

2.1.1. Construction Area

The construction sites are existing Phum Prek raw water intake site and the existing Phum Prek Water Treatment Plant site as shown in the Figure below.

2.1.1.1. Intake Site

The construction site of raw water intake is approx. 100 m wide facing and along the Sap River as shown on the Figure below.

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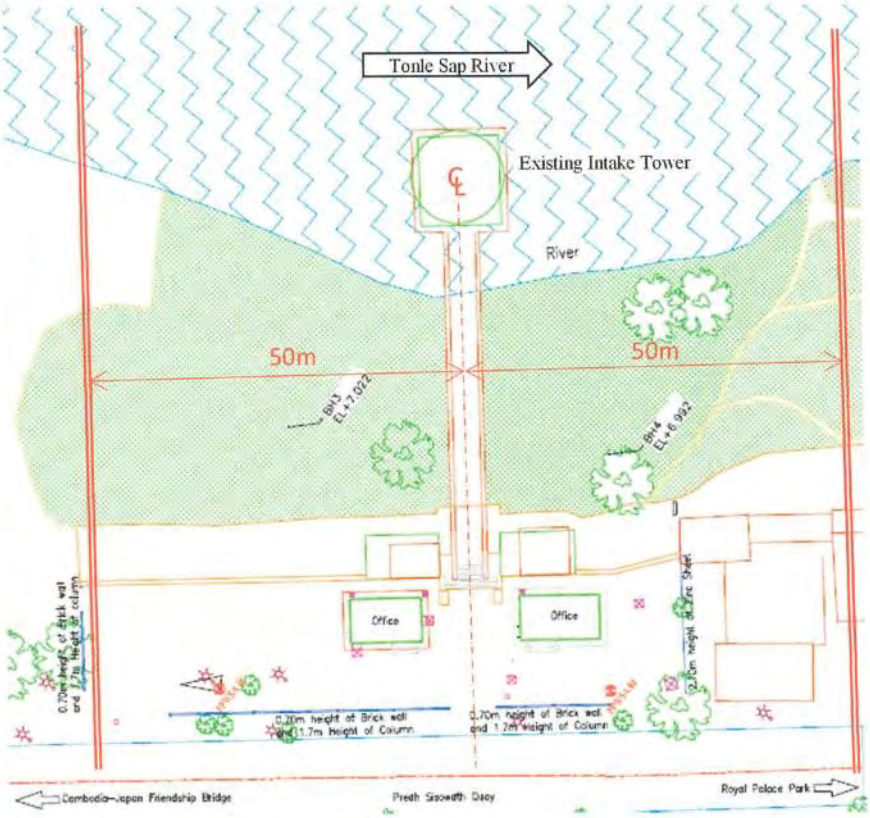

A photo describing current situation at downstream side of existing intake tower is shown in below.

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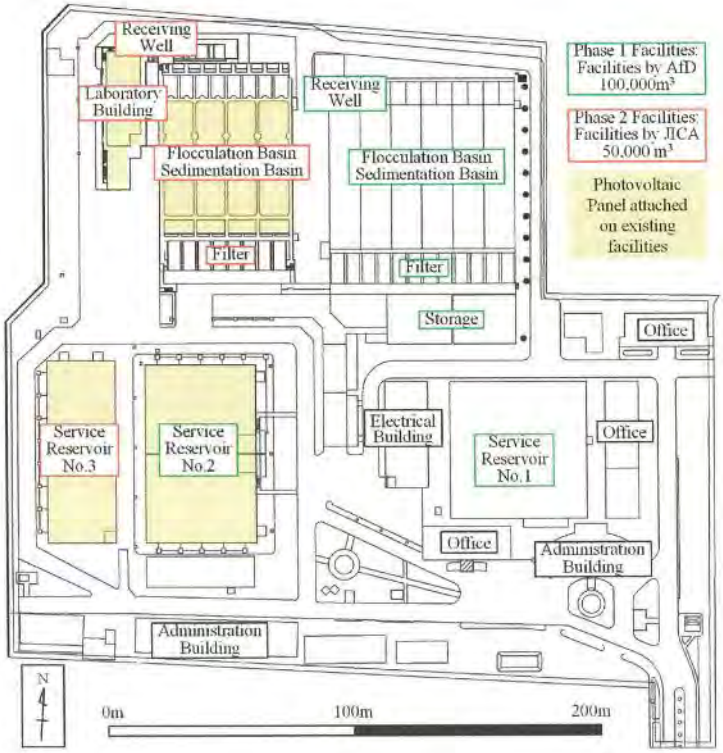
New 800mm transmission pipeline shall be constructed by PPWSA for the new water treatment facilities by the time the Contractor completes the construction before commencement of trial operation (as planned by December 2026).

2.1.1.2. Water Treatment Site

The construction site of water treatment plant is within the existing Phum Prek Water Treatment Plant.

The existing facilities in the Phum Prek Water Treatment Plan is shown on the Figure below.



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There are existing facilities of 2 phases listed as below.

A. Phase 1 Facilities of 100,000 m^3/day (1959)

a) Receiving Well
b) Mixing well
c) Sedimentation basin
d) Rapid sand filter
e) Service Reservoir No.1 (10,000 m^3)
f) Service Reservoir No.2 (10,000 m^3)

B. Phase 2 Facilities of 50,000 m^3/day (2003)

a) Receiving Well
b) Mixing well
c) Sedimentation basin
d) Rapid sand filter
e) Service Reservoir No.3 (5,000 m^3)
f) Pumping Station

C. Other Facilities

a) Administration Building
b) Chemical Building
c) Storage
d) Canteen
e) Work Offices
f) Others

The room for the construction of new facilities of 45,000 m^3/day are as shown in the Figure below.

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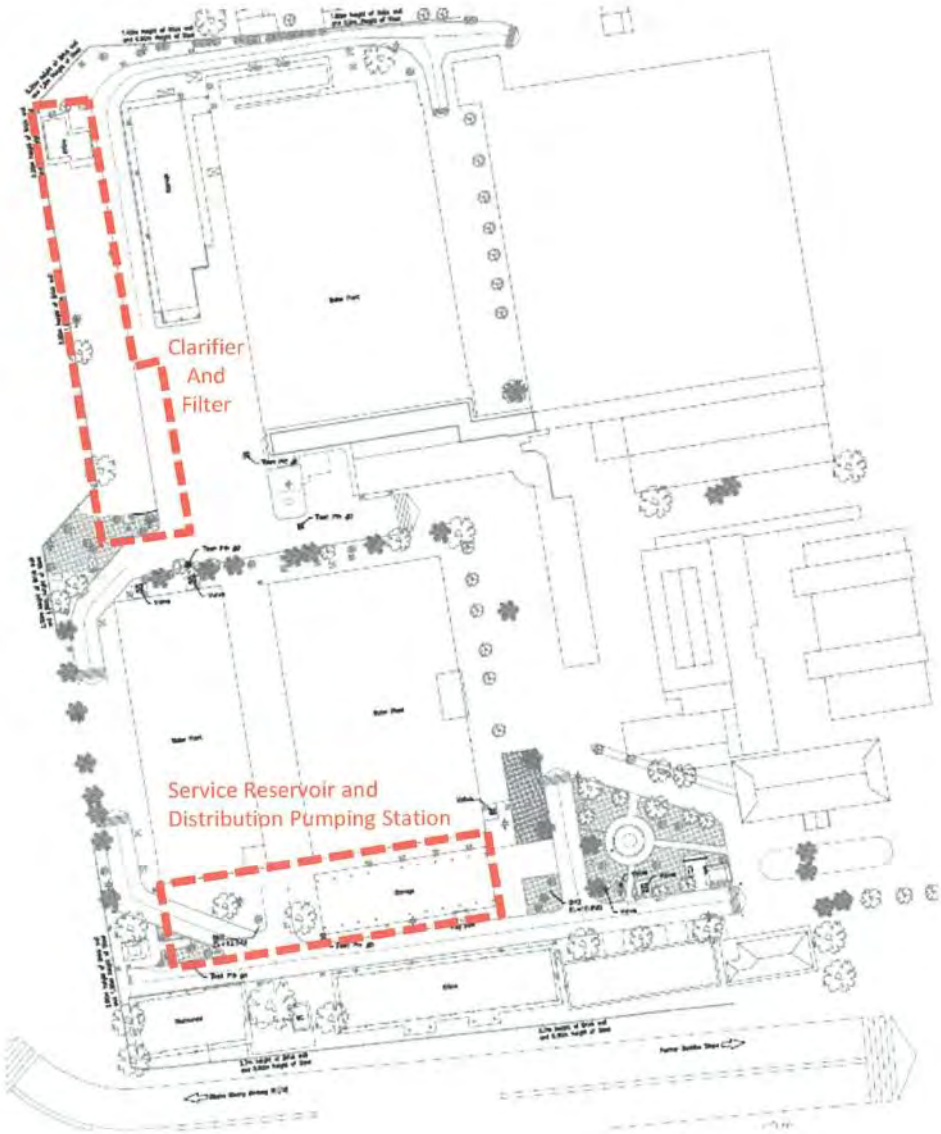

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A photo describing current situation around proposed clarifier and filter facilities is shown below.

A photo describing current situation around proposed distribution facilities is shown below.

The existing Water Treatment facilities (Phase 1 (100,000 m^3/day facilities) and Phase 2 (50,000 m^3/day facilities) will be used as it is. The New facilities will be constructed in the rooms of the Phum Prek WTP.

New 800mm transmission pipeline shall be constructed by PPWSA for the new water treatment facilities by the time the Contractor completes the construction before commencement of trial operation (January 2026).

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2.1.2. Raw Water Quality

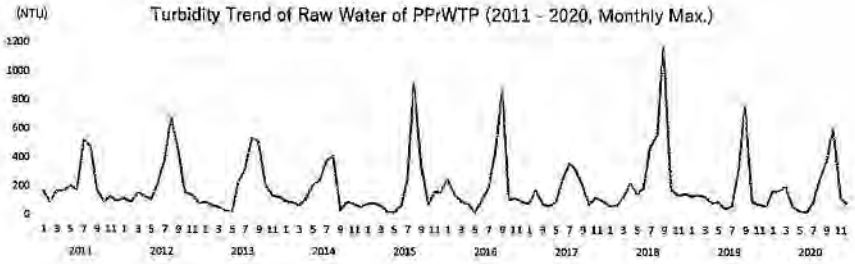
Raw water source shall be Tonle Sap River.

The raw water quality recorded at Phum Prek WTP during 2017-2020 shows following characteristics.

- pH is relatively high with the lowest values continuously over 7.0. On the other hand, highest values are slightly over 8.0 even in the late dry seasons (Dec.-Apr.) when sunshine duration is longer and the photosynthesis by phytoplankton is actively carried out.
- Turbidity lowers in the dry seasons with the values from 20 to 100NTU. It increases in the wet seasons with the values over 200NTU in many cases and over 1,000NTU in some cases. Since the turbidity values shifts in a wide range, it is required to adjust the dosage rate of the coagulant accordingly.
- Alkalinity shifts in a high range and does not lower than 20mg/L even in the lowest months. Thus, no problems for water quality management are expected as long as PAC (which does not consume much alkalinity) is used as coagulant.
- Ammonium nitrogen (NH4-N) shifts from <0.1 to 1.2mg/L with various trends in different months. This shift makes the forecast so difficult that the attention should be kept because the concentration of NH4-N affects the chlorination operation.

Followings are summary of raw water turbidity of Phum Prek WTP during 2011-2020.

- Average Turbidity in Dry Season: 70NTU
- Average Turbidity in Wet Season: 122NTU
- Average Turbidity over 10 years: 100NTU
- Maximum Turbidity over 10 years: 1163NTU
- Minimum Turbidity over 10 years: 7NTU



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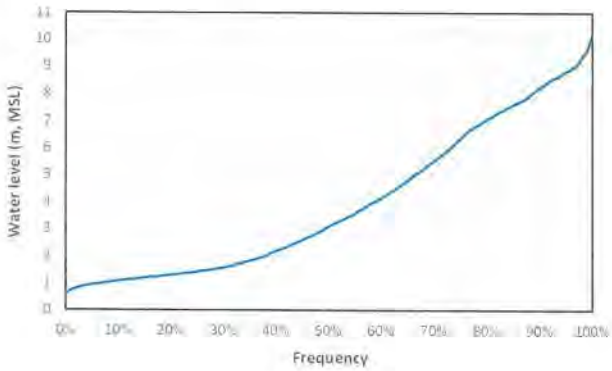
2.1.3. Water Level of Tonle Sap River

In Tonle Sap River, the minimum, the average and the maximum water level are 0.52, 3.93 and 10.16 (m AMSL) respectively. And the frequency is shown below.



2.2. Client's Requirements

2.2.1. Requirement for the D&B Works

2.2.1.1. Requirement of Water Treatment Capacity and Service Reservoir Capacity

Design Plant Treatment Capacity: 47,250 m^3/day.
Design Plant Production Capacity: 45,000 m^3/day.
Service Reservoir Capacity: 6,000 m^3

2.2.1.2. Treatment Loss

Treatment Loss is less than 5%.
Intake Quantity = Treated Water Quantity (for entire production capacity of 45,000 m^3/day) x 1.05 =47,250 m^3/day

2.2.1.3. Water quality test during O&M

The Contractor may outsource and pay for water quality test for treated water to confirm compliance with national drinking water standard to PPWSA, or install its own facility or laboratory to conduct their own water quality test.

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2.2.1.4. Intake Facility

The requirements for the new raw water intake facility are:

1. Raw water intake facility of 47,250 m^3/day
2. 1 VFD pump to supply for 47,250m^3/day new facilities, 1 VFD pump is standby for all facilities.
3. Pump Type is double suction horizontal centrifugal type.

2.2.1.5. Water Treatment Facility

New Water Treatment Facilities of 45,000 m^3/day comprising:

a) Coagulation system
b) Flocculation and sedimentation system; and
c) Filter system

2.2.1.6. Service Reservoir and Distribution Pumping Station

New Service Reservoir of 6,000 m^3 and Distribution Pumping Station

2.2.1.7. Distribution Pumps

3 VFD pumps (29 m^3/min, Head 42m, 280kW) for new service reservoir

2.2.1.8. Chemical

a) Coagulant : PAC is dissolved in the solution tanks at new facilities.
PAC is injected by feeding pump.
Injection point : Mixing well

b) Disinfectant : Sodium hypochlorite (NaClO) is generated by On-Site generator
NaClO is injected at Mixing well by feeding pump.
Injection points : Receiving well, Outlet of Sedimentation, Outlet of Filter

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2.2.2. Requirement for the O&M Services

2.2.2.1. Requirement of Treated Water Quantity

The Contractor shall make best efforts to produce water 45,000 m^3/day. The Contractor shall also request a meeting to PPWSA in case the actual production amount is varied from the production plan which shall be submitted to PPWSA in advance.

2.2.2.2. Requirement of Treated Water Quality

The water quality standards which the Contractor should meet the Cambodia National Drinking Water Quality Standard. The daily test items shall be analyzed by PPWSA in the laboratory in the Phum Prek WTP, and quarterly and yearly test items shall be analyzed by PPWSA too. Turbidity of treated water should be 1 NTU or less. The Contractor would not be required to treat trihalomethane precursors and odor substances.

Items to be Analyzed and Recorded in Phm Prek WTP	Parameter	Parameter			Exception	Formal Monitoring Examination level		
		Unit	Permissible limite			A	B	C
			National Drinking water Standard	Requirement for New Facilities		Daily	Quarterly	Annually
	Microbial							
	E.Coli or thermoteloerant	CFU or MPN / 100 ml	0	0			B	
	Chemical							
	Aluminium (Al)	mg/l	0.2	0.2	in the case that alum is used		B	
	Ammonia (NH_3)	mg/l	1.5	1.5			B	
	Arsenic (As)	mg/l	0.05	0.05	for the case of groundwater source			C
	Barium (Ba)	mg/l	0.7	0.7				C
	Cadmium (Cd)	mg/l	0.003	0.003				C
	Chloride (Cl^-)	mg/l	250	250			B	

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Items to be Analyzed and Recorded in Phm Prek WTP	Parameter	Parameter			Exception	Formal Monitoring Examination level		
		Unit	Permissible limite			A	B	C
			National Drinking water Standard	Requirement for New Facilities		Daily	Quarterly	Annually
●	Chlorine Cl_2 * (free residual)	mg/l	0.1-1.0	1.5	for the case of using chlorine for disinfectant	A		
	Chromium (Cr)	mg/l	0.05	0.05				C
	Copper (Cu)	mg/l	1	1	for the case that household plumbing uses copper pipes			C
	Fluoride (F)	mg/l	1.5	1.5	for the case of groundwater source			C
	Total hardness as $CaCO_3$	mg/l	300	300	for the case of groundwater source		B	
	Iron (Fe)	mg/l	0.3	0.3	case of groundwater		B	
	Lead (Pb)	mg/l	0.01	0.01				C
	Manganese (Mn)	mg/l	0.1	0.1	case of groundwater		B	
	Mercury (Hg)	mg/l	0.001	0.001				C
	Nitrate (NO_3^-)	mg/l	50	50			B	
	Nitrite (NO_2^-)	mg/l	3	3			B	
	Sodium (Na)	mg/l	250	250	case at coastal areas			C
	Sulfate ion (SO_4^{2-})	mg/l	250	250			B	
	Zinc (Zn)	mg/l	3	3				C
				Physical				
●	Colour	TCU	5	5		A		
●	pH	n/a	6.5-8.5	6.5-8.5		A		
●	TDS or Conductivity	mg/l or µS/cm	800 or 1600	800 or 1600		A		
●	Turbidity	NTU	5	1		A		

Annex 10 Project Data Sheet

Items to be Analyzed and Recorded in Phm Prek WTP	Parameter	Parameter			Exception	Formal Monitoring Examination level		
		Unit	Permissible limite			A	B	C
			National Drinking water Standard	Requirement for New Facilities		Daily	Quarterly	Annually
●	Taste and Odour	-	Acceptable	Acceptable		A		

*Residual chlorine must be daily analysed in production system and fortnightly (two weeks) at end points of networks (water supply system with more than 3001 connections). The number of samples is dependent on situations of end points of networks of each unit or service provider. We can analyse thermoteloerant coliform bacteria for E Coli.

**Conductivity is an acceptable alternative to TDS. The above limits assume that Conductivity is twice TDS, but this relationship should be confirmed at each site if conductivity is used.

*** Whether the analysis of taste and odour by operators is acceptable depends on users.

Source: National Drinking Water Quality Standard (MISTI)

Annex 10 Project Data Sheet

2.2.2.3. Work to Be Done by the Contractor

The works to be done by the Contractor shall include the following.

1. Design of New 45,000 m^3/day Water Treatment Facilities and 6,000 m^3 Service Reservoir and Distribution Pumping Station
   (a) Preliminary Design
   (b) Detailed Design
   (c) Application Work for Design
   (d) Laws and Regulations to be complied.
2. Construction of New Facilities
   (a) Civil and Equipment Works
   (b) Plant Mechanical Work
   (c) Plant Electrical Work
   (d) Application Work for Construction
3. Operation and Maintenance of New Facilities
   (a) Water Quality Control
   (b) Treated Water Volume Control in case required by PPWSA
   (c) Monitoring and Control of New Facilities
   (d) Maintenance and Repair
   (e) Management of Power Receiving, Water Use and Fuel / Chemical Storage and Safety
   (f) Cleaning
   (g) Security and Safety
   (h) Emergency Action
4. Hand-Over Work at the End of the O&M period
   (a) Performance Tests of WTP
   (b) Asset Check and Evaluation

2.2.2.4. Reporting Obligations

Following submittals shall be provided by the Contractor. Detail shall be provided in later stage

(a) At the time of work commencement
   (i) Work commencement application
   (ii) Design, Construction and Operation Plan
   (iii) Organization structure for the operation
(b) Design and Build period
   (i) Record and report related to construction works including progress record
   (ii) Draft of system operation manual and procedure

(iii) Draft of Operation and Maintenance Manual
(iv) Draft of Self-monitoring Report
(v) Modification and additional work confirmation report
(vi) Social and environmental monitoring
(vii) Commissioning reports

(c) At the time of hand-over
(i) Completion report or substantial completion certificate and list of outstanding works
(ii) Final system operation manual and procedure
(iii) Final operation and maintenance manual
(iv) Final self-monitoring reports template

(d) During operation period
(i) Social and environmental monitoring
(ii) Monthly report including self-monitoring report

(e) At the time of hand-back
(i) Performance check list of the facilities.
(ii) Remaining book value calculation and confirmation sheet.
(iii) Purchase agreement of the Contractor's facilities, if any.
(iv) Letter of Waiver of claims and liens and release of rights relating this project from PPWSA to the Contractor.

(f) At the time of Expiration of warranty against defect period
(i) Report on Expiration of Warranty against Defect Period

2.2.3. Requirement for the Training Services

The detailed program shall be proposed by the Contractor within the annual budget set by PPWSA. The following are the examples for the Contractor's proposal:

1. Data Analysis (Basic and Advanced)
2. Water Quality Analysis and Management
3. Maintenance of Electrical Equipment for Monitoring and Control
4. Preventive Maintenance

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FIELDS	OBJECTIVES	TARGET TRAINEES	MAIN SUBJECTS
Data analysis and evaluation (Basic)	To raise the level of basic skills for using operational records and other data. Be able to extract points to be improved in business operations.	Almost all department. Staff in charge of compiling data	- Basic statistics for data analysis - Validity evaluation of data - Monitoring and evaluation of operational data and extraction of improvement proposals (exercise)
Data analysis and evaluation (Advanced)	Be able to evaluate projects based on data and extract recommendations for improving O&M.	Staff In charge of data analysis in Planning & Project Dept., Production & Distribution Dept, Accounting & Finance Dept.	- Basic statistics for data analysis - Validity assessment of data - Evaluation of performance-based projects - Extraction of improvement recommendations through analysis of O&M records (exercise). Cases: electricity consumption data that can be used to evaluate the efficiency of individual pumps, analysis and comparison of electricity consumption by WTP, analysis of production unit costs by WTP, consideration of proper arrangement of a responsible WTP to each demand area, and reflection of the results of the functional evaluation of each equipment into updating the maintenance plan.
Water quality analysis	To strengthen capacity of water quality analysis (including accuracy control)	Staff in laboratories	- Improvement of water quality analysis parameters, monitoring points, frequency, etc. (basic theory) - Review of water quality analysis procedures and updating of SOPs (OJT) - Risk management (ISO17025) (basic theory, OJT) - Management of analytical instruments (calibration, accuracy control) (basic theory, OJT) - Disposal management of laboratory waste (basic theory)
Water quality management	to strengthen the capacity for water quality management (strengthen the capacity for data verification of water quality monitoring results, analysis, reflection on water treatment, and study of countermeasures).	Office in charge of water quality management	- Advice on improvement of O&M of WTPs based on water quality analysis results (basic theory, exercises) - Examination of emergency response and formulation of SOPs - Examination of the adequacy of monitoring items on water treatment (SOP review) - Analysis of water quality changes in the distribution area (OJT)
Maintenance of Mechanical and Electrical Equipment	To secure specialized personnel to maintain and manage mechanical and electronic equipment for monitoring and control.	Specific staff in charge of maintenance of electronical facilities	- Basics of equipment for monitoring and control - Maintenance of automatic measurement equipment (exercise) - Review of SOPs (OJT)
Preventive maintenance and asset management	To strengthen preventive maintenance by using maintenance information.	Staff in charge of maintenance of electrical and mechanical facilities	- Fixed asset management based on maintenance records. (including a systematic maintenance management plan) - Preparation of documents for maintenance work: Maintain asset ledgers, compile technical documents, manuals, as-built drawings, periodic inspection records, repair history, etc. - Preventive maintenance of pumps; evaluation based on O&M records. Evaluation of pump efficiency and speed control (Variable Speed Drive: VSD)

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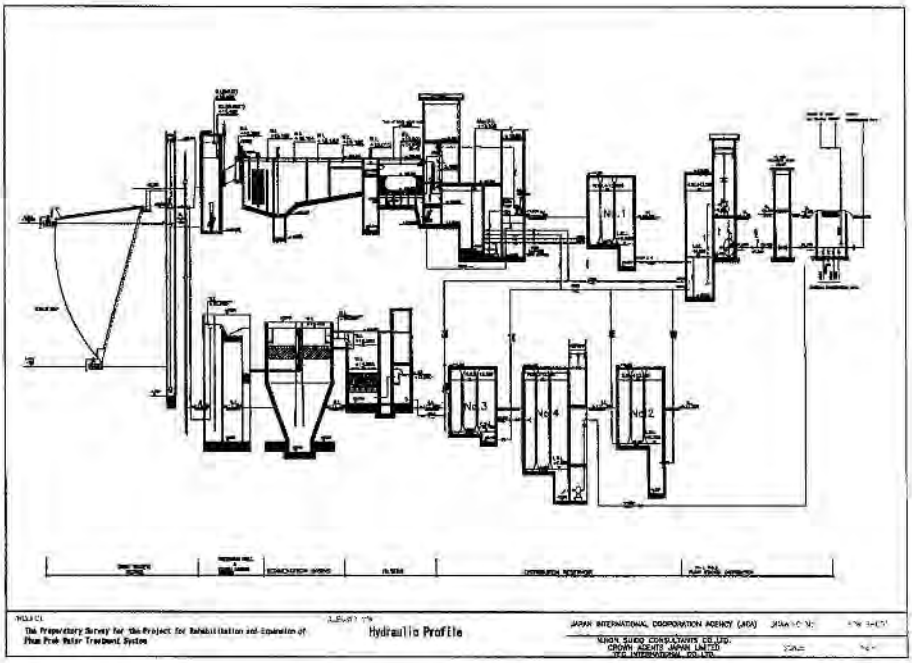
3. Comparator Facility Design

The Comparator Facility Design has been prepared by the Consultant only for the purposes of 1) cost estimates for the Grant and 2) reference documents to the potential bidders. Design works shall be done by the Contractor in accordance with the Client's Requirements during implementation phase.

Drawing List Drawing No,

	DRAWING No,	DESCRIPTION
-	PPWTP-001	Hydraulic Profile
-	PPWTP-010	Block Flow Diagram
-	PPWTP-101	Intake Facility Layout
-	PPWTP-111	Intake Facility
-	PPWTP-201	Raw Water Pipe
-	PPWTP-301	Water Treatment Facility Layout
-	PPWTP-311	Receiving Well & Mixing Channel
-	PPWTP-321	Clarifier
-	PPWTP-331	Rapid Sand Filter
-	PPWTP-341	No.4 Clear Water Reservoir & Distribution Pumping Station



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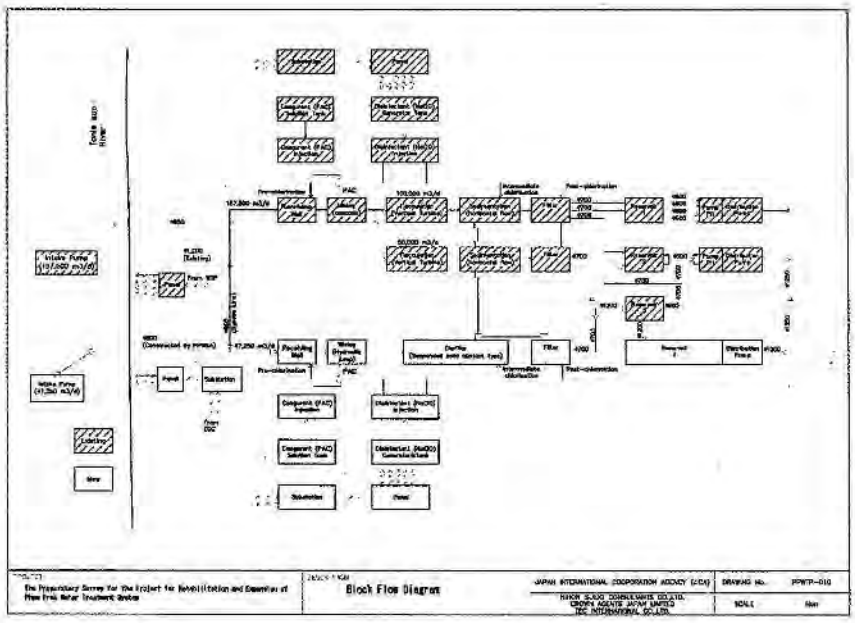

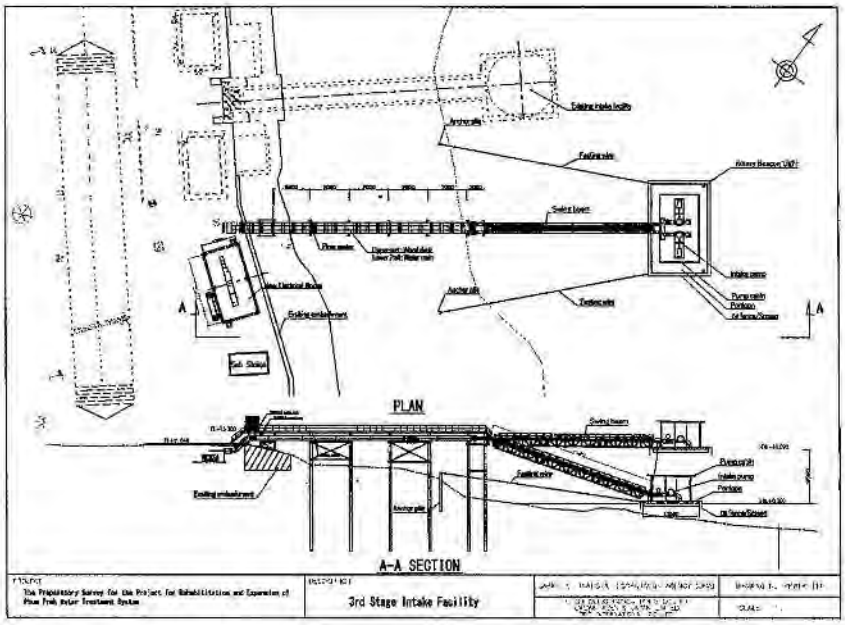

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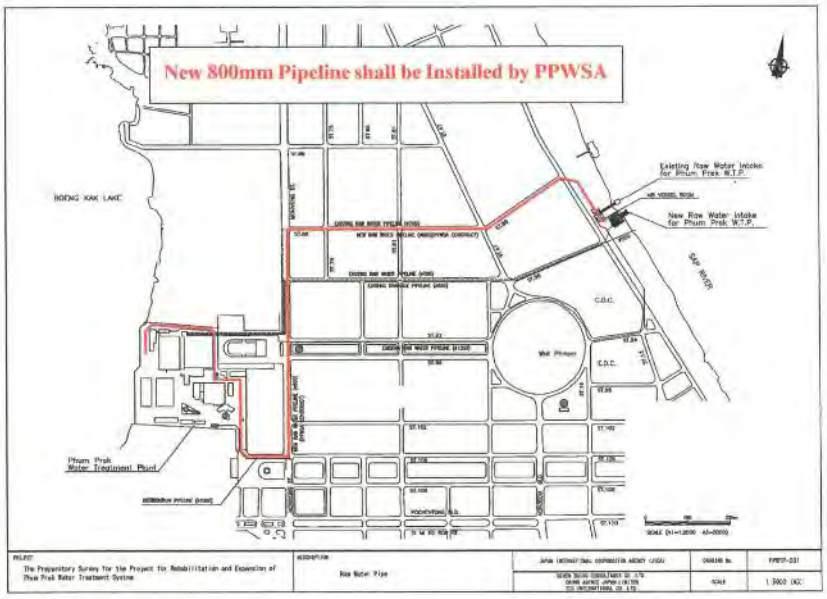

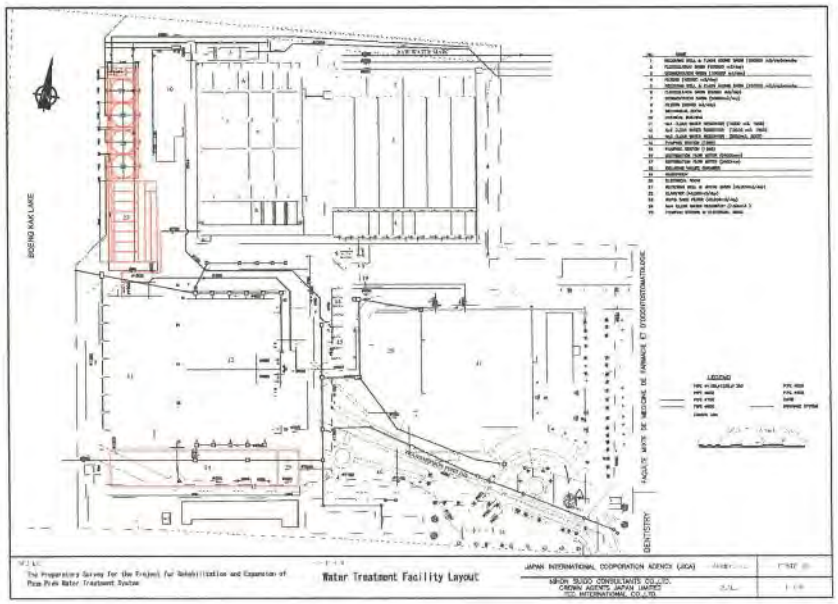

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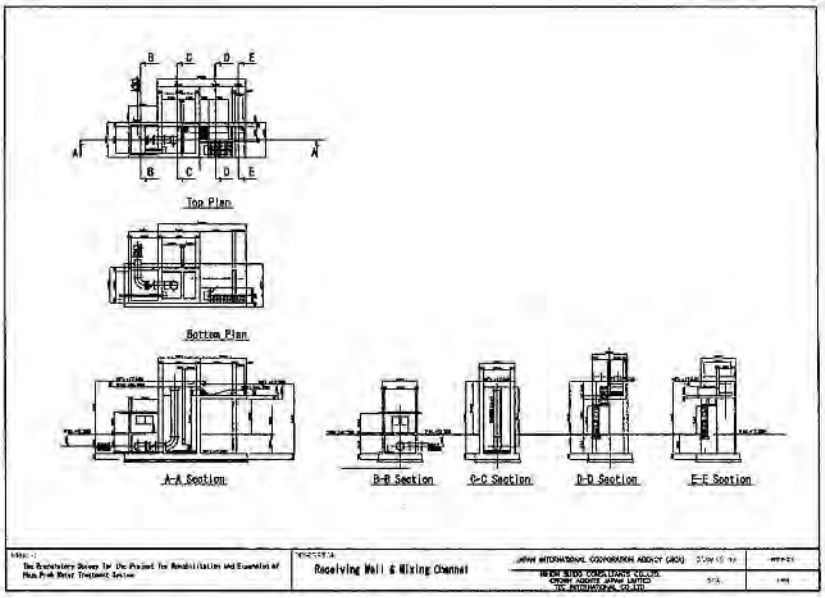

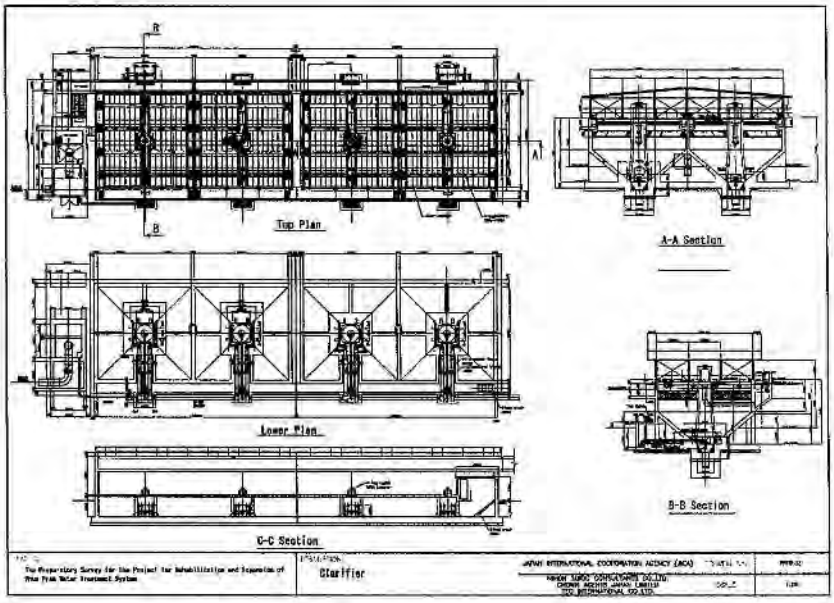

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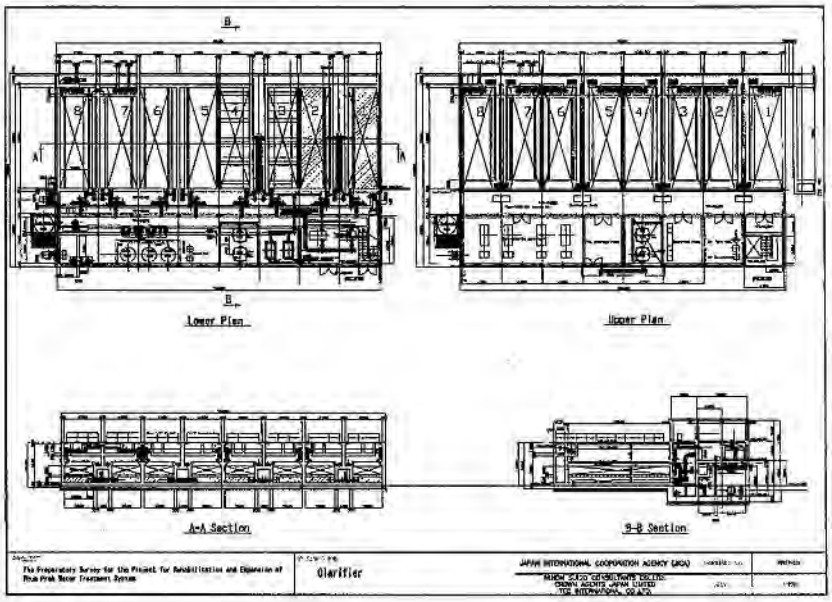

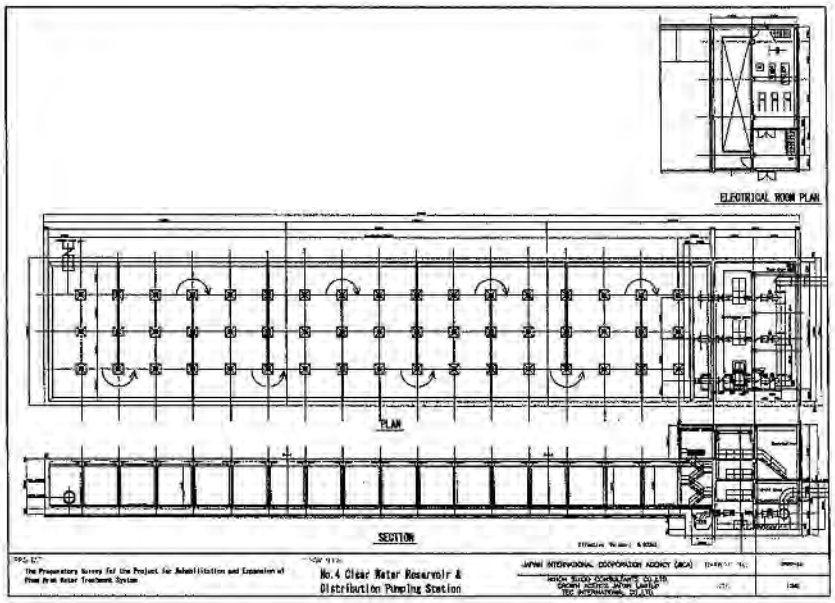

Annex 10 Project Data Sheet

Summary of Outline Design of Comparator Facility as for Reference

3.1. Intake Facility

Type:	Pontoon with Swing beam
Water source;	Sap river
Water level:	L.W.L +0.500m (aMSL)
	H.W.L +10.200m (aMSL)
Total intake capacity:	47,250 m^3/day
Swing beam length:	Approximately 30m
Intake pump Type:	Horizontal double suction volute pump with flywheel
	Volume 33m^3/min.
	Head 24m
Number:	2sets (1 duty + 1stand by)
Equipment:	Fixed coarse bar screen
Power Receiving:	2 feeder line (3-phase, 3-wire, 22kV)
	Transformers (2 nos., 22/0.38kV, 50Hz)

3.2. Water Treatment Facility

Inlet water:	Q= 47,250 m^3/day
Product water:	Q= 45,000 m^3/day

3.2.1. Receiving Well

Dimension:	width 3.2 m x length 3.8 m x depth 7.65 m
Detention time:	0.62 min.
Water level:	W.L +16.950 m (aMSL)

3.2.2. Mixing Basin

Method:	Hydraulic jump

3.2.3. High-rate Sedimentation

Type:	Sludge contact type with tube settler
Number:	4 basins
Upflow velocity:	75 mm/min.
Detention time:	61 min

3.2.4. Rapid Sand filter

Type:	Natural balancing gravity type rapid sand filter
Dimensions:	Width 3.5 m x Length 12 m

Annex 10 Project Data Sheet

Number:	8 basins
Filtration rate:	148 m/day (8 on duty)
	170 m/day (7 on duty ,1 back wash or at rest)
Filter layer:	Sillica Sand (e.s Φ1.0 mm U.C less than 1.7)
Underdrain system:	Plastic block with lateral type
Wash system:	Combine with air scouring and backwash
Air scouring velocity:	0.9m/min
Back wash velocity:	In weak stage 0.1 - 0.15 m/min.
	In strong stage 0.20 - 0.30 m/min.

3.2.5. Clear Water Reservoir

Effective Volume:	6,000m^3
Number:	1 basin
Water level:	L.W.L +8.400 m (aMSL)
	H.W.L +13.200 m (aMSL)
Effective depth:	H= 4.8 m
Distribution pump:	Type Horizontal double suction volute pump
	Volume 29.0 m^3/min.
	Head 42 m
Number:	3 sets (3 duty)

3.2.6. Chemical Facility

Chemical:	Poly aluminum chlorite (effective Al_2O_3:10% liquid)	
	Dosing point:	Receiving well
	Generated hypochlorite (effective CL2:1%)	
	Dosing point:	Pre. Receiving well
		Mid. Sedimentation treated water channel
		Post Filtration treated water channel
Chemical supply method:	From new chemical production facilities of SPC	
Dosing method:	Diaphragm metering pump	

3.2.7. Power Receiving and Distribution

Power Receiving:	2 feeder line (3-phase, 3-wire, 22kV)
	Transformers (2 nos., 22/0.38kV, 50Hz)

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3.2.8. SCADA System

Component equipment:	Industrial personal computer 3set
	SCADA software
	PLC
	MODEM
	Router/L2/L3
Number of I/O point:	around 3000
Automatic control target:	pump speed (Distribution pressure) PID

Major Monitoring Items

1) River water level
2) Pump pit water level
3) Intake pump flow rate control settings
4) Intake water flow rate
5) Chemical injection amount
6) Filtering head
7) Filtration water flow rate
8) No.4 Reservoir water Level
9) Distribution pump pressure control settings
10) Distribution pressure
11) Distribution flow rate
12) Water quality measurement data

Annex 10 Project Data Sheet

4. Contract Terms

4.1 Scope of Contracts

Contract	Scope of works/services
D&B Contract	Intake Facility, Raw Water Pumps, Water Treatment Facility, Service Reservoir, and Distribution Pumping Station, Distribution Pumps, SCADA, Power Receiving and Distribution Facilities for New Intake and Water Treatment Facilities, Chemical Generation, Dissolution and Dozing System
O&M Contract	Water Treatment Facilities
Training Contract	Trainings

The D&B Contract shall be prepared by the Consultant in accordance with FIDIC yellow book and JICA's standard form of contract and guidelines.

4.2 O&M Contract

4.2.1 Contract Terms

The O&M Contact terms are stipulated below:

	Contract Terms	Conditions
1	**O&M period**	Upon the completion, the ownership of the facility will be transferred from the Contractor to PPWSA, then PPWSA and the Contractor will agree the O&M contract for 10 years after commencement O&M on the facilities owned by PPWSA.
2	**Production of bulk water**	Production of treated bulk water is fundamentally a responsibility of the Contractor.
3	**Payment mechanism and price of bulk water**	As stipulated on a separate sheet
4	**VAT on the payment**	The Services, which consists, among others, of the supply of clean water, to be discharged by the Contractor most likely falls within the purview of the relevant Cambodian tax laws, including the Prakas No. 690 MEF.P dated 25 June 2015 on the Implementation of Value-Added Tax on Clean Water Production and Supplies to People, and the Prakas No. 559 dated 25 May 2017 on the Implementation for VAT on Non-Taxable Supplies, including its amendment or replacement, as a non-taxable supply and the Contractor shall not collect value added tax ("VAT") in its provision of the Services to PPWSA.

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		Notwithstanding application of These Prakas, in the event the Cambodian tax authority deems the Services a taxable supply for the purpose of VAT, and the Contractor is required to issue invoices with the applicable VAT, PPWSA shall promptly pay the invoiced amount which shall include VAT.
5	**Water quality testing and control**	- The Contractor may outsource and pay for water quality test for treated water to confirm compliance with national drinking water standard to PPWSA, or install its own facility or laboratory to conduct their own water quality test.
6	**Repairment**	During O&M period, the Contractor may use the facility free of charge, however, the Contractor shall be responsible for any repairment of the facilities at its own cost. the Contractor shall keep good conditions of the facility and equipment in accordance with the requirements set by PPWSA.
7	**Conditions for the hand-back**	- After the end of O&M period, PPWSA has the right to be handed back the facility from the Contractor under certain requirements. - The Contractor shall remove any additional facilities or equipment installed for its operation and restore the WTP to its initial condition at its own cost, if required by PPWSA. - PPWSA has the right to purchase any remaining inventories (e.g. parts and/or raw materials) at their book value.
8	**Private investment**	The Contractor may invest in some additional facilities, software, or any other equipment necessary for the operations. PPWSA has the right to purchase the private investments from the Contractor at their residual value (net book value) at the end of O&M period.
9	**Self-monitoring**	The Contractor shall monitor and report to PPWSA its operation in accordance with the requirements set by PPWSA.
10	**Operation data and financial information**	The Contractor shall record and report all the operation data and financial information in a required format. PPWSA may utilize the data to continue operation of the facility after hand-back.
11	**Early termination / compensation events**	- Termination for convenience (Unilateral termination) PPWSA has the right to terminate the contract early for public interest. In this case the Contractor shall be compensated in full, for all the private investments, inventories and additional costs incurred by the termination of the contract, and opportunity costs for the equity. Opportunity costs for the equity shall be a sum of net profit for the remaining contract period based on the Contractor's initial financial plan initially agreed in the contract. - Termination for default by PPWSA The termination condition shall be in line with the case of the termination

Annex 10 Project Data Sheet

		for convenience. - Termination for default by the Contractor PPWSA shall have the option to require the Contractor to transfer to PPWSA all of its right, title and interest in and to the assets and inventories. The value of the assets and inventories shall be net book value of the assets minus cost of damages and losses suffered by PPWSA due to the termination of the contract. - Termination for Force Majeure A Force Majeure is an event that is external, unpredictable, and irresistible and has a significant impact on the project. Both parties may terminate the contract if the impact of a Force Majeure lasts for 180 days. Neither party has any obligation to each other for the cost of mitigation measures to prevent increasing loss caused by Force Majeure. PPWSA shall have the option to require the Contractor to transfer to PPWSA all of its right, title and interest in and to the assets and inventories. The value of the assets and inventories shall be net book value of the assets.
12	**Invoice settlement**	The Contractor shall report and charge to PPWSA by the 10 days of each month for the bulk water produced in the previous month. PPWSA shall in return review the invoice and make payment within one month after the invoice receiving date. Currency to be used for the invoice settlement shall be Cambodian Riel.
13	**Staff employment**	1) PPWSA may take over the employment contracts from the Contractor at the end of O&M period.
14	**Insurance policy**	Unless required by the law, the Contractor shall have no obligation to obtain or subscribe to any kind of insurance policies during the term of the contract. However, at its sole discretion and its own cost, the Contractor may obtain relevant insurance policies that cover the third-party liabilities or any other risks in relation to its services and the facilities.
15	**Dispute settlement**	All proceedings in any arbitration in regard to the contract shall be conducted in English. The proceedings shall be held in the International Court of Arbitration (ICC) or the Singapore International Arbitration Centre (SIAC) in Singapore.

4.2.2 Payment Terms

The payment which the Client shall make to the Contractor in return for the Contractor's provision of the Services shall be calculated as follows:

Service Fee = volume of water delivered * unit price of bulk water

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Volume of water delivered shall be confirmed by a volume meter just after the filter.

The unit price of the bulk water shall be the one proposed by the Contractor in the bidding and subject to periodic revision upon the following dates:

(a) at the beginning of the fourth anniversary of the Starting Date;
(b) at the beginning of the seventh anniversary of the Starting Date; and
(c) at the beginning of the tenth anniversary of the Starting Date.

The inflation index for the purpose of this Contract shall be the latest available Consumer Price Index and Inflation Rate published by the National Bank of Cambodia.

4.2.3 Ceiling Price of Bulk Water

Based on the estimation by the Consultant, the ceiling price of bulk water shall be KHR **350**/m^3. The Contractor shall propose a unit price within the ceiling price which applies to the unit price of bulk water in the first year of operation based on the assumptions below.

Assumptions

Electricity		
Consumption		
Intake	[kWh]	-
Treatment	[kWh]	
Chemical	[kWh]	110,595
Distribution	[kWh]	
Others	[kWh]	29,200
# of employees		
Plant Manager (PM)	[persons]	1
Plant Operation Manager (POM)	[persons]	1
Deputy Operation Manager (DOM)	[persons]	1
Quality manager	[persons]	1
Admin/business staff	[persons]	3
M&E Engineer	[persons]	1
Operating staff	[persons]	6
Salaries (Annual)		
Plant Manager (PM)	[000KHR]	240,000
Plant Operation Manager (POM)	[000KHR]	666,000
Deputy Operation Manager (DOM)	[000KHR]	555,000
Quality manager	[000KHR]	47,634
Admin/business staff	[000KHR]	35,047
M&E Engineer	[000KHR]	35,047
Operating staff	[000KHR]	35,047

Raw material unit price		
PAC	KHR/kg	2,137
Salt for sodium hypochlorite	KHR/kg	2,531
Raw materials Consumption		
PAC	[g/m3]	10.0
Sodium hypochlorite	[g/m3]	6.5
Repair and maintenance		
Machinery	[000KHR]	436,600
Electrical equipment	[000KHR]	111,000
Repair and maintenance at hand-back		
Machinery	[000KHR]	436,600
Electrical equipment	[000KHR]	111,000
Civil works and others	[000KHR]	432,432
Other operating expenses		
Employee social security	[KHR/person/month]	40,000
Transportation	[000KHR/month]	1,850
Office keeping	[000KHR/month]	3,700
Accounting audit / legal services	[000KHR/month]	1,850
Other operating costs (as % of other op. expenses)	[%]	10%
Marginal Profit rate	[%]	35.0%

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Annual production	[000m3]	16,425	16,425	16,425	16,425	16,425	16,425	16,425	16,425	16,425	16,425	164,250	...(1)
Inflation index	[Index]	1.09	1.13	1.16	1.19	1.23	1.27	1.30	1.34	1.38	1.43		
Electricity price	[KHR/kWh]	584	584	584	584	584	584	584	584	584	584		
Discount rate	[%]												
FX rate	[KHR/JPY]												

Electricity cost	[000KHR]	81,640	81,640	81,640	81,640	81,640	81,640	81,640	81,640	81,640	81,640	816,403	
Labor cost	[000KHR]	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	2,359,104	23,591,040	
Raw materials cost	[000KHR]	621,280	621,280	621,280	621,280	621,280	621,280	621,280	621,280	621,280	621,280	6,212,598	
Repair and maintenance cost	[000KHR]	-	547,600	547,600	547,600	547,600	547,600	547,600	547,600	547,600	980,032	5,360,832	
Other operating expenses cost	[000KHR]	114,907	169,667	169,667	169,667	169,667	169,667	169,667	169,667	169,667	212,910	1,685,155	
Total	[000KHR]	3,176,911	3,779,271	3,779,271	3,779,271	3,779,271	3,779,271	3,779,271	3,779,271	3,779,271	4,254,847	37,666,029	...(2)

10 year total O&M cost	[000KHR]	37,666,029	=(2)
10 year total production	[000m3]	164,250	=(1)
10 year average O&M cost	**[KHR/m3]**	**229**	=(2)/(1)
Marginal Profit rate	**[%]**	35%	

Escalation flag												
Average O&M cost with escalation		250	250	250	273	273	273	299	299	299	326	
Margin	[000KHR]	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	
Unit Price of bulk water	[000KHR]	**337**	**337**	**337**	**369**	**369**	**369**	**403**	**403**	**403**	**440**	
Payment to SPC	[000KHR]	5,535,225	5,535,225	5,535,225	6,060,825	6,060,825	6,060,825	6,619,275	6,619,275	6,619,275	7,227,000	...(3)

O&M Price: Net present value	**[000KHR]**	**50,616,511**	...(4)	=sum(3) discounted with 4.5%
of Payment to SPC	**[000JPY]**	**1,368,013**	...(5)	=(4)/FX rate

4.2.4 Risk Allocation

Risk allocation between PPWSA and the Contractor in regard to the D&B Contract shall be in accordance with the concept of FIDIC yellow book and JICA's standard form of contract.

Risk allocation between PPWSA and the Contractor in regard to the O&M Contract is stipulated below:

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Risks	PPWSA	Contractor	Remarks/Examples
Facility risk		O	Unless caused by Force Majeure, any defects, deterioration, damage, or failure to the WTP operation shall be immediately fixed, repaired, patched, and/or replaced under the full responsibility of the Contractor at no additional cost on PPWSA.
Demand risk	O		PPWSA shall pay for 45,000m^3/day of treated water if the Contractor provides or is ready to provide 45,000m^3/day of treated water that satisfies the required water quality on a monthly average, regardless of any reason on PPWSA side (e.g. demand stays low or distribution pipes get damaged).
Operation risk		O	No payment shall be made if the delivered water does not satisfy the water quality requirement due to poor operation by the Contractor (e.g. facility malfunction, inappropriate usage of water treatment chemicals). In case the water delivered by the Contractor does not comply with the Client's requirements, the Contractor shall compensate for any damage (e.g. compensation to end-customers) suffered by PPWSA as a result of such poor operation by the Contractor. Unless required by the law, the Contractor shall have no obligation to obtain or subscribed to any kind of insurance policies during the term of the contract and in relation with the Services and the Water Treatment Facility. However, at its sole discretion and its own cost, the Contractor may obtain relevant insurance policies such as Third-party liability insurance, Professional liability insurance, Insurance against loss of or damage to the Contractor's property and other insurances.
Raw water supply risk	O		PPWSA has the obligation to supply raw water to the facility to be operated by the Contractor. The Contractor has a right to claim operating loss caused by the incident where the raw water is not supplied to the facility.
Raw water quality risk	O		Additional cost of production due to change in quality of raw water shall be covered by PPWSA and compensated to the Contractor.
Electricity price risk		O	Any fluctuations in electricity price shall be covered by the Contractor.

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Risks	PPWSA	Contractor	Remarks/Examples
Electricity availability risk	O		The Contractor shall have responsibility to procure electricity necessary for its operation. In case the electricity is not supplied to the facility due to blackout or other force majeure events, neither the Contractor has obligation to supply water to PPWSA, nor PPWSA must pay the Contractor for the period. The Contractor does not have a right to claim operating loss caused by such blackout to PPWSA.
Raw material supply risk		O	The Contractor shall have responsibility to procure raw materials necessary for its operation.
Inflation risk (during O&M period)	O		Increase in production costs caused by inflation (e.g. wages or raw materials) shall be covered by PPWSA according to the Price Formula for Bulk Water Supply.
Licensing risk	O		IEIA/EIA or any other permit/authorization necessary for the Contractor to operate the facility shall be obtained by PPWSA.
Legal risk (change of project specific law)	O		Additional cost caused by a change in law that specifically affects the project (e.g. upgrade of national quality standard for drinking water) shall be covered by PPWSA and compensated to the Contractor.
Legal risk (change of general law)		O	Additional cost caused by a change in general law that would affect the whole economy (e.g. VAT) shall be covered by the Contractor.
Force Majeure risk	O	O	A Force Majeure is an event that is external, unpredictable, and irresistible and has a significant impact on the project. Both parties may terminate the contract if the impact of a Force Majeure lasts for a certain period (based on practice of water utilities). Neither party has any obligation to each other for the cost of mitigation measures to prevent increasing loss caused by Force Majeure. PPWSA shall have the option to require the Contractor to transfer to PPWSA all of its right, title and interest in and to the Contractor's assets. The value of the Contractor's assets shall be net book value of the assets.

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4.3 Training Contract

Training Contract shall be drafted after the Contractor proposes and PPWSA accept the detailed training program. Payment for the Training Contract shall be a lump-sum basis and the Consultant proposes the ceiling price at $30,000 per year based on the cost estimates below.

Cost Items	Unit Price	Unit	Amount
Renumeration	$1,000/day/person	3 persons * 7 days/time * 1 times/year	$21,000
Flights	$2,000/flight	3 persons * 1 times/year	$6,000
Accommodation	$150/night	3 persons * 6 nights/time * 1 times/year	$2,700
Others	--	--	$300
Total			**$30,000**

KINGDOM OF CAMBODIA

NATION RELIGION KING

Annex 11
Approval Letter
of the Ceiling Prices
for the Bulk Water

PHNOM PENH
WATER SUPPLY AUTHORITY
Nº 167 PPWSA

Date: 22 Oct 2021

To: **JAPAN INTERNATIONAL COOPERATION AGENCY**
6th, 7th, 8th floors, Building #61-64, Preah Norodom Boulevard
Cornor of St.306, Phnom Penh, P.O. Box 613
Tel: +855(0)23 211 673/4, 212 142, 211 779
Fax +855(0) 217 366, 211 675

Attn: **Ms. KAMEI Haruko**
Chief Representative
JICA Cambodia Office

Subject: **Approval Letter of the Ceiling Prices for the Bulk Water**

Dear Madam,

With regard to the project for Rehabilitation and Expansion of Phum Prek Water Treatment System, I hereby confirm that Board of Directors of Phnom Penh Water Supply Authority (PPWSA) agreed to set the ceiling prices for the bulk water at KHR350/m^3.

Thank you for your assistance and cooperation.

Yours Sincerely,

LONG Naro
Director General of PPWSA

Cc: Consortium of Nihon Suido Consultants Co., Ltd.TEC International Co., Ltd. and Crown Agents Japan Ltd.

45 St 106, Sangkat Srah Chork, Khan Daun Penh, Phnom Penh 12202 Cambodia. (23) 635 80 80 Email: admin@ppwsa.com.kh

Annex 12
EPC Approval Letter
issued by MOE

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

រដ្ឋាករទឹកស្វយ័តក្រុងភ្នំពេញ
លេខ:......៤៣៥ ណ.ភ.....

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រាជធានីភ្នំពេញ ថ្ងៃទី..១២....ខែ..កក្កដា......ឆ្នាំ២០២១

សូមគោរពជូន
ឯកឧត្តមរដ្ឋមន្ត្រីក្រសួងបរិស្ថាន

ម្ចាស់គម្រោង តំណាងដោយ **ឯកឧត្តម ស៊ឹម ស៊ីថា** ជាអគ្គនាយកនៃរដ្ឋាករទឹកស្វយ័តក្រុងភ្នំពេញ ដែលមានអាសយដ្ឋានស្ថិតនៅផ្ទះលេខ៤៥ ផ្លូវ១០៦ សង្កាត់ស្រះចក ខណ្ឌដូនពេញ រាជធានីភ្នំពេញ។

សូមធ្វើកិច្ចសន្យាការពារបរិស្ថាន

ដើម្បីរួមចំណែកធានានូវនិរន្តរភាពបរិស្ថានក្នុងកិច្ចដំណើរការអភិវឌ្ឍប្រទេសជាតិ រដ្ឋាករទឹកស្វយ័តក្រុងភ្នំពេញ (ម្ចាស់គម្រោង) សូមធ្វើកិច្ចសន្យាការពារបរិស្ថានចំពោះក្រសួងបរិស្ថាន **សម្រាប់គម្រោងពង្រីក និងជួសជុលប្រព័ន្ធប្រព្រឹត្តកម្មទឹកស្អាតរោងចក្រភូមិព្រែក** ដែលមានទីតាំងស្ថិតនៅក្នុងភូមិសាស្ត្រ ផ្ទះលេខ៤៥ ផ្លូវ១០៦ សង្កាត់ស្រះចក ខណ្ឌដូនពេញ រាជធានីភ្នំពេញ របស់រដ្ឋាករទឹកស្វយ័តក្រុងភ្នំពេញ តាមប្រការដូចខាងក្រោម៖

ប្រការ១..

ជានារៀបចំរបាយការណ៍វាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន និងសង្គមដំបូង សម្រាប់គម្រោងពង្រីក និងជួសជុលប្រព័ន្ធប្រព្រឹត្តកម្មទឹកស្អាតរោងចក្រភូមិព្រែក ក្នុងករណីក្រសួងបរិស្ថានតម្រូវ។

ប្រការ២..

ជានាទទួលខុសត្រូវធ្វើការសម្អាត និងប្រមូលសំរាមសំណល់រឹងបង្កើតពីក្នុងទីបរិវេណ និងជុំវិញទីតាំងគម្រោងដោយត្រូវអនុលោមតាមបទប្បញ្ញត្តិមាត្រា១៥ មាត្រា១៦ មាត្រា១៧ មាត្រា១៨ និងមាត្រា២៥ នៃអនុក្រឹត្យលេខ១១៣ អនក្រ.បក ចុះថ្ងៃទី២៧ ខែសីហា ឆ្នាំ២០១៥ ស្តីពីការគ្រប់គ្រងសំរាមសំណល់រឹងទីប្រជុំជន។

ប្រការ៣..

ជានាទទួលខុសត្រូវអនុវត្តនូវគោលការណ៍បច្ចេកទេស និងវិធានការកាត់បន្ថយមួយចំនួនដូចខាងក្រោម៖

ក. <u>ដំណាក់កាលរចនា ឬមុនពេលសាងសង់</u>

- ម្ចាស់គម្រោងត្រូវរចនាប្លង់សាងសង់ប្រព័ន្ធទុយោទឹក-អាងប្រព្រឹត្តកម្មសម្អាតទឹកស្អាតឱ្យបានស្របទៅតាមបទដ្ឋានបច្ចេកទេសកំណត់របស់ស្ថាប័នជំនាញ និងត្រូវជូនដំណឹងអំពីសកម្មភាព

គម្រោង និងដោះស្រាយហេតុប៉ះពាល់ដីកម្មសិទ្ធិជាមួយប្រជាពលរដ្ឋជាមុនសិន (បើមាន) មុននឹងធ្វើការសាងសង់

- ម្ចាស់គម្រោងត្រូវសហការជាមួយស្ថាប័នពាក់ព័ន្ធលើការកំណត់ទីតាំងសាងសង់ ដើម្បីចៀសវាងហេតុប៉ះពាល់ផ្សេងៗ
- ម្ចាស់គម្រោងត្រូវជូនដំណឹងអំពីទីតាំងដែលត្រូវសាងសង់ពង្រីកទីតាំងបូមទឹកនៅថ្មីដល់អាជ្ញាធរមូលដ្ឋាន និងប្រជាជន ដើម្បីចៀសវាងហេតុប៉ះពាល់ និងដើម្បីរកវិធានការដោះស្រាយឱ្យបានសមស្រប។

ខ. ដំណាក់កាលសាងសង់

- ម្ចាស់គម្រោងនៅពេលដែលចាប់ផ្តើមសាងសង់ត្រូវជូនដំណឹងដល់ប្រជាពលរដ្ឋ និងបញ្ជាក់ពីពេលវេលាដែលត្រូវសាងសង់ និងត្រូវប្រញាប់រៀបចំទីតាំងដែលសាងសង់ឱ្យរួចជាស្រេចការសន្យាជាមួយប្រជាជន និងអាជ្ញាធរមូលដ្ឋាន
- ម្ចាស់គម្រោងត្រូវប្រញាប់លុបអាចម៍ដី និងសហការជាមួយក្រសួងសាធារណការ និងដឹកជញ្ជូនចាក់កៅស៊ូលើផ្លូវក្លាមៗ ឬចាក់បេតុងឱ្យបានត្រឹមត្រូវនៅពេលដែលការដឹកកប់ដាក់ទុយោទឹករួចរាល់
- ម្ចាស់គម្រោងត្រូវរៀបចំឱ្យមានស្លាកសញ្ញាចរាចរណ៍ និងភ្លើងសញ្ញានៅពេលយប់ព្រមទាំងសហការជាមួយនគរបាលមូលដ្ឋាន ដើម្បីការពារគ្រោះថ្នាក់ចរាចរណ៍ និងការកកស្ទះចរាចរណ៍នៅការដ្ឋានសាងសង់
- ម្ចាស់គម្រោងត្រូវអប់រំ និងណែនាំឱ្យកម្មករអនុវត្តន៍វិធានការការពារជំងឺកូវីដ-១៩ របស់ក្រសួងសុខាភិបាល ដោយគោរពឱ្យបានខ្ជាប់ខ្ជួន៣កុំ និង៣ការពារ
- ម្ចាស់គម្រោងត្រូវផ្តល់កន្លែងស្នាក់នៅជូនកម្មករឱ្យបានសមរម្យ និងផ្គត់ផ្គង់ទឹកស្អាតដល់កម្មករ ព្រមទាំងមានការបណ្តុះបណ្តាលការងារបច្ចេកទេស និងផ្តល់ឧបករណ៍សុវត្ថិភាពនៅពេលបំពេញការងារនៅក្នុងការដ្ឋាន
- ម្ចាស់គម្រោងត្រូវគ្រប់គ្រងសំណល់រឹង និងសំណល់រាវគ្រប់ប្រភេទចេញពីការដ្ឋានសាងសង់ និងកន្លែងស្នាក់នៅរបស់កម្មករឱ្យបានត្រឹមត្រូវ ដោយជ្រើសរើសទីតាំងទុកដាក់សំណល់តាមការណែនាំរបស់ក្រសួងបរិស្ថាន ឬមន្ទីរបរិស្ថានរាជធានីភ្នំពេញ ឬអាជ្ញាធរមូលដ្ឋាន ចៀសវាងការបោះចោល ឬបង្ហូរចូលទៅក្នុងទឹកទន្លេ
- ម្ចាស់គម្រោងត្រូវត្រួតពិនិត្យសំរាម សំណល់ភក់ និងបញ្ហាក្លិនដែលកើតចេញពីការបោះចោលសំរាមរបស់បុគ្គលិក-កម្មករ
- ម្ចាស់គម្រោងត្រូវគ្រប់គ្រងសំឡេង រំញ័រ ក្លិន និងផ្សែងដែលចេញពីសកម្មភាពអនុវត្តន៍គម្រោងឱ្យបានត្រឹមត្រូវតាមលក្ខណៈបច្ចេកទេសចៀសវាងប៉ះពាល់ដល់ប្រជាពលរដ្ឋរស់នៅក្បែរទីតាំងគម្រោង
- ម្ចាស់គម្រោងត្រូវផ្តល់លទ្ធភាពជូនប្រជាពលរដ្ឋក្នុងមូលដ្ឋានឱ្យចូលបម្រើការងារនៅក្នុងគម្រោងឱ្យស្របតាមជំនាញរបស់ពួកគាត់ ដើម្បីកាត់បន្ថយការចំណាកស្រុក

អគារ៨៥ ផ្លូវ១០៦ សង្កាត់ស្រះចក ខណ្ឌដូនពេញ ភ្នំពេញ ទូរស័ព្ទ: (៨៥៥) ២៣ ៦៣៥ ៨០ ៨០ Email: admin@ppwsa.com.kh

- ម្ចាស់គម្រោងត្រូវសហការជាមួយអាជ្ញាធរមូលដ្ឋាន និងស្ថាប័នជំនាញពាក់ព័ន្ធ ដើម្បីរកដំណោះស្រាយសមស្របនៅពេលមានបញ្ហាកើតឡើង
- រួមចំណែកអភិវឌ្ឍន៍ហេដ្ឋារចនាសម្ព័ន្ធ និងលើកកម្ពស់ជីវភាពប្រជាពលរដ្ឋក្នុងសង្កាត់-ខណ្ឌ ដែលនៅជុំវិញតំបន់គម្រោង។

គ. ដំណាក់កាលប្រតិបត្តិ

- ម្ចាស់គម្រោងត្រូវសហការជាមួយអាជ្ញាធរមូលដ្ឋាន និងស្ថាប័នជំនាញពាក់ព័ន្ធ ដើម្បីរកដំណោះស្រាយសមស្របនៅពេលមានបញ្ហាកើតឡើង (បែកលូ ធ្លាយទុយោទឹក និងខូចប្រព័ន្ធសម្អាតទឹកស្អាត) តាមរយៈសកម្មភាពជីកជញ្ជូន ការសាងសង់សំណង់ផ្សេងៗ ការអភិវឌ្ឍជាដើម
- ម្ចាស់គម្រោងត្រូវមានផែនការអង្កេតតាមដានជាប្រចាំ ដើម្បីចៀសវាងហេតុប៉ះពាល់ផ្សេងៗ ដោយសារការលេចធ្លាយ ឬស្នុះទុយោទឹក ជាដើម និងត្រូវលើកផែនការជួសជុល-ថែទាំជាប្រចាំ ដើម្បីចៀសវាងកុំឱ្យការប៉ះពាល់ដល់ការប្រើប្រាស់ និងផ្គត់ផ្គង់ទឹកស្អាតដល់ប្រជាជនដែលរស់នៅក្នុងមូលដ្ឋាន
- ម្ចាស់គម្រោងត្រូវមានផែនការពិនិត្យគុណភាពទឹកជាប្រចាំនៅត្រង់ចំណុចបូមទឹក និងចំណុចចុងក្រោយចូលទៅក្នុងអាងប្រព្រឹត្តកម្មសម្អាតទឹកជាមុន មុននឹងបង្ហូរចូលទៅក្នុងអាងស្តុកទឹក។

ឃ. ដំណាក់កាលបញ្ចប់

- ម្ចាស់គម្រោងត្រូវជូនដំណឹងដោយសហការជាមួយអាជ្ញាធរមូលដ្ឋាន និងស្ថាប័នដែលពាក់ព័ន្ធជាមុនសិន ដើម្បីទទួលបាននូវការផ្តល់យោបល់ និងបញ្ចៀសហេតុប៉ះពាល់ជាមួយប្រជាជនក៏ដូចជាធនធានបរិស្ថានដែលមានស្រាប់
- ម្ចាស់គម្រោងត្រូវស្តារធនធានបរិស្ថានឡើងវិញ ដើម្បីបញ្ចៀសហេតុប៉ះពាល់ផ្សេងៗលើប្រភពទឹកធម្មជាតិ ជាពិសេសទីតាំងប្រព័ន្ធបូមទឹកពីទន្លេសាប។

ប្រការ៤.

ធានាផ្តល់របាយការណ៍អង្កេតតាមដានបរិស្ថាន (Environmental Monitoring Report) រៀងរាល់ ៦ខែម្តង នៅក្នុងកិច្ចដំណើរការសាងសង់ និងប្រតិបត្តិគម្រោង ជូនក្រសួងបរិស្ថាន ដើម្បីពិនិត្យ និងវាយតម្លៃ។

ប្រការ៥.

ក្នុងករណី ក្រសួងបរិស្ថានតម្រូវឱ្យម្ចាស់គម្រោងធ្វើការកែប្រែនូវបច្ចេកទេសបរិស្ថានណាមួយ ដើម្បីឱ្យសមស្របទៅតាមគោលការណ៍ណែនាំ និងកម្រិតបទដ្ឋានបរិស្ថាន ម្ចាស់គម្រោងនឹងទទួលអនុវត្ត ទៅតាមគោលការណ៍ណែនាំនោះទាំងស្រុង។

ប្រការ៦.

ទៅថ្ងៃអនាគត បើម្ចាស់គម្រោងមានគម្រោងពង្រីកបន្ថែម ឬផ្លាស់ប្តូរ ឬកែសម្រួលរបាយការណ៍

អគារ៤៥ ផ្លូវ១០៦ សង្កាត់ស្រះចក ខណ្ឌដូនពេញ ភ្នំពេញ ទូរស័ព្ទ: (៨៥៥) ២៣ ៦៣៥ ៨០ ៨០ Email: admin@ppwsa.com.kh

សិក្សាសមទ្ធិលទ្ធភាព (Feasibility Study Report) ឬផ្នាកសកម្មភាព ម្ចាស់គម្រោងនឹងរាយការណ៍ជូនក្រសួងបរិស្ថានឱ្យបានមុន ១ខែ។

ប្រការ៧.

អនុញ្ញាតឱ្យមន្ត្រីជំនាញពីក្រសួងបរិស្ថាន ឬមន្ទីរបរិស្ថានរាជធានីភ្នំពេញ ដែលមានលិខិតបញ្ជាបេសកកម្មត្រឹមត្រូវ ដើម្បីធ្វើការត្រួតពិនិត្យក្នុងទីតាំងតំបន់គម្រោង។

ប្រការ៨.

ក្នុងករណីដែលម្ចាស់គម្រោងពុំបានគោរពតាមប្រការណាមួយ ឬអនុវត្តផ្ទុយពីកិច្ចសន្យានេះ ឬ លិខិតបទដ្ឋានគតិយុត្តចូលជាធរមានផ្សេងៗទៀត ម្ចាស់គម្រោងសូមទទួលខុសត្រូវចំពោះមុខច្បាប់ជាធរមាន។

អគ្គនាយក

ស៊ីម ស៊ីថា

បានឃើញ និងសូមគោរពជូន
ឯកឧត្តមរដ្ឋមន្ត្រីក្រសួងបរិស្ថាន មេត្តាពិនិត្យ និងសម្រេច
លេខ៖ ១០០២ រ.ហ.ប.ស
ថ្ងៃសុក្រ ១៣រោច ខែកុម្ភៈ ឆ្នាំឆ្លូវ ត្រីស័ក ព.ស.២៥៦៥
រាជធានីភ្នំពេញ ថ្ងៃទី ៦ ខែ មីនា ឆ្នាំ២០២១
ប្រធាននាយកដ្ឋានវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន

ហាញ់-សេរី

បានឃើញ និងឯកភាព
ថ្ងៃ ២រ ៨ស៊ីត ខែកក្កដា ឆ្នាំឆ្លូវ ត្រីស័ក ព.ស.២៥៦៥
រាជធានីភ្នំពេញ ថ្ងៃទី ១៦ ខែកក្កដា ឆ្នាំ២០២១
៤. រដ្ឋមន្ត្រីក្រសួងបរិស្ថាន
រដ្ឋលេខាធិការ

និន-ពន្លក

អគារ៤៥ ផ្លូវ១០៦ សង្កាត់ស្រះចក ខណ្ឌដូនពេញ ភ្នំពេញ ទូរស័ព្ទ: (៨៥៥) ២៣ ៦៣៥ ៨០ ៨០ Email: admin@ppwsa.com.kh

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

ក្រសួងបរិស្ថាន
លេខ: ១១០០.ស.ប.ស

ថ្ងៃ ចន្ទ ១កើត ខែត្រាមាស ឆ្នាំឆ្លូវ ត្រីស័ក ព.ស. ២៥៦៥
រាជធានីភ្នំពេញ ថ្ងៃទី១៦ ខែ មីនា ឆ្នាំ២០២១

សូមជម្រាបជូន
ឯកឧត្តមអគ្គនាយករដ្ឋាករទឹកស្វយ័តក្រុងភ្នំពេញ

កម្មវត្ថុ ៖ ការណែនាំសំណើសុំរៀបចំកិច្ចសន្យាការពារបរិស្ថាន សម្រាប់គម្រោងពង្រីក និងជួសជុលប្រព័ន្ធប្រព្រឹត្តកម្មទឹកស្អាតរោងចក្រកូមិព្រៃក របស់រដ្ឋាករទឹកស្វយ័តក្រុងភ្នំពេញ នៅរាជធានីភ្នំពេញ

យោង ៖
- ព្រះរាជក្រមលេខ នស/រកម/១២៩៦/៣៦ ចុះថ្ងៃទី២៤ ខែធ្នូ ឆ្នាំ១៩៩៦ ដែលប្រកាសឱ្យប្រើច្បាប់ស្តីពីកិច្ចការពារបរិស្ថាន និងការគ្រប់គ្រងធនធានធម្មជាតិ
- អនុក្រឹត្យលេខ៧២ អនក្រ.បក ចុះថ្ងៃទី១១ ខែសីហា ឆ្នាំ១៩៩៩ ស្តីពីកិច្ចដំណើរការវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន
- ប្រកាសលេខ០២១ ប្រក.ប.ស ចុះថ្ងៃទី០៣ ខែកុម្ភៈ ឆ្នាំ២០២០ ស្តីពីចំណាត់ថ្នាក់នៃការវាយតម្លៃហេតុប៉ះពាល់បរិស្ថានសម្រាប់គម្រោងអភិវឌ្ឍន៍
- លិខិតលេខ២៧០ ល.ស ចុះថ្ងៃទី៤ ខែឧសភា ឆ្នាំ២០២១ របស់រដ្ឋាករទឹកស្វយ័តក្រុងភ្នំពេញ
- របាយការណ៍ចុះពិនិត្យទីតាំងចុះថ្ងៃទី២ ខែកក្កដា ឆ្នាំ២០២១ របស់មន្ត្រីជំនាញនាយកដ្ឋានវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាននៃក្រសួងបរិស្ថាន

សេចក្តីដូចមានចែងក្នុងកម្មវត្ថុ និងយោងខាងលើ ខ្ញុំសូមជម្រាបជូន **ឯកឧត្តមអគ្គនាយក** ជ្រាបថា ក្រសួងបរិស្ថានឯកភាពលើកិច្ចសន្យាការពារបរិស្ថាន សម្រាប់គម្រោងពង្រីក និងជួសជុលប្រព័ន្ធប្រព្រឹត្តកម្មទឹកស្អាតរោងចក្រកូមិព្រៃក ដែលមានទីតាំងស្ថិតនៅផ្ទះលេខ៤៥ ផ្លូវ១០៦ សង្កាត់ស្រះចក ខណ្ឌដូនពេញ រាជធានីភ្នំពេញ របស់រដ្ឋាករទឹកស្វយ័តក្រុងភ្នំពេញ (ម្ចាស់គម្រោង) ដោយម្ចាស់គម្រោងត្រូវគោរពតាមកិច្ចសន្យាការពារបរិស្ថានលេខ៥៣៥ ល.ស ចុះថ្ងៃទី២ ខែសីហា ឆ្នាំ២០២១ របស់រដ្ឋាករទឹកស្វយ័តក្រុងភ្នំពេញ។

អាស្រ័យដូចបានជម្រាបជូនខាងលើ សូម **ឯកឧត្តមអគ្គនាយក** អនុវត្ត និងចាត់ចែងតាមការគួរ។

សូម **ឯកឧត្តមអគ្គនាយក** ទទួលនូវការគោរពអានពីខ្ញុំ។

ជ.រដ្ឋមន្ត្រី
រដ្ឋលេខាធិការ

និន-ពន្លក

ចម្លងជូន:
- ទីស្តីការគណៈរដ្ឋមន្ត្រី
- ក្រសួងសេដ្ឋកិច្ច និងហិរញ្ញវត្ថុ
- ក្រសួងសាធារណការ និងដឹកជញ្ជូន
- ក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍
- ក្រសួងធនធានទឹក និងឧតុនិយម
- រដ្ឋបាលរាជធានីភ្នំពេញ
- មន្ទីរបរិស្ថានរាជធានីភ្នំពេញ
- ឯកសារ កាលប្បវត្តិ

អគារបរិសាកសេដ្ឋ ជ ម្ចាស់លេខ8503 ផ្លូវកៅស៊ូអមមាត់ទន្លេបាសាក់ សង្កាត់ទន្លេបាសាក់ ខណ្ឌចំការមន ភ្នំពេញ ទូរស័ព្ទ: 023 235 004 / 023 235 006

Annex 12 EPC Approval Letter issued by MOE

Kingdom of Cambodia
Nation Religion King

Ministry of Environment
No. 1100 ស.ជ.ណ.ប.ស្ត

Monday, the 8th of Sravana, the year of Chhlov Trisak, B.C. 2565
Phnom Penh 16th August 2021

Please be informed

H.E Director General of Phnom Penh Water Supply Authority

Objective: Application for Environmental Protection Contract for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System of Phnom Penh Water Supply Authority located in Phnom Penh City

Reference:

- Preah Reach Kram No. NS/RKM/1296/36 dated December 24, 1996 announcing to use the Law on the Environmental Protection and Natural Resources Management
- Sub-decree No. 72 ANKR.BK dated August 11, 1999 on Environmental Impact Assessment (EIA)
- Prakas No. 021 ប្រក.ប.ស្ត dated February 03, 2020 on the classification of environmental impact assessment for development projects
- Letter No. 270 LS dated May 04, 2021 of Phnom Penh Water Supply Authority
- Site Inspection Report dated July 02, 2021 by the Expert Officer of the Environmental Impact Assessment Department of the Ministry of Environment

As stated in the subject and reference above, I would like to inform **His Excellency the Director General** that the Ministry of Environment has agreed on an environmental protection contract for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System, located at # No. 45, St. 106 Sangkat Srah Chak, Khan Daun Penh, Phnom Penh by the Phnom Penh Water

Supply Authority (Project Owner), and hereby project owner have to adhere the environmental protection contract No. 535 LS dated August 02, 2021 by Phnom Penh Water Supply Authority. **His Excellency the Director General** should implement and manage as appropriate following the term mentioned above.

ถ. Minister

Secretary of State

TIN Ponlork

To

Minister of Environment

I, the undersigned, **SIM Sitha**, Director of Phnom Penh Water Supply Authority (PPWSA), located #45, Street 106, Sangkat Sreh Chork, Khan Doun Penh, Phnom Penh City.

Hereby assure my commitment to environmental protection

To contribute to ensuring environmental sustainability for the sustainable development, PPWSA would like to assure our commitment to environmental protection to the Ministry of Environment for The Project for Rehabilitation and Expansion Of Phum Prek Water Treatment System which is located #45, Street 106, Sangkat Sreh Chork, Khan Doun Penh, Phnom Penh City, of the Phnom Penh Water Supply Authority as following:

Article 1.-

Undertake to prepare the Initial Environmental Impact Assessment for the project to expand and repair the water treatment system of Phum Prek in case of the Ministry of Environment's requirements.

Article 2.-

Undertake to clean and collect the solid waste generated from the premises and around the factory in accordance with Article 15, Article 16, Article 18, and Article 25 of Subdecree No. 113 S.E., dated August 27, 2015, on the Management of Urban Solid Waste.

Article 3.-

Undertake to implement the following any technical and mitigation measures

A. Design phase or before construction

- The project owner must design the construction plan of the water pipe-water treatment system in accordance with the technical standards from the professional institution and inform the project activities and resolve the impact on land ownership with the effected people (if any) before construction.

- The project owner must cooperate with relevant institutions on determining the construction site to avoid any impact.

- The project owner must inform the local authority and people about the location to be built and expand the new raw water pumping site to avoid the impact.

B. Construction phase

- The project owner, when starting construction, must inform the people and confirm the time to build and be cleared after completing at the site as promised with the people and local authorities.

- The project owner must immediately clear the rubble and cooperate with the Ministry of Public Works and Transport to immediately pour the rubber on the road or pour the concrete properly when the excavation is completed.

- The project owner must set up traffic signs and lights at night and cooperate with the local police to prevent traffic accidents and traffic congestion at the construction site.

- The project owner must educate and instruct the workers to implement the measures to prevent Kovid-19 disease of the Ministry of Health with strict adherence to 3 contraindications and 3 protections.

- The project owner must provide appropriate accommodation for the workers and supply clean water to the workers, as well as provide technical training and provide safety equipment when working on site.

- The project owner must manage all kinds of solid and liquid waste from the construction site and the workers' accommodation properly by choosing the location to store the waste according to the instructions of the Ministry of Environment or the Department of Environment of Phnom Penh or local authorities to avoid dumping into the river.

- The project owner must inspect the garbage, mud and odor caused by the garbage of the staff-workers.

- The project owner must control the noise, vibration, smell and smoke from the project implementation activities properly in a technical manner to avoid affecting the people living near the project site.

- The project owner must enable local people to work in the project in accordance with their skills to reduce migration.

- The project owner must cooperate with local authorities and relevant professional institutions to find appropriate solutions when problems arise.

- To contribute to the development of infrastructure and improve the living standards of the people in the Sangkat-Khan around the project area.

C. Execution phase

- The project owner must cooperate with local authorities and relevant professional institutions to find appropriate solutions when problems occur (leaks, water pipes and water supply system damage) through transport activities, building, construction, development, etc.

- The project owner must have a plan to monitor regularly to avoid any impact due to leaks or blockages of water pipes, etc. and to plan regular repairs - maintenance to avoid affecting the use and supply of clean water to the local people.

- The project owner must plan to check the water quality regularly at the pumping point and the last point into the water treatment plant before draining into the reservoir.

D. Completion stage

- The project owner must inform in collaboration with the local authorities and relevant institutions in advance to get advice and avoid harm to the people as well as existing environmental resources.

- The project owner must restore environmental resources to avoid any impact on natural water sources, especially the location of the pumping system from the Tonle Sap.

Article 4.-

Undertake to submit the environmental monitoring report every six months regarding the company's project management to the Ministry of Environment for review and evaluation.

Article 5.-

In the event that the Ministry of Environment requires the company to adjust any environmental technique to ensure conformity with the environmental guidance and standards, we undertake to completely comply with it.

Article 6.-

In the future, if the company has any plan to add, or adjust, or change the Feasibility Study Report or suspend its activities, it will report it to the Ministry of Environment 30 days in advance.

Article 7.-

Permit officials from the Ministry of Environment or Phnom Penh Department of Environment who have a valid mission order to inspect and provide recommendations for the project's operation.

Article 8.-

In the event that the company fails to comply with any article or breaches this commitment or other legal instruments in force, it undertakes to accept responsibility before the law in force.

....., Year of the .....

Phnom Penh, ..., 2021

Signature and stamp

Director

Seen and forwarded to
H.E. the Minister for review and decision

No. ..... EIAD

....., Year of .....

Phnom Penh, ..., 2021

Director of Environmental Impact Assessment Department

Seen and approved

....., Year of.....

Phnom Penh, ..., 2021

pp Minister of Environment

Secretary of State

資　料 5　参考資料（収集資料リスト）

収集資料リスト

		プロジェクト ID		調査団番号			
地域	東南アジア	調査名	プンプレック上水道拡張計画準備調査	調査の種類	協力準備調査	担当部課	地球環境部水資源グループ
国名	カンボジア	配属機関名	プノンペン水道公社（PPWSA）	現地調査期間	2021/1-2022/8		

発行機関	No.	資料名	説明	形式	収集資料	専門家作成資料	JICA作成資料	言語	翻訳状況	取り扱い区分	図書館記入欄	備考
PPWSA	A-1	PPWSA 組織図	PPWSA 組織図	電子データ 画像	○			英語				
PPWSA	A-2	Water Production of Each WTP	各浄水場の浄水量、薬品使用量、電気使用量	電子データ Excel	○			英語				
PPWSA	A-3	Water Quality of Existing WTP	既存浄水場の水質記録	電子データ エクセル	○			英語				
PPWSA	A-4	River Water Level	既存取水場における河川水位	電子データ エクセル	○			英語				
PPWSA	A-5	Phum Prek WTP Drawings	プンプレック浄水場図面	電子データ CAD	○			英語				

資　料 6　その他の資料・情報

6.1 概略設計図

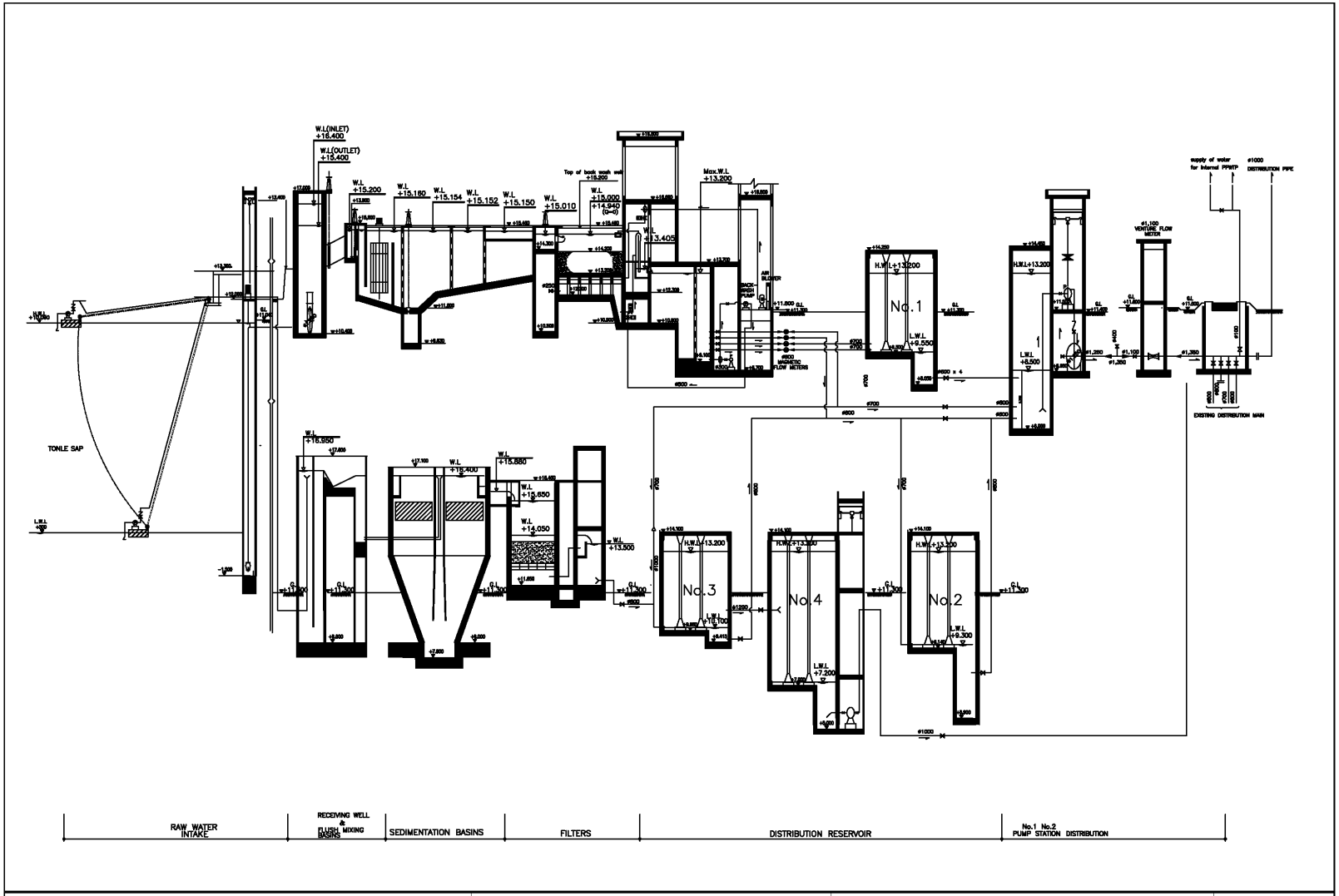
6.2 環境保護契約の環境省承認レター

6.3 環境チェックリスト

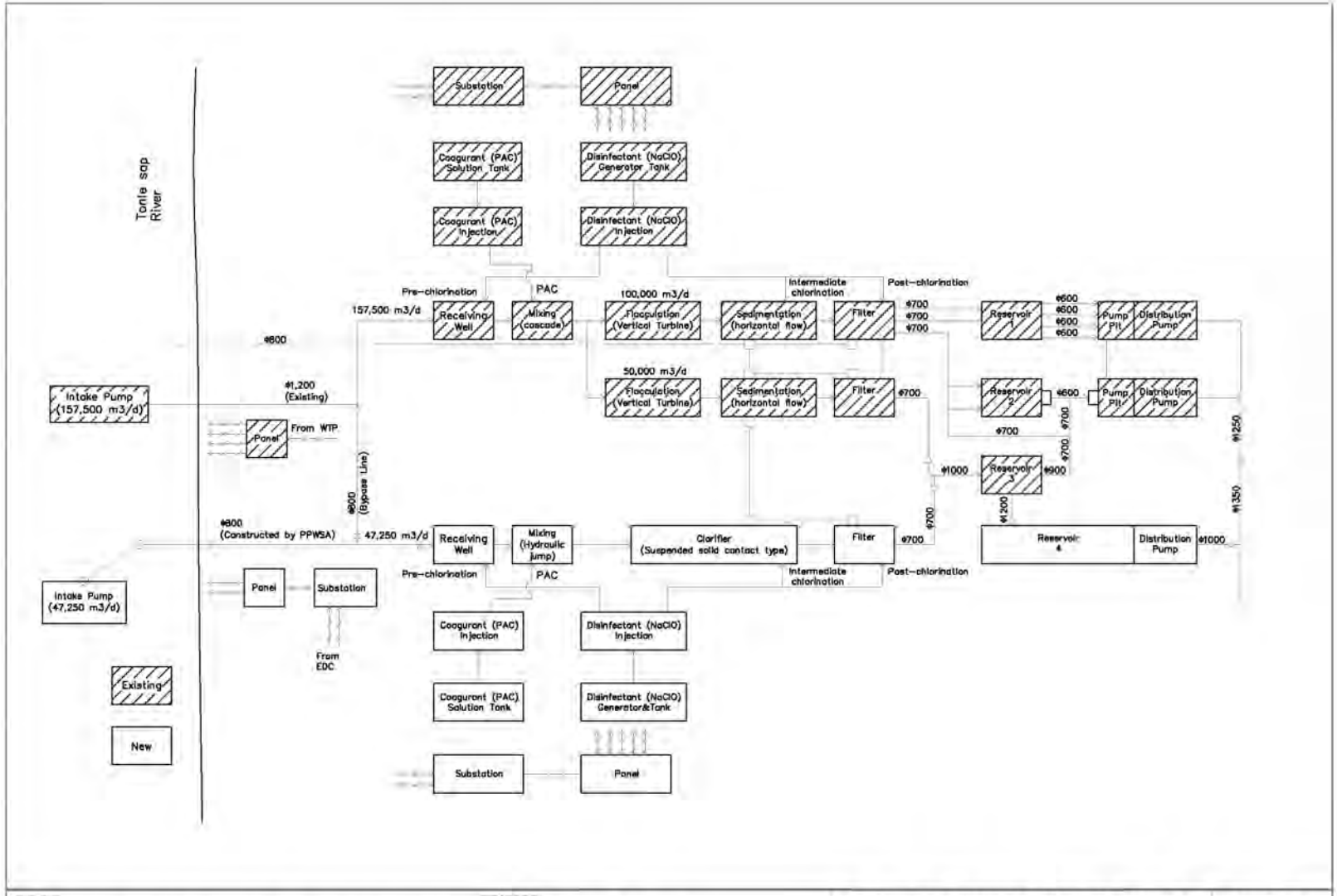
6.4 環境管理計画及び環境モニタリング計画

6.5 環境モニタリング フォーム

資　料 6-1　概略設計図



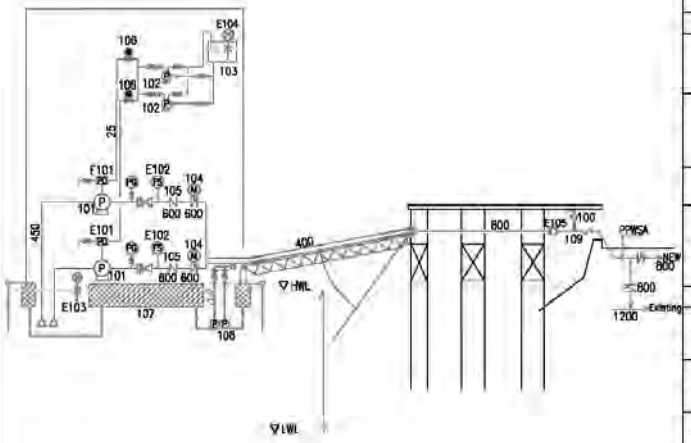
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Hydraulic Profile	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-001
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	Non



PROJECT:
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System

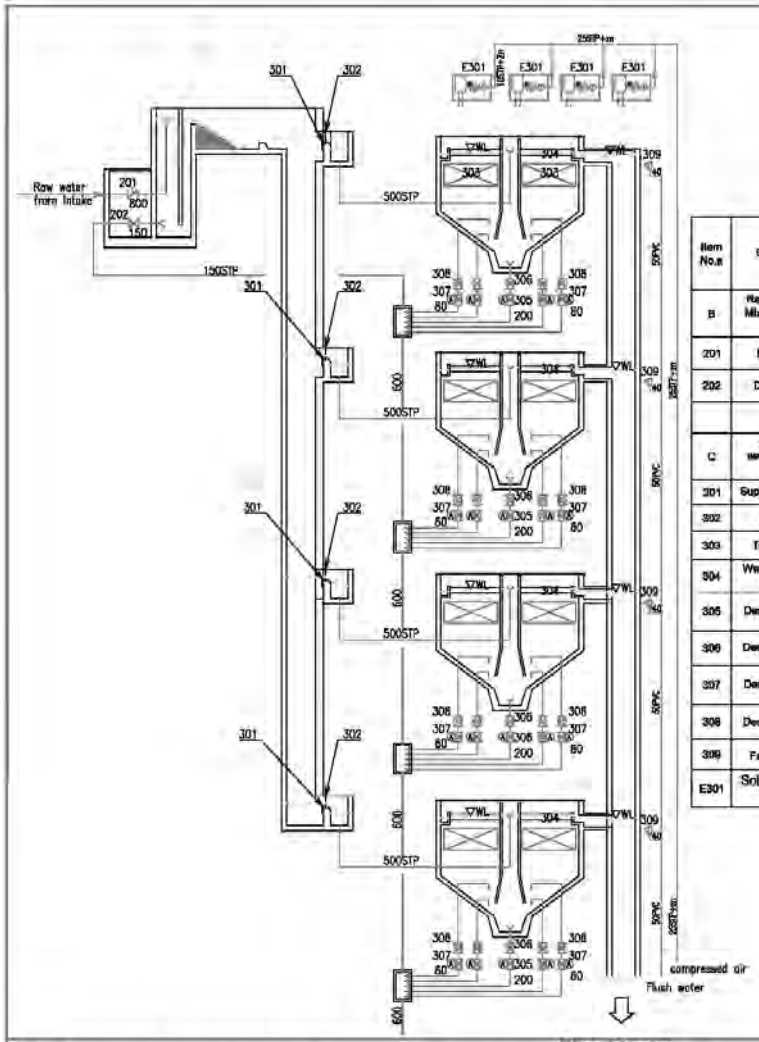
DESCRIPTION:
Block Flow Diagram

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-010
NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	Non



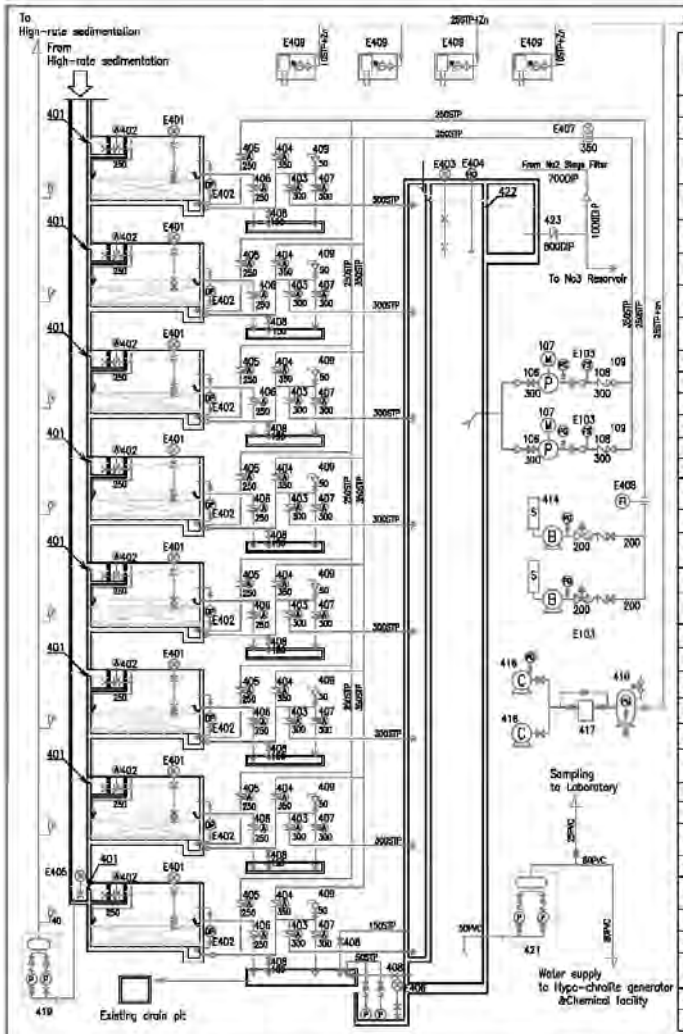
Item No.	Description	Quantity			Type	Spec		Head (m)	kW	V	Notes
		Duty	Stand by	Total							
A	Intake Facility										
101	Intake pump	1	1	2	Horizontal shaft double suction volute pump with separate type flywheel	33.0	m3/min	24	200	380	VWVF, Space heater, RTD (Winding), Thermometer with contact (Bearing for pump, motor and flywheel), Pressure gauge (for discharge)
102	Vacuum pump	1	1	2	Horizontal water sealed type	0.3	m3/min	-3	0.75	380	ressure gauge (for discharge)
103	Sealing water storage tank	1	0	1	Closed box type						Water level gauge,Ball tap,Drain valve
104	Butterfly valve (Discharge)	1	1	2	Electric drive butterfly valve	600	mm	24	0.4	380	Limit switch, Torque switch, Interlock switch, Potentiometer, Space heater, Opening indicator,
105	Check Valve	1	1	2	Wafer butterfly type	600	mm				Bypass valve
106	Ball Valve	1	1	2	Electric drive ball valve	25	mm		0.1	380	Limit switch, Space heater, Opening indicator,
107	Pontoon	1	0	1	Floating platform						Pump cabin,ventilation fan,2-Rotary beacon light,Oil fence
108	Cleaning pump	1	1	2	Submersible type, Automatic alternate operate	0.1	m3/min	20	1.5	380	Gate valve,Check valve,Float switch
109	Air vent Valve	1	0	1	Floating platform	100	mm				Isolation Valve
E101	Prime detector	1	1	2	Electrod type						2P
E102	Flow switch	1	1	2	Mass flow measur type	15	mm			100 -240	
E103	Water level detector	1	0	1	Electrod type						3P
E104	Water level detector	1	0	1	Electrod type						3P
E105	Flow meter	1	0	1	Ultrasonic type	0-2,500	m3/hr				DN600

PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Flow Diagram (Intake Facility)	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-011
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	Non.



Item No.s	Description	Quantity			Type	Spec		Head [m]	kW	V	Notes
		Duty	Stand by	Total							
B	Recieving well Mixing channel Facility										
201	Inlet valve	1	0	1	Manual drive bulterfly valve	800	mm				Position indicator(on-site)
202	Drain valve	1	0	1	Stem rize type manual gate valve	150	mm				Hand wheel
C	High-rate sedimentation Facility										
301	Suppressed weir	4	0	4	Submersible sewage pump	2.0	m				
302	Stop log	4	0	4	PVC Plate	30	mm				
303	Tube settler	4	0	4	PVC,60Å	117	m2				
304	Water collecting trough	8	0	32	Orifice type , FRP	w 0. 4 ~ h0. 4±0.5	m				
305	Desludge valve	4	0	4	Pneumatic double acting excentric valve	200	mm				Limit switches,speed controler position indicator
306	Desludge Valve	4	0	4	Manual excentric valve	60	mm				Hand wheel
307	Desludge valve	16	0	16	Pneumatic double acting excentric valve	60	mm				Limit switches,speed control position indicator
308	Desludge valv 6	16	0	16	Manual excentric valve	60	mm				Hand wheel
309	Faucet valv 6	4	0	4	45Å quick connection	40	mm				Hand wheel,40 m mhose×2sets, fire hose nozzle×2sets
E301	Solenoid valve box	4	0	4	Indoor wall mounted Pannal						

PROJECT The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Flow Diagram (Recieving Well, Mixing Channel ,Clarifier Facility)	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No. PPWTP-012
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE Non.



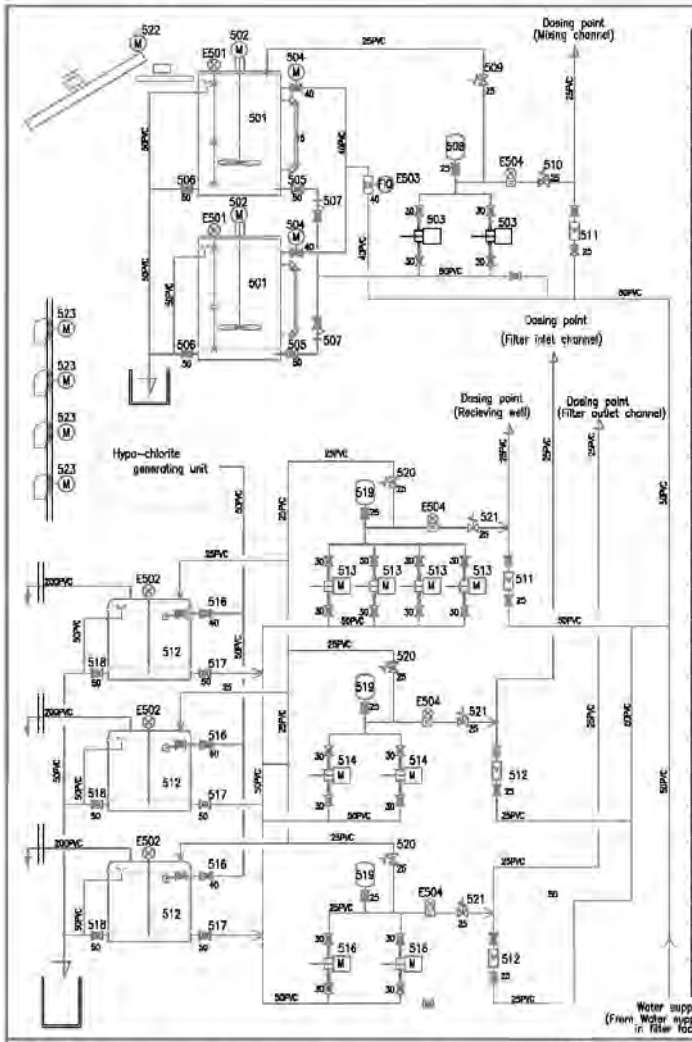
Item No.	Description	Quantity Duty	Stand by	Total	Type	Spec		Head [m]	kW	V	Notes
D	Filtration Facility										
401	Inlet weir	8	0	8	Suppressed weir	2.0m	50				304SS
402	Raw water valve	8	0	8	Double action pneumatic drive butterfly valve	350	mm				PN10,ISO5752 Series14,Long stem Limit switches,position indicator canopy(SS304)
403	Filtered water valve	8	0	8	Double action pneumatic drive butterfly valve	300	mm				PN10,ISO5752 series14,Limit switches,Position indicator (on- site)
404	Backwash valve	8	0	8	Double action pneumatic drive butterfly valve	350	mm				PN10,ISO5752 series14,Limit switches,Position indicator (on- site)
405	Air scouring valve	8	0	8	Double action pneumatic drive butterfly valve	250	mm				PN10,ISO5752 series14,Limit switches,Position indicator (on- site)
406	Waste valve	8	0	8	Double action pneumatic drive butterfly valve	350	mm				PN10,ISO5752 series14,Limit switches,Position indicator (on- site)
407	Drawdown valve	8	0	8	Double action pneumatic drive butterfly valve	300	mm				PN10,ISO5752 series14,Limit switches,position indicator (on- site)
408	Drain Valve	10	0	10	Manual drive gate valve	150	mm				PN10,Resilient valve,Handwheel
409	Air vent valve	8	0	8	Intake and exhaust valve	50	mm				Isolation valve mounted
410	Backwash pump	1	1	2	Horizontal mixed flow pump	12.6	m3/min	4	16.5	380	VVVF
411	Isolation valve	1	1	2	Manual drive gate valve	250	mm				
412	Check valve	1	1	2	Swing type	250	mm				
413	Delivery valve	1	1	5	Manual drive gate valve	250	mm				
414	Air blower	1	1	2	Root Blower	37.8	m3/min	2.5	18.5	380	Safety valve,Flexible joint,Check valve Gate valve,Silencer
415	Flow meter	4	1	5	Orifis type	250	mm				Flow indicator (on-site)
416	Air compressor	1	1	2	Oil free scroll type mounted air dryer	140	L/min		1.5	380	0.53Mpa
417	Air dryer	1	0	1	Freezing type	200	L/min		0.19	200	
418	Air tank	1	0	1	Pressure vessel	400	L				Safty valve,drain valve, Pressure gauge with switch
419	Flush pump	1	0	1	Water supply unit	0.2	m3/min	30	2.2	380	VVVF
420	Floor drain pump	1	1	2	Submersible drain pump	0.2	m3/min	2	0.4	380	
421	Water supply unit	1	0	1	Water supply unit	0.3	m3/min	30	3.0	380	VVVF
422	Outlet weir	1	0	1	Rectangular type	3	m				Total filtration flow
423	Outlet valve	1	0	1	Manual butterfly valve	800	mm				
424	Filter sand	8	0	8	Silica sand (ES=E 1.0 , UC≦1.7)	44.1/basin	m3				JWWA A103 , AWWA B-100
425	Underdrain system	8	0	8	Block type with porous plate	42 /basin	m2				HDPE
E401	Level detector	8	0	0	Electrod (4P)	0-3	m				Filtration basin
E402	Differential pressure Gauge	8	0	0	Diaphragm type	0-2	m				Filter head loss
E403	Level detector	1	0	1	Electrod (3P)	0-3	m				
E404	Total filtration flow meter	1	0	1	Submersible flow meter	0-0.3	m			85~ 242	with weir
E405	Level detector	1	0	1	Electrod (3P)	0-3	m				
E406	Level detector	1	0	1	Electrode(3p)	1	m				
E407	Flow meter	1	0	1	Electromagnetic flow meter	350	mm		0.016	100~ 240	Backwash flow rate
E408	Flow meter	1	0	1	orifis type	250	mm				
E409	Solenoid valve box	4	0	4	Indoor wall mounted type					230	F,R & isolation valve

PROJECT
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System

DESCRIPTION
Flow Diagram
(Filter)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
NIHON SUIDO CONSULTANTS CO.,LTD.
CROWN AGENTS JAPAN LIMITED
TEC INTERNATIONAL CO.,LTD.

DRAWING No. PPWTP-013
SCALE Non.



Item No.s	Description	Quantity			Type	Spec		Head [m]	kW	V	Notes
		Duty	Stand by	Total							
E	Chemical Facility										
501	PAC solution tank	1	1	2	Vertical Cylindrical type polyethymen open tank	5	m3				Gauge pipe 15mm
502	Dissolving mixer	1	1	2	Top mount vertical type				1.5	380	316SS
503	PAC dosing pump	1	1	2	Magnetic drive diaphragm pump	6	l/min.	10bar	0.24	220	
504	Water supply valve	1	1	2	Electric drive ball valve	40	mm		0.1	100 -230	
505	Outlet valve	1	1	2	Manual operate ball valve	50	mm				
506	Drain valve	1	1	2	Manual operated ball valve	50	mm				
507	Strainer	1	1	2	Y-type , 0.8mm opening	50	mm				
508	Air chamber	1	0	1	Flange type,PVC	7	L				
509	Relief valve	1	0	1	Spring type,PVC	25	mm				
510	Back pressure valve	1	0	1	Spring type,PVC	25	mm				
511	Flow meter	4	0	4	Rotameter	25	mm				Water flow rate(on site)
512	Hypo-chlorite storage tank	3	0	3	Vertical Cylinder type polyethymen closed tank	2	m3				Nozzle(inlet,outlet,overflow,drain, exhaust,gage,electrod),Ball tap
513	Pre.hypo chlorite dosing pump	3	1	4	Magnetic drive diaphragm pump	15	l/min.	40	0.24	220	
514	Mid.hypo chlorite dosing pump	1	1	2	Magnetic drive diaphragm pump	15	l/min.	40	0.24	220	
515	Post.hypo chlorite dosing pump	1	1	2	Magnetic drive diaphragm pump	15	l/min.	40	0.24	220	
516	Inlet valve	3	0	3	Manual operated ball valve	40	mm			100 -230	
517	Outlet valve	3	0	3	Manual operated ball valve	50	mm				
518	Drain valve	3	0	3	Manual operated ball valve	50	mm				
519	Air chamber	3	0	3	Flange type,PVC	25	mm				
520	Relief valve	3	0	3	Spring type,PVC	25	mm				
521	Back pressure valve	3	0	3	Spring type,PVC	25	mm				
522	Lifting conveyor	1	0	1	Belt conveyor	W400 xL5500	mm		0.75	380	
523	Exhaust fan (inlet)	3	1	4	Pressure ventilation fan	7000	m3/hr.	30Pa	0.4	380	Weather cover
524	Pedestrian bridge	1	0	1	Steel made over pass	L7A W1	m				JIS SS400 + FRP GRATING
E501	Level detector	2	0	2	Electrod (5P)	0-3	m				316SS
E502	Level detector	3	0	3	Electrod (3P)	0-3	m				Titanium
E503	Flow meter	1	0	1	Turbine type	40	mm			100 -230	Electric integrating flowmeter
E504	Flow meter	4	0	4	Electro magnetic flowmeter	25	mm			100 -230	

PROJECT
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System

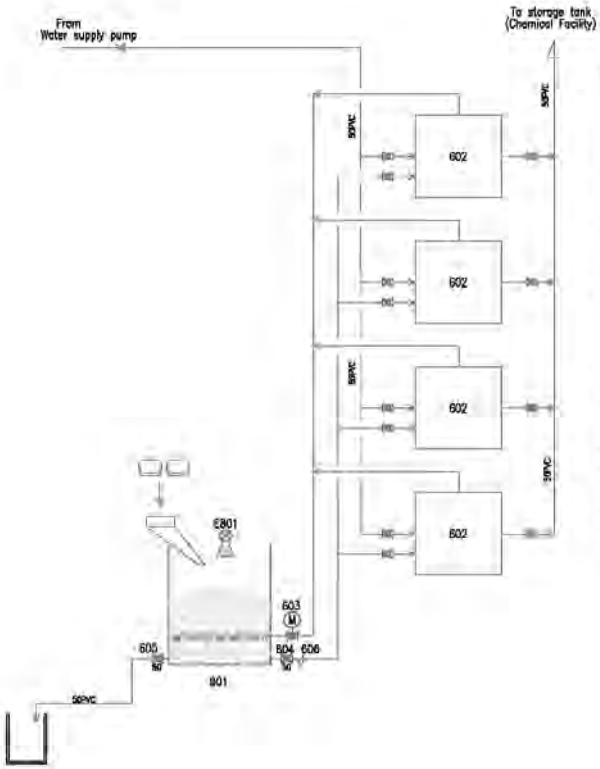
DESCRIPTION
Flow Diagram
(Chemical)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
NIHON SUIDO CONSULTANTS CO.,LTD.
CROWN AGENTS JAPAN LIMITED
TEC INTERNATIONAL CO.,LTD.

DRAWING No. PPWTP-14
SCALE Non.

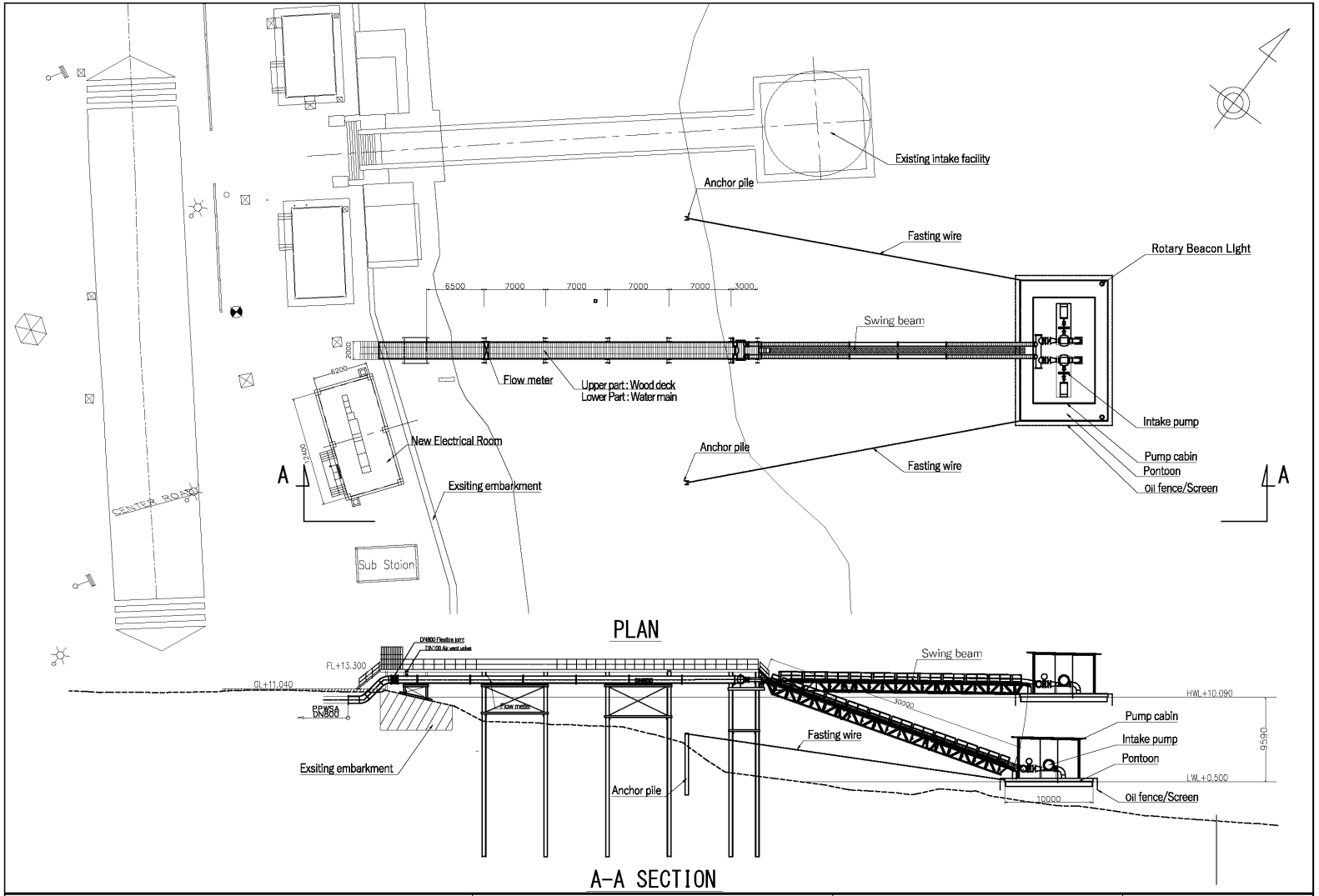
Item No.#	Description	Quantity									
		Duty	Stand by	Total	Type	Spec		Head [m]	kW	V	Notes
F	Distribution Facility										
701	Isolation valve (Suction)	3	0	3	Butterfly valve	600	mm				Limit switch, Position indicator (on-site)
702	Distribution pump	3	0	3	Double suction volute pump	29	m3/min	42	280	380	VVVF, Space heater, RTD (Winding), Thermometer with contact (Bearing for pump, motor), Compound gauge (for suction), Pressure gauge (for discharge)
703	Check Valve	3		3	Swing type	600	mm				
704	Butterfly valve (Discharge)	3	0	3	Electric drive	600	mm		1.5	380	Limit switch, Torque switch, Interlock switch, Potentiometer, Space heater, Opening indicator
705	Sump pump	1	0	2	Submersible sewage pump	0.15	m3/min	15	2.2	380	
706	Exhaust fan (Inlet)	3	0	3	In Line fan	5050	m3/hr		0.4	380	
707	Exhaust fan (outlet)	3	0	3	Roof fan	8898	m3/hr		0.4	380	
708	Overhead traveling crane	1	1	1	Electric motor drive	5	ton		5.5	380	
709	Reservoir inlet valve	1	0	1	Manual operate Butterfly valve	1200	mm				
710	Reservoir outlet valve	1	0	1	Manual operate Butterfly valve	1000	mm				
710	Ventilation pipe	18	0	18	Natural ventilation	350	mm				FRP pipe With insect screen#20
E701	Water Level Meter	1	0	1	Immersion type level meter	0-5	m			24V DC	No.4 CLEAR WATER RESERVOIR
E702	Flow switch	3	0	3	Mass flow measure type	0.3-3	m3/sec			100-240	
E703	Flow Meter	1	0	1	Ultrasonic	0-12000	m3/hr				DN1000
E704	Pressure Transmitter	1	0	1	Desital pressure gaug E	0-1.0	Mpa			24V DC	
E705	Level detector	1	0	1	Electrode(3p)	1m x 3					sump PE

PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Flow Diagram (Distribution Facility)	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-015
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	Non.

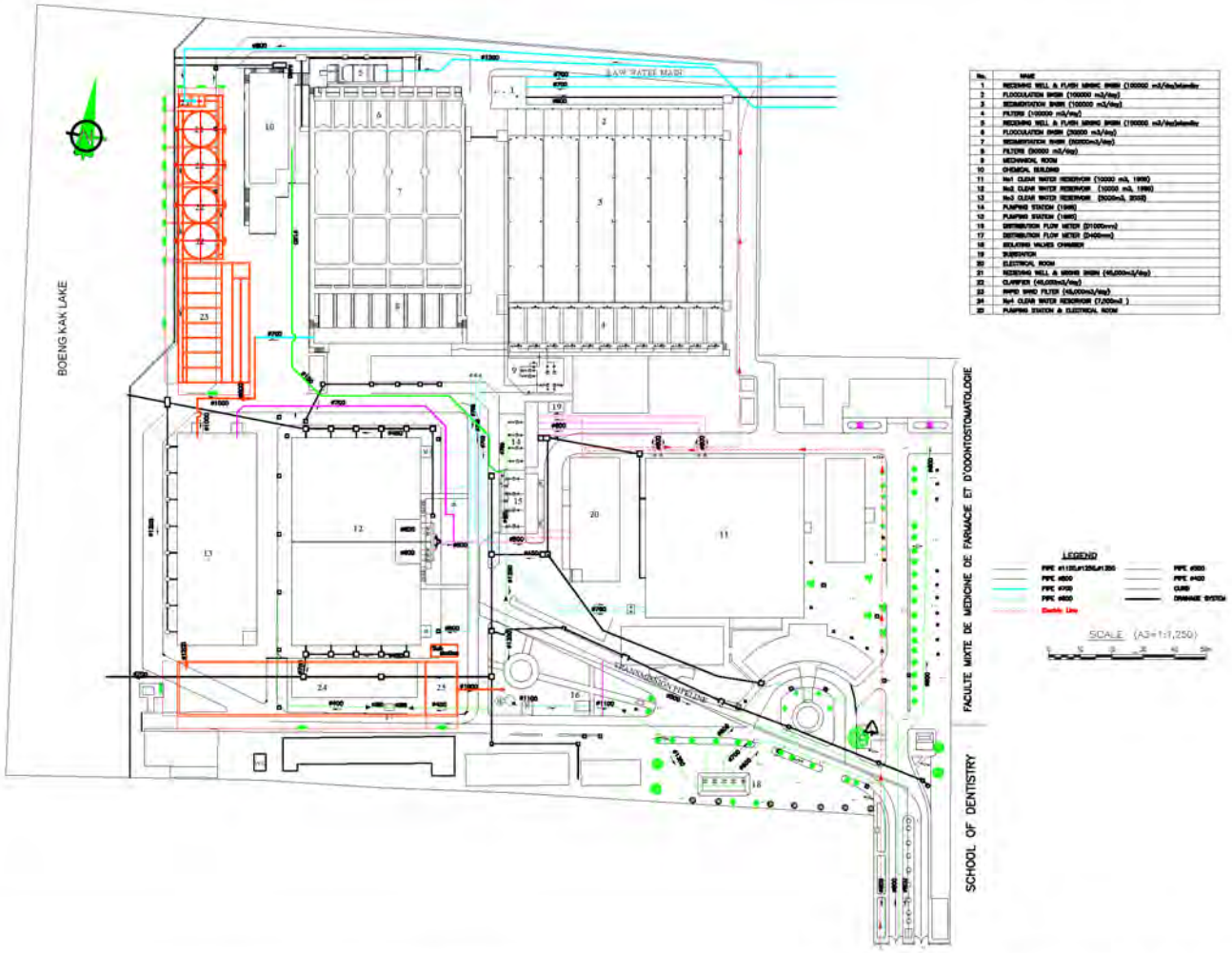


Item No.s	Description	Quantity			Type	Spec		Head (m)	kW	V	Notes
		Duty	Stand by	Total							
G	Hypo-chlorite generator Facility										
601	Salt suturate tank	1	0	1	Vertical open polyethylen type	6	m3				HDPE
602	Hypo-chlorite generator	3	1	4	Electrolyzer skid	9.5 (0.8%)	kg/hr.		3.5 kVA	230/ 380	Flowmeter,Brine pump Electrolyzer cell,Control panel
	Hypo-chlorite generator	3	1	4	Rectifier	9.5 (0.8%)	kg/hr.		75 kVA	230/ 380	
603	Water supply valve	1	0	1	Electric drive ball valve	50	mm		0.1	100 -230	PVC
604	Outlet valve	1	0	1	Manual operated ball valve	50	mm				PVC
606	Drain valve	1	0	1	Manual operated ball valve	50	mm				PVC
607	Strainer	1	0	1	Y-type , 0. fine opening	50	mm				PVC
E601	Salt level detector	1	0	1	Micro wave level meter	0-3	m			18~36 DC	

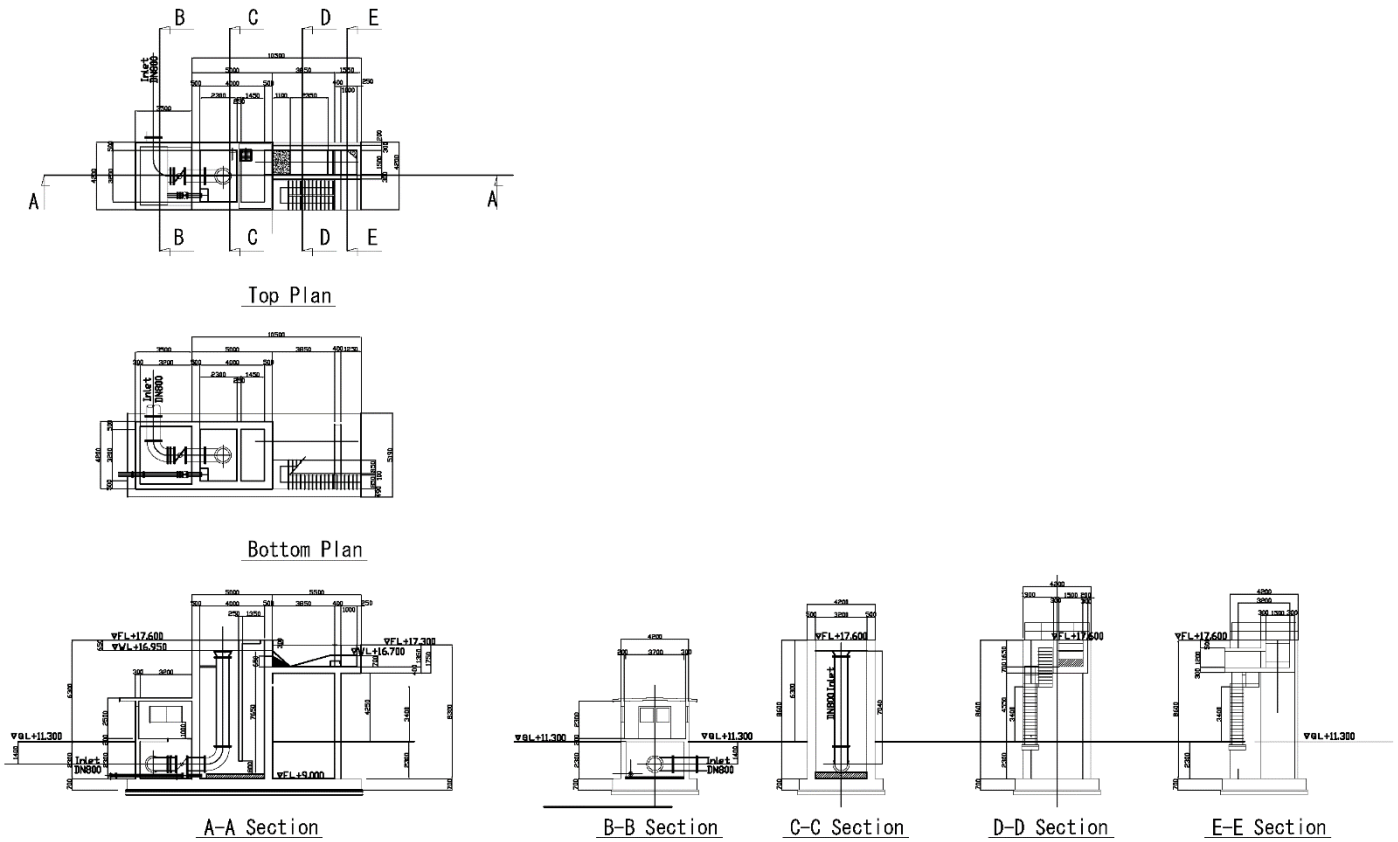
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Flow Diagram (Hypo-chlorite generator Facility)	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWPT-016
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	Non.



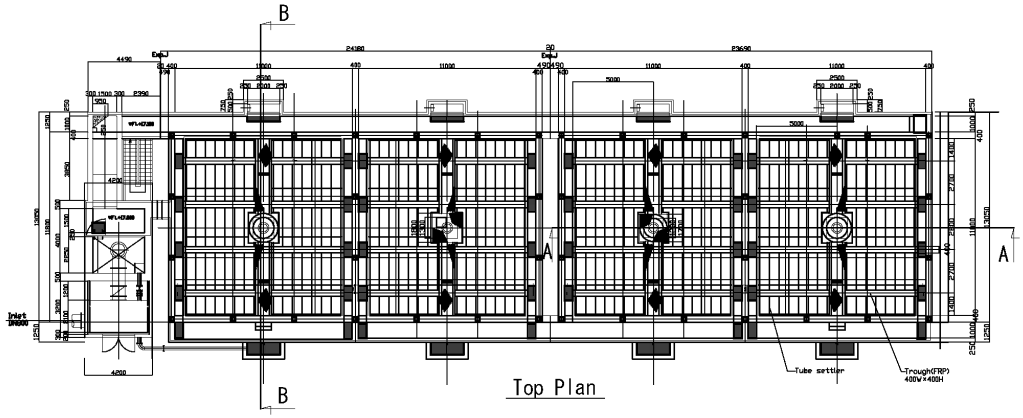
PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No. PPWTP-111
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	3rd Stage Intake Facility	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE 1:



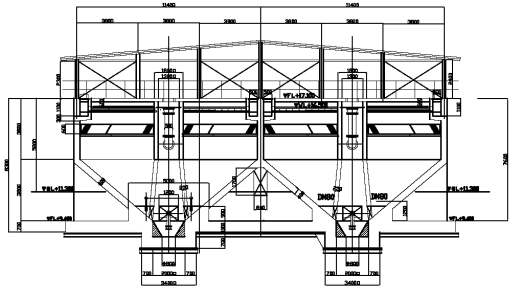
PROJECT The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	DESCRIPTION Water treatment Facility Layout	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	DRAWING No. PPWTP-NCT-G-001 SCALE



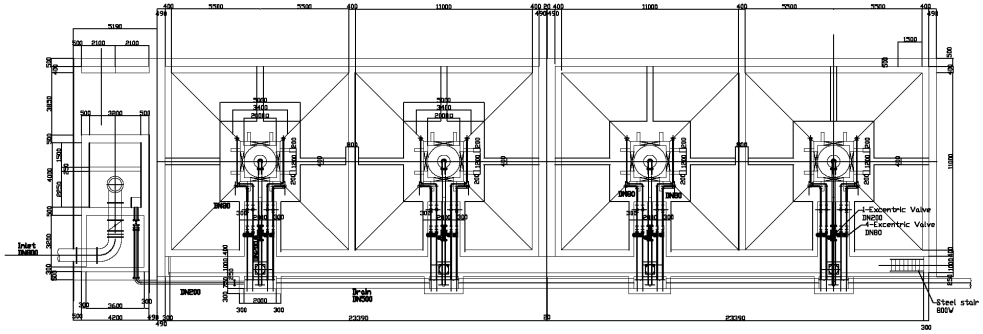
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Receiving Well & Mixing Channel	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPHP-311
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:250



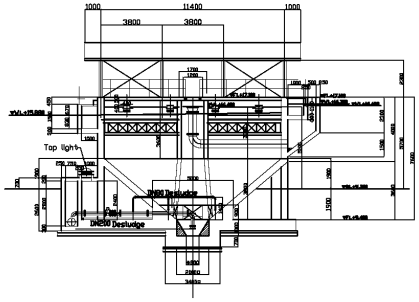
Top Plan



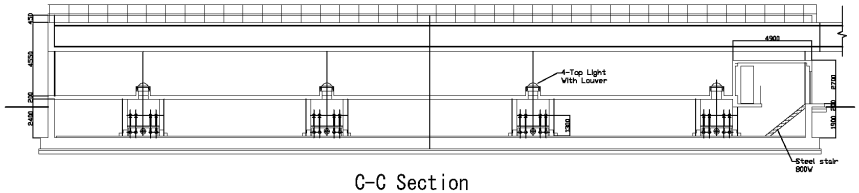
A-A Section



Lower Plan

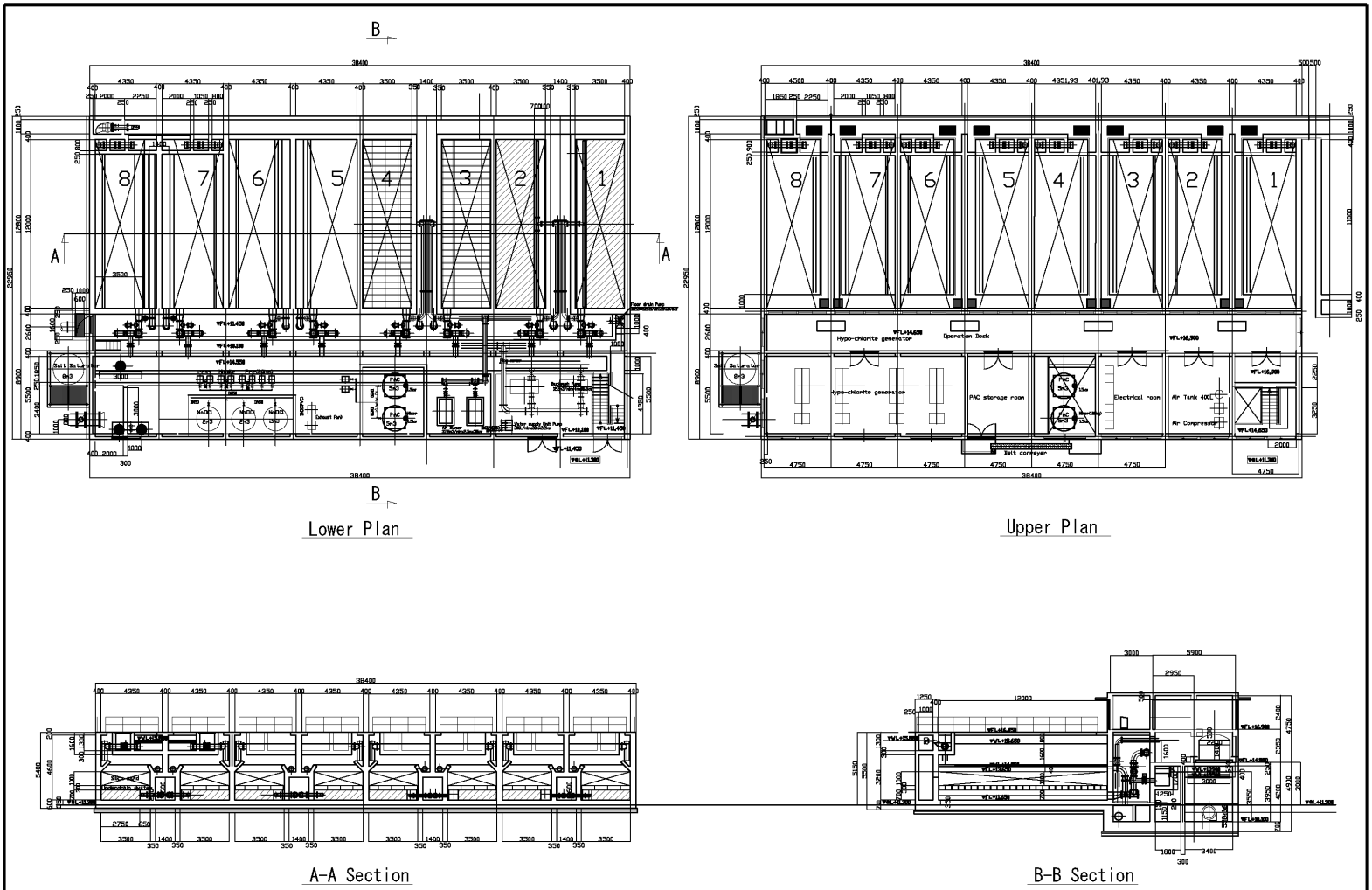


B-B Section

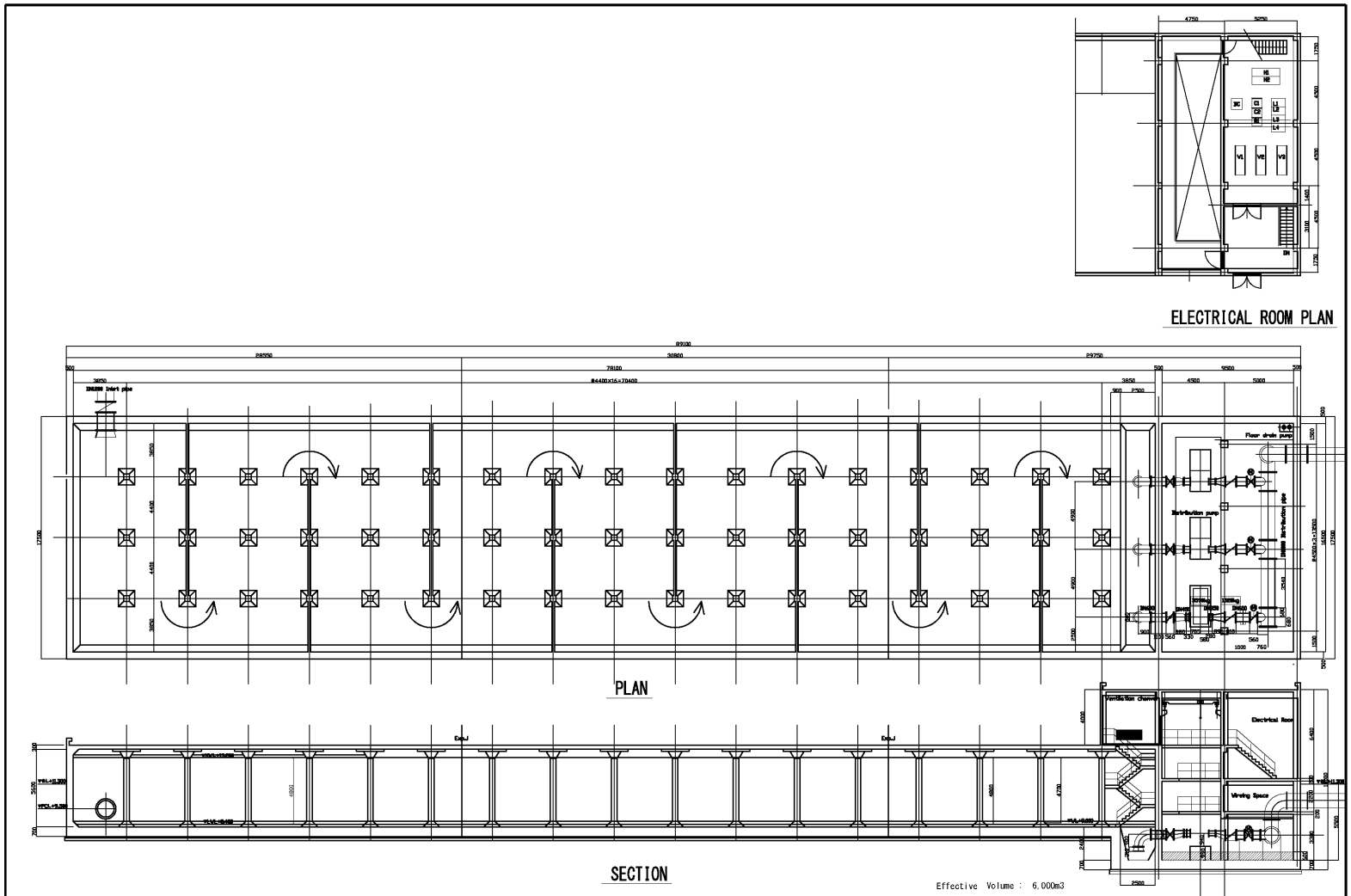


C-C Section

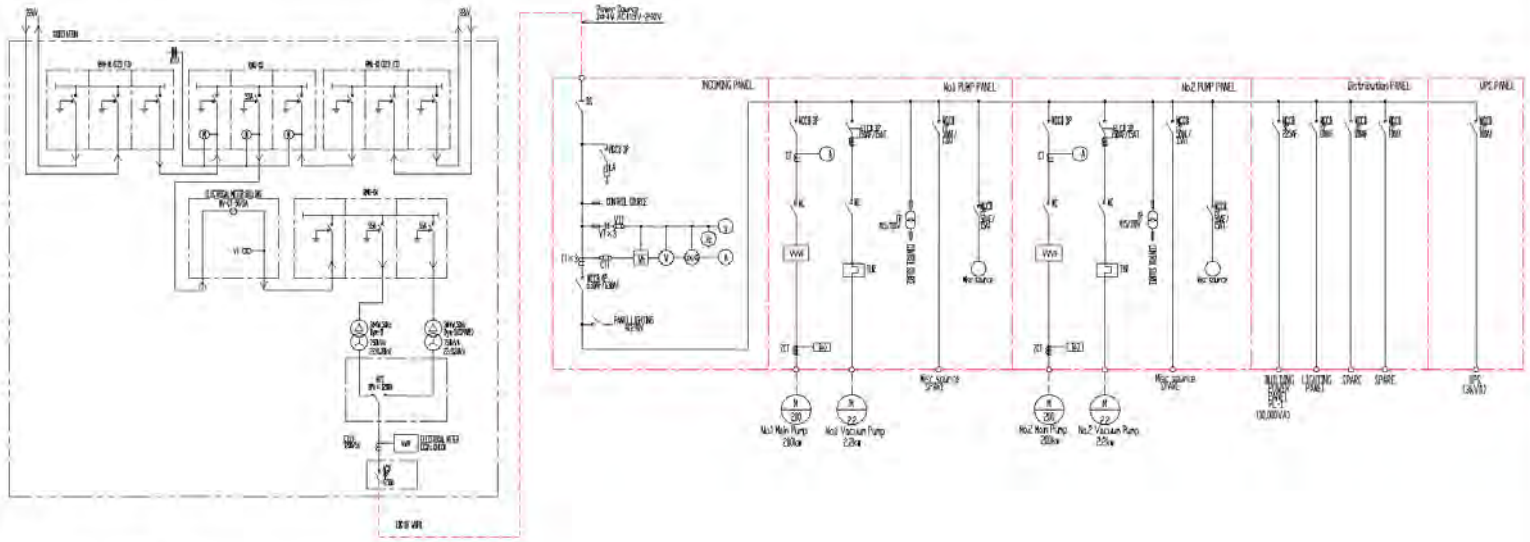
PROJECT	DESCRIPTION		
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Clarifier	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) DRAWING No.	PPWTP-321
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD. SCALE	1:250



PROJECT	DESCRIPTION		
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Clarifier	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No. PPWTP-331
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE 1:250

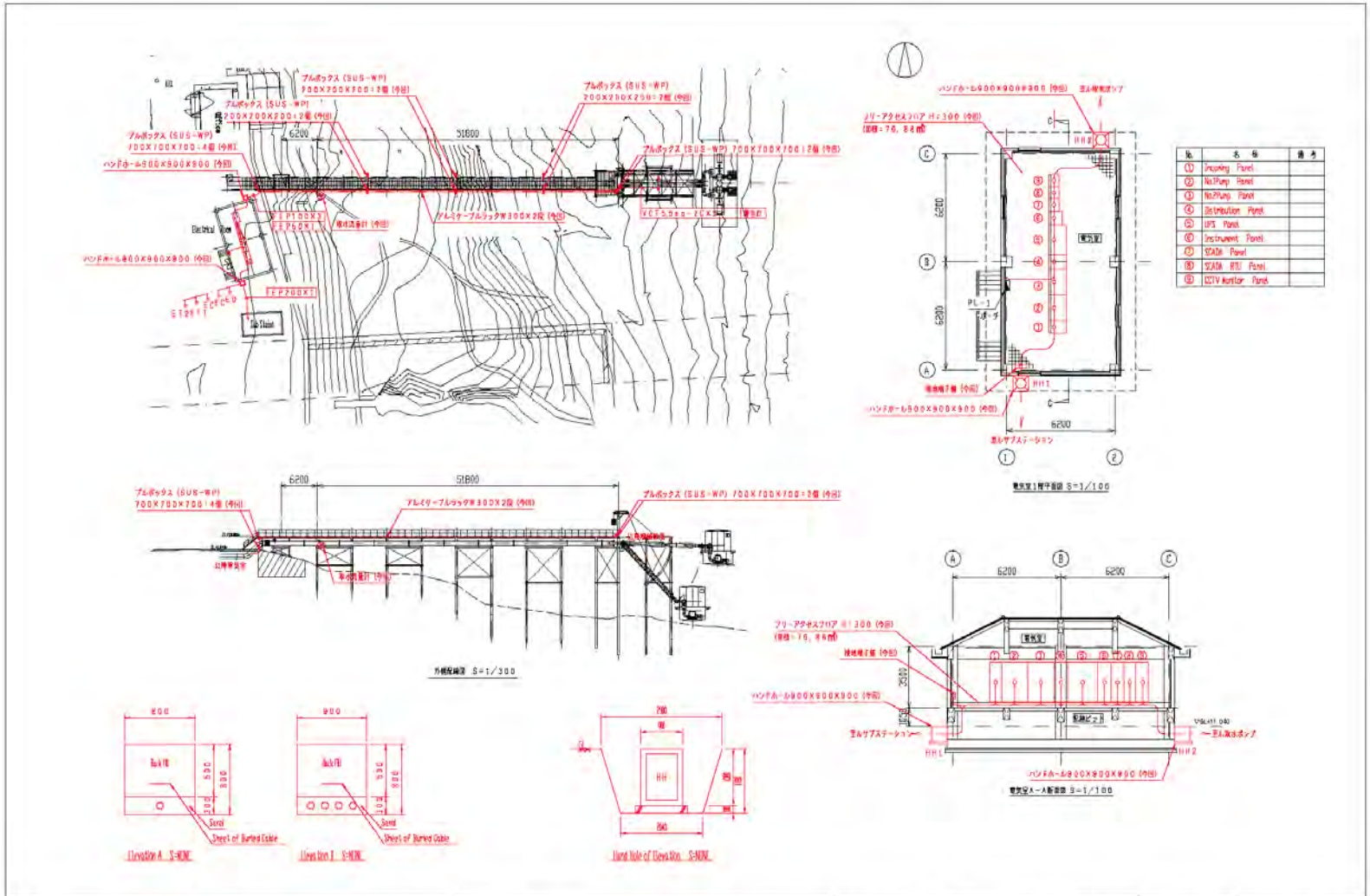


PROJECT	DESCRIPTION		
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	No.4 Clear Water Reservoir & Distribution Pumping Station	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA) DRAWING No.	PPWTP-341
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD. SCALE	1:250

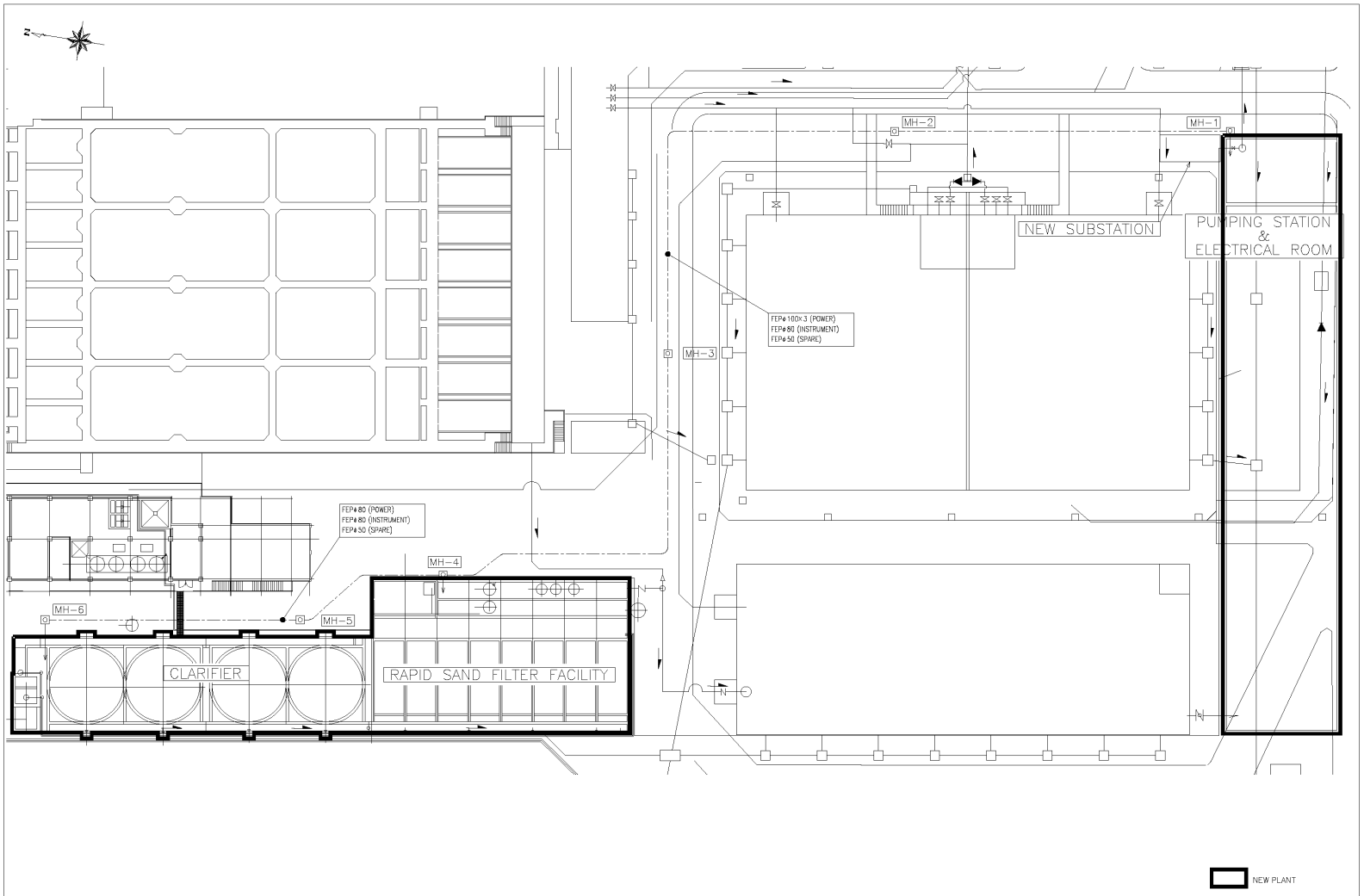


SYMBOL	DESCRIPTION
LA	LIGHTNING ARRESTER
PT	POTENTIAL TRANSFORMER
F	FUSE
CT	CURRENT TRANSFORMER
MCCB	MOLDED CASE CIRCUIT BREAKER
OCR	OVER CURRENT GROUNDING RELAY
VS	VOLTAGE SELECTOR SWITCH
AS	AMMETER SELECTOR SWITCH
Tr	TRANSFORMER
ZCT	ZERO PHASE CURRENT TRANSFORMER
[illegible]	INDICATOR METER
[illegible]	UNDER VOLTAGE RELAY
[illegible]	OVER VOLTAGE RELAY
R	RESISTOR
C	CONDENSER
V	VOLTMETER
A	AMMETER
[illegible]	BATTERY
[illegible]	POWER FACTOR METER
[illegible]	OVER CURRENT RELAY
[illegible]	FREQUENCY METER
[illegible]	KWH KVAR METER
[illegible]	SPEED INDICATOR
[illegible]	AUXILIARY RELAY
ACR	ALTERNATING CURRENT REACTOR
MC	MAGNETIC CONTACTOR
[illegible]	THERMAL RELAY

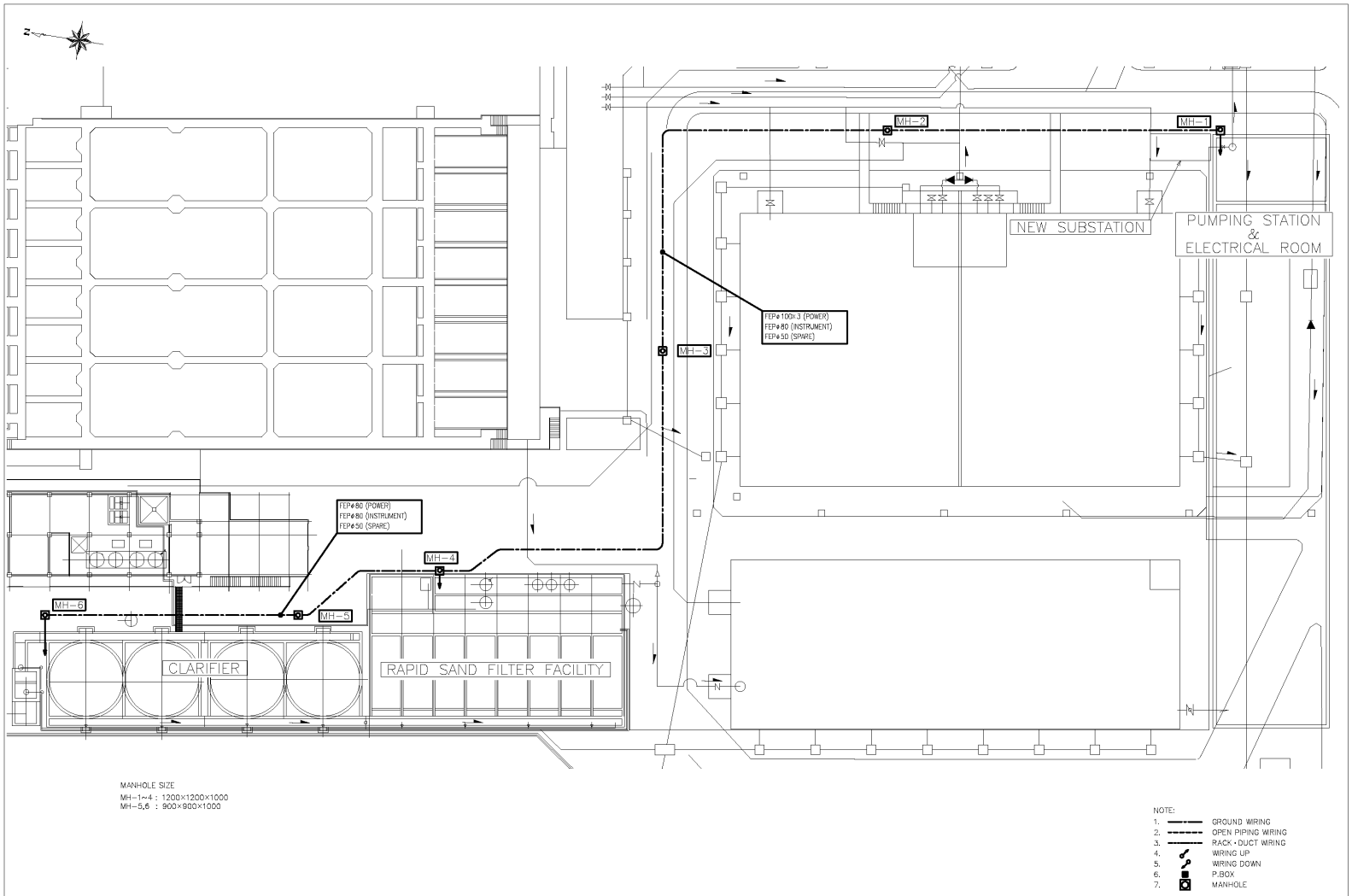
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project For Rehabilitation and Expansion of Phum Preek Water Treatment System	Single Line Diagram	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-500
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



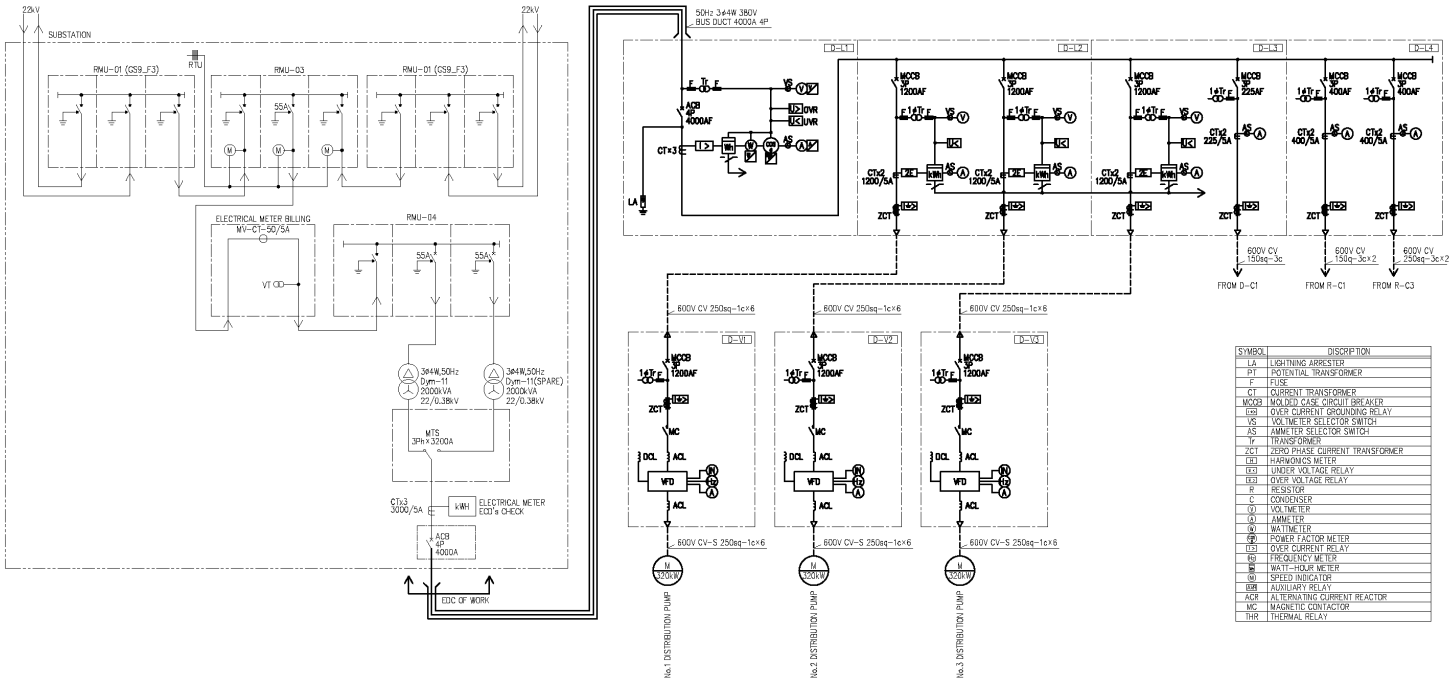
PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-500
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Intake Facility Layout Plan	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1/300,1/100,NONE



PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	WTP Plan	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-600
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:500

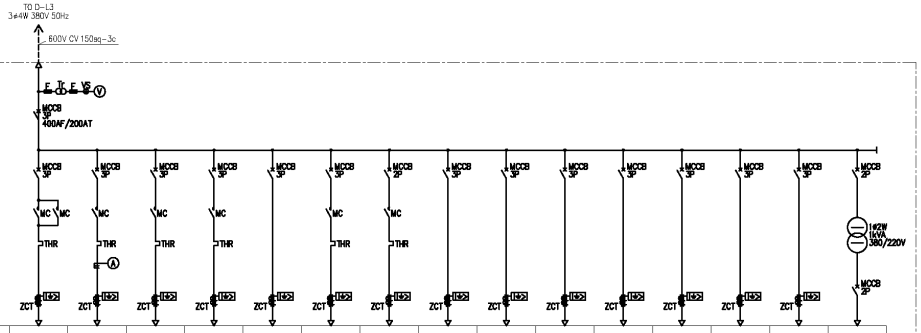


PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-601
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	WTP Outdoor Wiring Route Plan	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:500



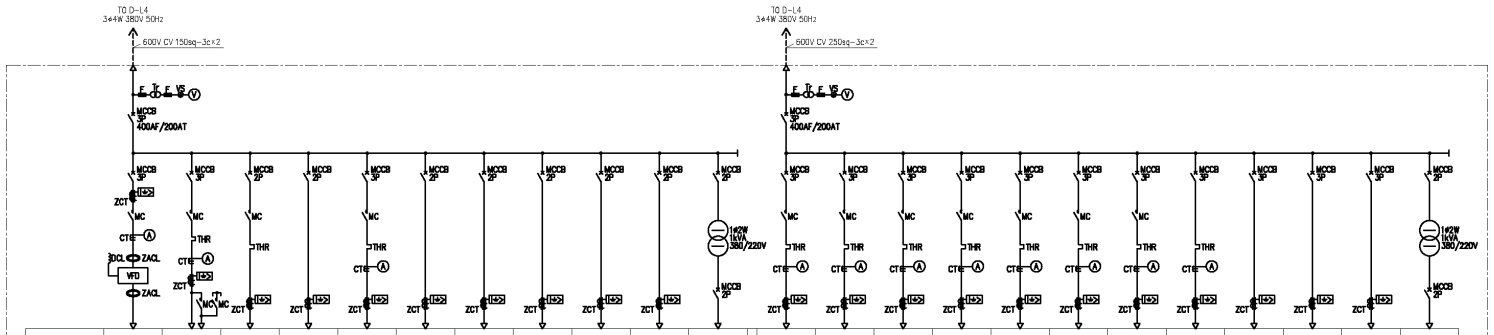
SYMBOL	DISCRIPTION
LA	LIGHTNING ARRESTER
PT	POTENTIAL TRANSFORMER
F	FUSE
CT	CURRENT TRANSFORMER
MCCB	MOLDED CASE CIRCUIT BREAKER
OCR	OVER CURRENT GROUNDING RELAY
VS	VOLTMETER SELECTOR SWITCH
AS	AMMETER SELECTOR SWITCH
Tr	TRANSFORMER
ZCT	ZERO PHASE CURRENT TRANSFORMER
H	HARMONICS METER
UV	UNDER VOLTAGE RELAY
OV	OVER VOLTAGE RELAY
R	RESISTOR
C	CONDENSER
V	VOLTMETER
A	AMMETER
W	WATTMETER
PF	POWER FACTOR METER
OC	OVER CURRENT RELAY
Hz	FREQUENCY METER
Wh	WATT-HOUR METER
N	SPEED INDICATOR
AUX	AUXILIARY RELAY
ACR	ALTERNATING CURRENT REACTOR
MC	MAGNETIC CONTACTOR
THR	THERMAL RELAY

PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-611
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	WTP Single Line Diagram (1)	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



TAG NUMBER															
DESCRIPTION	No.□ DISCHARGE VALVE	No.□ SUMP PUMP	No.□ EXHAUST FAN (INLET)	No.□ EXHAUST FAN (OUTLET)	OVERHEAD TRAVELING CRANE	No.□ DISTRIBUTION PUMP HEATER	No.□ DISCHARGE VALVE HEATER	SPARE	DC POWER SUPPLY PANEL	LIGHTING PANEL	OUTDOOR LIGHTING PANEL	BUILDING POWER PANEL	No.1 RELAY PANEL	SPARE	AUXILIARY POWER SOURCE
AF / AT	50 / 15	50 / 25	50 / 15	50 / 15	50 / 50	50 / 10	50 / 10		50 / 50	225 / 200	100 / 100	400 / 350	50 / 50		50 / 10
kW (kVA)	1.5	2.2	0.4	0.4	5.5	0.3	0.3		5.0	26.9	10.0	50.0	5.0		(1.0)
V	380	380	380	380	380	220	220		220	220	220	220	220		380/220
A	13.0	18.0	5.0	5.0	43.0	5.0	5.0		43.0	164.0	80.0	330.0	43.0		
DUTY	3	1	2	2	1	3	3		1	1	1	1	1		1
STANDBY	0	1	1	1	0	0	0		0	0	0	0	0		0
TOTAL	3	2	3	3	1	3	3		1	1	1	1	1		1
CABLE SIZE	600V CV 3.5sq-3c	600V CV 3.5sq-3c	600V CV 3.5sq-3c	600V CV 3.5sq-3c	600V CV 3.5sq-3c	600V CV 3.5sq-3c	600V CV 3.5sq-3c		600V CV 8sq-3c	600V CV 60sq-3c	600V CV 22sq-3c	600V CV 150sq-3c	600V CV 3.5sq-3c		
DESCRIPTION	D:1~3	□:1,2	□:1~3	□:1~3		D:1~3	D:1~3								
PANEL NAME	(D-C1,2) No.1,2 CONTROL CENTER for DISTRIBUTION PUMP														

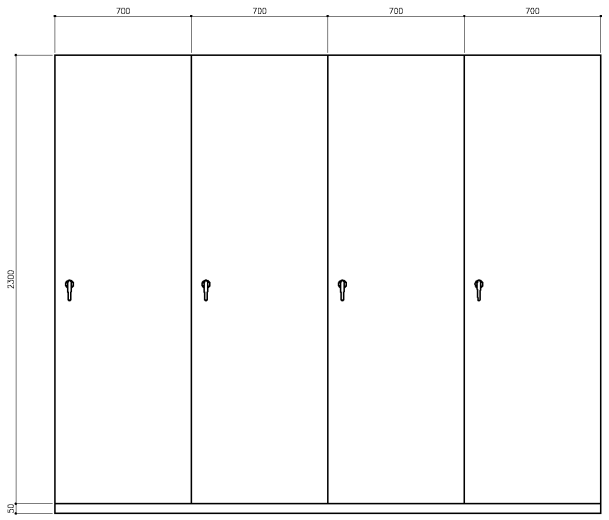
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	WTP Single Line Diagram (2)	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-612
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



TAG NUMBER											
DESCRIPTION	No.0 BACKWASH PUMP	No.0 AIR BLOWER	No.0 AIR COMPRESSOR	FLUSH PUMP UNIT	No.0 FLOOR DRAIN PUMP	WATER SUPPLY UNIT	LIGHTING PANEL	OUTDOOR LIGHTING PANEL	BUILDING POWER PANEL	No.1 RELAY PANEL	AUXILIARY POWER SOURCE
AF / AT	150 / 125	225 / 225	50 / 15	50 / 25	50 / 15	50 / 25	630 / 500	100 / 100	100 / 100	50 / 50	
kW (kVA)	18.5	30.0	1.5	2.2	0.4	3.0	62.7	10.0	7.5	5.0	
V	380	380	380	380	380	380	220	220	220	220	380/220
A	116.0	184.0	13.0	18.0	5.0	29.0	449.0	80.0	57.0	43.0	
DUTY	1	1	1	1	1	1	1	1	1	1	1
STANDBY	1	1	1	0	1	0	0	0	0	0	0
TOTAL	2	2	2	1	2	1	1	1	1	1	1
CABLE SIZE	600V CV-S 38sq-3c	600V CV 60sq-3c	600V CV 3.5sq-3c	600V CV 3.5sq-3c	600V CV 3.5sq-3c	600V CV 3.5sq-3c	600V CV 250sq-3c	600V CV 22sq-3c	600V CV 14sq-3c	600V CV 5.5sq-3c	
DESCRIPTION	0:1,2	0:1,2	0:1,2		0:1,2						
PANEL NAME	(R-C1,2) No.1,2 CONTROL CENTER for RAPID SAND FILTER										

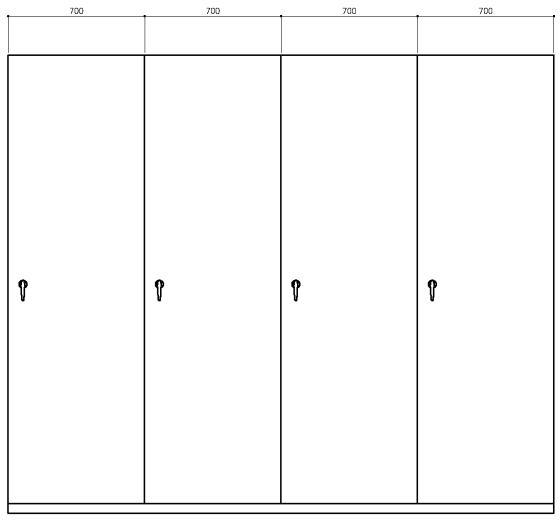
TAG NUMBER												
DESCRIPTION	No.0 DISSOLVING MIXER	No.0 PAC DOSING PUMP	No.0 PRE.HYPO DOSING PUMP	No.0 MID.HYPO DOSING PUMP	No.0 POST.HYPO DOSING PUMP	LIFTING CONVEYOR	EXHAUST FAN (INLET)	No.0 HYPO-CHLORITE GENERATOR	No.1 RELAY PANEL	LIGHTING PANEL (CLARIFIER)	OUTDOOR LIGHTING PANEL (CLARIFIER)	AUXILIARY POWER SOURCE
AF / AT	50 / 15	50 / 15	50 / 15	50 / 15	50 / 15	50 / 15	50 / 15	225 / 150	50 / 25	150 / 150	100 / 100	50 / 15
kW (kVA)	1.5	0.24	0.24	0.24	0.24	0.75	0.4	(77.0)	2.0	19.2	10.0	
V	380	220	220	220	220	380	380	380	220	220	220	380/220
A	13.0	5.0	5.0	5.0	5.0	8.0	5.0	167	18.0	137.0	80.0	
DUTY	1	1	3	1	1	1	3	3	1	1	1	1
STANDBY	1	1	1	1	1	0	1	1	0	0	0	0
TOTAL	2	2	4	2	2	1	4	4	1	1	1	1
CABLE SIZE	600V CV 3.5sq-3c	600V CV 3.5sq-3c	600V CV 3.5sq-3c	600V CV 3.5sq-3c	600V CV 3.5sq-3c	600V CV 3.5sq-3c	600V CV 3.5sq-3c	600V CV 60sq-3c	600V CV 3.5sq-3c	600V CV 38sq-3c	600V CV 22sq-3c	
DESCRIPTION	0:1,2	0:1,2	0:1~4	0:1,2	0:1,2		0:1~4 ELECTROYZER SKID	0:1~4 RECTIFIER				
PANEL NAME	(R-C3~5) No.3~5 CONTROL CENTER for RAPID SAND FILTER											

PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-613
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	WTP Single Line Diagram (3)	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



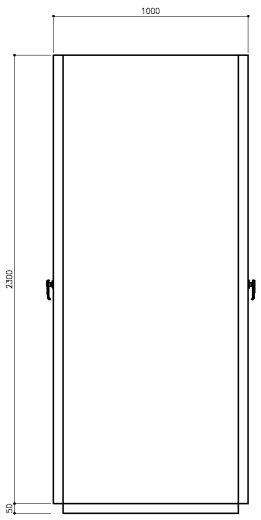
ITEM No.	D-L1	D-L2	D-L3	D-L4
NAME	LOW VOLTAGE PANEL	No.1 DISTRIBUTION PANEL	No.2 DISTRIBUTION PANEL	No.3 DISTRIBUTION PANEL

FRONT VIEW



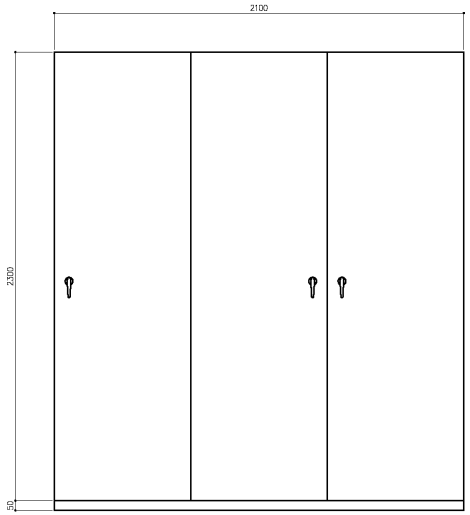
ITEM No.	D-L4	D-L3	D-L2	D-L1
NAME	No.3 DISTRIBUTION PANEL	No.2 DISTRIBUTION PANEL	No.1 DISTRIBUTION PANEL	LOW VOLTAGE PANEL

BACK VIEW



SIDE VIEW

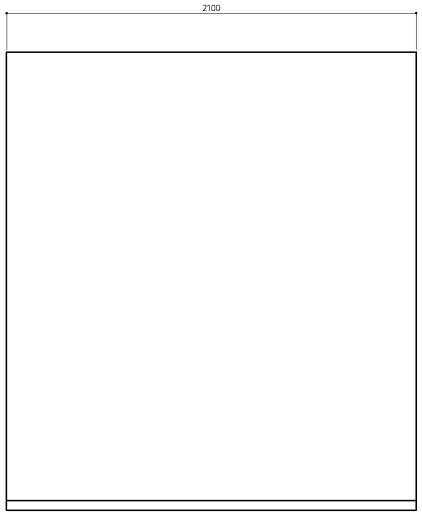
PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-D621
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	NO.4 Distribution Pumping Station Low Voltage Panel	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:20



ITEM No.	D-V□
NAME	No.□ 380V VFD FOR DISTRIBUTION PUMP

※ □ 1~3

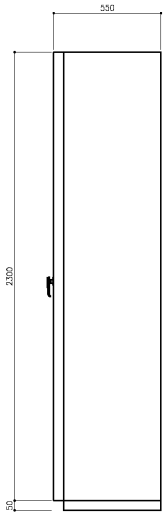
FRONT VIEW



ITEM No.	D-V□
NAME	No.□ 380V VFD FOR DISTRIBUTION PUMP

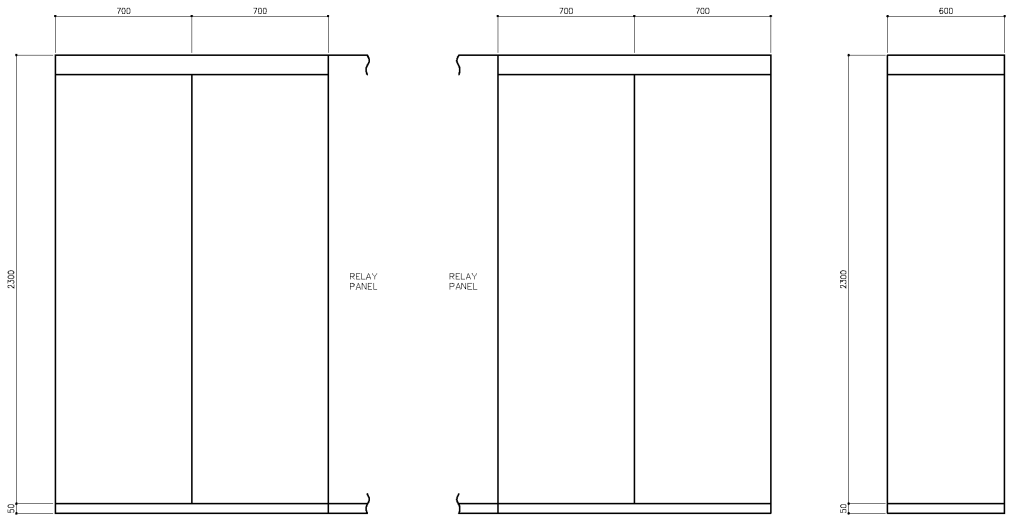
※ □ 1~3

BACK VIEW



SIDE VIEW

PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-D622
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	NO.4 Distribution Pumping Station VFD Panel	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:20



ITEM No.	D-C1	D-C2
NAME	No.1 CONTROL CENTER FOR DISTRIBUTION PUMP	No.2 CONTROL CENTER FOR DISTRIBUTION PUMP

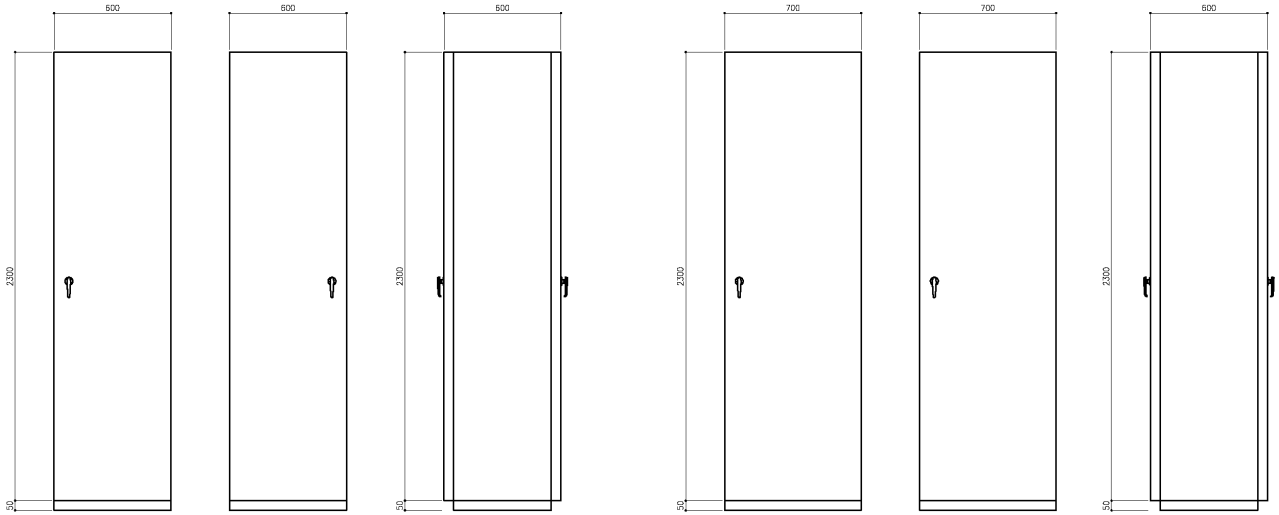
ITEM No.	D-C2	D-C1
NAME	No.2 CONTROL CENTER FOR DISTRIBUTION PUMP	No.1 CONTROL CENTER FOR DISTRIBUTION PUMP

FRONT VIEW

BACK VIEW

SIDE VIEW

PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	NO.4 Distribution Pumping Station Control Center	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-D623
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:20



ITEM No.	D-P
NAME	PLC PANEL FOR DISTRIBUTION PUMP

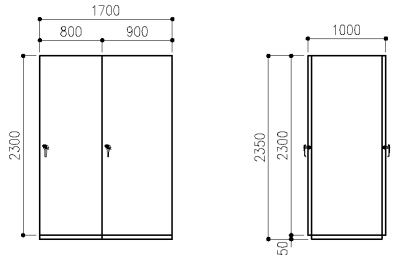
ITEM No.	D-P
NAME	PLC PANEL FOR DISTRIBUTION PUMP

ITEM No.	D-KP
NAME	INSTRUMENT PANEL FOR DISTRIBUTION PUMP

ITEM No.	D-KP
NAME	INSTRUMENT PANEL FOR DISTRIBUTION PUMP

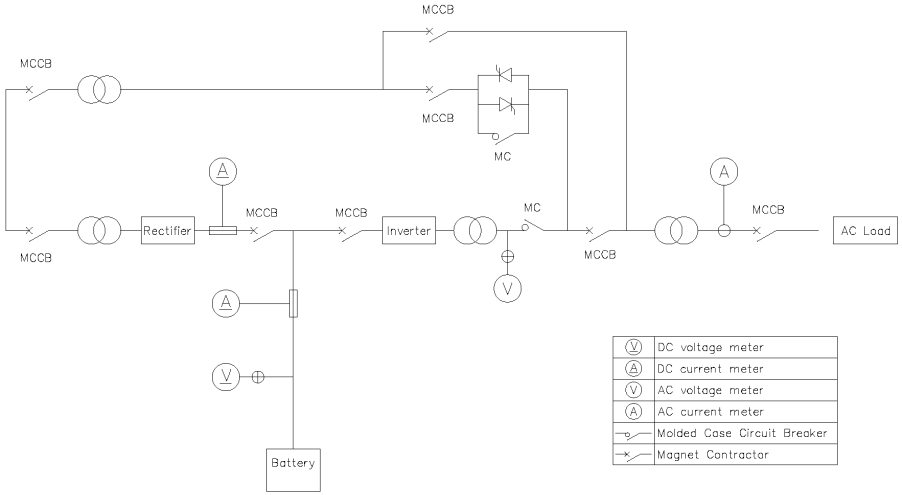
FRONT VIEW BACK VIEW SIDE VIEW FRONT VIEW BACK VIEW SIDE VIEW

PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-D625
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	NO.4 Distribution Pumping Station PLC & Instrument Panel	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:20



FRONT VIEW

SIDE VIEW



Ⓥ	DC voltage meter
Ⓐ	DC current meter
Ⓥ	AC voltage meter
Ⓐ	AC current meter
	Molded Case Circuit Breaker
	Magnet Contractor

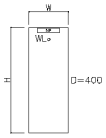
UPS Single diagram

Item No.	D-UPS
Name Plate Panel Name	UPS PANEL FOR DISTRIBUTION PUMP
Bord Type	Metal clad enclosure in door use, doors in the front and the rear
UPS Capacity	More than 3kVA
Input Voltage	380V 3-phase, 50Hz
Output Voltage	AC230V single-phase
Backup time	The battery supply to the UPS shall need more than 30minutes for the full load of UPS capacity.
Component	ELCB, MCCB, current transformer, Converter, Inverter, Capacitor, Static bypass switch protection relay. V, A, Hz meter.
Battery	Sealed Lead Acid Battery, Sealed Lead Acid Battery, Maintenance Free type.
Battery Charger Type	The float and boost battery charger shall be static type composed of silicon controlled rectifiers and diodes connected in three phase full wave bridge circuit along with electronic controllers. Each battery charger shall be suitable for float charging the battery under normal conditions and boost charging the battery when it has discharged during service conditions. The charge-over from float to boost mode and vice versa shall be automatic.
Charger Cubicle	Self-standing, metal clad enclosure indoor use, doors in the front and the rear. The components shall be housed in a well ventilated sheet metal cubicle.
UPS (Uninterruptible Power Supply)	The UPS shall be on-line type incorparating a 3-phase full wave bridge rectifier and pule width modulation inverter technology with microprocessor control. It shall incorporate a static bypass switch that shall operate in event of UPS failure, overload or manual initiation in order to transfer the output supply to mains without disturbance to the output supply.
Quantity	2

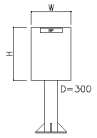
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	No.4 Distribution Pumping Station UPS Panel	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-D626
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:50

Local Operation Panels table

Panel Name	Tag No.	Quantity		Type	Size	Object Equipment		COS	PBS	VS	Indication Lamp	Instrument Device	Remarks
		Lot 1	Lot 2			Tag No.	Load Name						
No.□ Distribution Pump	D-LCP-1-□	3	–	IS	800W x1000H		Common	1, 2	9, 10				
							No.1 Supply Fan		1, 2		1,2,4,5,7x6 10,11,13,14	A	□ : 1 ~ 3
							Discharge Valve		3, 4		1, 4	ZI	□ : 1 ~ 3
							Motor Space Heater		1, 2		2		□ : 1 ~ 3
Sump Pump	D-LCP-2	1	–	IS	600W x900H		Common	2	9, 10				
							No.1 Sump Drainage Pump		1, 2		1, 4		
							No.2 Sump Drainage Pump		1, 2		1, 4		
Exhaust Fan (Inlet)	D-LCP-3	1	–	IS	600W x600H		Common	2	9, 10				
							No.1 Exhaust Fan (Inlet)		1, 2		1, 4		
							〃						
							No.3 Exhaust Fan (Inlet)		1, 2		1, 4		
Exhaust Fan (Outlet)	D-LCP-4	1	–	IS	600W x600H		Common	2	9, 10				
							No.1 Exhaust Fan (Outlet)		1, 2		1, 4		
							〃						
							No.3 Exhaust Fan (Outlet)		1, 2		1, 4		



LCP General Arrangement
(Panel Type IC)



LCP General Arrangement
(Panel Type IS)

NP	Name Plate
COS	Changeover Switch
IA	Integrated Annunciator
PBS	Push Button Switch
A	Ammeter
V	Volt Meter
LI	Level Indicator
PI	Pressure Indicator
FI	Flow Indicator
ZI	Valve Position

COS: Change Over Switch	
0	Individual–off–cooperation
1	Local–off–Remote
2	Manual–off–Auto
3	Select Stand-by (Auto-No.1–No.2)
4	Select Stand-by (No.1–No.2–No.3)
9	Incoming1–2

PBS: Push Button Switch	
1	Stop
2	Start
3	Close or On
4	Open or Off
5	Reverse
6	Inching
7	No.1 – No.2 start
8	No.2 – No.1 start
9	Lamp Test
10	Alarm Reset
11	Ready (Dissolved)

VS: Speed Control Switch	
1	Down–Up

Indication Lamp (Integrated Annunciator)		
1	Electrical Fault	(LED lamp) (xxxx)
2	Equipment Fault	(LED lamp) (xxxx)
3	Over Torque	(LED lamp) (xxxx)
4	Over Load	(LED lamp) (xxxx)
5	Level L.L.	(LED lamp) (xxxx)
6	Level H.H.	(LED lamp) (xxxx)
7	Temperature H.H.	(LED lamp) (xxxx)
8	Temperature H	(LED lamp) (xxxx)
9	Pressure L.L.	(LED lamp) (xxxx)
10	Pressure H.H.	(LED lamp) (xxxx)
11	Non Flow	(LED lamp) (xxxx)
12	Non Seal Water	(LED lamp) (xxxx)
13	Auto Mode	(LED lamp) (xxxx)
14	Power	
15	Posible to Wash	

Panel Type

IC: Indoor control switch gear

OC: Outdoor control switch gear

IS: Indoor with stanchion, IW: Indoor Wall Mounted

OS: Outdoor with stanchion, OW: Outdoor Wall Mounted

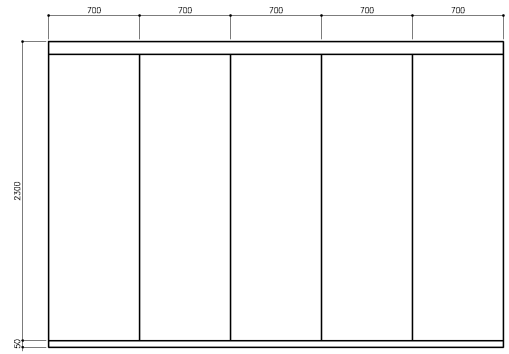
ID: Indoor Desk Type (Operation Console)

(Window material: Polycarbonate)

The size of panels are reference.

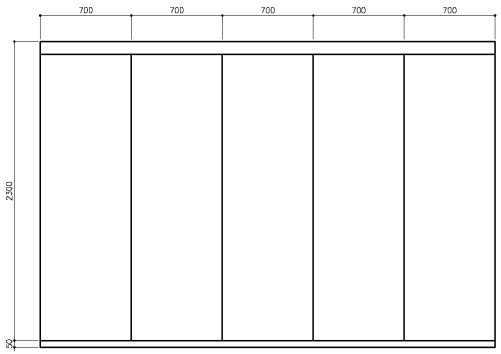
Space heater shall be required for all panels with thermostat and snap switch.

PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP–D627
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	No.4 Distribution Pumping Station Local Panel	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



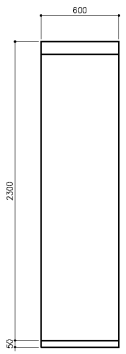
ITEM No.	R−C1	R−C2	R−C3	R−C4	R−C5
NAME	No.1 CONTROL CENTER FOR RAPID SAND FILTER	No.2 CONTROL CENTER FOR RAPID SAND FILTER	No.3 CONTROL CENTER FOR RAPID SAND FILTER	No.4 CONTROL CENTER FOR RAPID SAND FILTER	No.5 CONTROL CENTER FOR RAPID SAND FILTER

FRONT VIEW



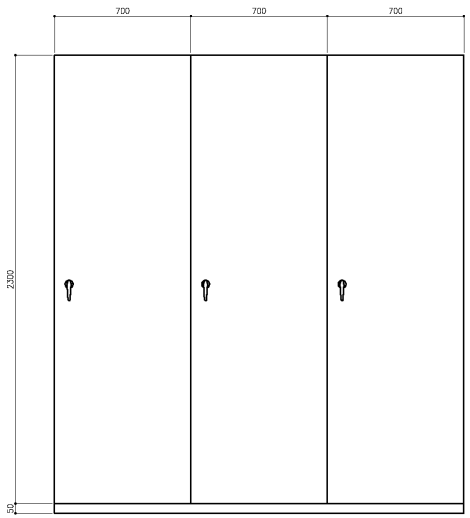
ITEM No.	R−C5	R−C4	R−C3	R−C2	R−C1
NAME	No.5 CONTROL CENTER FOR RAPID SAND FILTER	No.4 CONTROL CENTER FOR RAPID SAND FILTER	No.3 CONTROL CENTER FOR RAPID SAND FILTER	No.2 CONTROL CENTER FOR RAPID SAND FILTER	No.1 CONTROL CENTER FOR RAPID SAND FILTER

BACK VIEW



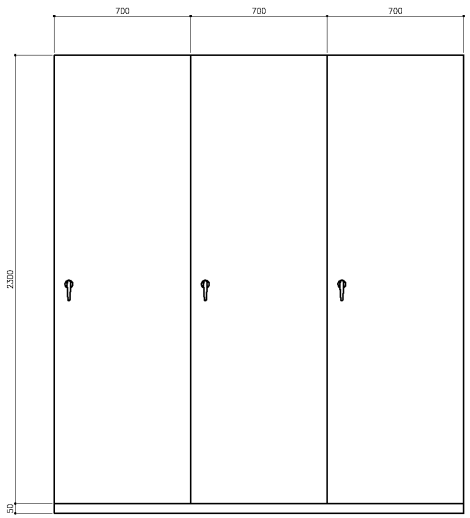
SIDE VIEW

PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter Control Center	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP−W621
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:30



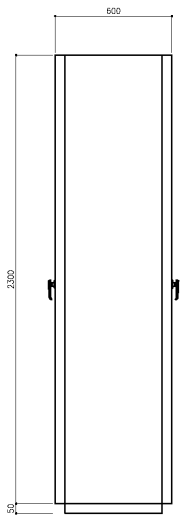
ITEM No.	R-R1	R-R2	R-R3
NAME	No.1 RELAY PANEL FOR RAPID SAND FILTER	No.2 RELAY PANEL FOR RAPID SAND FILTER	No.3 RELAY PANEL FOR RAPID SAND FILTER

FRONT VIEW



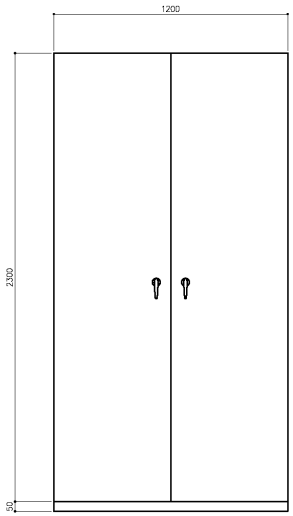
ITEM No.	R-R3	R-R2	R-R1
NAME	No.3 RELAY PANEL FOR RAPID SAND FILTER	No.2 RELAY PANEL FOR RAPID SAND FILTER	No.1 RELAY PANEL FOR RAPID SAND FILTER

BACK VIEW



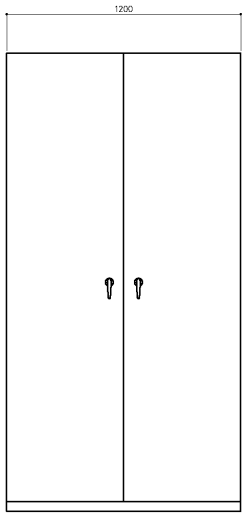
SIDE VIEW

PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter Relay Panel	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W622
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:20



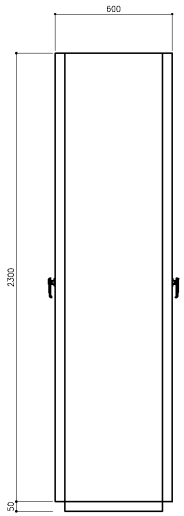
ITEM No.	R-CP
NAME	CONTROL PANEL

FRONT VIEW



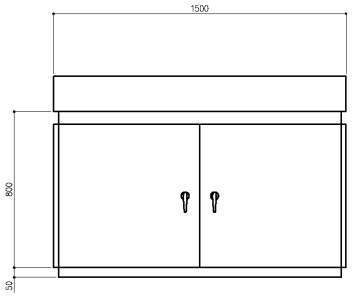
ITEM No.	R-CP
NAME	CONTROL PANEL

BACK VIEW



SIDE VIEW

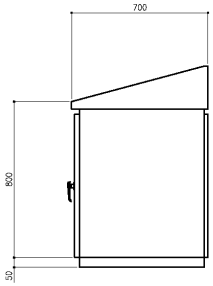
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter Control Panel	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W623
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:20



ITEM No.	R-CP-□
NAME	No.△ CONTROL PANEL FOR RAPID SAND FILTER

□:1~4 , △:1,2/3,4/5,6/7,8

FRONT VIEW



ITEM No.	R-CP-□
NAME	No.△ CONTROL PANEL FOR RAPID SAND FILTER

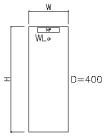
□:1~4 , △:1,2/3,4/5,6/7,8

SIDE VIEW

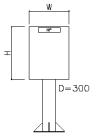
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter Control Panel for Rapid Sand Filter	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W624
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:20

Local Operation Panels table

Panel Name	Tag No.	Quantity		Type	Size	Object Equipment		COS	PBS	VS	Indication Lamp	Instrument Device	Remarks
		Lot 1	Lot 2			Tag No.	Load Name						
Back Wash Pump	R-LCP-1	1	–	IS	600W x700H		Common	2	9, 10		5, 6		
							No.1 Back Wash Pump		1, 2		1, 4		
							No.2 Back Wash Pump		1, 2		1, 4		
							# Back Wash Valve	2	1, 3, 4		1, 4		
Air Blower	R-LCP-2	1	–	IS	600W x700H		Common	2	9, 10		5, 6		
							No.1 Air Blower		1, 2		1, 4		
							No.2 Air Blower		1, 2		1, 4		
Pac Dissolution Mixer	R-LCP-3	1	–	IS	600W x700H		Common		9, 10		5, 6		
							No.1 Pac Dissolution Mixer		1, 2		1, 4		
							No.2 Pac Dissolution Mixer		1, 2		1, 4		
Floor Drainage Pump	R-LCP-4	1	–	IS	600W x700H		Common	2, 4	9, 10		5, 6		
							No.1 Floor Drainage Pump		1, 2		1, 4		
							No.2 Floor Drainage Pump		1, 2		1, 4		
Exhaust Fan (Inlet)	R-LCP-5	1	–	IS	600W x700H		Common	2, 4	9, 10		5, 6		
							No.1 Exhaust Fan (Inlet)		1, 2		1, 4		
							〃						
							No.2 Exhaust Fan (Inlet)		1, 2		1, 4		



LCP General Arrangement
(Panel Type IC)



LCP General Arrangement
(Panel Type IS)

NP	Name Plate
COS	Changeover Switch
IA	Integrated Annunciator
PBS	Push Button Switch
A	Ammeter
V	Volt Meter
LI	Level Indicator
PI	Pressure Indicator
FI	Flow Indicator
ZI	Valve Position

COS: Change Over Switch	
0	Individual–off–cooperation
1	Local–off–Remote
2	Manual–off–Auto
3	Select Stand-by (Auto-No.1-No.2)
4	Select Stand-by (No.1-No.2-No.3)
9	Incoming1–2

PBS: Push Button Switch	
1	Stop
2	Start
3	Close or On
4	Open or Off
5	Reverse
6	Inching
7	No.1 – No.2 start
8	No.2 – No.1 start
9	Lamp Test
10	Alarm Reset
11	Ready (Dissolved)

VS: Speed Control Switch		
1	Down–Up	
Indication Lamp (Integrated Annunciator)		
1	Electrical Fault	(LED lamp) (xxxx)
2	Equipment Fault	(LED lamp) (xxxx)
3	Over Torque	(LED lamp) (xxxx)
4	Over Load	(LED lamp) (xxxx)
5	Level L.L.	(LED lamp) (xxxx)
6	Level H.H.	(LED lamp) (xxxx)
7	Temperature H.H.	(LED lamp) (xxxx)
8	Temperature L.L.	(LED lamp) (xxxx)
9	Pressure L.L.	(LED lamp) (xxxx)
10	Pressure H.H.	(LED lamp) (xxxx)
11	Non Flow	(LED lamp) (xxxx)
12	Non Seal Water	(LED lamp) (xxxx)
13	Auto Mode	(LED lamp) (xxxx)
14	Power	
15	Posible to Wash	

Panel Type

IC: Indoor control switch gear

OC: Outdoor control switch gear

IS: Indoor with stanchion, IW: Indoor Wall Mounted

OS: Outdoor with stanchion, OW: Outdoor Wall Mounted

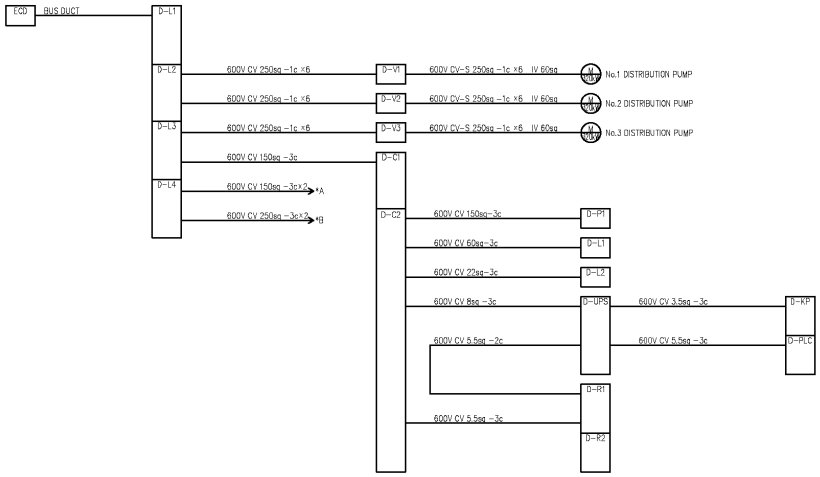
ID: Indoor Desk Type (Operation Console)

(Window material: Polycarbonate)

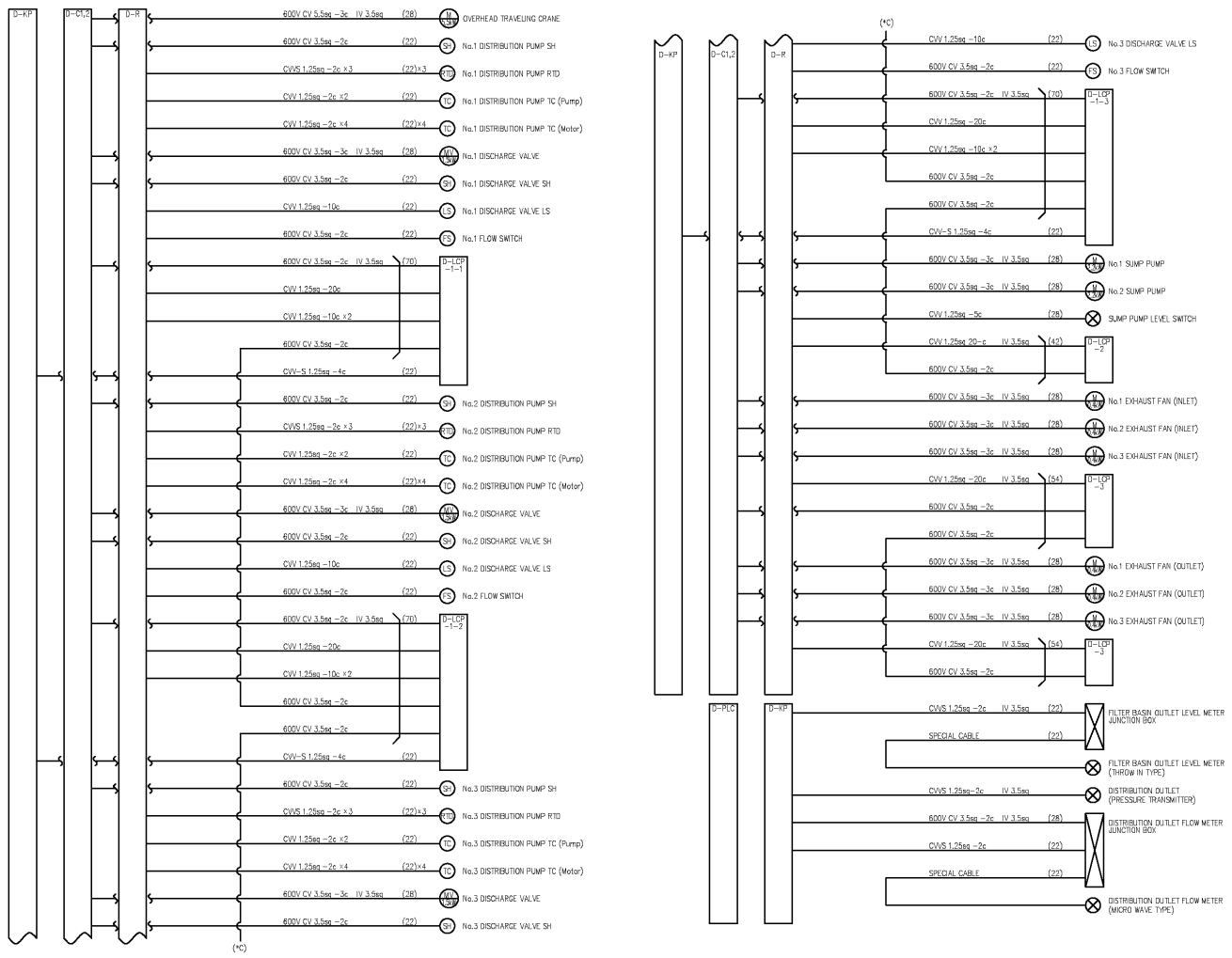
The size of panels are reference.

Space heater shall be required for all panels
with thermostat and snap switch.

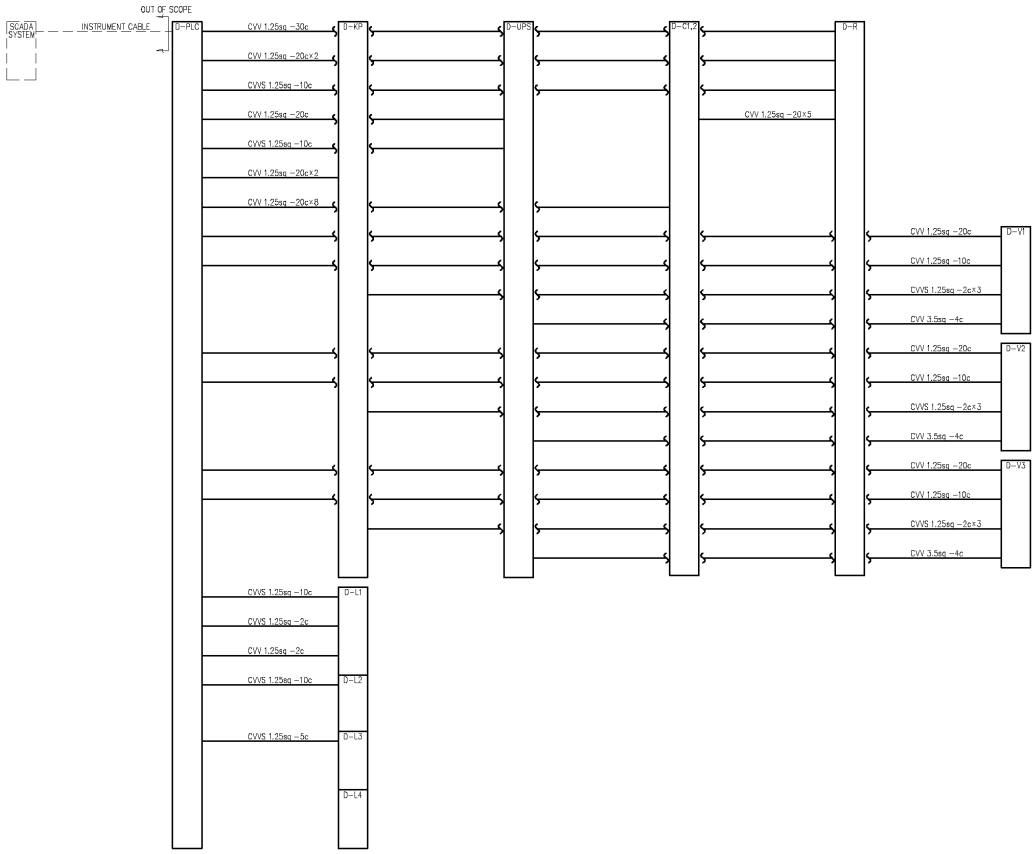
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter Local Panel	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP–W625
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



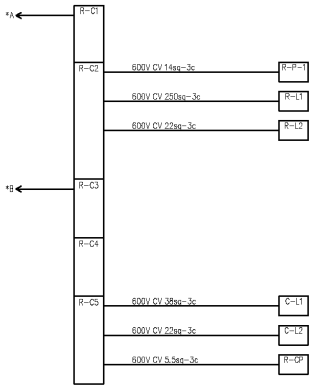
PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-D631
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Distribution Pump Cable Line Diagram (1)	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



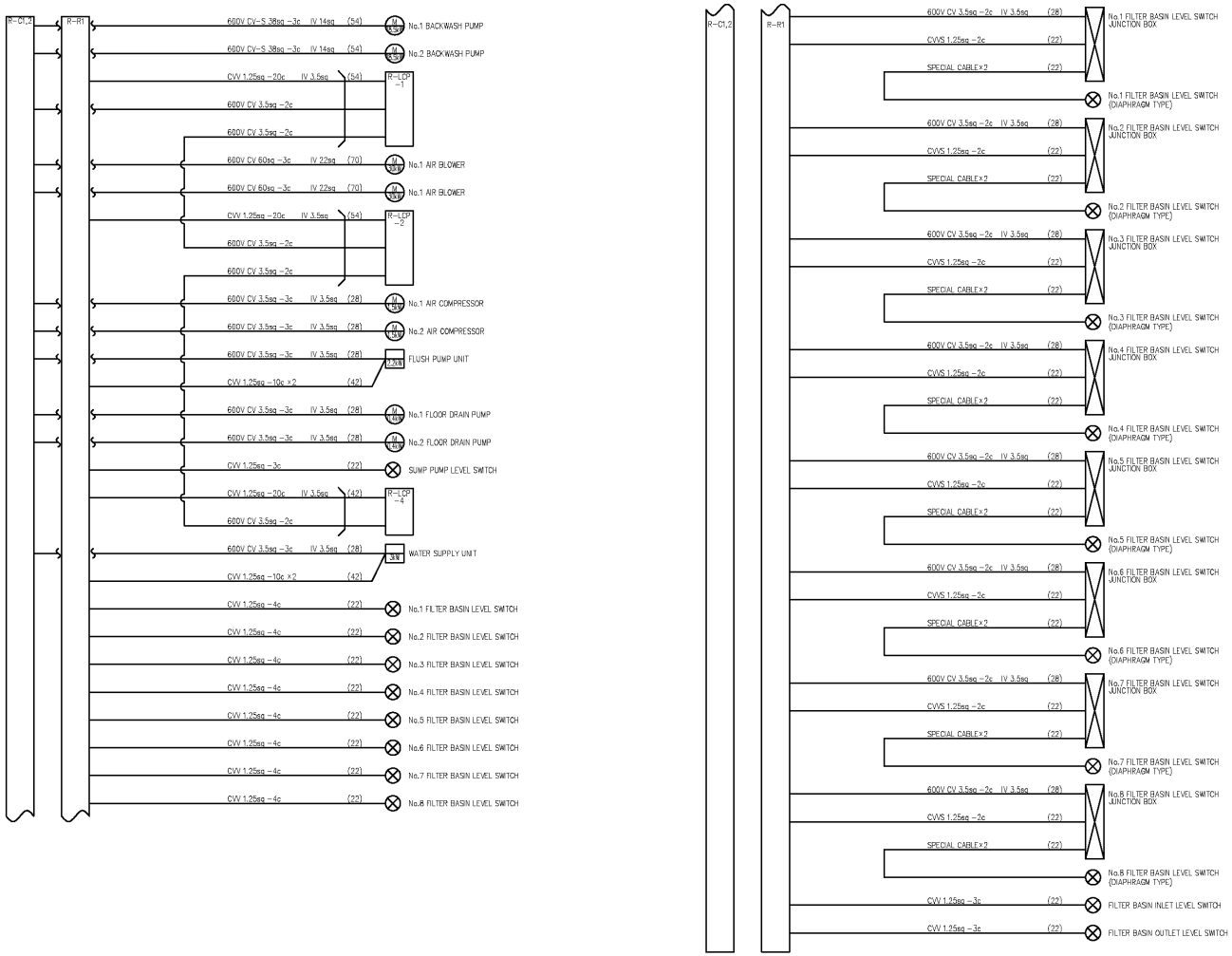
PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-D632
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Distribution Pump Cable Line Diagram (2)	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



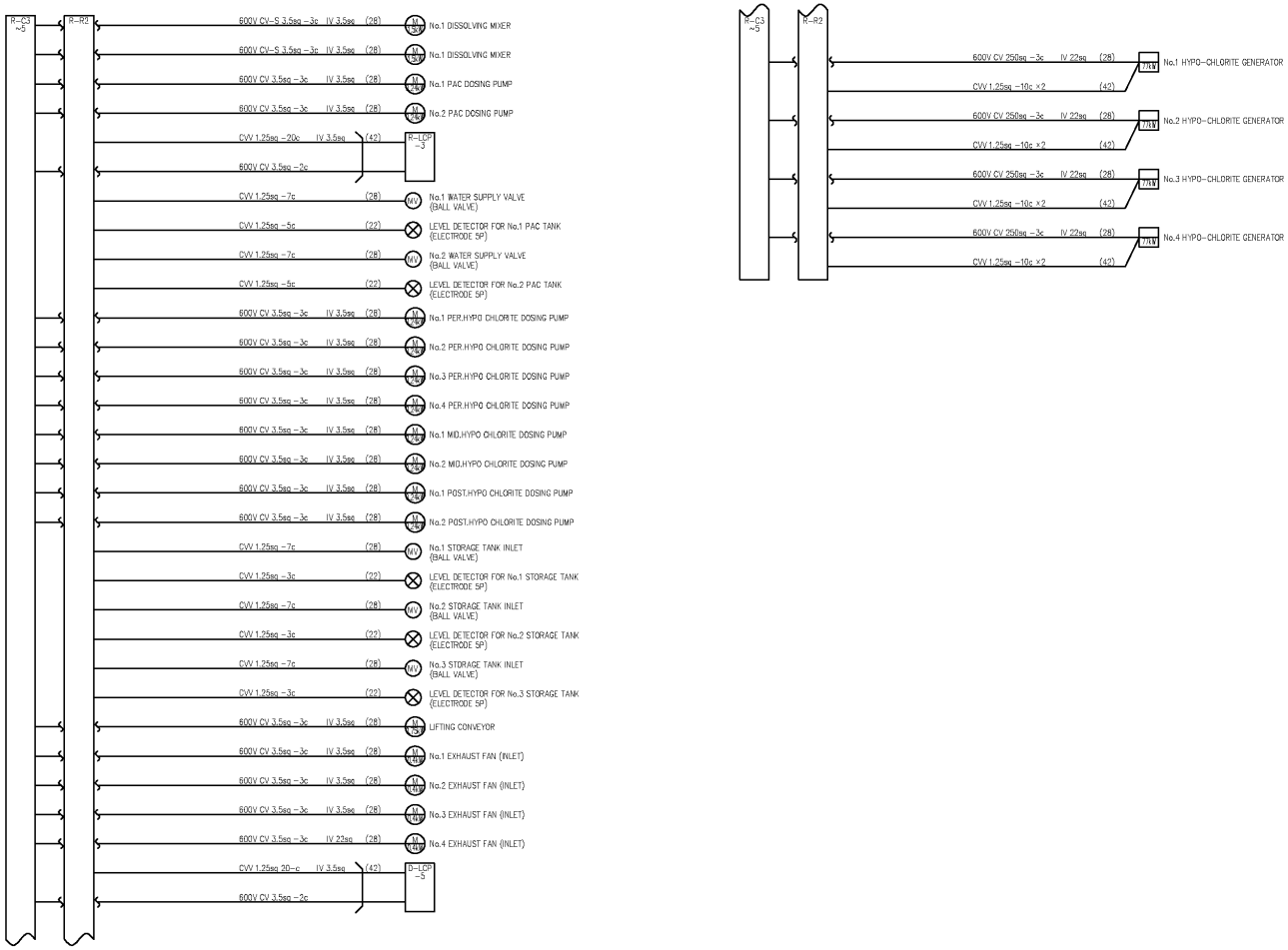
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Distribution Pump Cable Line Diagram (3)	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-D633
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



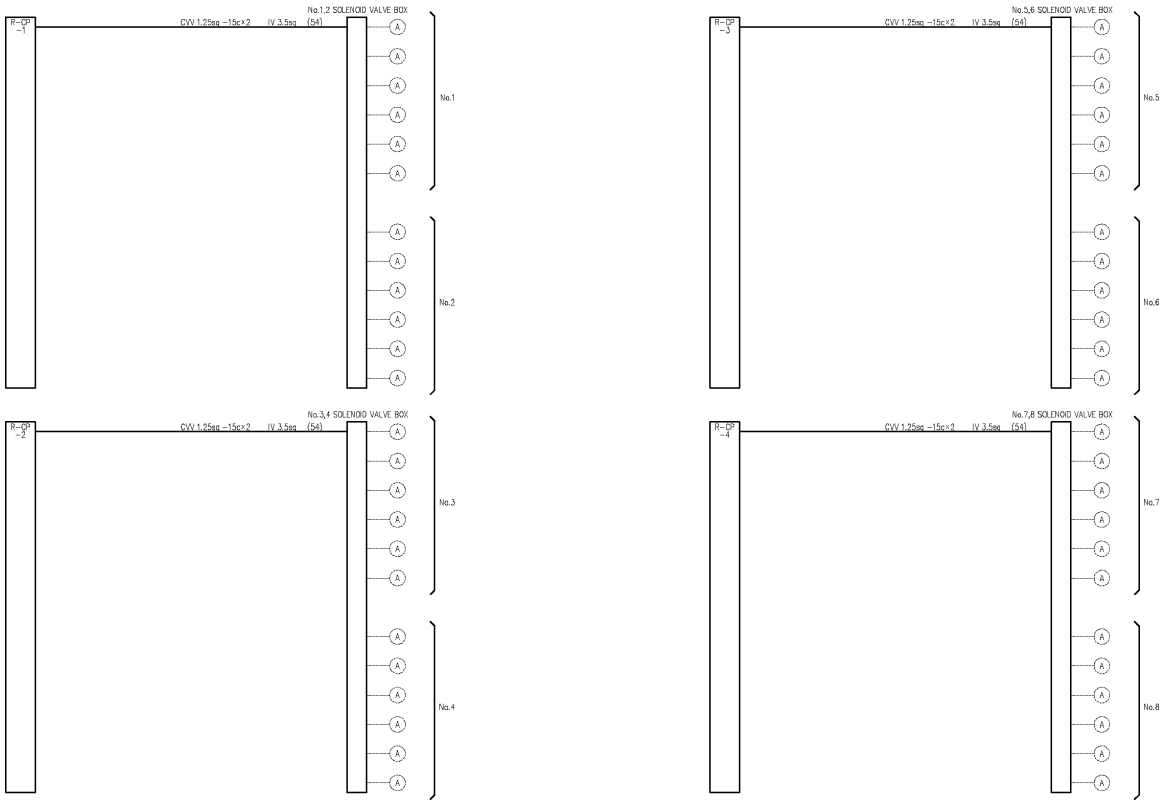
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter Cable Line Diagram (1)	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W631
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



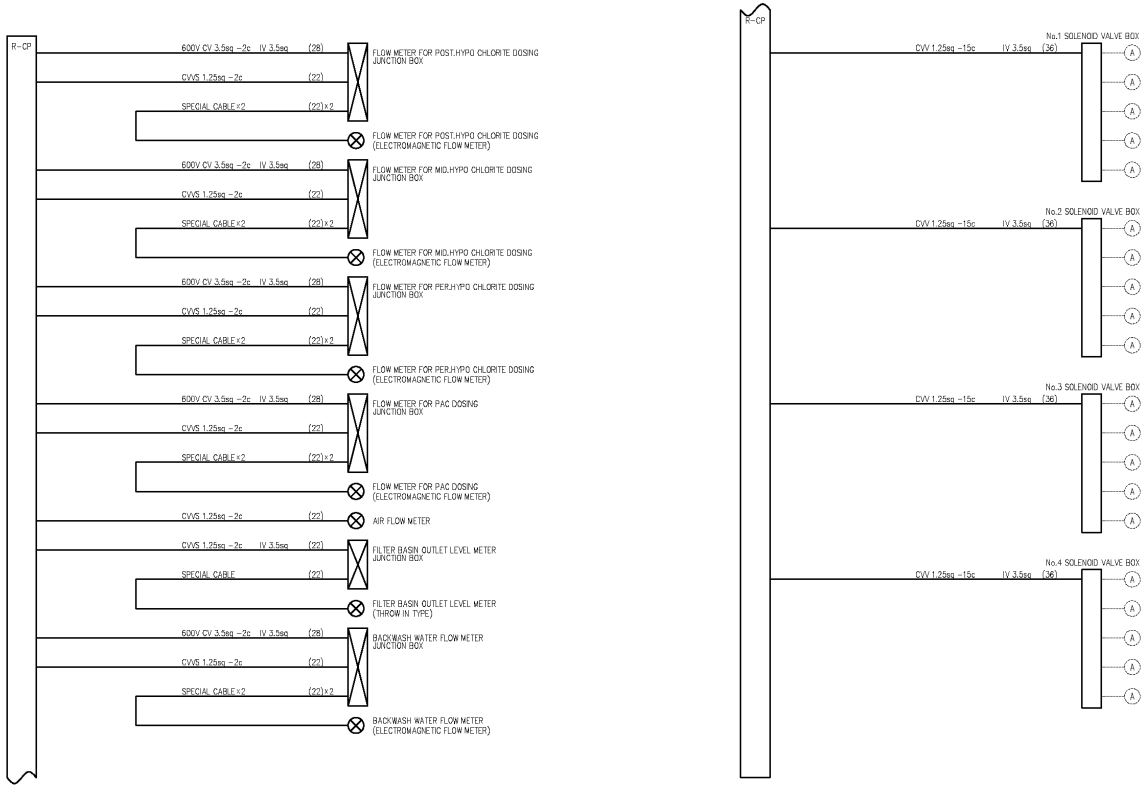
PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W632
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter Cable Line Diagram (2)	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



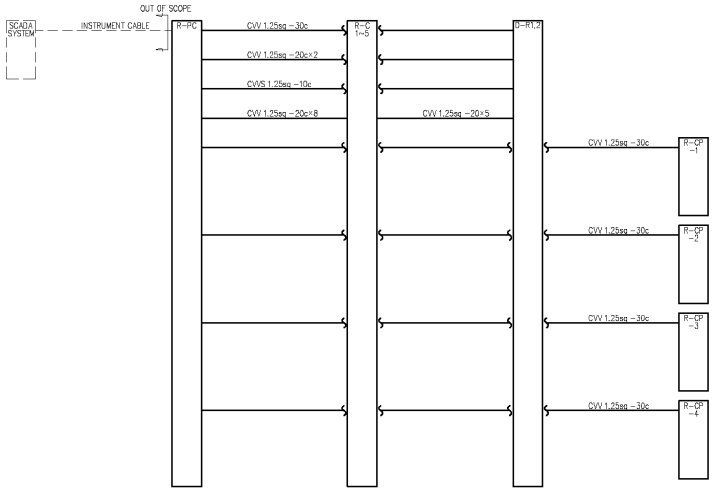
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter Cable Line Diagram (3)	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W633
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



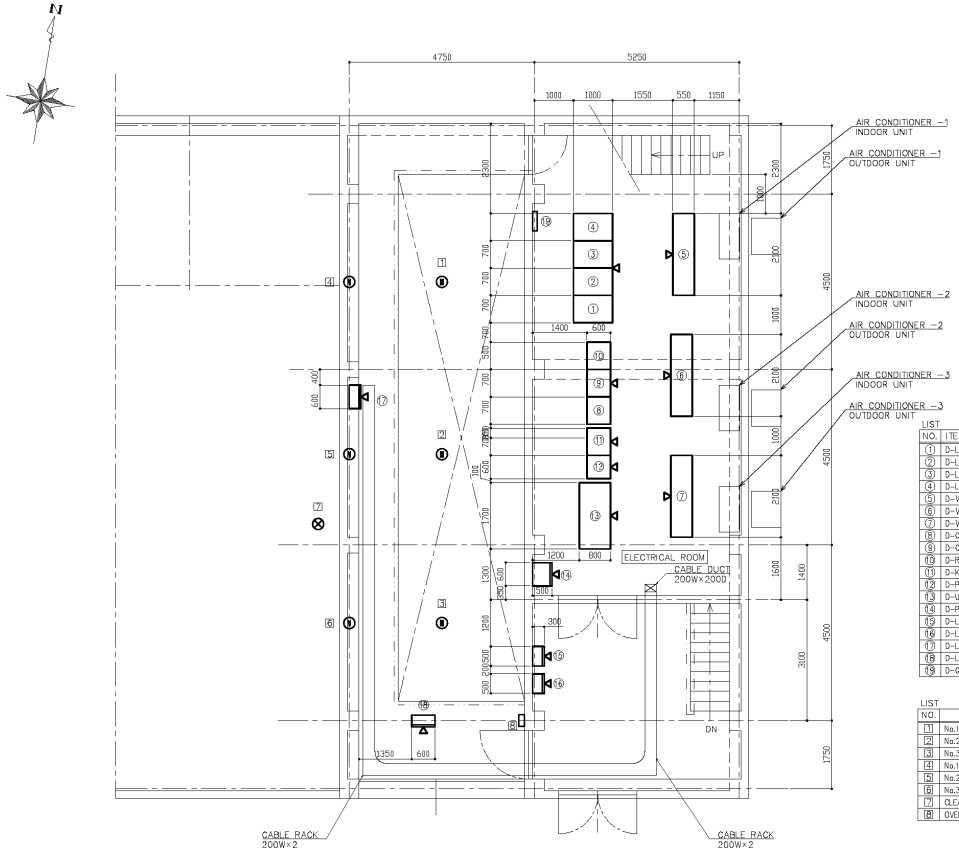
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter Cable Line Diagram (4)	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W634
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



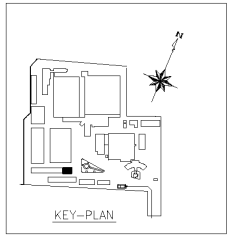
PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-W635
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter Cable Line Diagram (5)	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter Cable Line Diagram (6)	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W636
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



GROUND FLOOR PLAN



KEY-PLAN

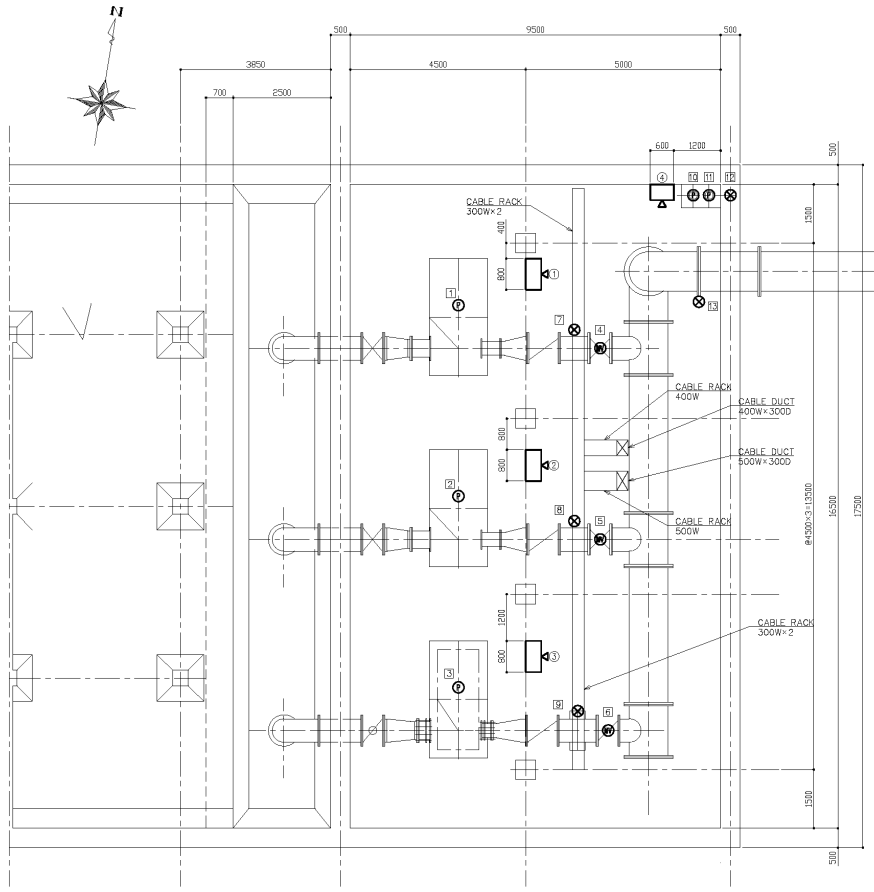
LIST

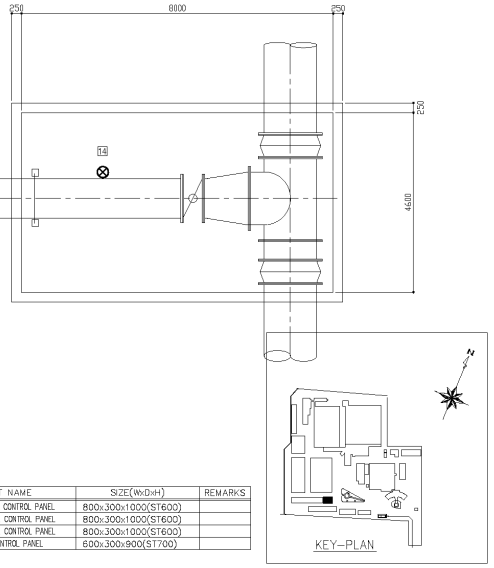
NO.	ITEM NO.	EQUIPMENT NAME	SIZE(WxDxH)	REMARKS
①	D-L1	LOW VOLTAGE RECEIVING PANEL	700x1000x2300	
②	D-L2	No.1 DISTRIBUTION PANEL	700x1000x2300	
③	D-L3	No.2 DISTRIBUTION PANEL	700x1000x2300	
④	D-L4	No.3 DISTRIBUTION PANEL	700x1000x2300	
⑤	D-V1	No.1 380V VFD FOR DISRIBUTION PUNP PANEL	2100x550x2300	
⑥	D-V2	No.2 380V VFD FOR DISRIBUTION PUNP PANEL	2100x550x2300	
⑦	D-V3	No.3 380V VFD FOR DISRIBUTION PUNP PANEL	2100x550x2300	
⑧	D-C1	No.1 CONTROLCENTER for DISRIBUTION PUMP	700x600x2300	
⑨	D-C2	No.2 CONTROLCENTER for DISRIBUTION PUMP	700x600x2300	
⑩	D-R1	RELAY PANEL for DISRIBUTION PUMP	700x600x2300	
⑪	D-I-P	INSTRUMENT PANEL for DISRIBUTION PUMP	700x600x2300	
⑫	D-P	PLC PANEL for DISRIBUTION PUMP	600x600x2300	
⑬	D-UPS	UPS PANEL	1700x800x2300	
⑭	D-P1	BUILDING POWER PANEL	600x500x1900	
⑮	D-L1	LIGHTING PANEL	500x300x700	
⑯	D-L2	OUTDOOR LIGHTING PANEL	500x300x700	
⑰	D-LCP-3	EXHAUST FAN (INLET)	600x300x600(ST1000)	
⑱	D-LCP-4	EXHAUST FAN (OUTLET)	600x300x600(ST1000)	
⑲	D-CTB	GROUNDING TERMINAL BOX (4P+2P)	500x120x500	

LIST

NO.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.1 EXHAUST FAN (OUTLET)	0.4kW	
2	No.2 EXHAUST FAN (OUTLET)	0.4kW	
3	No.3 EXHAUST FAN (OUTLET)	0.4kW	
4	No.1 EXHAUST FAN (INLET)	0.4kW	
5	No.2 EXHAUST FAN (INLET)	0.4kW	
6	No.3 EXHAUST FAN (INLET)	0.4kW	
7	CLEAR WATER RESERVOIR LEVEL METER		THROW IN TYPE
8	OVERHEAD TRAVELING CRANE	5.5kW	

PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	No.4 Distribution Pumping Station (Ground Floor)Equipment Layout Plan	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-D634
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:100





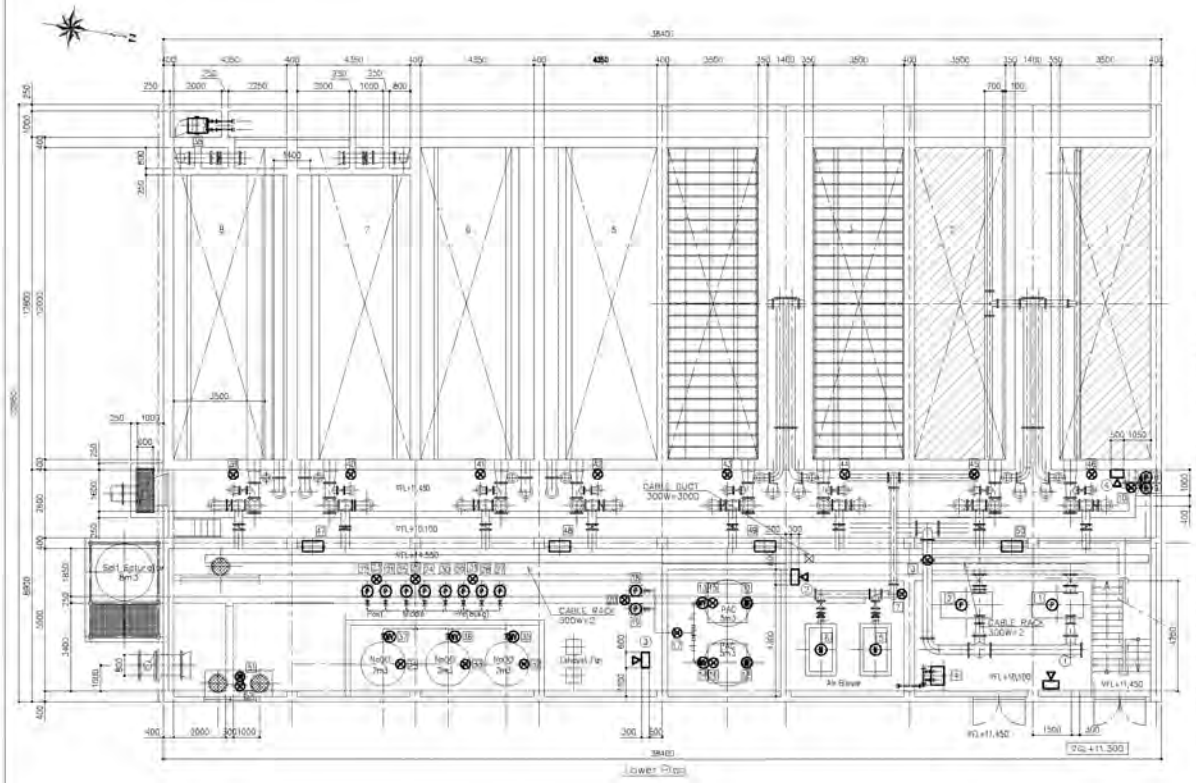
LIST

NO.	ITEM NO.	EQUIPMENT NAME	SIZE(W×D×H)	REMARKS
①	D-LCP-1-1	No.1 LIFT PUMP LOCAL CONTROL PANEL	800×300×1000(ST600)	
②	D-LCP-1-2	No.2 LIFT PUMP LOCAL CONTROL PANEL	800×300×1000(ST600)	
③	D-LCP-1-3	No.3 LIFT PUMP LOCAL CONTROL PANEL	800×300×1000(ST600)	
④	D-LCP-2	SUMP PUMP LOCAL CONTROL PANEL	600×300×900(ST700)	

LIST

NO.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.1 DISTRIBTON PUMP	280kW	
2	No.2 DISTRIBTON PUMP	280kW	
3	No.3 DISTRIBTON PUMP	280kW	
4	No.1 BUTTERFLY VALVE (DISCHARGE)	1.5kW	
5	No.2 BUTTERFLY VALVE (DISCHARGE)	1.5kW	
6	No.3 BUTTERFLY VALVE (DISCHARGE)	1.5kW	
7	No.1 FLOW SWITCH		
8	No.2 FLOW SWITCH		
9	No.3 FLOW SWITCH		
10	No.1 SUMP PUMP	2.2kW	
11	No.2 SUMP PUMP	2.2kW	
12	SUMP PUMP LEVEL DETECTOR		ELECTRODE
13	PRESSURE TRANSMITTER		
14	FLOW METER		ULTRASONIC

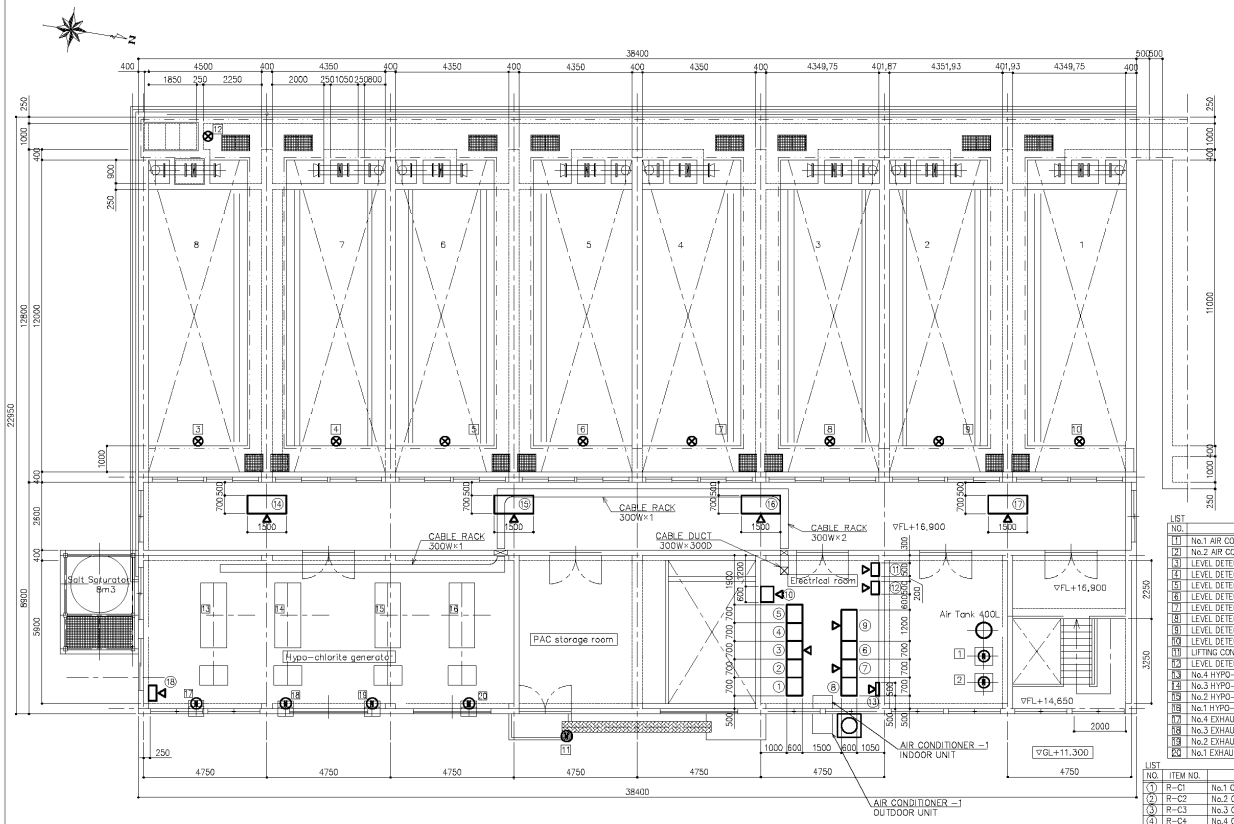
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	No.4 Distribution Pumping Station (BOTTOM) Equipment layout Plan	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-D635
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:100



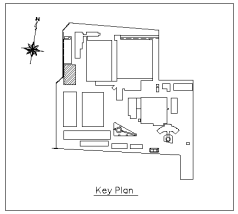
LIST No.	COMPONENT NAME	POWER(kW)	REMARKS
1	No.1 BACKWASH PUMP	18.5kW	
2	No.2 BACKWASH PUMP	18.5kW	
3	FLOW METER for RAW WATER		ELECTROMAGNETIC TYPE
4	WATER SUPPLY UNIT	3.0kW	
5	No.1 AIR BLOWER	30kW	
6	No.2 AIR BLOWER	30kW	
7	FLOW METER for AERATION		ORIFIS TYPE
8	No.1 FLOOR DRAIN PUMP	0.4kW	
9	No.2 FLOOR DRAIN PUMP	0.4kW	
10	LEVEL DETECTOR for FLOOR DRAIN		ELECTRODE (3P)
11	No.1 PAC TANK DISSOLVING MIXER	7.5kW	
12	No.2 PAC TANK DISSOLVING MIXER	1.5kW	
13	No.1 PAC TANK WATER SUPPLY VALVE	0.1kW	ELECTRIC BALL VALVE
14	No.2 PAC TANK WATER SUPPLY VALVE	0.1kW	ELECTRIC BALL VALVE
15	LEVEL DETECTOR for No.1 PAC TANK		ELECTRODE (3P)
16	LEVEL DETECTOR for No.2 PAC TANK		ELECTRODE (3P)
17	FLOW METER for WATER SUPPLY		
18	No.1 PAC DOSING PUMP	0.24kW	
19	No.2 PAC DOSING PUMP	0.24kW	
20	FLOW METER for PAC DOSING		ELECTROMAGNETIC TYPE
21	No.1 POST HYPO CHLORITE DOSING PUMP	0.24kW	
22	No.2 POST HYPO CHLORITE DOSING PUMP	0.24kW	
23	FLOW METER for POST HYPO CHLORITE DOSING		
24	No.1 MID HYPO CHLORITE DOSING PUMP	0.24kW	
25	No.2 MID HYPO CHLORITE DOSING PUMP	0.24kW	
26	FLOW METER for MID HYPO CHLORITE DOSING		
27	No.1 PRE HYPO CHLORITE DOSING PUMP	0.24kW	
28	No.2 PRE HYPO CHLORITE DOSING PUMP	0.24kW	
29	No.3 PRE HYPO CHLORITE DOSING PUMP	0.24kW	
30	No.4 PRE HYPO CHLORITE DOSING PUMP	0.24kW	
31	FLOW METER for PRE HYPO CHLORITE DOSING		
32	LEVEL DETECTOR for No.1 HYPO CHLORITE STORAGE TANK		ELECTRODE (3P)
33	LEVEL DETECTOR for No.2 HYPO CHLORITE STORAGE TANK		ELECTRODE (3P)
34	LEVEL DETECTOR for No.3 HYPO CHLORITE STORAGE TANK		ELECTRODE (3P)
35	INLET VALVE for No.1 HYPO CHLORITE STORAGE TANK		ELECTRIC BALL VALVE
36	INLET VALVE for No.2 HYPO CHLORITE STORAGE TANK		ELECTRIC BALL VALVE
37	INLET VALVE for No.3 HYPO CHLORITE STORAGE TANK		ELECTRIC BALL VALVE
38	FLUSH PUMP UNIT	2.5kW	
39	DIFFERENTIAL PRESSURE GAUGE for No.8 FILTER BASIN		DIAPHRAGM TYPE
40	DIFFERENTIAL PRESSURE GAUGE for No.7 FILTER BASIN		DIAPHRAGM TYPE
41	DIFFERENTIAL PRESSURE GAUGE for No.6 FILTER BASIN		DIAPHRAGM TYPE
42	DIFFERENTIAL PRESSURE GAUGE for No.5 FILTER BASIN		DIAPHRAGM TYPE
43	DIFFERENTIAL PRESSURE GAUGE for No.4 FILTER BASIN		DIAPHRAGM TYPE
44	DIFFERENTIAL PRESSURE GAUGE for No.3 FILTER BASIN		DIAPHRAGM TYPE
45	DIFFERENTIAL PRESSURE GAUGE for No.2 FILTER BASIN		DIAPHRAGM TYPE
46	DIFFERENTIAL PRESSURE GAUGE for No.1 FILTER BASIN		DIAPHRAGM TYPE
47	SOLENOID VALVE BOX for No.7,8 FILTER BASIN		
48	SOLENOID VALVE BOX for No.5,6 FILTER BASIN		
49	SOLENOID VALVE BOX for No.3,4 FILTER BASIN		
50	SOLENOID VALVE BOX for No.1,2 FILTER BASIN		
51	LEVEL DETECTOR		ELECTRODE (3P)
52	FLOW METER		MAGNESIN TYPE

LIST No.	ITEM No.	EQUIPMENT NAME	SIZE(WxDxH)	REMARKS
1	W-LCP-1	BAKWASH PUMP LOCAL CONTROL PANEL	800×300×700 (STN00)	
2	W-LCP-2	AIR BLOWER LOCAL CONTROL PANEL	800×300×700 (STN00)	
3	W-LCP-3	PAC MIXER LOCAL CONTROL PANEL	800×300×700 (STN00)	
4	W-LCP-4	FROOR DRAIN PUMP LOCAL CONTROL PANEL	800×300×700 (STN00)	

PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-WE37
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter (Lower Floor) Equipment Layout Plan	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:150



Upper Plan



Key Plan

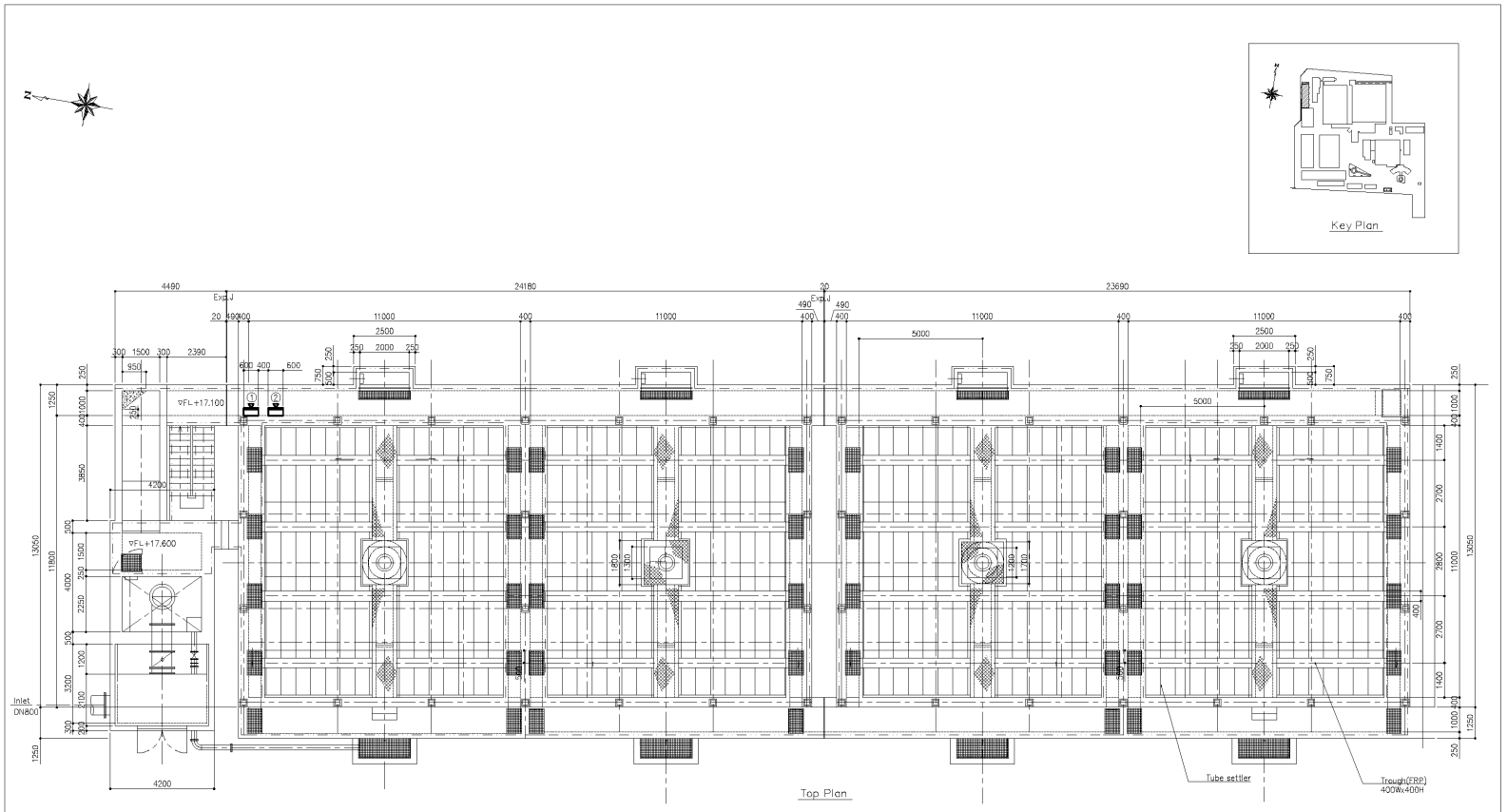
LIST

NO.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.1 AIR COMPRESSOR	1.5kW	AIR DRYER BUILT-IN
2	No.2 AIR COMPRESSOR	1.5kW	AIR DRYER BUILT-IN
3	LEVEL DETECTOR for No.8 FILTER BASIN		
4	LEVEL DETECTOR for No.7 FILTER BASIN		
5	LEVEL DETECTOR for No.6 FILTER BASIN		
6	LEVEL DETECTOR for No.5 FILTER BASIN		
7	LEVEL DETECTOR for No.4 FILTER BASIN		
8	LEVEL DETECTOR for No.3 FILTER BASIN		
9	LEVEL DETECTOR for No.2 FILTER BASIN		
10	LEVEL DETECTOR for No.1 FILTER BASIN		
11	LIFTING CONVEYOR	0.75kW	
12	LEVEL DETECTOR		
13	No.4 HYPO-CHLORITE GENERATOR	7.7kVA	
14	No.3 HYPO-CHLORITE GENERATOR	7.7kVA	
15	No.2 HYPO-CHLORITE GENERATOR	7.7kVA	
16	No.1 HYPO-CHLORITE GENERATOR	7.7kVA	
17	No.4 EXHAUST FAN (INLET)	0.4kW	
18	No.3 EXHAUST FAN (INLET)	0.4kW	
19	No.2 EXHAUST FAN (INLET)	0.4kW	
20	No.1 EXHAUST FAN (INLET)	0.4kW	

LIST

NO.	ITEM NO.	EQUIPMENT NAME	SIZE(WxDxH)	REMARKS
①	R-C1	No.1 CONTROLCENTER for RAPID SAND FILTER	700x600x2300	
②	R-C2	No.2 CONTROLCENTER for RAPID SAND FILTER	700x600x2300	
③	R-C3	No.3 CONTROLCENTER for RAPID SAND FILTER	700x600x2300	
④	R-C4	No.4 CONTROLCENTER for RAPID SAND FILTER	700x600x2300	
⑤	R-C5	No.5 CONTROLCENTER for RAPID SAND FILTER	700x600x2300	
⑥	R-R1	No.1 RELAY PANEL for RAPID SAND FILTER	700x600x2300	
⑦	R-R2	No.2 RELAY PANEL for RAPID SAND FILTER	700x600x2300	
⑧	R-R3	No.3 RELAY PANEL for RAPID SAND FILTER	700x600x2300	
⑨	R-CP	CONTROL PANEL for RAPID SAND FILTER	1200x600x2300	
⑩	R-P-1	BUILDING POWER PANEL	600x500x1800	
⑪	R-L-1	LIGHTING PANEL	500x300x700	
⑫	R-L-2	OUTDOOR LIGHTING PANEL	500x300x700	
⑬	R-TGB	GROUNDING TERMINAL BOX(4P+2P)	500x1200x500	
⑭	R-CP-4	No.8,7 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
⑮	R-CP-3	No.5,6 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
⑯	R-CP-2	No.3,4 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
⑰	R-CP-1	No.1,2 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
⑱	R-LCP-5	EXHAUST FAN (INLET) LOCAL PANEL	600x300x700 (STB900)	

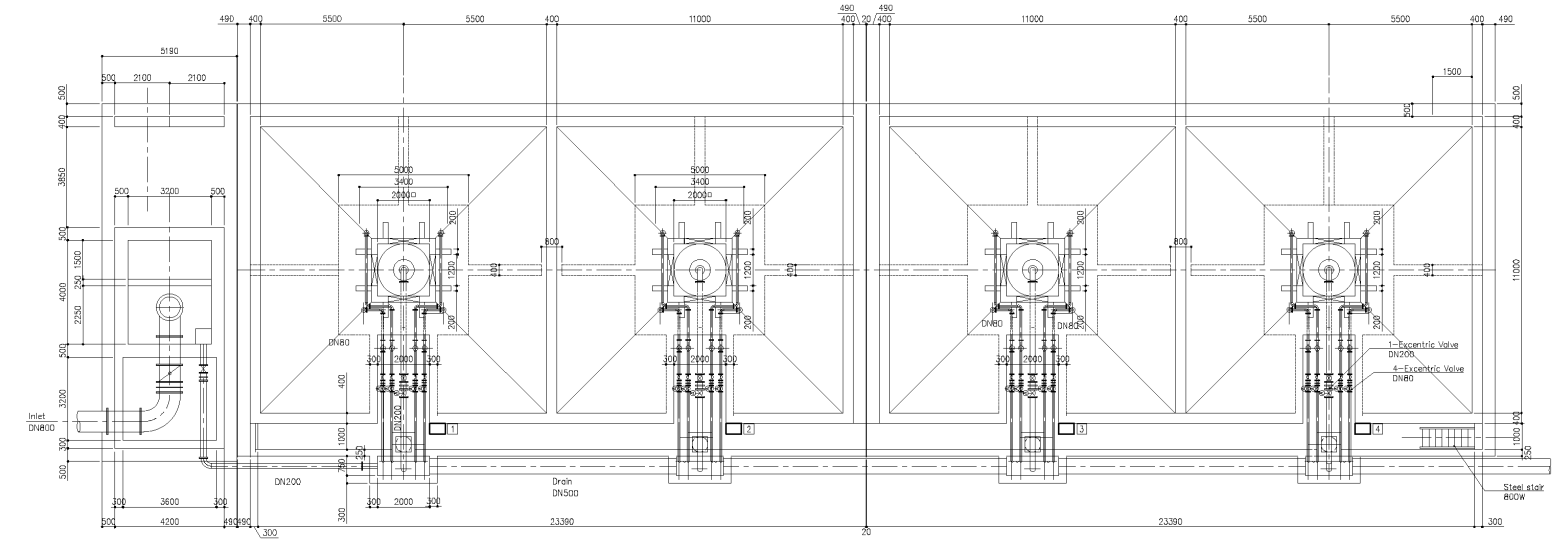
PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W638
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter (Upper Floor) Equipment Layout Plan	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:150



LIST

NO.	ITEM NO.	EQUIPMENT NAME	SIZE(WxDxH)	REMARKS
①	C-L-1	LIGHTING PANEL FOR CLARIFIER	500x300x700(ST900)	
②	C-L-2	OUTDOOR LIGHTING PANEL FOR CLARIFER	500x300x700(ST900)	

PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Clarifier (Top Plan) Equipment Layout Plan	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-W639
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:150

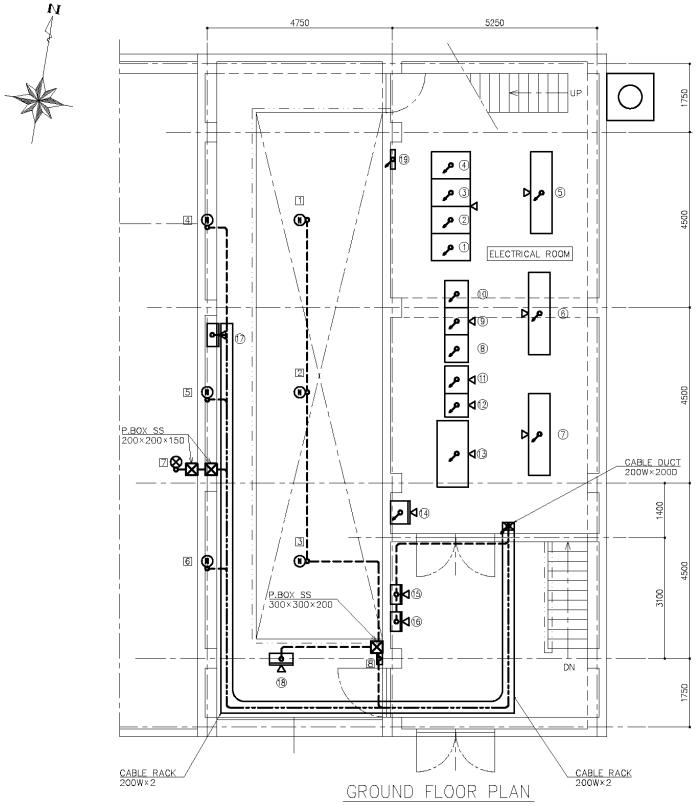


Lower Plan

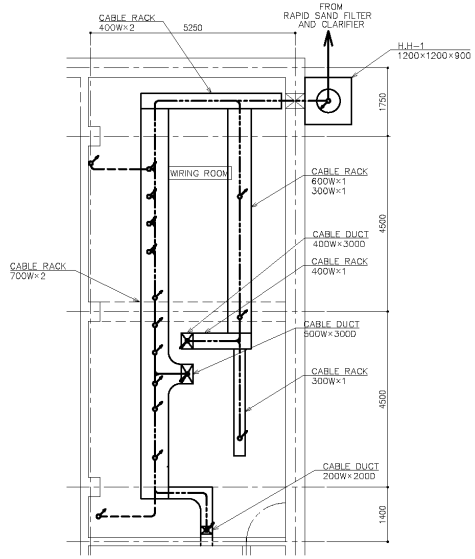
LIST

NO.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.4 SOLENOID VALVE BOX		
2	No.3 SOLENOID VALVE BOX		
3	No.2 SOLENOID VALVE BOX		
4	No.1 SOLENOID VALVE BOX		

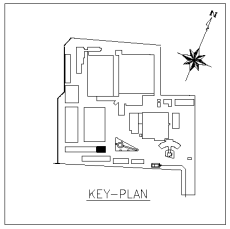
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Clarifier (Lower Plan) Equipment Layout Plan	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-W640
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:150



GROUND FLOOR PLAN



GROUND FLOOR PLAN



LIST

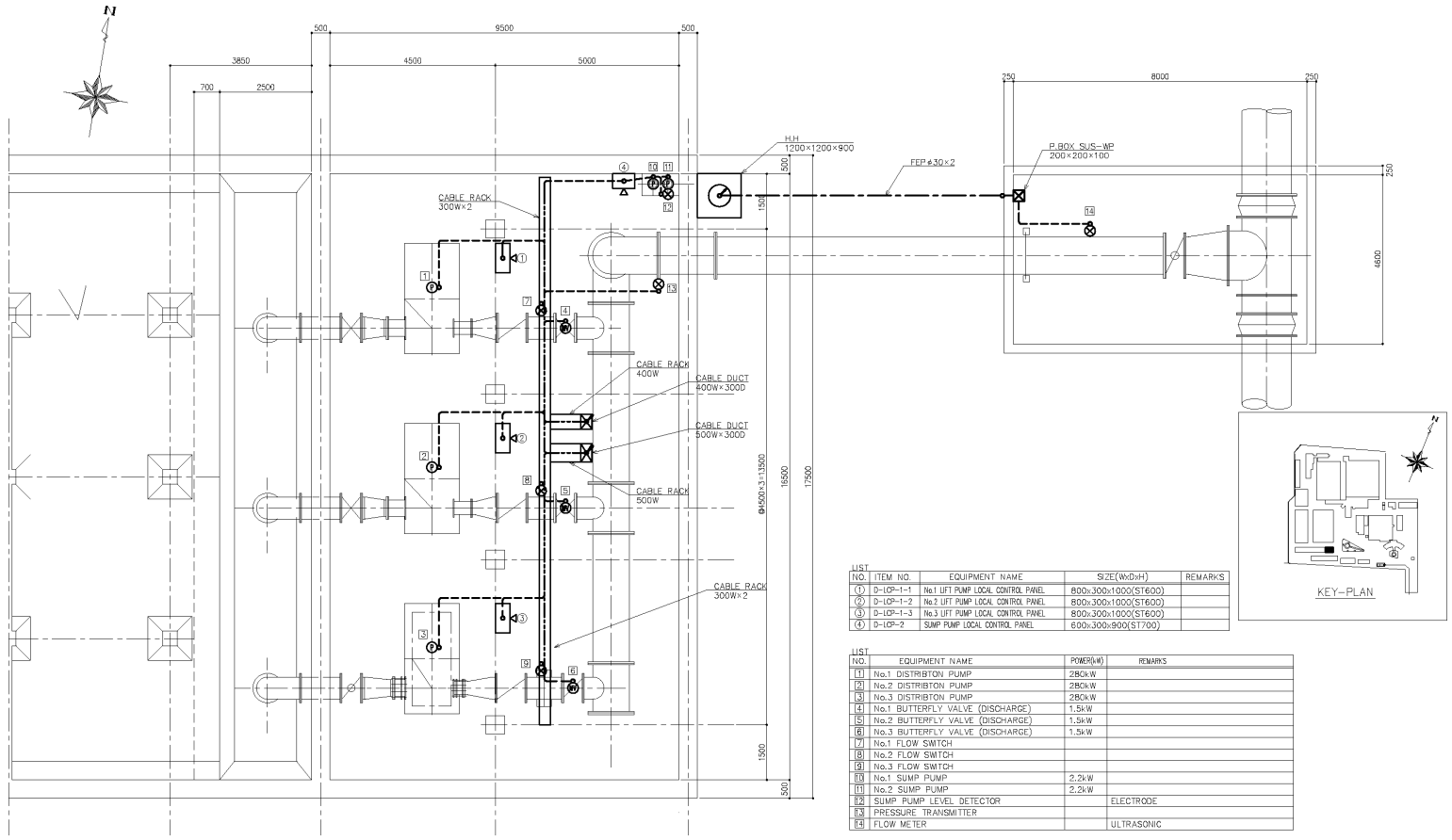
NO.	ITEM NO.	EQUIPMENT NAME	SIZE(W×D×H)	REMARKS
①	D-L1	LOW VOLTAGE RECEIVING PANEL	700x1000x2300	
②	D-L2	No.1 DISTRIBUTION PANEL	700x1000x2300	
③	D-L3	No.2 DISTRIBUTION PANEL	700x1000x2300	
④	D-L4	No.3 DISTRIBUTION PANEL	700x1000x2300	
⑤	D-V1	No.1 380V VFD FOR DISRIBUTION PUNP PANEL	2100x550x2300	
⑥	D-V2	No.2 380V VFD FOR DISRIBUTION PUNP PANEL	2100x550x2300	
⑦	D-V3	No.3 380V VFD FOR DISRIBUTION PUNP PANEL	2100x550x2300	
⑧	D-C1	No.1 CONTROLCENTER for DISRIBUTION PUMP	700x600x2300	
⑨	D-C2	No.2 CONTROLCENTER for DISRIBUTION PUMP	700x600x2300	
⑩	D-R1	RELAY PANEL for DISRIBUTION PUMP	700x600x2300	
⑪	D-KP	INSTRUMENT PANEL for DISRIBUTION PUMP	700x600x2300	
⑫	D-P	PLC PANEL for DISRIBUTION PUMP	600x600x2300	
⑬	D-UPS	UPS PANEL	1700x800x2300	
⑭	D-P1	BUILDING POWER PANEL	600x500x1900	
⑮	D-L1	LIGHTING PANEL	500x300x700	
⑯	D-L2	OUTDOOR LIGHTING PANEL	500x300x700	
⑰	D-LCP-3	EXHAUST FAN (INLET)	600x300x600(ST1000)	
⑱	D-LCP-4	EXHAUST FAN (OUTLET)	600x300x600(ST1000)	
⑲	D-GTB	GROUNDING TERMINAL BOX (4P+2P)	500x120x500	

LIST

NO.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.1 EXHAUST FAN (OUTLET)	0.4kW	
2	No.2 EXHAUST FAN (OUTLET)	0.4kW	
3	No.3 EXHAUST FAN (OUTLET)	0.4kW	
4	No.1 EXHAUST FAN (INLET)	0.4kW	
5	No.2 EXHAUST FAN (INLET)	0.4kW	
6	No.3 EXHAUST FAN (INLET)	0.4kW	
7	CLEAR WATER RESERVOIR LEVEL METER		THROW IN TYPE
8	OVERHEAD TRAVELING CRANE	5.5kW	

NOTE:
1. GROUND WIRING
2. OPEN PIPING WIRING
3. RACK・DUCT WIRING
4. WIRING UP
5. WIRING DOWN
6. P.BOX

PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	No.4 Distribution Pumping Station (Ground Floor)Piping & Wiring Plan	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-D636
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:100



BOTTOM PLAN

LIST

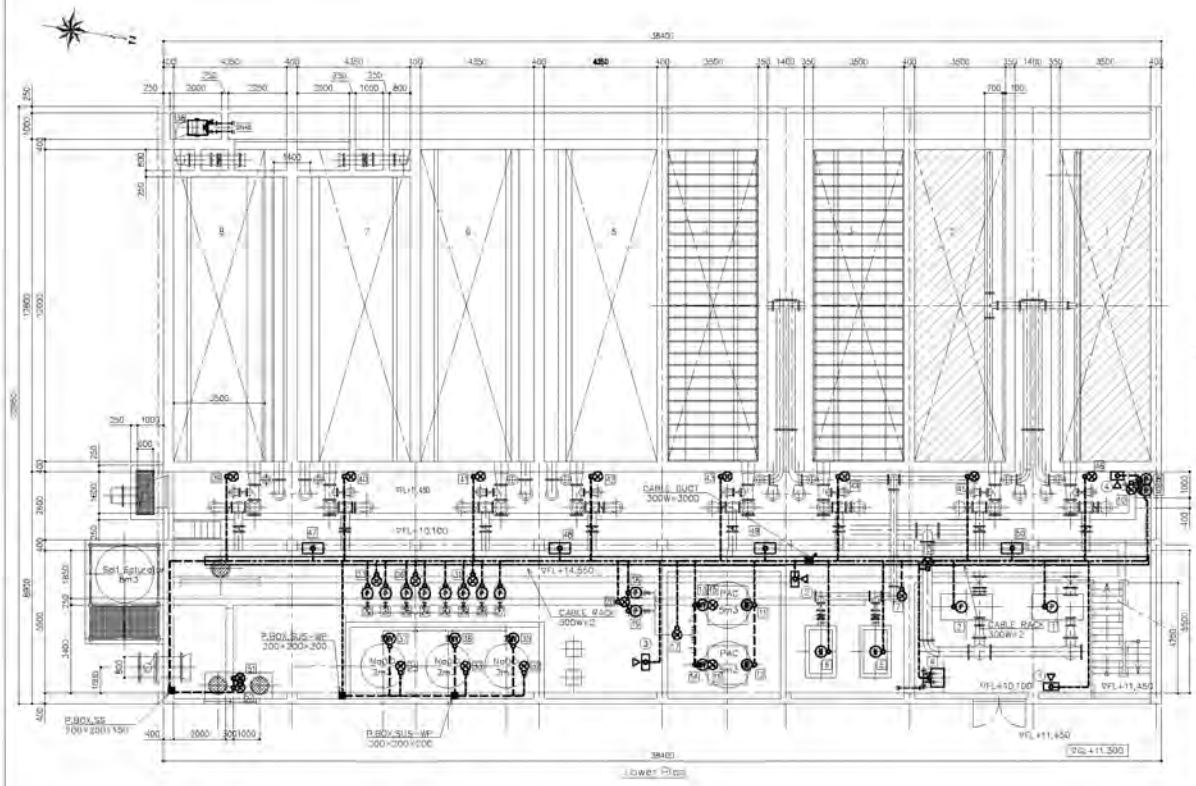
NO.	ITEM NO.	EQUIPMENT NAME	SIZE(WxDxH)	REMARKS
①	D-LCP-1-1	No.1 LIFT PUMP LOCAL CONTROL PANEL	800x300x1000(ST600)	
②	D-LCP-1-2	No.2 LIFT PUMP LOCAL CONTROL PANEL	800x300x1000(ST600)	
③	D-LCP-1-3	No.3 LIFT PUMP LOCAL CONTROL PANEL	800x300x1000(ST600)	
④	D-LCP-2	SUMP PUMP LOCAL CONTROL PANEL	600x300x900(ST700)	

LIST

NO.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.1 DISTRIBTON PUMP	280kW	
2	No.2 DISTRIBTON PUMP	280kW	
3	No.3 DISTRIBTON PUMP	280kW	
4	No.1 BUTTERFLY VALVE (DISCHARGE)	1.5kW	
5	No.2 BUTTERFLY VALVE (DISCHARGE)	1.5kW	
6	No.3 BUTTERFLY VALVE (DISCHARGE)	1.5kW	
7	No.1 FLOW SWITCH		
8	No.2 FLOW SWITCH		
9	No.3 FLOW SWITCH		
10	No.1 SUMP PUMP	2.2kW	
11	No.2 SUMP PUMP	2.2kW	
12	SUMP PUMP LEVEL DETECTOR		ELECTRODE
13	PRESSURE TRANSMITTER		
14	FLOW METER		ULTRASONIC

NOTE:
1. GROUND WIRING
2. OPEN PIPING WIRING
3. RACK・DUCT WIRING
4. WIRING UP
5. WIRING DOWN
6. P.BOX

PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	No.4 Distribution Pumping Station (BOTTOM) Piping & Wiring Plan	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-D637
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:100

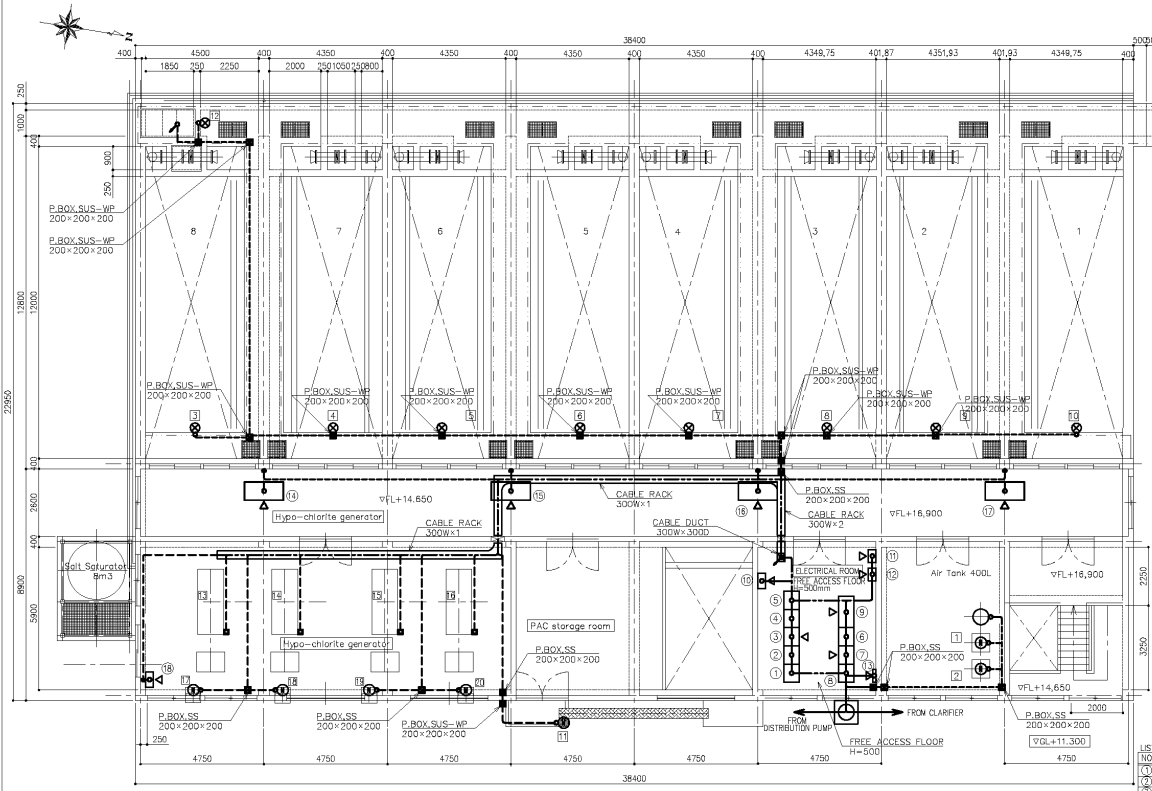


LIST No.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.1 BACKWASH PUMP	18.5kW	
2	No.2 BACKWASH PUMP	18.5kW	
3	FLOW METER for RAW WATER		ELECTROMAGNETIC TYPE
4	WATER SUPPLY UNIT	3.0kW	
5	No.1 AIR BLOWER	30kW	
6	No.2 AIR BLOWER	30kW	
7	FLOW METER for AERATION		ORIFIS TYPE
8	No.1 FLOOR DRAIN PUMP	0.4kW	
9	No.2 FLOOR DRAIN PUMP	0.4kW	
10	LEVEL DETECTOR for FLOOR DRAIN		ELECTRODE (3P)
11	No.1 PAC TANK DISSOLVING WATER	7.5kW	
12	No.2 PAC TANK DISSOLVING WATER	7.5kW	
13	No.1 PAC TANK WATER SUPPLY VALVE	0.1kW	ELECTRIC BALL VALVE
14	No.2 PAC TANK WATER SUPPLY VALVE	0.1kW	ELECTRIC BALL VALVE
15	LEVEL DETECTOR for No.1 PAC TANK		ELECTRODE (3P)
16	LEVEL DETECTOR for No.2 PAC TANK		ELECTRODE (3P)
17	FLOW METER for WATER SUPPLY		
18	No.1 PAC DOSING PUMP	0.24kW	
19	No.2 PAC DOSING PUMP	0.24kW	
20	FLOW METER for PAC DOSING		ELECTROMAGNETIC TYPE
21	No.1 POST HYPO CHLORITE DOSING PUMP	0.24kW	
22	No.2 POST HYPO CHLORITE DOSING PUMP	0.24kW	
23	FLOW METER for POST HYPO CHLORITE DOSING		
24	No.1 MID HYPO CHLORITE DOSING PUMP	0.24kW	
25	No.2 MID HYPO CHLORITE DOSING PUMP	0.24kW	
26	FLOW METER for MID HYPO CHLORITE DOSING		
27	No.1 PER HYPO CHLORITE DOSING PUMP	0.24kW	
28	No.2 PER HYPO CHLORITE DOSING PUMP	0.24kW	
29	No.3 PER HYPO CHLORITE DOSING PUMP	0.24kW	
30	No.4 PER HYPO CHLORITE DOSING PUMP	0.24kW	
31	FLOW METER for PER HYPO CHLORITE DOSING		
32	LEVEL DETECTOR for No.1 HYPO CHLORITE STORAGE TANK		ELECTRODE (3P)
33	LEVEL DETECTOR for No.2 HYPO CHLORITE STORAGE TANK		ELECTRODE (3P)
34	LEVEL DETECTOR for No.3 HYPO CHLORITE STORAGE TANK		ELECTRODE (3P)
35	INLET VALVE for No.1 HYPO CHLORITE STORAGE TANK		ELECTRIC BALL VALVE
36	INLET VALVE for No.2 HYPO CHLORITE STORAGE TANK		ELECTRIC BALL VALVE
37	INLET VALVE for No.3 HYPO CHLORITE STORAGE TANK		ELECTRIC BALL VALVE
38	FLUSH PUMP UNIT	7.5kW	
39	DIFFERENTIAL PRESSURE GAUGE for No.8 FILTER BASIN		DIAPHRAGM TYPE
40	DIFFERENTIAL PRESSURE GAUGE for No.7 FILTER BASIN		DIAPHRAGM TYPE
41	DIFFERENTIAL PRESSURE GAUGE for No.6 FILTER BASIN		DIAPHRAGM TYPE
42	DIFFERENTIAL PRESSURE GAUGE for No.5 FILTER BASIN		DIAPHRAGM TYPE
43	DIFFERENTIAL PRESSURE GAUGE for No.4 FILTER BASIN		DIAPHRAGM TYPE
44	DIFFERENTIAL PRESSURE GAUGE for No.3 FILTER BASIN		DIAPHRAGM TYPE
45	DIFFERENTIAL PRESSURE GAUGE for No.2 FILTER BASIN		DIAPHRAGM TYPE
46	DIFFERENTIAL PRESSURE GAUGE for No.1 FILTER BASIN		DIAPHRAGM TYPE
47	SOLENOID VALVE BOX for No.7,8 FILTER BASIN		
48	SOLENOID VALVE BOX for No.5,6 FILTER BASIN		
49	SOLENOID VALVE BOX for No.3,4 FILTER BASIN		
50	SOLENOID VALVE BOX for No.1,2 FILTER BASIN		
51	LEVEL DETECTOR		ELECTRODE (3P)
52	FLOW METER		IMMERSION TYPE

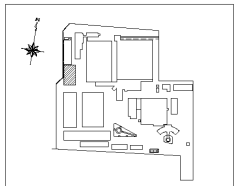
LIST No.	ITEM NO.	EQUIPMENT NAME	SIZE(W×D×H)	REMARKS
1	W-LCP-1	BAKWASH PUMP LOCAL CONTROL PANEL	800×300×700 (STN00)	
2	W-LCP-2	AIR BLOWER LOCAL CONTROL PANEL	800×300×700 (STN00)	
3	W-LCP-3	PAC MIXER LOCAL CONTROL PANEL	800×300×700 (STN00)	
4	W-LCP-4	FROOR DRAIN PUMP LOCAL CONTROL PANEL	800×300×700 (STN00)	

NOTE
1. GROUND WIRING
2. OPEN WIRING WIRING
3. RACK・DUCT WIRING
4. WIRING UP
5. WIRING DOWN
6. P.BOX

PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-W641
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter (Lower Floor) Piping & Wiring Plan	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:150



Upper Plan



Key Plan

NOTE:
1. GROUND WIRING
2. OPEN PIPING WIRING
3. RACK・DUCT WIRING
4. WIRING UP
5. WIRING DOWN
6. P.BOX

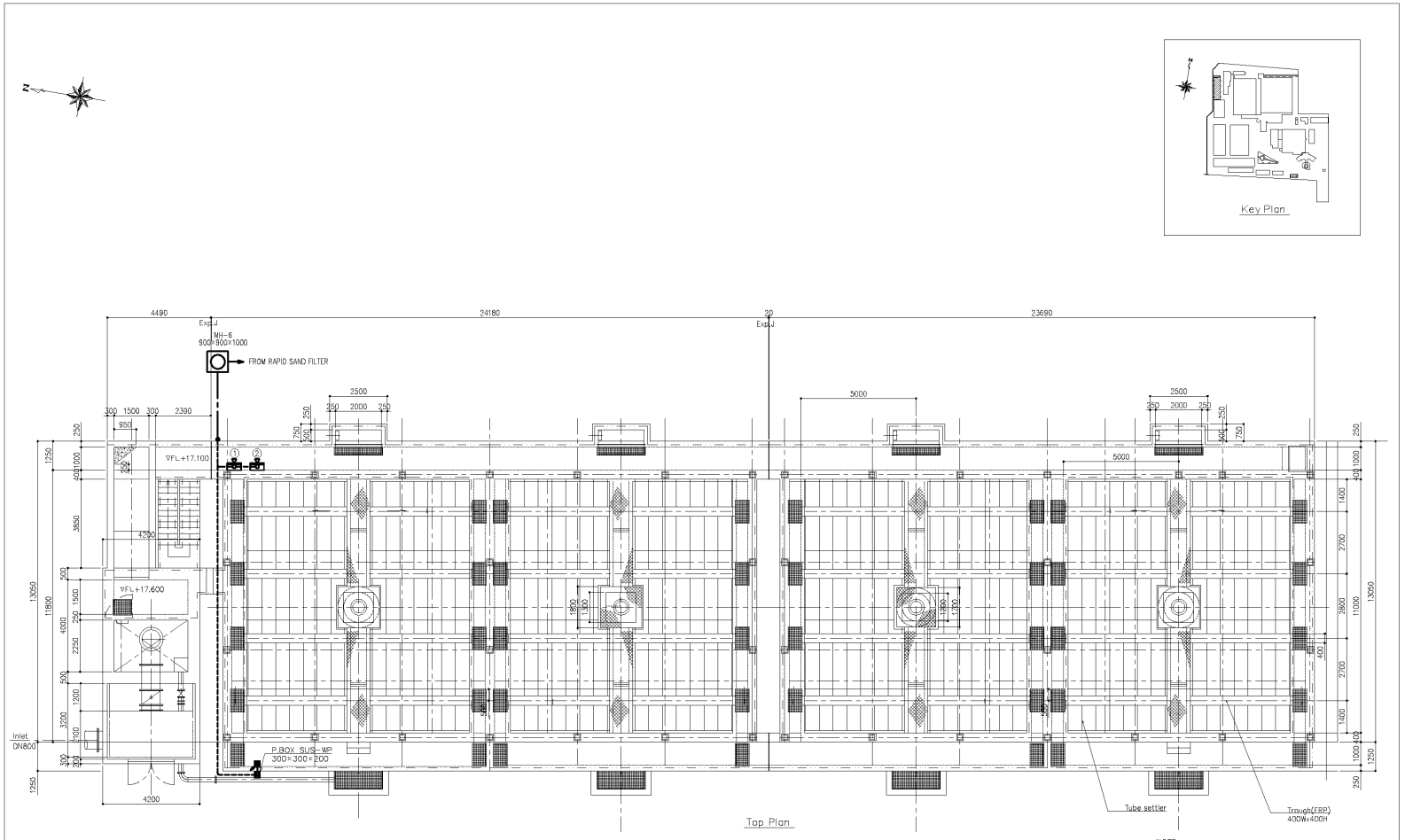
LIST

NO.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.1 AIR COMPRESSOR	1.5kW	AIR DRYER BUILT-IN
2	No.2 AIR COMPRESSOR	1.5kW	AIR DRYER BUILT-IN
3	LEVEL DETECTOR for No.8 FILTER BASIN		
4	LEVEL DETECTOR for No.7 FILTER BASIN		
5	LEVEL DETECTOR for No.6 FILTER BASIN		
6	LEVEL DETECTOR for No.5 FILTER BASIN		
7	LEVEL DETECTOR for No.4 FILTER BASIN		
8	LEVEL DETECTOR for No.3 FILTER BASIN		
9	LEVEL DETECTOR for No.2 FILTER BASIN		
10	LEVEL DETECTOR for No.1 FILTER BASIN		
11	LIFTING CONVEYOR	0.75kW	
12	LEVEL DETECTOR		
13	No.4 HYPO-CHLORITE GENERATOR	7.7kVA	
14	No.3 HYPO-CHLORITE GENERATOR	7.7kVA	
15	No.2 HYPO-CHLORITE GENERATOR	7.7kVA	
16	No.1 HYPO-CHLORITE GENERATOR	7.7kVA	
17	No.4 EXHAUST FAN (INLET)	0.4kW	
18	No.3 EXHAUST FAN (INLET)	0.4kW	
19	No.2 EXHAUST FAN (INLET)	0.4kW	
20	No.1 EXHAUST FAN (INLET)	0.4kW	

LIST

NO.	ITEM NO.	EQUIPMENT NAME	SIZE(W×D×H)	REMARKS
1	R-C1	No.1 CONTROLCENTER for RAPID SAND FILTER	700×600×2300	
2	R-C2	No.2 CONTROLCENTER for RAPID SAND FILTER	700×600×2300	
3	R-C3	No.3 CONTROLCENTER for RAPID SAND FILTER	700×600×2300	
4	R-C4	No.4 CONTROLCENTER for RAPID SAND FILTER	700×600×2300	
5	R-C5	No.5 CONTROLCENTER for RAPID SAND FILTER	700×600×2300	
6	R-R1	No.1 RELAY PANEL for RAPID SAND FILTER	700×600×2300	
7	R-R2	No.2 RELAY PANEL for RAPID SAND FILTER	700×600×2300	
8	R-R3	No.3 RELAY PANEL for RAPID SAND FILTER	700×600×2300	
9	R-CP	CONTROL PANEL for RAPID SAND FILTER	1200×600×2300	
10	R-P-1	BUILDING POWER PANEL	600×500×1900	
11	R-L-1	LIGHTING PANEL	500×300×700	
12	R-L-2	OUTDOOR LIGHTING PANEL	500×300×700	
13	R-TGB	GROUNDING TERMINAL BOX(4P+2P)	500×120×500	
14	R-CP-4	No.8,7 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
15	R-CP-3	No.5,6 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
16	R-CP-2	No.3,4 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
17	R-CP-1	No.1,2 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
18	R-LOP-5	EXHAUST FAN (INLET) LOCAL PANEL	600×300×700 (STB00)	

PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W642
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter (Upper Floor) Piping & Wiring Plan	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:150



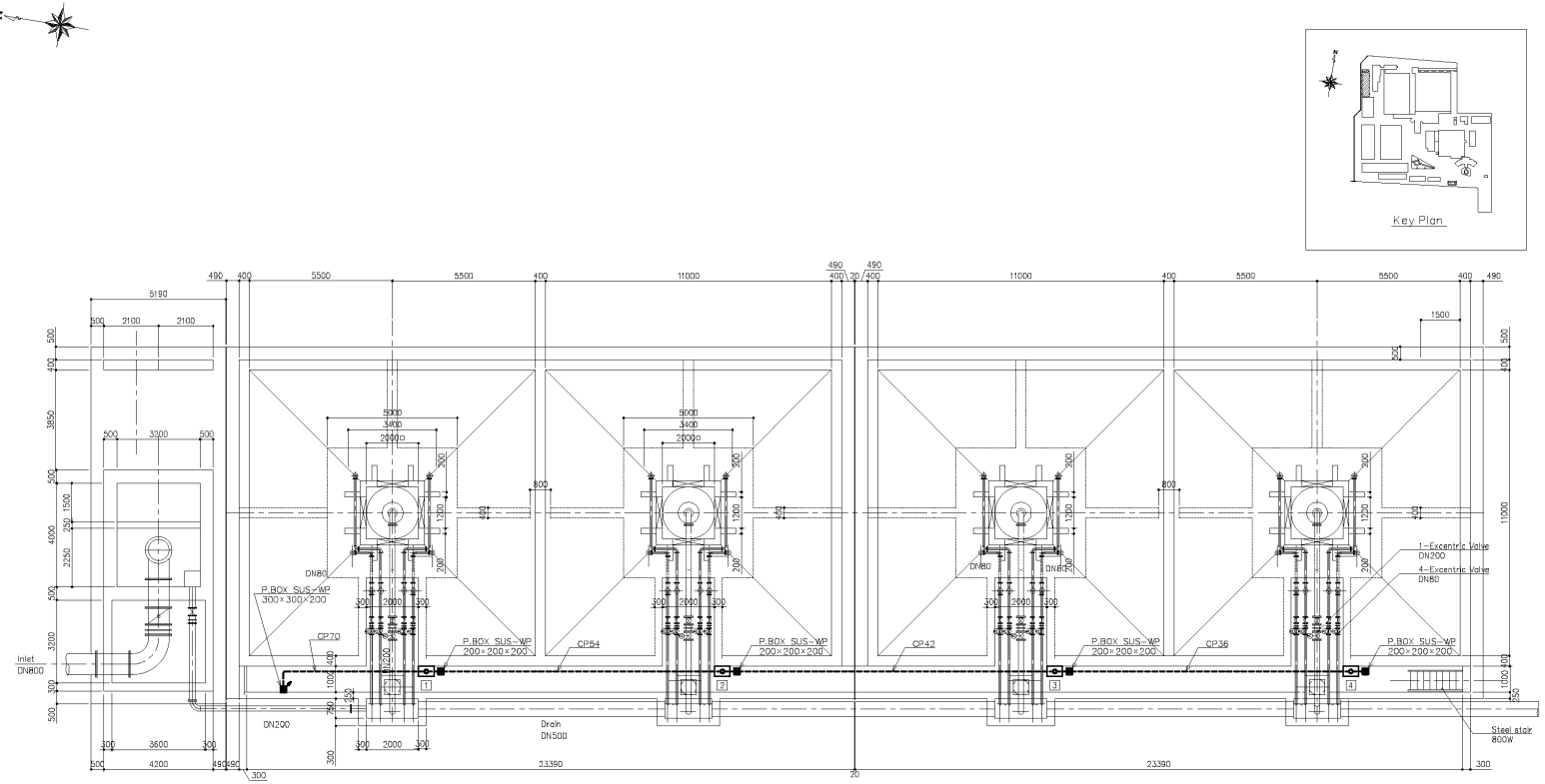
LIST

NO.	ITEM NO.	EQUIPMENT NAME	SIZE(WxDxH)	REMARKS
①	C-L-1	LIGHTING PANEL FOR CLARIFIER	500x300x700(ST900)	
②	C-L-2	OUTDOOR LIGHTING PANEL FOR CLARIFER	500x300x700(ST900)	

NOTE:

1. GROUND WIRING
2. OPEN PIPING WIRING
3. RACK・DUCT WIRING
4. WIRING UP
5. WIRING DOWN
6. P.BOX

PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-W643
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Clarifier (Top Plan) Piping & Wiring Plan	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:150

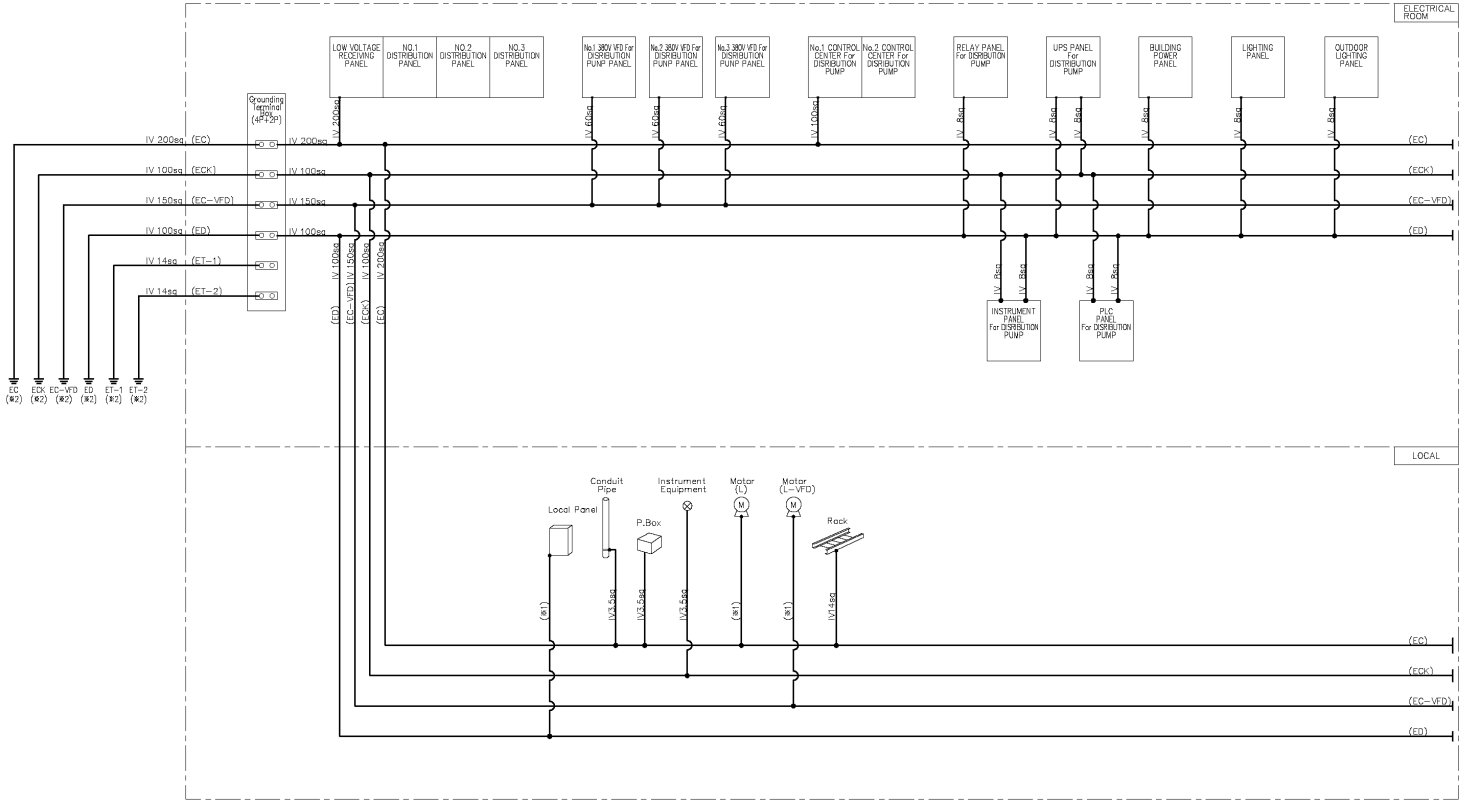


LIST

NO.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.4 SOLENOID VALVE BOX		
2	No.3 SOLENOID VALVE BOX		
3	No.2 SOLENOID VALVE BOX		
4	No.1 SOLENOID VALVE BOX		

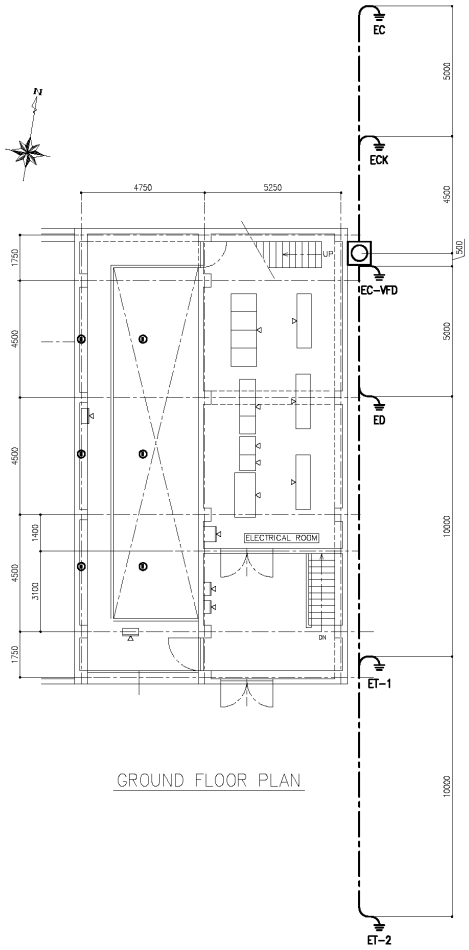
NOTE:
1. GROUND WIRING
2. OPEN PIPING WIRING
3. RACK・DUCT WIRING
4. WIRING UP
5. WIRING DOWN
6. P.BOX

PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-W644
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Clarifier (Lower) Piping & Wiring Plan	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:150

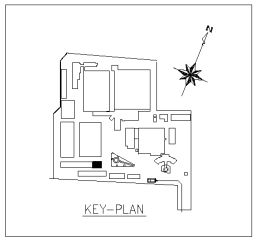


Note)
※1 : Refer to Cable Schedule
※2 : Resistance to Groundings Are All 2Ω Under

The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	DESCRIPTION No.4 Distribution Pumping Station Grounding Diagram	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-D638
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE

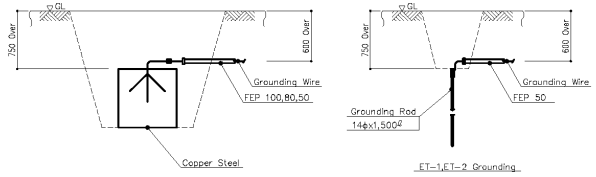


GROUND FLOOR PLAN



KEY-PLAN

Grounding s=None



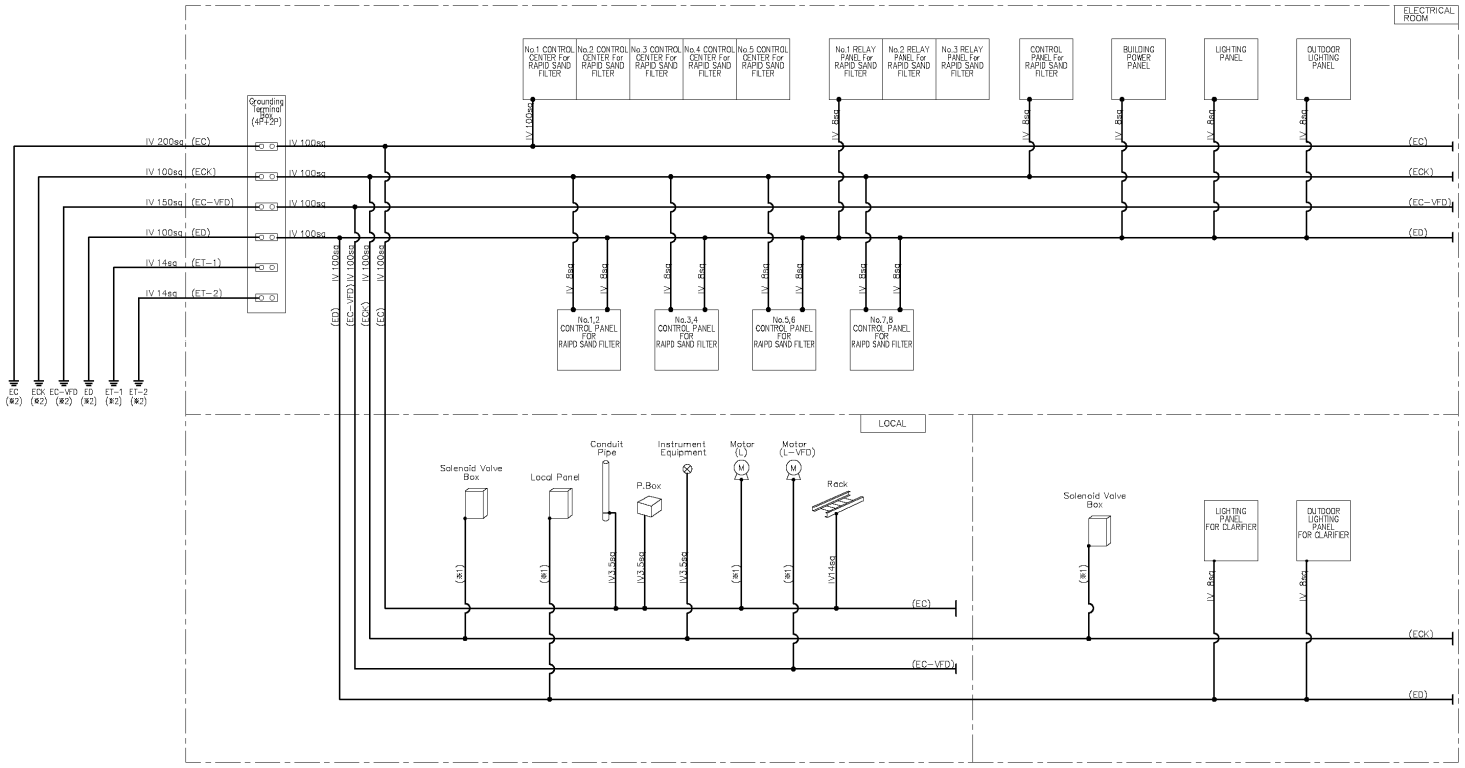
EC,ECK,EC-VFD,ED Grounding

ET-1,ET-2 Grounding

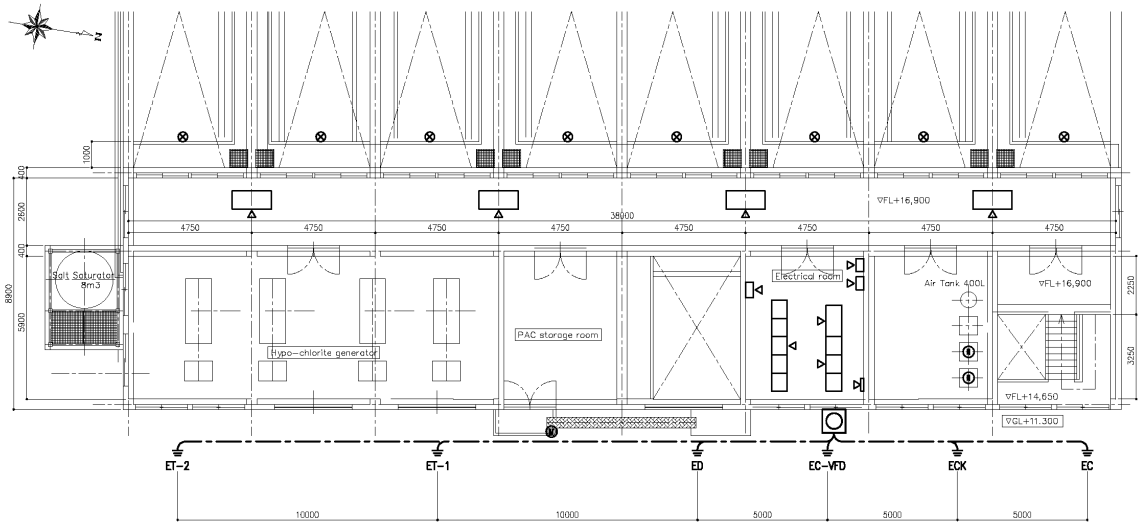
Grounding Spec.

Type	Classification	Application	Material	Grounding Wire	Resistance To Grounding	Size
EC	C	Low Tension 380V Equipment	Copper Steel 90□x1.5t	200sq	2Ω Under	FEP 80
ECK	C	Instrument Equipment	Copper Steel 90□x1.5t	100sq	2Ω Under	FEP 80
EC-VFD	C	Low Tension VFD Equipment	Copper Steel 90□x1.5t	150sq	2Ω Under	FEP 80
ED	D	Low Tension Equipment	Copper Steel 90□x1.5t	100sq	2Ω Under	FEP 50
ET-1	Test-1	Test	Copper Rod 14φx1500L	14sq	2Ω Under	FEP 50
ET-2	Test-2	Test	Copper Rod 14φx1500L	14sq	2Ω Under	FEP 50

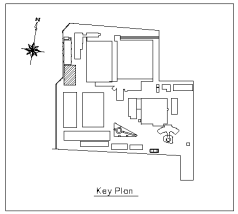
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	No.4 Distribution Pumping Station (Ground Floor)Grounding Excavation Plan	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-D639
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:150



The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	DESCRIPTION Rapid Sand Filter Grounding Diagram	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-W645
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE

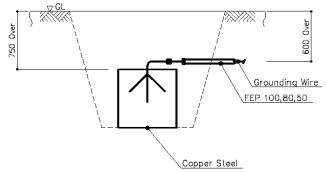


Upper Plan

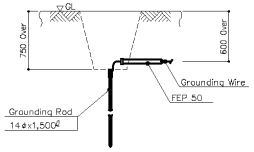


Key Plan

Grounding s=None



EC,ECK,EC-VFD,ED Grounding

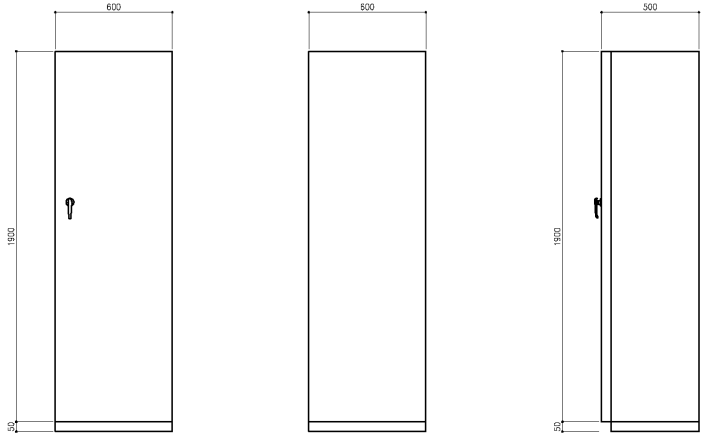


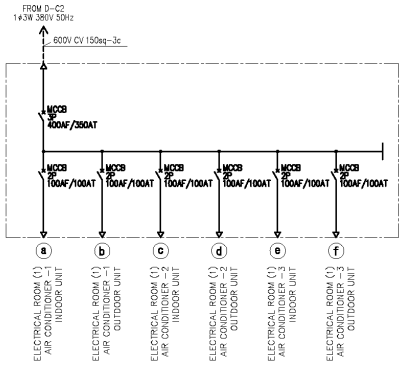
ET-1,ET-2 Grounding

Grounding Spec.

Type	Classification	Application	Material	Grounding Wire	Resistance To Grounding	Size
EC	C	Low Tension 300V Equipment	Copper Steel 90□1.5t	100sq	2Ω Under	FEP 80
ECK	C	Instrument Equipment	Copper Steel 90□1.5t	100sq	2Ω Under	FEP 80
EC-VFD	C	Low Tension VFD Equipment	Copper Steel 90□1.5t	100sq	2Ω Under	FEP 80
ED	D	Low Tension Equipment	Copper Steel 90□1.5t	100sq	2Ω Under	FEP 50
ET-1	Test-1	Test	Copper Rod 14φx1500L	14sq	2Ω Under	FEP 50
ET-2	Test-2	Test	Copper Rod 14φx1500L	14sq	2Ω Under	FEP 50

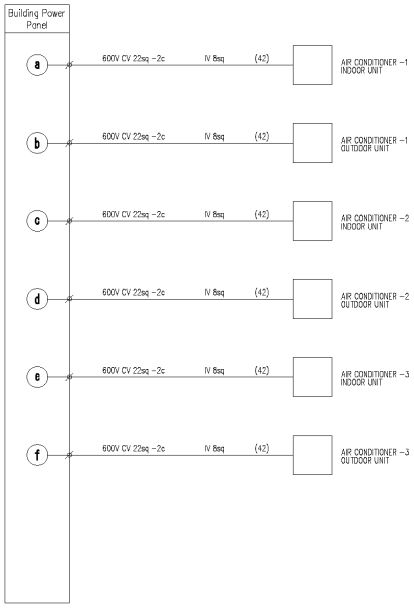
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter (Upper Floor) Grounding Excavation Plan	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-W646
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:150



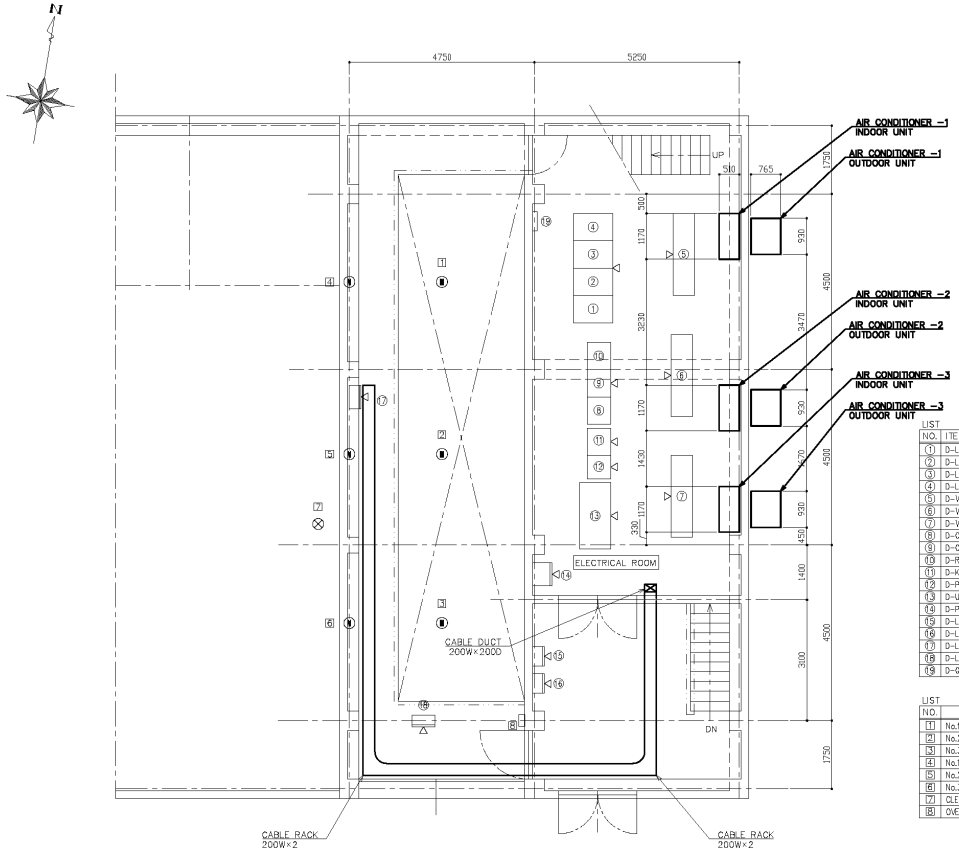


Single Line

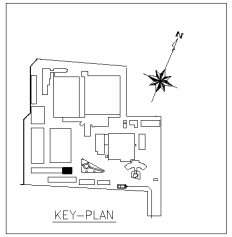
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	NO.4 Distribution Pumping Station Building Power Panel	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-D650
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:20



PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	No. 4 Distribution Pumping Station Air Conditioner Line Diagram	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-D651
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



GROUND FLOOR PLAN



KEY-PLAN

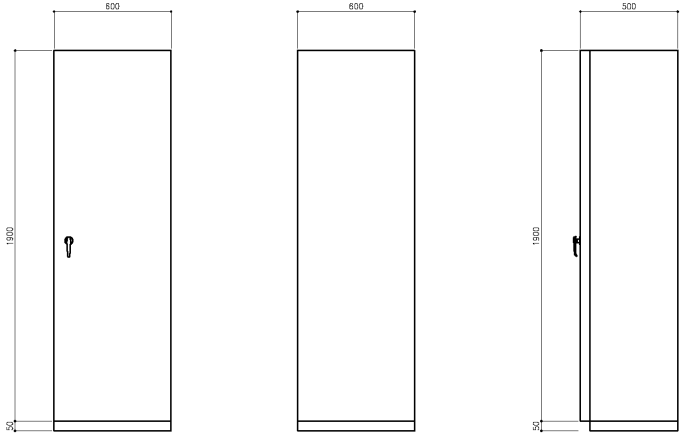
LIST

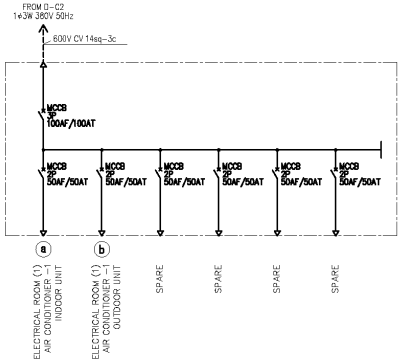
NO.	ITEM NO.	EQUIPMENT NAME	SIZE(WxDxH)	REMARKS
①	D-L1	LOW VOLTAGE RECEIVING PANEL	700x1000x2300	
②	D-L2	No.1 DISTRIBUTION PANEL	700x1000x2300	
③	D-L3	No.2 DISTRIBUTION PANEL	700x1000x2300	
④	D-L4	No.3 DISTRIBUTION PANEL	700x1000x2300	
⑤	D-V1	No.1 380V VFD FOR DISRIBUTION PUNP PANEL	2100x550x2300	
⑥	D-V2	No.2 380V VFD FOR DISRIBUTION PUNP PANEL	2100x550x2300	
⑦	D-V3	No.3 380V VFD FOR DISRIBUTION PUNP PANEL	2100x550x2300	
⑧	D-C1	No.1 CONTROLCENTER for DISRIBUTION PUMP	700x600x2300	
⑨	D-C2	No.2 CONTROLCENTER for DISRIBUTION PUMP	700x600x2300	
⑩	D-R1	RELAY PANEL for DISRIBUTION PUMP	700x600x2300	
⑪	D-I-P	INSTRUMENT PANEL for DISRIBUTION PUMP	700x600x2300	
⑫	D-P	PLC PANEL for DISRIBUTION PUMP	600x600x2300	
⑬	D-UPS	UPS PANEL	1700x800x2300	
⑭	D-P1	BUILDING POWER PANEL	600x500x1900	
⑮	D-L1	LIGHTING PANEL	500x300x700	
⑯	D-L2	OUTDOOR LIGHTING PANEL	500x300x700	
⑰	D-LCP-3	EXHAUST FAN (INLET)	600x300x600(ST1000)	
⑱	D-LCP-4	EXHAUST FAN (OUTLET)	600x300x600(ST1000)	
⑲	D-CTB	GROUNDING TERMINAL BOX (4P+2P)	500x120x600	

LIST

NO.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.1 EXHAUST FAN (OUTLET)	0.4kW	
2	No.2 EXHAUST FAN (OUTLET)	0.4kW	
3	No.3 EXHAUST FAN (OUTLET)	0.4kW	
4	No.1 EXHAUST FAN (INLET)	0.4kW	
5	No.2 EXHAUST FAN (INLET)	0.4kW	
6	No.3 EXHAUST FAN (INLET)	0.4kW	
7	CLEAR WATER RESERVOIR LEVEL METER		THROW IN TYPE
8	OVERHEAD TRAVELING CRANE	5.5kW	

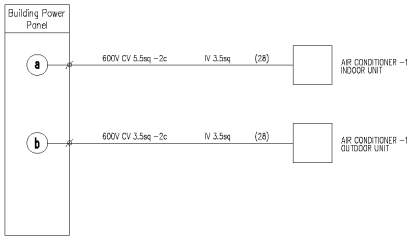
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	No.4 Distribution Pumping Station (Ground Floor) Air Conditioner Layout Plan	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-D652
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:100



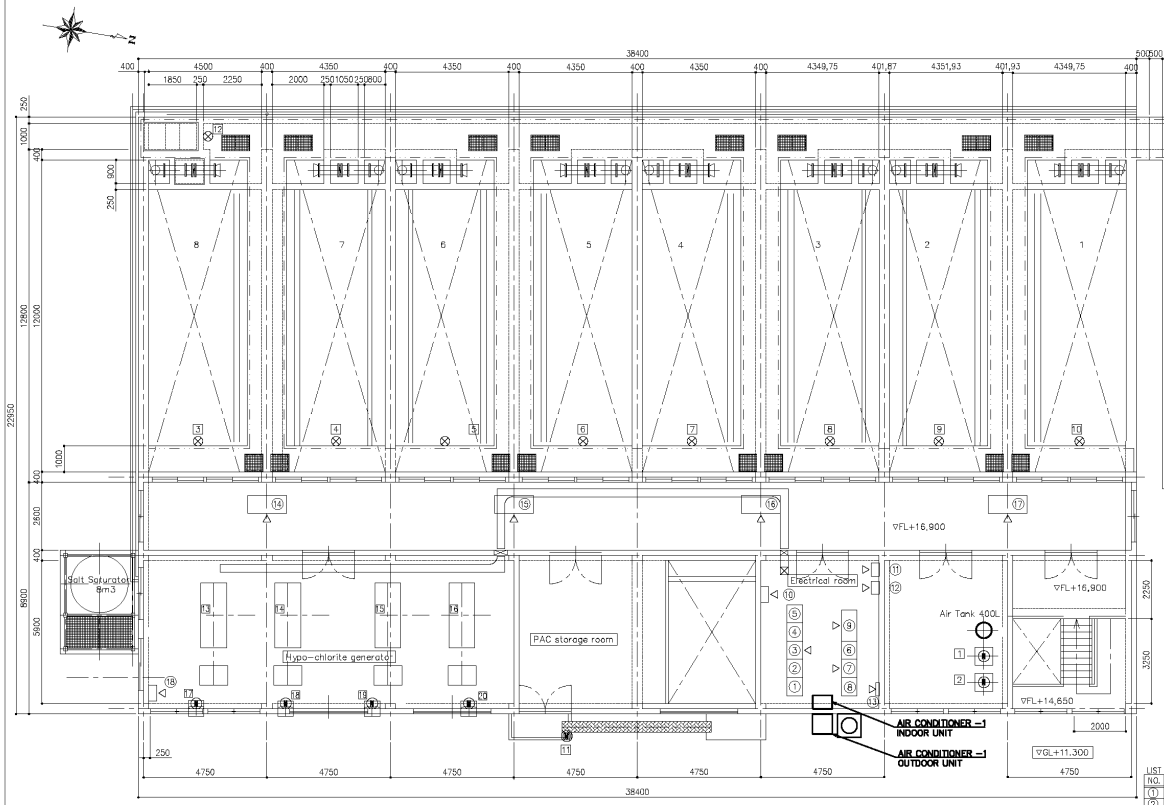


Single Line

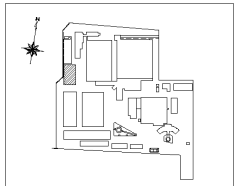
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter Building Power Panel	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W650
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:20



PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter Air Conditioner Line Diagram	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W651
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



Upper Plan



Key Plan

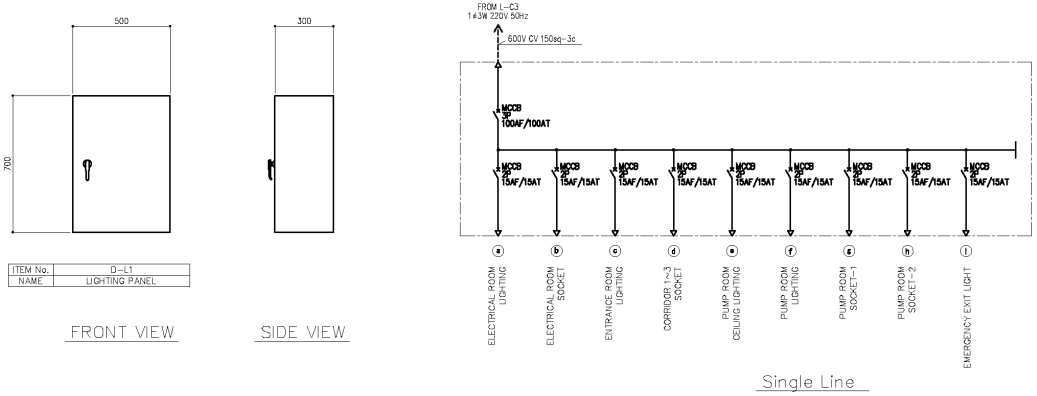
LIST

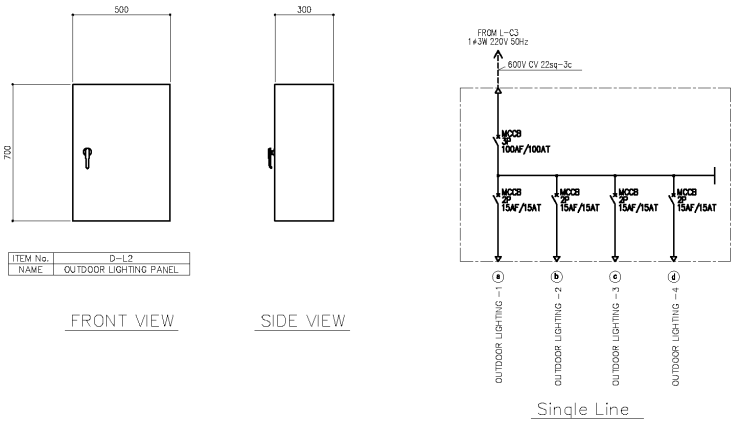
NO.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.1 AIR COMPRESSOR	1.5kW	AIR DRYER BUILT-IN
2	No.2 AIR COMPRESSOR	1.5kW	AIR DRYER BUILT-IN
3	LEVEL DETECTOR for No.8 FILTER BASIN		
4	LEVEL DETECTOR for No.7 FILTER BASIN		
5	LEVEL DETECTOR for No.6 FILTER BASIN		
6	LEVEL DETECTOR for No.5 FILTER BASIN		
7	LEVEL DETECTOR for No.4 FILTER BASIN		
8	LEVEL DETECTOR for No.3 FILTER BASIN		
9	LEVEL DETECTOR for No.2 FILTER BASIN		
10	LEVEL DETECTOR for No.1 FILTER BASIN		
11	LIFTING CONVEYOR	0.75kW	
12	LEVEL DETECTOR		
13	No.4 HYPO-CHLORITE GENERATOR	77kVA	
14	No.3 HYPO-CHLORITE GENERATOR	77kVA	
15	No.2 HYPO-CHLORITE GENERATOR	77kVA	
16	No.1 HYPO-CHLORITE GENERATOR	77kVA	
17	No.4 EXHAUST FAN (INLET)	0.4kW	
18	No.3 EXHAUST FAN (INLET)	0.4kW	
19	No.2 EXHAUST FAN (INLET)	0.4kW	
20	No.1 EXHAUST FAN (INLET)	0.4kW	

LIST

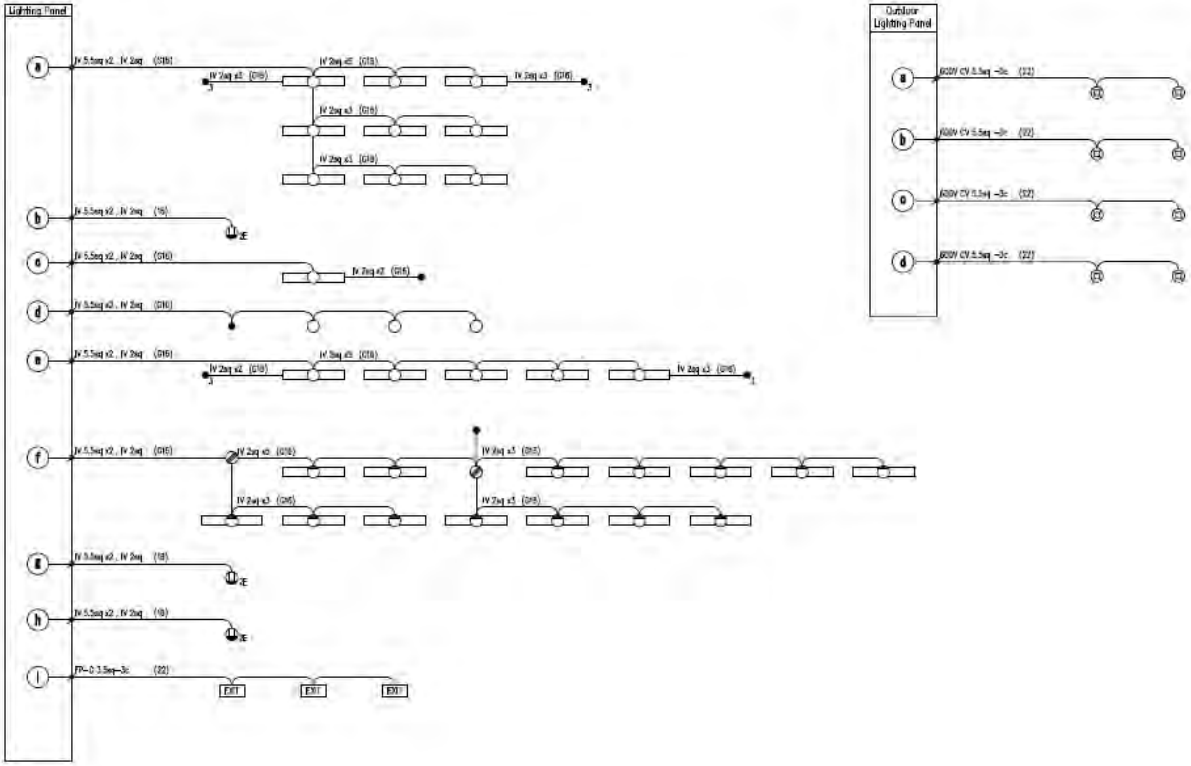
NO.	ITEM NO.	EQUIPMENT NAME	SIZE(WxDxH)	REMARKS
1	R-C1	No.1 CONTROLCENTER for RAPID SAND FILTER	700x600x2300	
2	R-C2	No.2 CONTROLCENTER for RAPID SAND FILTER	700x600x2300	
3	R-C3	No.3 CONTROLCENTER for RAPID SAND FILTER	700x600x2300	
4	R-C4	No.4 CONTROLCENTER for RAPID SAND FILTER	700x600x2300	
5	R-C5	No.5 CONTROLCENTER for RAPID SAND FILTER	700x600x2300	
6	R-R1	No.1 RELAY PANEL for RAPID SAND FILTER	700x600x2300	
7	R-R2	No.2 RELAY PANEL for RAPID SAND FILTER	700x600x2300	
8	R-R3	No.3 RELAY PANEL for RAPID SAND FILTER	700x600x2300	
9	R-CP	CONTROL PANEL for RAPID SAND FILTER	1200x600x2300	
10	R-P-1	BUILDING POWER PANEL	600x500x1900	
11	R-L-1	LIGHTING PANEL	500x300x700	
12	R-L-2	OUTDOOR LIGHTING PANEL	500x300x700	
13	R-TGB	GROUNDING TERMINAL BOX(4P+2P)	500x120x500	
14	R-CP-4	No.6,7 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
15	R-CP-3	No.5,6 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
16	R-CP-2	No.3,4 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
17	R-CP-1	No.1,2 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
18	R-LCP-5	EXHAUST FAN (INLET) LOCAL PANEL	600x300x700 (ST900)	

PROJECT The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	DESCRIPTION Rapid Sand Filter (Upper Floor) Air Conditioner Layout Plan	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-W652
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:150

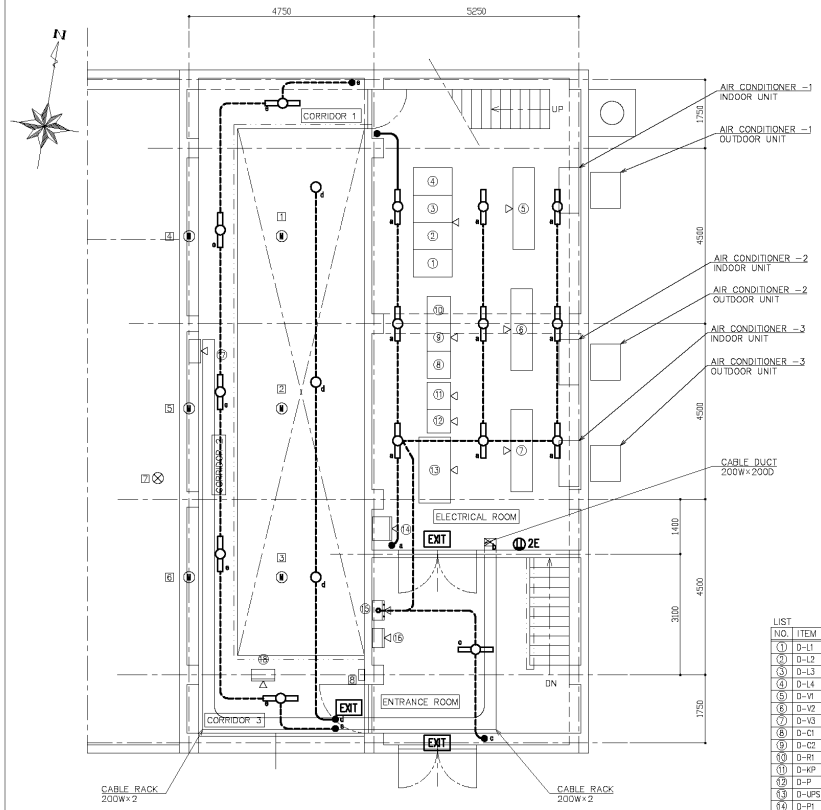




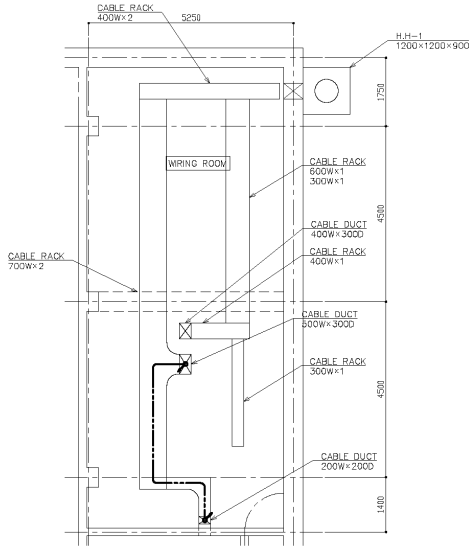
PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-D653
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	NO.4 Distribution Pumping Station Lighting Panel & Outdoor Lighting Panel	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:20



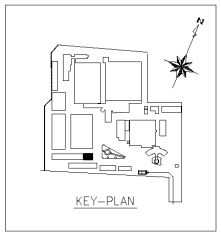
PROJECT The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	DESCRIPTION **No. 4 Distribution Pumping Station Lighting Line Diagram**	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-D654
		NIHON SUIDO CONSULTANTS CO.,LTD CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



GROUND FLOOR PLAN



GROUND FLOOR PLAN



KEY-PLAN

LIST

NO.	ITEM NO.	EQUIPMENT NAME	SIZE(W×D×H)	REMARKS
1	D-L1	LOW VOLTAGE RECEIVING PANEL	700×1000×2300	
2	D-L2	No.1 DISTRIBUTION PANEL	700×1000×2300	
3	D-L3	No.2 DISTRIBUTION PANEL	700×1000×2300	
4	D-L4	No.3 DISTRIBUTION PANEL	700×1000×2300	
5	D-V1	No.1 380V VFD FOR DISRIBUTION PUNP PANEL	2100×550×2300	
6	D-V2	No.2 380V VFD FOR DISRIBUTION PUNP PANEL	2100×550×2300	
7	D-V3	No.3 380V VFD FOR DISRIBUTION PUNP PANEL	2100×550×2300	
8	D-C1	No.1 CONTROLCENTER for DISRIBUTION PUMP	700×600×2300	
9	D-C2	No.2 CONTROLCENTER for DISRIBUTION PUMP	700×600×2300	
10	D-R1	RELAY PANEL for DISRIBUTION PUMP	700×600×2300	
11	D-KP	INSTRUMENT PANEL for DISRIBUTION PUMP	700×600×2300	
12	D-P	PLC PANEL for DISRIBUTION PUMP	600×600×2300	
13	D-UPS	UPS PANEL	1700×800×2300	
14	D-P1	BUILDING POWER PANEL	600×500×1900	
15	D-L1	LIGHTING PANEL	500×300×700	
16	D-L2	OUTDOOR LIGHTING PANEL	500×300×700	
17	D-LCP-3	EXHAUST FAN (INLET)	600×300×600(ST1000)	
18	D-LCP-4	EXHAUST FAN (OUTLET)	600×300×600(ST1000)	

LIST

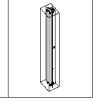
NO.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.1 EXHAUST FAN (OUTLET)	0.4kW	
2	No.2 EXHAUST FAN (OUTLET)	0.4kW	
3	No.3 EXHAUST FAN (OUTLET)	0.4kW	
4	No.1 EXHAUST FAN (INLET)	0.4kW	
5	No.2 EXHAUST FAN (INLET)	0.4kW	
6	No.3 EXHAUST FAN (INLET)	0.4kW	
7	CLEAR WATER RESERVOIR LEVEL METER		THROW IN TYPE
8	OVER HEAD TRAVELING CRANE	5.5kW	

LEGEND

SYMBOL	NAME (TYPE)
●	EMBEDDED SWITCH (1P 15A×1)
●3	EMBEDDED SWITCH (2W 15A×1)
⊕AC	Socket (With 2P 15A×2+E)
⊠	P.BOX (150×150×100 SS)
⊢——→	OPEN PIPING

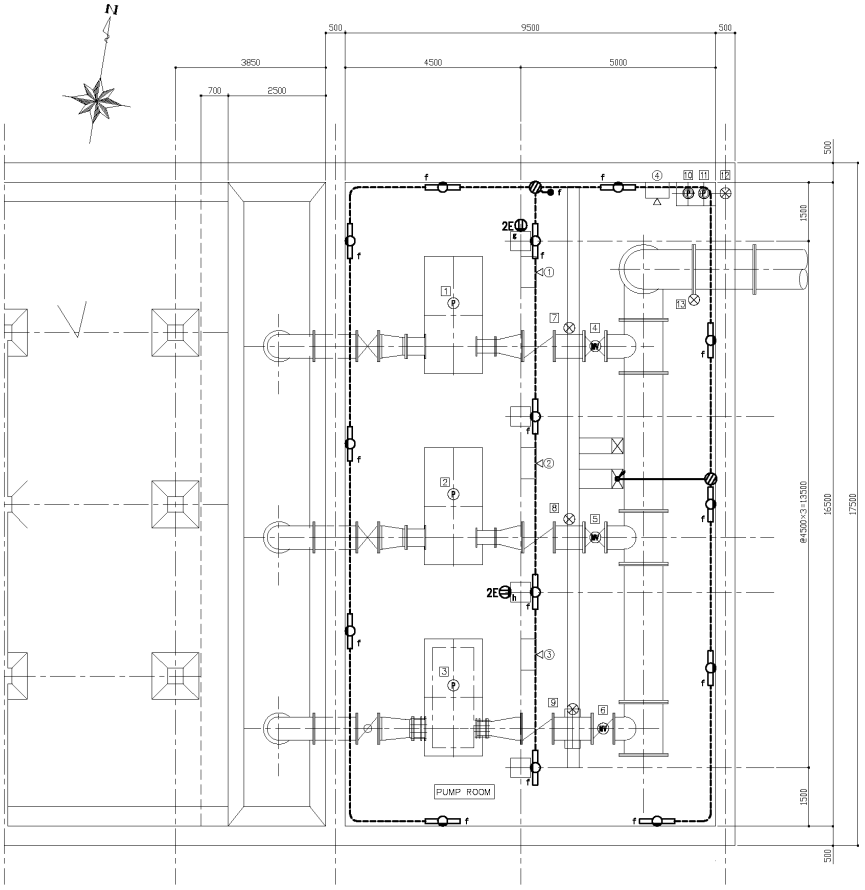
SYMBOL	LED 70W
○	

SYMBOL	40W×2
	

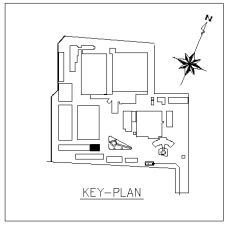
SYMBOL	40W×2 (PROTECTOR)
	

SYMBOL	20W
EXIT	

PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	No.4 Distribution Pumping Station (Ground Floor)Lighting Layout Plan	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-D655
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:100



BOTTOM PLAN



KEY-PLAN

LIST

NO.	ITEM NO.	EQUIPMENT NAME	SIZE(WxDxH)	REMARKS
①	D-LCP-1-1	No.1 LIFT PUMP LOCAL CONTROL PANEL	800x300x1000(ST600)	
②	D-LCP-1-2	No.2 LIFT PUMP LOCAL CONTROL PANEL	800x300x1000(ST600)	
③	D-LCP-1-3	No.3 LIFT PUMP LOCAL CONTROL PANEL	800x300x1000(ST600)	
④	D-LCP-2	SUMP PUMP LOCAL CONTROL PANEL	800x300x900(ST700)	

LIST

NO.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.1 DISTRIBTON PUMP	280kW	
2	No.2 DISTRIBTON PUMP	280kW	
3	No.3 DISTRIBTON PUMP	280kW	
4	No.1 BUTTERFLY VALVE (DISCHARGE)	1.5kW	
5	No.2 BUTTERFLY VALVE (DISCHARGE)	1.5kW	
6	No.3 BUTTERFLY VALVE (DISCHARGE)	1.5kW	
7	No.1 FLOW SWITCH		
8	No.2 FLOW SWITCH		
9	No.3 FLOW SWITCH		
10	No.1 SUMP PUMP	2.2kW	
11	No.2 SUMP PUMP	2.2kW	
12	SUMP PUMP LEVEL DETECTOR		ELECTRODE
13	PRESSURE TRANSMITTER		
14	FLOW METER		ULTRASONIC

SYMBOL	LED17W
	

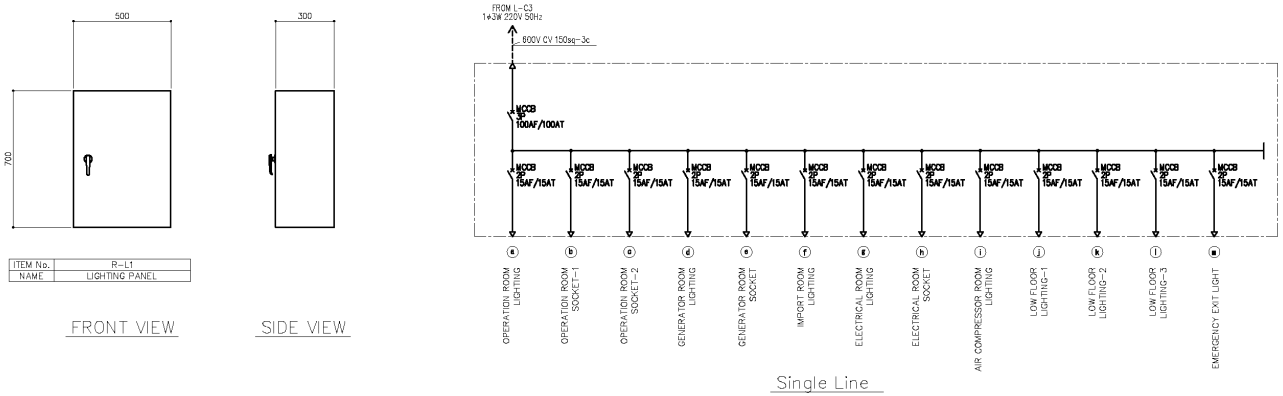
SYMBOL	40W-2
	

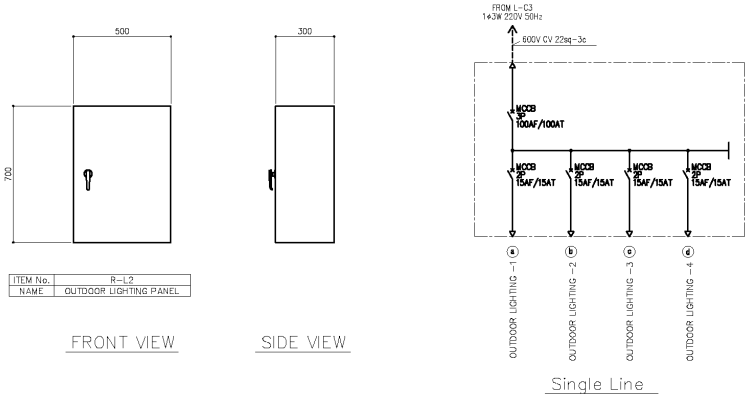
SYMBOL	40W-2 (PROTECTOR)
	

LEGEND

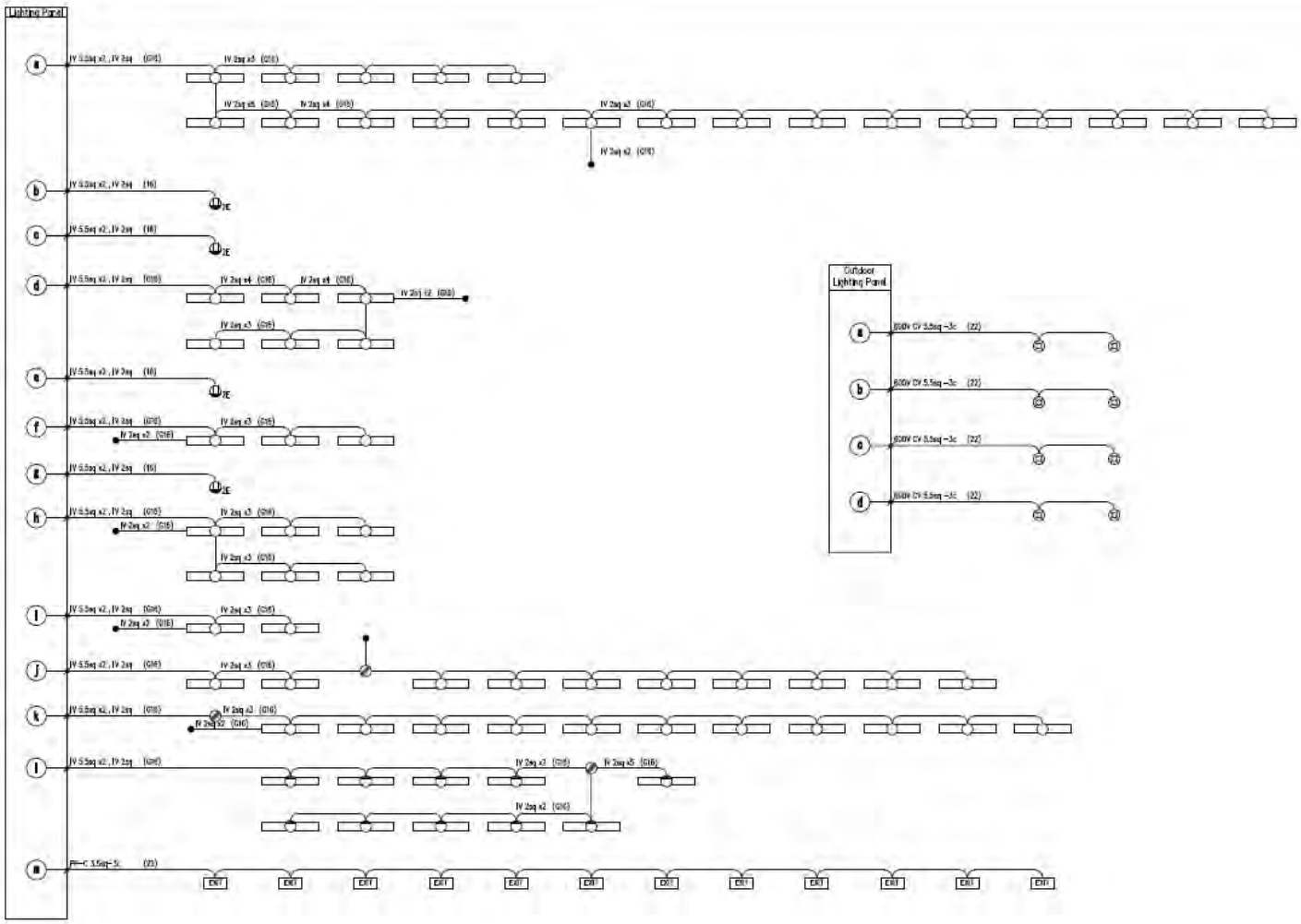
SYMBOL	NAME (TYPE)
●	EMBEDDED SWITCH (1P 15A×1)
●3	EMBEDDED SWITCH (2M 15A×1)
2E	Socket (WTH 3P 15A×2+E)
☒	P.BOX (150×150×100 SS)
	OPEN PIPING

PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	No.4 Distribution Pumping Station (BOTTOM) Lighting Layout Plan	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-D656
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:100

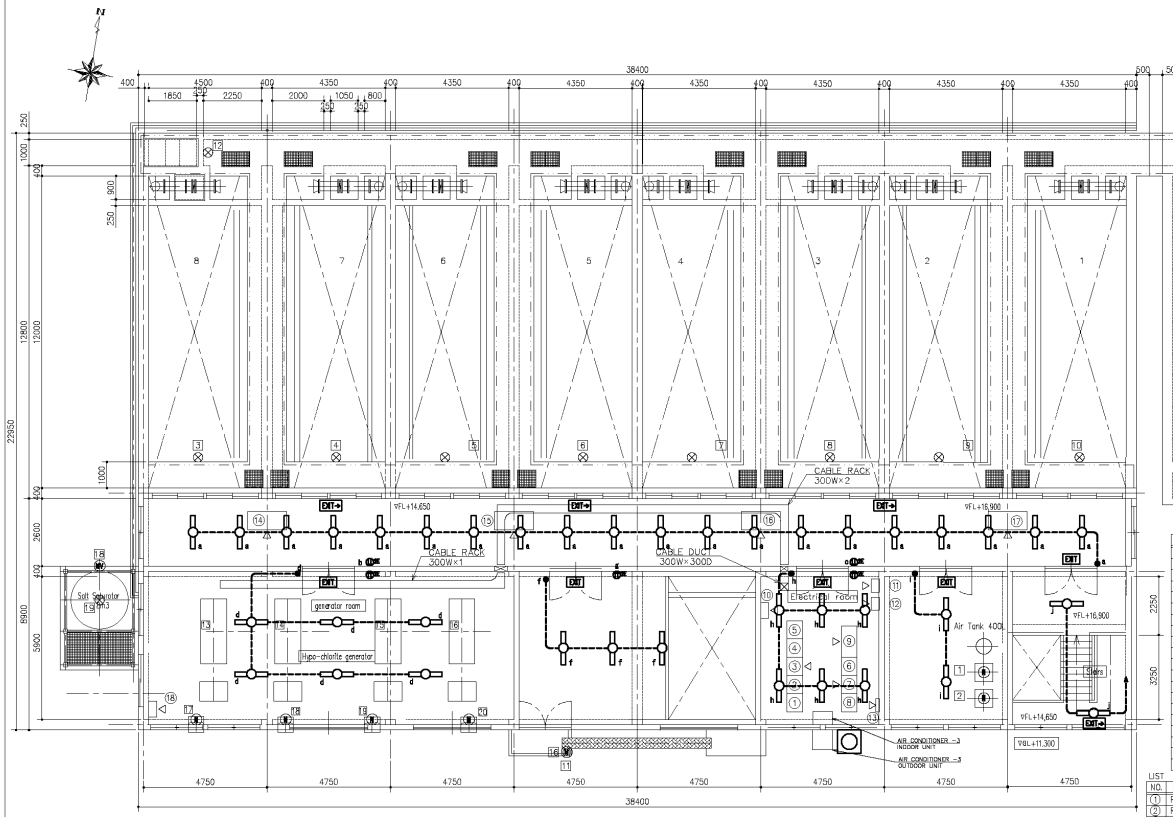




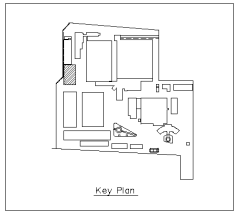
PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter Lighting Panel & Outdoor Lighting Panel	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W653
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:20



PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	**Rapid Sand Filter Lighting Line Diagram**	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W654
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



Upper Plan



Key Plan

LIST

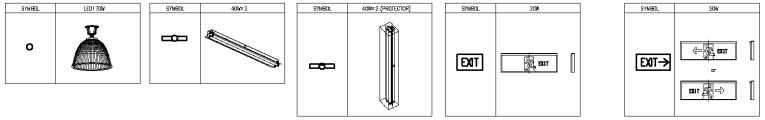
NO.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.1 AIR COMPRESSOR	1.5kW	AIR DRYER BUILT-IN
2	No.2 AIR COMPRESSOR	1.5kW	AIR DRYER BUILT-IN
3	LEVEL DETECTOR for No.8 FILTER BASIN		
4	LEVEL DETECTOR for No.7 FILTER BASIN		
5	LEVEL DETECTOR for No.6 FILTER BASIN		
6	LEVEL DETECTOR for No.5 FILTER BASIN		
7	LEVEL DETECTOR for No.4 FILTER BASIN		
8	LEVEL DETECTOR for No.3 FILTER BASIN		
9	LEVEL DETECTOR for No.2 FILTER BASIN		
10	LEVEL DETECTOR for No.1 FILTER BASIN		
11	LIFTING CONVEYOR	0.75kW	
12	LEVEL DETECTOR		
13	No.4 HYPO-CHLORITE GENERATOR	77kVA	
14	No.3 HYPO-CHLORITE GENERATOR	77kVA	
15	No.2 HYPO-CHLORITE GENERATOR	77kVA	
16	No.1 HYPO-CHLORITE GENERATOR	77kVA	
17	No.4 EXHAUST FAN (INLET)	0.4kW	
18	No.3 EXHAUST FAN (INLET)	0.4kW	
19	No.2 EXHAUST FAN (INLET)	0.4kW	
20	No.1 EXHAUST FAN (INLET)	0.4kW	

LIST

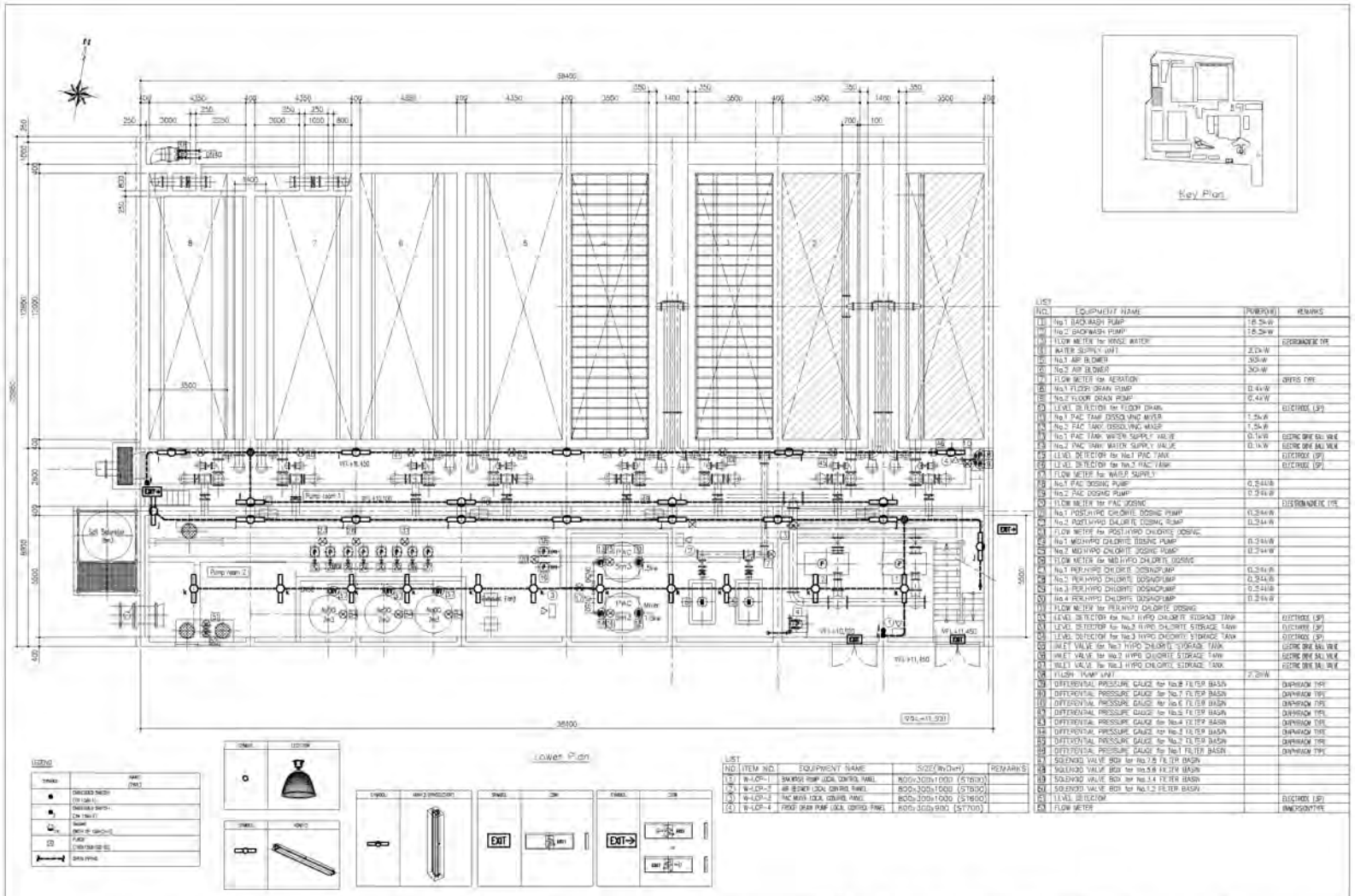
NO.	ITEM NO.	EQUIPMENT NAME	SIZE(WxDxH)	REMARKS
1	R-C1	No.1 CONTROLCENTER for RAPID SAND FILTER	700×600×2300	
2	R-C2	No.2 CONTROLCENTER for RAPID SAND FILTER	700×600×2300	
3	R-C3	No.3 CONTROLCENTER for RAPID SAND FILTER	700×600×2300	
4	R-C4	No.4 CONTROLCENTER for RAPID SAND FILTER	700×600×2300	
5	R-C5	No.5 CONTROLCENTER for RAPID SAND FILTER	700×600×2300	
6	R-R1	No.1 RELAY PANEL for RAPID SAND FILTER	700×600×2300	
7	R-R2	No.2 RELAY PANEL for RAPID SAND FILTER	700×600×2300	
8	R-R3	No.3 RELAY PANEL for RAPID SAND FILTER	700×600×2300	
9	R-CP	CONTROL PANEL for RAPID SAND FILTER	1200×600×2300	
10	R-P-1	BUILDING POWER PANEL	600×500×1900	
11	R-L-1	LIGHTING PANEL	500×300×700	
12	R-L-2	OUTDOOR LIGHTING PANEL	500×300×700	
13	R-TGB	GROUNDING TERMINAL BOX(4P+2P)	500×120×500	
14	R-CP-4	No.8,7 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
15	R-CP-3	No.5,6 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
16	R-CP-2	No.3,4 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
17	R-CP-1	No.1,2 CONTROL PANEL FOR RAPID SAND FILTER	DESK TYPE	
18	R-LCP-5	EXHAUST FAN (INLET) LOCAL PANEL	600×300×700 (ST900)	

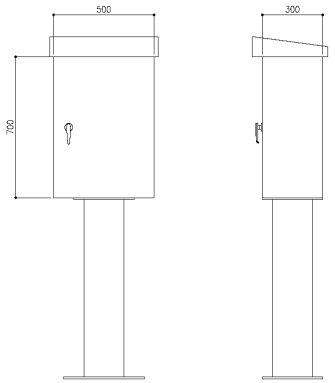
LEGEND

SYMBOL	NAME (TYPE)
●	EMBEDDED SWITCH (1P 15A×1)
●3	EMBEDDED SWITCH (3W 15A×3)
2E	Socket (WITH 2P 15A×2+E)
⊠	P.BOX (150×150×100 BS)
	OPEN PIPING



PROJECT	DESCRIPTION	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	DRAWING No.	PPWTP-W655
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Rapid Sand Filter (Upper Floor) Lighting Layout Plan	NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:150

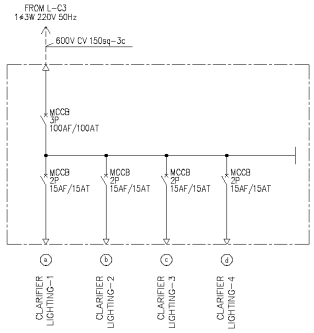

Key Plan
Lower Plan
Pump room 1
Pump room 2
Soft Selector
LIST
NO. EQUIPMENT NAME POWER(kW) REMARKS
1 No.1 BACKWASH PUMP 18.5kW
2 No.2 BACKWASH PUMP 18.5kW
3 FLOW METER for RINSE WATER ELECTROMAGNETIC TYPE
4 WATER SUPPLY UNIT 2.0kW
5 No.1 AIR BLOWER 30kW
6 No.2 AIR BLOWER 30kW
7 FLOW METER for AERATION ORIFIS TYPE
8 No.1 FLOOR DRAIN PUMP 0.4kW
9 No.2 FLOOR DRAIN PUMP 0.4kW
10 LEVEL DETECTOR for FLOOR DRAIN ELECTRODE (SP)
11 No.1 PAC TANK DISSOLVING MIXER 1.5kW
12 No.2 PAC TANK DISSOLVING MIXER 1.5kW
13 No.1 PAC TANK WATER SUPPLY VALVE 0.1kW ELECTRIC BALL VALVE
14 No.2 PAC TANK WATER SUPPLY VALVE 0.1kW ELECTRIC BALL VALVE
15 LEVEL DETECTOR for No.1 PAC TANK ELECTRODE (SP)
16 LEVEL DETECTOR for No.2 PAC TANK ELECTRODE (SP)
17 FLOW METER for WATER SUPPLY
18 No.1 PAC DOSING PUMP 0.24kW
19 No.2 PAC DOSING PUMP 0.24kW
20 FLOW METER for PAC DOSING ELECTROMAGNETIC TYPE
21 No.1 POSTHYPO CHLORITE DOSING PUMP 0.24kW
22 No.2 POSTHYPO CHLORITE DOSING PUMP 0.24kW
23 FLOW METER for POSTHYPO CHLORITE DOSING
24 No.1 MIDHYPO CHLORITE DOSING PUMP 0.24kW
25 No.2 MIDHYPO CHLORITE DOSING PUMP 0.24kW
26 FLOW METER for MIDHYPO CHLORITE DOSING
27 No.1 PERHYPO CHLORITE DOSINGPUMP 0.24kW
28 No.2 PERHYPO CHLORITE DOSINGPUMP 0.24kW
29 No.3 PERHYPO CHLORITE DOSINGPUMP 0.24kW
30 No.4 PERHYPO CHLORITE DOSINGPUMP 0.24kW
31 FLOW METER for PERHYPO CHLORITE DOSING
32 LEVEL DETECTOR for No.1 HYPO CHLORITE STORAGE TANK ELECTRODE (SP)
33 LEVEL DETECTOR for No.2 HYPO CHLORITE STORAGE TANK ELECTRODE (SP)
34 LEVEL DETECTOR for No.3 HYPO CHLORITE STORAGE TANK ELECTRODE (SP)
35 INLET VALVE for No.3 HYPO CHLORITE STORAGE TANK ELECTRIC BALL VALVE
36 INLET VALVE for No.2 HYPO CHLORITE STORAGE TANK ELECTRIC BALL VALVE
37 INLET VALVE for No.1 HYPO CHLORITE STORAGE TANK ELECTRIC BALL VALVE
38 FLUSH TRAP UNIT 2.2kW
39 DIFFERENTIAL PRESSURE GAUGE for No.8 FILTER BASIN DIAPHRAGM TYPE
40 DIFFERENTIAL PRESSURE GAUGE for No.7 FILTER BASIN DIAPHRAGM TYPE
41 DIFFERENTIAL PRESSURE GAUGE for No.6 FILTER BASIN DIAPHRAGM TYPE
42 DIFFERENTIAL PRESSURE GAUGE for No.5 FILTER BASIN DIAPHRAGM TYPE
43 DIFFERENTIAL PRESSURE GAUGE for No.4 FILTER BASIN DIAPHRAGM TYPE
44 DIFFERENTIAL PRESSURE GAUGE for No.3 FILTER BASIN DIAPHRAGM TYPE
45 DIFFERENTIAL PRESSURE GAUGE for No.2 FILTER BASIN DIAPHRAGM TYPE
46 DIFFERENTIAL PRESSURE GAUGE for No.1 FILTER BASIN DIAPHRAGM TYPE
47 SOLENOID VALVE BOX for No.7,8 FILTER BASIN
48 SOLENOID VALVE BOX for No.5,6 FILTER BASIN
49 SOLENOID VALVE BOX for No.3,4 FILTER BASIN
50 SOLENOID VALVE BOX for No.1,2 FILTER BASIN
51 LEVEL DETECTOR ELECTRODE (SP)
52 FLOW METER DIAPHRAGM TYPE
LIST
NO. ITEM NO. EQUIPMENT NAME SIZE(WxDxH) REMARKS
1 W-LCP-1 BACKWASH PUMP LOCAL CONTROL PANEL 800x300x1000 (ST600)
2 W-LCP-2 AIR BLOWER LOCAL CONTROL PANEL 800x300x1000 (ST600)
3 W-LCP-3 PAC MIXER LOCAL CONTROL PANEL 800x300x1000 (ST600)
4 W-LCP-4 FLOOR DRAIN PUMP LOCAL CONTROL PANEL 800x300x900 (ST700)
EXIT
PROJECT
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System
DESCRIPTION
Rapid Sand Filter (Lower Floor) Lighting Layout Plan
JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)
NIHON SUIDO CONSULTANTS CO.,LTD.
CROWN AGENTS JAPAN LIMITED
TEC INTERNATIONAL CO.,LTD.
DRAWING No. PPWTP-WE56
SCALE 1:150



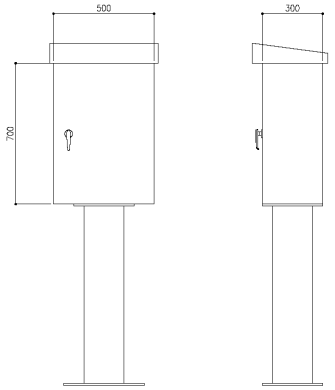
ITEM No.	C-L1
NAME	LIGHTING PANEL FOR CLARIFIER

FRONT VIEW

SIDE VIEW



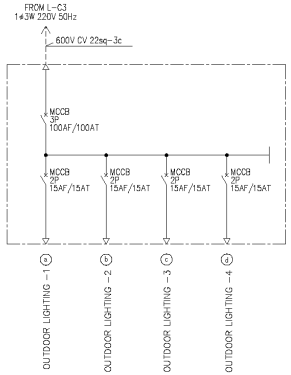
Single Line



ITEM No.	C-L2
NAME	OUTDOOR LIGHTING PANEL FOR CLARIFIER

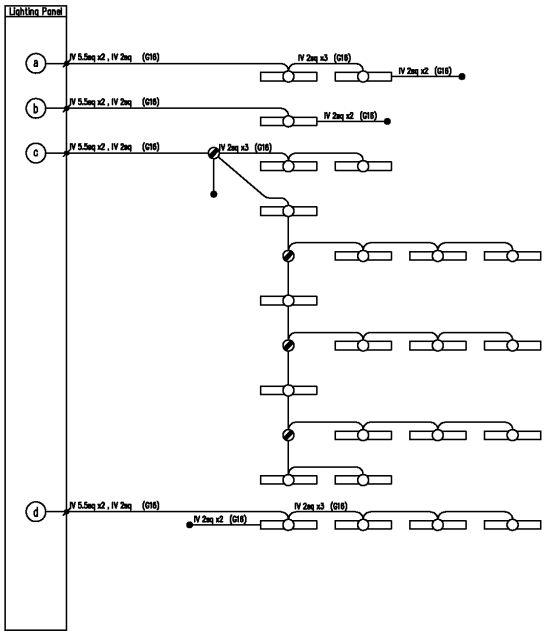
FRONT VIEW

SIDE VIEW

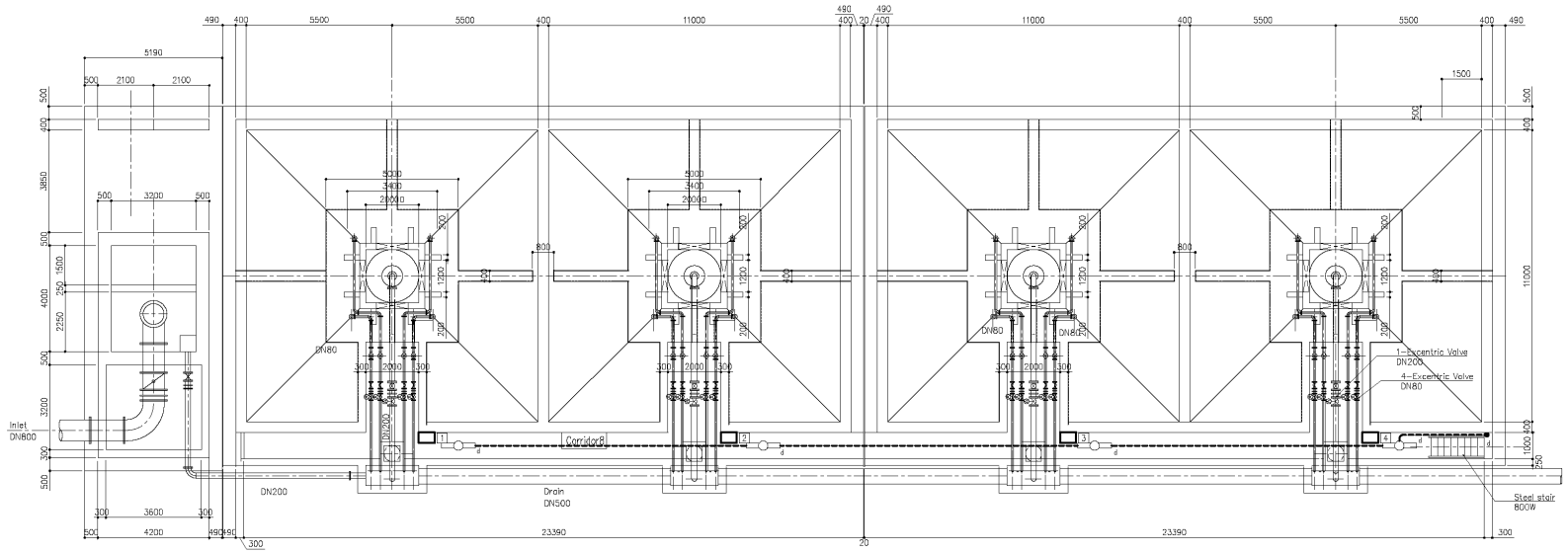


Single Line

PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	**Clarifier Lighting Panel & Outdoor Lighting Panel**	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W657
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:20



PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Clarifier Lighting Line Diagram	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W658
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	NONE



Lower Plan

LEGEND

SYMBOL	NAME (TYPE)
●	EMBEDDED SWITCH (1P 15A×1)
●3	EMBEDDED SWITCH (2W 15A×1)
2E	Socket (WITH 2P 15A×2+E)
⊠	PUSH (150×150×100 SS)
	OPEN PIPING

SYMBOL	4DA×2

LIST

NO.	EQUIPMENT NAME	POWER(kW)	REMARKS
1	No.4 SOLENOID VALVE BOX		
2	No.3 SOLENOID VALVE BOX		
3	No.2 SOLENOID VALVE BOX		
4	No.1 SOLENOID VALVE BOX		

PROJECT	DESCRIPTION			
The Preparatory Survey for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System	Clarifier (Lower Plan) Lighting Layout Plan	JAPAN INTERNATIONAL COOPORATION AGENCY (JICA)	DRAWING No.	PPWTP-W660
		NIHON SUIDO CONSULTANTS CO.,LTD. CROWN AGENTS JAPAN LIMITED TEC INTERNATIONAL CO.,LTD.	SCALE	1:150

資　料 6-2　環境保護契約の環境省承認レター

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

រដ្ឋាការទឹកស្វយ័តក្រុងភ្នំពេញ
លេខ:.....២៣៤.ណ.....

ថ្ងៃ.....ខែ.....ឆ្នាំ.....
ថ្ងៃ..ទី..ខ..ឆ..ខ..ខ.....ឆ្នាំ..ជ..ត ត្រីស័ក ព.ស.២៥៦៥
រាជធានីភ្នំពេញ ថ្ងៃទី..០២....ខែ.០៣.....ឆ្នាំ២០២១

សូមគោរពជូន
ឯកឧត្តមរដ្ឋមន្ត្រីក្រសួងបរិស្ថាន

ម្ចាស់គម្រោង តំណាងដោយ **ឯកឧត្តម ស៊ឹម ស៊ីថា** ជាអគ្គនាយកនៃរដ្ឋាការទឹកស្វយ័តក្រុងភ្នំពេញ ដែលមានអាសយដ្ឋានស្ថិតនៅផ្ទះលេខ ៤៥ ផ្លូវ ១០៦ សង្កាត់ស្រះចក ខណ្ឌដូនពេញ រាជធានីភ្នំពេញ។

សូមធ្វើកិច្ចសន្យាការពារបរិស្ថាន

ដើម្បីរួមចំណែកធានានូវនិរន្តរភាពបរិស្ថានក្នុងកិច្ចដំណើរការអភិវឌ្ឍប្រទេសជាតិ រដ្ឋាការទឹកស្វយ័តក្រុងភ្នំពេញ (ម្ចាស់គម្រោង) សូមធ្វើកិច្ចសន្យាការពារបរិស្ថានចំពោះក្រសួងបរិស្ថាន **សម្រាប់គម្រោងពង្រីក និងជួសជុលប្រព័ន្ធប្រព្រឹត្តកម្មទឹកស្អាតរោងចក្រកូមិព្រៃក** ដែលមានទីតាំងស្ថិតនៅក្នុងភូមិសាស្ត្រផ្ទះលេខ ៤៥ ផ្លូវ ១០៦ សង្កាត់ស្រះចក ខណ្ឌដូនពេញ រាជធានីភ្នំពេញ របស់រដ្ឋាការទឹកស្វយ័តក្រុងភ្នំពេញ តាមប្រការដូចខាងក្រោម:

ប្រការ ១..

ធានារៀបចំរបាយការណ៍វាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន និងសង្គមដំបូង សម្រាប់គម្រោងពង្រីក និងជួសជុលប្រព័ន្ធប្រព្រឹត្តកម្មទឹកស្អាតរោងចក្រកូមិព្រៃក ក្នុងករណីក្រសួងបរិស្ថានតម្រូវ។

ប្រការ ២..

ធានាទទួលខុសត្រូវធ្វើការសម្អាត និងប្រមូលសំរាមសំណល់រឹងបង្កើតពីក្នុងទីបរិវេណ និងជុំវិញទីតាំងគម្រោងដោយត្រូវអនុលោមតាមបទប្បញ្ញត្តិមាត្រា ១៥ មាត្រា ១៦ មាត្រា ១៧ មាត្រា ១៨ និងមាត្រា ២៥ នៃអនុក្រឹត្យលេខ ១១៣ អនក្រ.បក ចុះថ្ងៃទី ២៧ ខែសីហា ឆ្នាំ ២០១៥ ស្តីពីការគ្រប់គ្រងសំរាមសំណល់រឹងទីប្រជុំជន។

ប្រការ ៣..

ធានាទទួលខុសត្រូវអនុវត្តនូវគោលការណ៍បច្ចេកទេស និងវិធានការកាត់បន្ថយមួយចំនួនដូចខាងក្រោម:

ក. <u>ជំណាក់កាលរចនា ឬមុនពេលសាងសង់</u>

- ម្ចាស់គម្រោងត្រូវរចនាប្លង់សាងសង់ប្រព័ន្ធទុយោទឹក-អាងប្រព្រឹត្តកម្មសម្អាតទឹកស្អាតឱ្យបានស្របទៅតាមបទដ្ឋានបច្ចេកទេសកំណត់របស់ស្ថាប័នជំនាញ និងត្រូវជូនដំណឹងអំពីសកម្មភាព

អគារ ៤៥ ផ្លូវ ១០៦ សង្កាត់ស្រះចក ខណ្ឌដូនពេញ ភ្នំពេញ ទូរស័ព្ទ: (៨៥៥) ២៣ ៦៣៥ ៨០ ៨០ Email: admin@ppwsa.com.kh

គម្រោង និងដោះស្រាយហេតុប៉ះពាល់ដីកម្មសិទ្ធិជាមួយប្រជាពលរដ្ឋជាមុនសិន (បើមាន) មុននឹងធ្វើការសាងសង់

- ម្ចាស់គម្រោងត្រូវសហការជាមួយស្ថាប័នពាក់ព័ន្ធលើការកំណត់ទីតាំងសាងសង់ ដើម្បីចៀសវាងហេតុប៉ះពាល់ផ្សេងៗ
- ម្ចាស់គម្រោងត្រូវជូនដំណឹងអំពីទីតាំងដែលត្រូវសាងសង់ពង្រីកទីតាំងបូមទឹកនៅថ្មីដល់អាជ្ញាធរមូលដ្ឋាន និងប្រជាជន ដើម្បីចៀសវាងហេតុប៉ះពាល់ និងដើម្បីរកវិធានការដោះស្រាយឱ្យបានសមស្រប។

២. ដំណាក់កាលសាងសង់

- ម្ចាស់គម្រោងនៅពេលដែលចាប់ផ្តើមសាងសង់ត្រូវជូនដំណឹងដល់ប្រជាពលរដ្ឋ និងបញ្ជាក់ពីពេលវេលាដែលត្រូវសាងសង់ និងត្រូវប្រញាប់រៀបចំទីតាំងដែលសាងសង់ឱ្យរួចជាស្រេចការសន្យាជាមួយប្រជាជន និងអាជ្ញាធរមូលដ្ឋាន
- ម្ចាស់គម្រោងត្រូវប្រញាប់លុបអាចម៍ដី និងសហការជាមួយក្រសួងសាធារណការ និងដឹកជញ្ជូនចាក់កៅស៊ូលើផ្លូវភ្លាមៗ ឬចាក់បេតុងឱ្យបានត្រឹមត្រូវនៅពេលដែលការជីកកប់ដាក់ទុយោទឹករួចរាល់
- ម្ចាស់គម្រោងត្រូវរៀបចំឱ្យមានស្លាកសញ្ញាចរាចរណ៍ និងភ្លើងសញ្ញានៅពេលយប់ព្រមទាំងសហការជាមួយនគរបាលមូលដ្ឋាន ដើម្បីការពារគ្រោះថ្នាក់ចរាចរណ៍ និងការកកស្ទះចរាចរណ៍នៅការដ្ឋានសាងសង់
- ម្ចាស់គម្រោងត្រូវអប់រំ និងណែនាំឱ្យកម្មករអនុវត្តន៍វិធានការការពារជំងឺកូវីដ-១៩ របស់ក្រសួងសុខាភិបាល ដោយគោរពឱ្យបានខ្ជាប់ខ្ជួន៣កុំ និង៣ការពារ
- ម្ចាស់គម្រោងត្រូវផ្តល់កន្លែងស្នាក់នៅជូនកម្មករឱ្យបានសមរម្យ និងផ្គត់ផ្គង់ទឹកស្អាតដល់កម្មករ ព្រមទាំងមានការបណ្តុះបណ្តាលការងារបច្ចេកទេស និងផ្តល់ឧបករណ៍សុវត្ថិភាពនៅពេលបំពេញការងារនៅក្នុងការដ្ឋាន
- ម្ចាស់គម្រោងត្រូវគ្រប់គ្រងសំណល់រឹង និងសំណល់រាវគ្រប់ប្រភេទចេញពីការដ្ឋានសាងសង់ និងកន្លែងស្នាក់នៅរបស់កម្មករឱ្យបានត្រឹមត្រូវ ដោយជ្រើសរើសទីតាំងទុកដាក់សំណល់តាមការណែនាំរបស់ក្រសួងបរិស្ថាន ឬមន្ទីរបរិស្ថានរាជធានីភ្នំពេញ ឬអាជ្ញាធរមូលដ្ឋាន ចៀសវាងការបោះចោល ឬបង្ហូរចូលទៅក្នុងទឹកទន្លេ
- ម្ចាស់គម្រោងត្រូវត្រួតពិនិត្យសំរាម សំណល់ភក់ និងបញ្ហាក្លិនដែលកើតចេញពីការបោះចោលសំរាមរបស់បុគ្គលិក-កម្មករ
- ម្ចាស់គម្រោងត្រូវគ្រប់គ្រងសំឡេង រំញ័រ ក្លិន និងផ្សែងដែលចេញពីសកម្មភាពអនុវត្តន៍គម្រោងឱ្យបានត្រឹមត្រូវតាមលក្ខណៈបច្ចេកទេសចៀសវាងប៉ះពាល់ដល់ប្រជាពលរដ្ឋរស់នៅក្បែរទីតាំងគម្រោង
- ម្ចាស់គម្រោងត្រូវផ្តល់លទ្ធភាពជូនប្រជាពលរដ្ឋក្នុងមូលដ្ឋានឱ្យចូលបម្រើការងារនៅក្នុងគម្រោងឱ្យស្របតាមជំនាញរបស់ពួកគាត់ ដើម្បីកាត់បន្ថយការចំណាកស្រុក

អគារ៤៥ ផ្លូវ១០៦ សង្កាត់ស្រះចក ខណ្ឌដូនពេញ ភ្នំពេញ ទូរស័ព្ទ: (៨៥៥) ២៣ ៦៣៥ ៨០ ៨០ Email: admin@ppwsa.com.kh

- ម្ចាស់គម្រោងត្រូវសហការជាមួយអាជ្ញាធរមូលដ្ឋាន និងស្ថាប័នជំនាញពាក់ព័ន្ធ ដើម្បីរកដំណោះស្រាយសមស្របនៅពេលមានបញ្ហាកើតឡើង
- រួមចំណែកអភិវឌ្ឍន៍ហេដ្ឋារចនាសម្ព័ន្ធ និងលើកកម្ពស់ជីវភាពប្រជាពលរដ្ឋក្នុងសង្កាត់-ខណ្ឌ ដែលនៅជុំវិញតំបន់គម្រោង។

គ. ដំណាក់កាលប្រតិបត្តិ

- ម្ចាស់គម្រោងត្រូវសហការជាមួយអាជ្ញាធរមូលដ្ឋាន និងស្ថាប័នជំនាញពាក់ព័ន្ធ ដើម្បីរកដំណោះស្រាយសមស្របនៅពេលមានបញ្ហាកើតឡើង (បែកលូ ធ្លាយទុយោទឹក និងខូចប្រព័ន្ធសម្អាតទឹកស្អាត) តាមរយៈសកម្មភាពជីកជញ្ជូន ការសាងសង់សំណង់ផ្សេងៗ ការអភិវឌ្ឍជាដើម
- ម្ចាស់គម្រោងត្រូវមានផែនការអង្កេតតាមដានជាប្រចាំ ដើម្បីចៀសវាងហេតុប៉ះពាល់ផ្សេងៗ ដោយសារការលេចធ្លាយ ឬស្ទះទុយោទឹក ជាដើម និងត្រូវលើកផែនការជួសជុល-ថែទាំជាប្រចាំ ដើម្បីចៀសវាងកុំឱ្យការប៉ះពាល់ដល់ការប្រើប្រាស់ និងផ្គត់ផ្គង់ទឹកស្អាតដល់ប្រជាជនដែលរស់នៅក្នុងមូលដ្ឋាន
- ម្ចាស់គម្រោងត្រូវមានផែនការពិនិត្យគុណភាពទឹកជាប្រចាំនៅត្រង់ចំណុចបូមទឹក និងចំណុចចុងក្រោយចូលទៅក្នុងអាងប្រព្រឹត្តកម្មសម្អាតទឹកជាមុន មុននឹងបង្ហូរចូលទៅក្នុងអាងស្តុកទឹក។

ឃ. <u>ដំណាក់កាលបញ្ចប់</u>

- ម្ចាស់គម្រោងត្រូវជូនដំណឹងដោយសហការជាមួយអាជ្ញាធរមូលដ្ឋាន និងស្ថាប័នដែលពាក់ព័ន្ធជាមុនសិន ដើម្បីទទួលបាននូវការផ្តល់យោបល់ និងបញ្ចៀសហេតុប៉ះពាល់ជាមួយប្រជាជន ក៏ដូចជាធនធានបរិស្ថានដែលមានស្រាប់
- ម្ចាស់គម្រោងត្រូវស្តារធនធានបរិស្ថានឡើងវិញ ដើម្បីបញ្ចៀសហេតុប៉ះពាល់ផ្សេងៗលើប្រភពទឹកធម្មជាតិ ជាពិសេសទីតាំងប្រព័ន្ធបូមទឹកពីទន្លេសាប។

ប្រការ៤..

ធានាផ្តល់របាយការណ៍អង្កេតតាមដានបរិស្ថាន (Environmental Monitoring Report) រៀងរាល់ ៦ខែម្តង នៅក្នុងកិច្ចដំណើរការសាងសង់ និងប្រតិបត្តិគម្រោង ជូនក្រសួងបរិស្ថាន ដើម្បីពិនិត្យ និងវាយតម្លៃ។

ប្រការ៥..

ក្នុងករណី ក្រសួងបរិស្ថានតម្រូវឱ្យម្ចាស់គម្រោងធ្វើការកែប្រែនូវបច្ចេកទេសបរិស្ថានណាមួយ ដើម្បីឱ្យសមស្របទៅតាមគោលការណ៍ណែនាំ និងកម្រិតបទដ្ឋានបរិស្ថាន ម្ចាស់គម្រោងនឹងទទួលអនុវត្ត ទៅតាមគោលការណ៍ណែនាំនោះទាំងស្រុង។

ប្រការ៦..

ទៅថ្ងៃអនាគត បើម្ចាស់គម្រោងមានគម្រោងពង្រីកបន្ថែម ឬផ្លាស់ប្តូរ ឬកែសម្រួលរបាយការណ៍

អគារ៤៥ ផ្លូវ១០៦ សង្កាត់ស្រះចក ខណ្ឌជ្ជុនពេញ ភ្នំពេញ ទូរស័ព្ទ: (៨៥៥) ២៣ ៦៣៥ ៨០ ៨០ Email: admin@ppwsa.com.kh

សិក្សាសមទិ្ធលទ្ធភាព (Feasibility Study Report) ឬផ្នាកសកម្មភាព ម្ចាស់គម្រោងនឹងរាយការណ៍ជូនក្រសួងបរិស្ថានឱ្យបានមុន ១ខែ។

ប្រការ៧.

អនុញ្ញាតឱ្យមន្ត្រីជំនាញពីក្រសួងបរិស្ថាន ឬមន្ទីរបរិស្ថានរាជធានីភ្នំពេញ ដែលមានលិខិតបញ្ជាបេសកកម្មត្រឹមត្រូវ ដើម្បីធ្វើការត្រួតពិនិត្យក្នុងទីតាំងតំបន់គម្រោង។

ប្រការ៨.

ក្នុងករណីដែលម្ចាស់គម្រោងពុំបានគោរពតាមប្រការណាមួយ ឬអនុវត្តផ្ទុយពីកិច្ចសន្យានេះ ឬ លិខិតបទដ្ឋានគតិយុត្តចូលជាធរមានផ្សេងៗទៀត ម្ចាស់គម្រោងសូមទទួលខុសត្រូវចំពោះមុខច្បាប់ជាធរមាន។

អគ្គនាយក

ស៊ឹម ស៊ីថា

បានឃើញ និងសូមគោរពជូន
ឯកឧត្តមរដ្ឋមន្ត្រីក្រសួងបរិស្ថាន មេត្តាពិនិត្យ និងសម្រេច
លេខ: ១០០២ រ.ហ.ប.ស
ថ្ងៃសុក្រ ១៣រោច ខែទុតិយាសាឍ ឆ្នាំឆ្លូវ ត្រីស័ក ព.ស.២៥៦៥
រាជធានីភ្នំពេញ ថ្ងៃទី ៦ ខែ សីហា ឆ្នាំ២០២១
ប្រធាននាយកដ្ឋានវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន

ជាញ់-សេរី

បានឃើញ និងឯកភាព
ថ្ងៃ ២ រ ៨កើត ខែ ក្រាមាសក ឆ្នាំឆ្លូវ ត្រីស័ក ព.ស.២៥៦៥
រាជធានីភ្នំពេញ ថ្ងៃទី ១៣ ខែ ២ ឆ្នាំ២០២១
៤. រដ្ឋមន្ត្រីក្រសួងបរិស្ថាន
រដ្ឋលេខាធិការ

និន-ពន្លក

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

ក្រសួងបរិស្ថាន
លេខ: ១១០០.ស.ជ.ណ.ប.ស

ថ្ងៃ ចន្ទ ១០ រោច ខែស្រាពណ៍ ឆ្នាំឆ្លូវ ត្រីស័ក ព.ស. ២៥៦៥
រាជធានីភ្នំពេញ ថ្ងៃទី ១៦ ខែ សីហា ឆ្នាំ២០២១

សូមជម្រាបជូន
ឯកឧត្តមអគ្គនាយកដ្ឋានការទឹកស្វយ័តក្រុងភ្នំពេញ

កម្មវត្ថុ ៖ ករណីសំណើសុំរៀបចំកិច្ចសន្យាការពារបរិស្ថាន សម្រាប់គម្រោងពង្រីក និងជួសជុលប្រព័ន្ធប្រព្រឹត្តកម្មទឹកស្អាតរោងចក្រកូមិព្រៃក របស់រដ្ឋាករទឹកស្វយ័តក្រុងភ្នំពេញ នៅរាជធានីភ្នំពេញ

យោង ៖ - ព្រះរាជក្រមលេខ នស/រកម/១២៩៦/៣៦ ចុះថ្ងៃទី២៤ ខែធ្នូ ឆ្នាំ១៩៩៦ ដែលប្រកាសឱ្យប្រើច្បាប់ស្តីពីកិច្ចការពារបរិស្ថាន និងការគ្រប់គ្រងធនធានធម្មជាតិ
- អនុក្រឹត្យលេខ៧២ អនក្រ.បក ចុះថ្ងៃទី១១ ខែសីហា ឆ្នាំ១៩៩៩ ស្តីពីកិច្ចដំណើរការវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន
- ប្រកាសលេខ០២១ ប្រក.ប.ស្ត ចុះថ្ងៃទី០៣ ខែកុម្ភៈ ឆ្នាំ២០២០ ស្តីពីចំណាត់ថ្នាក់នៃការវាយតម្លៃហេតុប៉ះពាល់បរិស្ថានសម្រាប់គម្រោងអភិវឌ្ឍន៍
- លិខិតលេខ២៧០ ល.ស ចុះថ្ងៃទី៤ ខែឧសភា ឆ្នាំ២០២១ របស់រដ្ឋាករទឹកស្វយ័តក្រុងភ្នំពេញ
- របាយការណ៍ចុះពិនិត្យទីតាំងចុះថ្ងៃទី២ ខែកក្កដា ឆ្នាំ២០២១ របស់មន្ត្រីជំនាញនាយកដ្ឋានវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាននៃក្រសួងបរិស្ថាន

សេចក្តីដូចមានចែងក្នុងកម្មវត្ថុ និងយោងខាងលើ ខ្ញុំសូមជម្រាបជូន **ឯកឧត្តមអគ្គនាយក** ជ្រាបថា ក្រសួងបរិស្ថានឯកភាពលើកិច្ចសន្យាការពារបរិស្ថាន សម្រាប់គម្រោងពង្រីក និងជួសជុលប្រព័ន្ធប្រព្រឹត្តកម្មទឹកស្អាតរោងចក្រកូមិព្រៃក ដែលមានទីតាំងស្ថិតនៅផ្ទះលេខ៤៥ ផ្លូវ១០៦ សង្កាត់ស្រះចក ខណ្ឌដូនពេញ រាជធានីភ្នំពេញ របស់រដ្ឋាករទឹកស្វយ័តក្រុងភ្នំពេញ (ម្ចាស់គម្រោង) ដោយម្ចាស់គម្រោងត្រូវគោរពតាមកិច្ចសន្យាការពារបរិស្ថានលេខ៥៣៥ ល.ស ចុះថ្ងៃទី២ ខែសីហា ឆ្នាំ២០២១ របស់រដ្ឋាករទឹកស្វយ័តក្រុងភ្នំពេញ។

អាស្រ័យដូចបានជម្រាបជូនខាងលើ សូម **ឯកឧត្តមអគ្គនាយក** អនុវត្ត និងចាត់ចែងតាមការគួរ។

សូម **ឯកឧត្តមអគ្គនាយក** ទទួលនូវការរាប់អានពីខ្ញុំ។

រ.រដ្ឋមន្ត្រី
រដ្ឋលេខាធិការ

ឌិន_ពន្ធកូ

ចម្លងជូន:
- ទីស្តីការគណៈរដ្ឋមន្ត្រី
- ក្រសួងសេដ្ឋកិច្ច និងហិរញ្ញវត្ថុ
- ក្រសួងសាធារណការ និងដឹកជញ្ជូន
- ក្រសួងឧស្សាហកម្ម វិទ្យាសាស្ត្រ បច្ចេកវិទ្យា និងនវានុវត្តន៍
- ក្រសួងធនធានទឹក និងឧតុនិយម
- រដ្ឋបាលរាជធានីភ្នំពេញ
- មន្ទីរបរិស្ថានរាជធានីភ្នំពេញ
- ឯកសារ កាលប្បវត្តិ

អគារមរតកតេជោ ដីឡូតិ៍លេខ503 ផ្លូវកៅស៊ូអមមាត់ទន្លេបាសាក់ សង្កាត់ទន្លេបាសាក់ ខណ្ឌចំការមន ភ្នំពេញ ទូរស័ព្ទ: 023 235 004 / 023 235 006

Kingdom of Cambodia
Nation Religion King

Ministry of Environment
No. 1100 ស.ជ.ណ.ប.ស្ថ

Monday, the 8th of Sravana, the year of Chhlov Trisak, B.C. 2565
Phnom Penh 16th August 2021

Please be informed

H.E Director General of Phnom Penh Water Supply Authority

Objective: Application for Environmental Protection Contract for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System of Phnom Penh Water Supply Authority located in Phnom Penh City

Reference:

- Preah Reach Kram No. NS/RKM/1296/36 dated December 24, 1996 announcing to use the Law on the Environmental Protection and Natural Resources Management
- Sub-decree No. 72 ANKR.BK dated August 11, 1999 on Environmental Impact Assessment (EIA)
- Prakas No. 021 ប្រ.ក.ប.ស្ថ dated February 03, 2020 on the classification of environmental impact assessment for development projects
- Letter No. 270 LS dated May 04, 2021 of Phnom Penh Water Supply Authority
- Site Inspection Report dated July 02, 2021 by the Expert Officer of the Environmental Impact Assessment Department of the Ministry of Environment

As stated in the subject and reference above, I would like to inform **His Excellency the Director General** that the Ministry of Environment has agreed on an environmental protection contract for the Project for Rehabilitation and Expansion of Phum Prek Water Treatment System, located at # No. 45, St. 106 Sangkat Srah Chak, Khan Daun Penh, Phnom Penh by the Phnom Penh Water

Supply Authority (Project Owner), and hereby project owner have to adhere the environmental protection contract No. 535 LS dated August 02, 2021 by Phnom Penh Water Supply Authority.

His Excellency the Director General should implement and manage as appropriate following the term mentioned above.

ជ. Minister

Secretary of State

TIN Ponlork

To

Minister of Environment

I, the undersigned, **SIM Sitha**, Director of Phnom Penh Water Supply Authority (PPWSA), located #45, Street 106, Sangkat Sreh Chork, Khan Doun Penh, Phnom Penh City.

Hereby assure my commitment to environmental protection

To contribute to ensuring environmental sustainability for the sustainable development, PPWSA would like to assure our commitment to environmental protection to the Ministry of Environment for The Project for Rehabilitation and Expansion 0f Phum Prek Water Treatment System which is located #45, Street 106, Sangkat Sreh Chork, Khan Doun Penh, Phnom Penh City, of the Phnom Penh Water Supply Authority as following:

Article 1.-

Undertake to prepare the Initial Environmental Impact Assessment for the project to expand and repair the water treatment system of Phum Prek in case of the Ministry of Environment's requirements.

Article 2.-

Undertake to clean and collect the solid waste generated from the premises and around the factory in accordance with Article 15, Article 16, Article 18, and Article 25 of Subdecree No. 113 S.E., dated August 27, 2015, on the Management of Urban Solid Waste.

Article 3.-

Undertake to implement the following any technical and mitigation measures

A. <u>Design phase or before construction</u>

- The project owner must design the construction plan of the water pipe-water treatment system in accordance with the technical standards from the professional institution and inform the project activities and resolve the impact on land ownership with the effected people (if any) before construction.

- The project owner must cooperate with relevant institutions on determining the construction site to avoid any impact.

- The project owner must inform the local authority and people about the location to be built and expand the new raw water pumping site to avoid the impact.

B. Construction phase

- The project owner, when starting construction, must inform the people and confirm the time to build and be cleared after completing at the site as promised with the people and local authorities.

- The project owner must immediately clear the rubble and cooperate with the Ministry of Public Works and Transport to immediately pour the rubber on the road or pour the concrete properly when the excavation is completed.

- The project owner must set up traffic signs and lights at night and cooperate with the local police to prevent traffic accidents and traffic congestion at the construction site.

- The project owner must educate and instruct the workers to implement the measures to prevent Kovid-19 disease of the Ministry of Health with strict adherence to 3 contraindications and 3 protections.

- The project owner must provide appropriate accommodation for the workers and supply clean water to the workers, as well as provide technical training and provide safety equipment when working on site.

- The project owner must manage all kinds of solid and liquid waste from the construction site and the workers' accommodation properly by choosing the location to store the waste according to the instructions of the Ministry of Environment or the Department of Environment of Phnom Penh or local authorities to avoid dumping into the river.

- The project owner must inspect the garbage, mud and odor caused by the garbage of the staff-workers.

- The project owner must control the noise, vibration, smell and smoke from the project implementation activities properly in a technical manner to avoid affecting the people living near the project site.

- The project owner must enable local people to work in the project in accordance with their skills to reduce migration.

- The project owner must cooperate with local authorities and relevant professional institutions to find appropriate solutions when problems arise.

- To contribute to the development of infrastructure and improve the living standards of the people in the Sangkat-Khan around the project area.

C. Execution phase

- The project owner must cooperate with local authorities and relevant professional institutions to find appropriate solutions when problems occur (leaks, water pipes and water supply system damage) through transport activities, building, construction, development, etc.

- The project owner must have a plan to monitor regularly to avoid any impact due to leaks or blockages of water pipes, etc. and to plan regular repairs - maintenance to avoid affecting the use and supply of clean water to the local people.

- The project owner must plan to check the water quality regularly at the pumping point and the last point into the water treatment plant before draining into the reservoir.

D. Completion stage

- The project owner must inform in collaboration with the local authorities and relevant institutions in advance to get advice and avoid harm to the people as well as existing environmental resources.

- The project owner must restore environmental resources to avoid any impact on natural water sources, especially the location of the pumping system from the Tonle Sap.

Article 4.-

Undertake to submit the environmental monitoring report every six months regarding the company's project management to the Ministry of Environment for review and evaluation.

Article 5.-

In the event that the Ministry of Environment requires the company to adjust any environmental technique to ensure conformity with the environmental guidance and standards, we undertake to completely comply with it.

Article 6.-

In the future, if the company has any plan to add, or adjust, or change the Feasibility Study Report or suspend its activities, it will report it to the Ministry of Environment 30 days in advance.

Article 7.-

Permit officials from the Ministry of Environment or Phnom Penh Department of Environment who have a valid mission order to inspect and provide recommendations for the project's operation.

Article 8.-

In the event that the company fails to comply with any article or breaches this commitment or other legal instruments in force, it undertakes to accept responsibility before the law in force.

……, Year of the ……

Phnom Penh, ……., 2021

Signature and stamp

Director

Seen and forwarded to
H.E. the Minister for review and decision

No. …….. EIAD

……, Year of …….

Phnom Penh, ……, 2021

Director of Environmental Impact Assessment Department

Seen and approved

……, Year of……

Phnom Penh, ……, 2021

pp Minister of Environment

Secretary of State

資　料 6-3　環境チェックリスト

Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1. Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process?	N/A	(a) EIA or Initial Environmental Impact Assessment (IEIA) reports are not required for the Project. Apart from it, Initial Environmental Examination (IEE) had been conducted according to JICA guidelines.
		(b) Have EIA reports been approved by authorities of the host country's government?	N/A	(b) EIA or Initial Environmental Impact Assessment (IEIA) reports are not required for the Project.
		(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?	N/A	(c) EIA or Initial Environmental Impact Assessment (IEIA) reports are not required for the Project. On the other hand, EPC (Environmental Protection Contract), which has the simplest procedure among the EIA / IEIA / EPC, was approved by MoE in August 2021.
		(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	Y	(d) In this project, among the EIA / IEIA / EPC stipulated in the environment-related law, only the EPC, which has the simplest procedure, is required. The EPC was approved by MoE in August 2021.
	(2) Explanation to the Public	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the local stakeholders?	Y	(a) Stakeholder meetings with local authorities were held 4 times from 19 to 20-May, 2021 on-line. Public Consultation meeting with Related Department of Phnom Penh was held on 25-May, 2021 on-line. In the meetings, contents of the project and the potential impacts been adequately explained appropriately.
		(b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	Y	(b) The Project is an expansion, not a new construction project. Thus, opinions concerning serious environmental impacts were not stated. In other hand, social concerns such as traffic / noise / air quality (dust) issues were raised. PPWSA responded that the impacts would be limited and minimized. And they also stated that they will reflect the opinions to the construction methods and the design.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	Y	(a) The alternative studies (without project ⇔ with project) have been examined. In order to meet the water demand, “with project” option was is selected.
2. Mitigation Measures	(1) Air Quality	(a) Is there a possibility that chlorine from chlorine storage facilities and chlorine injection facilities will cause air pollution?	N	(a) On-site sodium hypochlorite generation system with high safety will be applied. Therefore, chlorine gas will not be used in the Project and leakage of chlorine is not expected.
		(b) Do chlorine concentrations within the working environments comply with the country’s occupational health and safety standards?	Y	(b) In the on-site sodium hypochlorite generation system, the disinfectant is produced and stored in liquid form. Therefore, no danger of gas leaks is expected. (in Cambodia there are no regulations on chlorine concentrations within working environments)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Water Quality	(a) Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards?	Y	(a) During construction phase, the amount of wastewater generated from the construction site is estimated to be very limited and treated. While during operation phase, backwash water will be treated before discharging applying the standard.
	(3) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed in accordance with the country's regulations?	Y (N)	(a) In Cambodia, there are no laws or regulations on WTP sludge disposal. During construction phase: part of construction waste soil will be reused for backfilling at construction site. The remaining waste soil will be reused for backfilling of various kinds of other constructions. During operation period: WTP sludge will be collected and transported to soil users or landfill sites.
	(4) Noise and Vibration	(a) Do noise and vibrations generated from the facilities, such as pumping stations comply with the country's standards?	Y	(a) All pumps will be installed within pump stations, therefore, the noise and vibration level in outside of pump stations is considered to be almost the same as the background level of the site.
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	N	(a) During construction period and operation period, no groundwater will be extracted. Therefore, the impacts of subsidence are not expected.
3. Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	N	(a) The project sites are not located in protected area or environmentally sensitive areas designated by Cambodia laws or international treaties. Therefore, there is no possibility that the project will affect the protected areas.
	(2) Ecosystem and Biota	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?	N	(a) The project site doesn't encompass primeval forests, tropical rain forests, and ecologically valuable habitats.
		(b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?	N	(b) Within the project site, there are no protected habitats of endangered species designated by Cambodia laws or international treaties and conventions.
		(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?	N	(c) It is not anticipated to cause significant ecological impacts because there are no protected habitats in and around the Project area, and no significant pollution caused by the Project is expected.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(d) Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	N	(d) Additional intake of 0.16% of monthly minimum flowrate of the River will not have significant impacts on ecosystem and biota.
	(3) Hydrology	a) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect surface water and groundwater flows?	N	(a) Additional intake of 0.16% of monthly minimum flowrate of the River will not have significant impacts on hydrology
4. Social Environment	(1) Resettlement	a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	N/A	(a) No resettlement or land acquisition are planned.
		(b) Is adequate explanation on compensation and resettlement given to affected people prior to resettlement?	N/A	(b) No resettlement or land acquisition are planned.
		(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	N/A	(c) No resettlement or land acquisition are planned.
		(d) Is the compensations going to be paid prior to the resettlement?	N/A	(d) No resettlement or land acquisition are planned.
		(e) Is the compensation policies prepared in document?	N/A	(e) No resettlement or land acquisition are planned.
		(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?	N/A	(f) No resettlement or land acquisition are planned.
		(g) Are agreements with the affected people obtained prior to resettlement?	N/A	(g) No resettlement or land acquisition are planned.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	N/A	(h) No resettlement or land acquisition are planned.
		(i) Are any plans developed to monitor the impacts of resettlement?	N/A	(i) No resettlement or land acquisition are planned.
		(j) Is the grievance redress mechanism established?	N/A	(j) No resettlement or land acquisition are planned.
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	N	(a) All proposed facilities will be located within the existing PPWSA owned sites and will not affect the living environment of the surrounding inhabitants. The project is expected to improve the living environment as the water supply rate increases.
		(b) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect the existing water uses and water area uses?	N	(a) Additional intake of 0.16% of monthly minimum flowrate of the River will not have significant impacts on the existing water uses and water area uses.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	N	(a) There will be no negative impact since pagodas are not in and around the Project component sites. No cultural heritages exist in the Project area as well.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	N	(a) Facilities in the WTP premises will be out of the public view. The intake facility will alternate the existing intake facility as a newer building. Thus, deterioration of landscape is not expected.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	N/A	(a) There is no ethnic minority or indigenous group in the project area (Sangkat Srah Chak and Sangkat Wat Phnom).
		(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	N/A	(b) Ditto
	(6) Working Conditions	(a) Is the project proponent (~~not~~) violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?	N	(a) Cambodian laws and ordinances (such as Labor Law 1997 and amendment Law 2018, the Law on Social Security, Sub-Decree 11/16, on Health Care Scheme etc.) associated with working conditions (such as wage and hours of work etc.) will be followed by the project proponent during construction works and operation of the project based on Environmental Management Plan (EMP).

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?	Y	(b) Safety considerations will be taken during construction works and operation of the project based on the EMP. In addition, inspections of PPWSA and other authorities on safety will be conducted.
		(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?	Y	(c) Safety and health program and safety training for workers will be planned and implemented during construction works and operation of the project based on the EMP. (such as wearing safety shoes and elements during construction, following Standard Operation Procedures for the works during operation)
		(d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	Y	(d) Appropriate measures will be taken based on the EMP. (e.g., specific security guards will be assigned by contractor and PPWSA will conduct regular inspection during construction and operation)
5. Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	Y	(a) Mitigation measures on utilization of local resources (fishing), water usage/water right, traffic control, poor households, accidents (such as safety plan preparation, O/M manual etc.), air pollution (such as preventing dust by covering trucks and spraying exposed areas with water etc.), water pollution, wastes (sludge reuse methods etc.), noise and vibrations (such as application of reasonable construction schedule and methods etc.) have been proposed.
		(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?	Y	(b) The construction activities which could give adverse impacts to the natural environment (Tonle Sap River) will be at Intake site. The possible impacts were considered to be short term and very limited, however, still countermeasures for prevention (of, such as high turbidity, oil leakage and so forth) were considered.
		(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	Y	(c) Before construction starts, information will be delivered to residents and users around the Intake site. Proper construction schedule and methods to reduce traffic disruption and traffic accident will be prepared. Education of staff/workers on the safety and fire will also be conducted to reduce impacts.
		(d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?	Y	(d) Proper construction schedule and methods to reduce traffic disruption and traffic accident will be prepared.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	Y	(a) Environmental monitoring plan has been prepared and shown in the main report.

<table>
<tr><th>Category</th><th>Environmental Item</th><th>Main Check Items</th><th>Yes: Y
No: N</th><th>Confirmation of Environmental Considerations
(Reasons, Mitigation Measures)</th></tr>
<tr><td></td><td></td><td>(b) What are the items, methods and frequencies of the monitoring program?</td><td>-</td><td>(b) The items, methods and frequencies of the monitoring plan is shown below.
<table>
<tr><th>Monitoring Parameter</th><th>Monitoring Parameter (method)</th><th>Monitoring Frequency</th></tr>
<tr><td colspan="3">During Construction Phase</td></tr>
<tr><td>Traffic</td><td>Visual observation</td><td>During working hours of every day</td></tr>
<tr><td>Air quality</td><td>CO, NO_2, SO_2, O_3, Pb, TSP, PM10 and PM2.5</td><td>Once, preconstruction: Once/6 months during construction</td></tr>
<tr><td>Waste</td><td>Volume of wastes</td><td>Once/week</td></tr>
<tr><td>Noise</td><td>Equivalent continuous A sound level ($L_{aeq, 10}$)</td><td>Once, preconstruction:
Once/6 months during construction</td></tr>
<tr><td>Water pollution</td><td>pH, DO, SS, turbidity, COD, NH_4-N, Coliform</td><td>Once, preconstruction:
Once/6 months during construction</td></tr>
<tr><td colspan="3">During Operation Phase</td></tr>
<tr><td>Waste</td><td>Volume of wastes and disposal method</td><td>Once/month</td></tr>
<tr><td>Water pollution</td><td>pH, DO, SS, turbidity, COD, NH_4-N, Coliform</td><td>Once/3 months</td></tr>
</table></td></tr>
<tr><td></td><td></td><td>(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?</td><td>Y</td><td>(c) Monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework) has been prepared and shown in the main report.</td></tr>
<tr><td></td><td></td><td>(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?</td><td>Y</td><td>(d) Monitoring format has been proposed and shown in the Annex of the main report.</td></tr>
<tr><td rowspan="2">6 Note</td><td>Reference to Checklist of Other Sectors</td><td>(a) Where necessary, pertinent items described in the Dam and River Projects checklist should also be checked.</td><td>N/A</td><td>(a) Additional intake of 0.16% of monthly minimum flowrate of the River will not have significant impacts.</td></tr>
<tr><td>Note on Using Environmental Checklist</td><td>(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).</td><td>N/A</td><td>(a) The Project does not include factors in terms of transboundary or global issues.</td></tr>
</table>

資　料 6-4　環境管理計画及び環境モニタリング計画

6-4-1 ENVIRONMENTAL MANAGEMENT PLAN

Table　Mitigation Measures for Environmental and Social Impacts (During Construction)

No.	Item	Proposed Mitigation Measures	Implementing & (Inspection) Organization	Estimated Cost (USD/year)
Social/natural Environment				
1	Land use and utilization of local resources (fishing) / Biota and ecosystem	1) Design riverbank protection to prevent land erosion 2) If worker camp is needed, locate accommodation of construction workers with distance of at least 20m from Tonle Sap River. 3) Prepare temporary toilets or a septic tank for staff-worker for daily use. 4) Prepare location for fuel and fuel residue storage tanks. 5) Waste from construction activities, such as rubble from excavations, will be cleared immediately after construction 6) Educate staff-workers on the implementation of sanitary measures in the construction field.	Contractor (PPWSA & communes)	Included in construction costs
2	Existing social infrastructures and services (such as traffic etc.)	The construction of the WTP may create traffic disruption. 1) Prepare a detailed traffic control plan and to coordinate with local government. 2) Prepare proper construction schedule and methods to reduce traffic disruption and traffic accident. 3) Assign traffic control person at the entrance of the sites while construction is taking place. 4) Cooperate with the Traffic Police to facilitate traffic.	Contractor (PPWSA, Traffic Police Office, communes)	Included in construction costs
3	Infectious diseases such as HIV/AIDS	1) Prepare appropriate manning plan. 2) Educate staff/workers on the sanitation safety. 3) Set up regularly inspection etc.	Contractor (PPWSA, supervised by MISTI)	Included in construction costs
4	Accidents (risk etc.)	1) Prepare appropriate construction plan. 2) Educate staff/workers on the safety. 3) Set up regularly inspection etc.	Contractor (PPWSA, supervised by MISTI)	Included in construction costs
5	Biota and ecosystem			
Pollution				
1	Air pollution	1) Cover stored materials with plastic or other materials. 2) Cover trucks, and to spray exposed areas with water. 3) Wash vehicles before going out the construction site. 4) Minimize traffic over freshly exposed surfaces. 5) Install barrier walls for limiting wind dispersing if necessary. 6) Prepare air quality monitoring plan and carry it out during construction. (for details, see Environmental Monitoring Plan)	Contractor (MoE/PDE, PPWSA)	Included in construction costs
2	Water pollution	1) Steel sheet pile will be installed to prevent scouring on the bottom of the main body. 2) Carry out water quality monitoring. 3) Temporary toilets will be placed to store domestic wastewater during construction.	Contractor (MoE/PDE, PPWSA)	Included in construction costs
3	Waste	1) Prepare reasonable plan for solid waste disposal, especially for excavated soil. 2) Install temporary toilets at the construction site for	Contractor (MoE/PDE, PPWSA)	PPWSA may benefit from it (selling the wastes

No.	Item	Proposed Mitigation Measures	Implementing & (Inspection) Organization	Estimated Cost (USD/year)
		workers, and set sanitary bins for domestic wastes. 3) Dispose solid wastes appropriately.		to buyer)
4	Noise and vibration	1) Prepare a detailed plan for noise control and coordinate with local government. 2) Prepare proper construction schedule and methods. 3) Set speed limits for vehicles and train workers on mitigation measures for environmental impacts. 4) Use low noise level equipment, if necessary. 5) Prepare noise monitoring plan and carrying out monitoring during construction.	Contractor (MoE/PDE, PPWSA)	Included in construction costs

Table Mitigation Measures for Environmental and Social Impacts (During O&M)

No.	Item	Proposed Mitigation Measures	Implementing & (Inspection) Organization	Estimated Cost (USD/year)
Social/natural Environment				
1	Land use and utilization of local resources (fishing) / Biota and ecosystem	1) Monitor the sources that could lead to the leakage of oil into the water body. 2) Prohibit the disposal of fuel residue into Tonle Sap River that affects both the quality of water to be used and the water quality of downstream Tonle Sap River.	Operator (PPWSA, supervised by MISTI)	Included in OM costs
2	Water usage/water right	1) Monitor the water level (flowrate) of Tonle Sap River. 2) Monitor the water usage around the Intake facility.	Operator (PPWSA, supervised by MISTI)	Included in OM costs
3	Accidents (risk etc.)	1) Prepare appropriate O/M plan. 2) Educate staff/workers on the safety. 3) Set up regularly inspection etc.	Operator (PPWSA, supervised by MISTI)	Included in OM costs
Pollution				
1	Water pollution	1) Keep the facilities and equipment in good condition. 2) Carry out water quality monitoring for raw water and discharged water.	Operator (MoE/PDE, PPWSA)	Included in OM costs of the WTP
2	Soil pollution / Waste	1) Prepare reasonable plan for solid waste disposal, especially for sludge. 2) Thickened sludge will be transported to the landfill site by PPWSA or sold to local construction company as backfilling materials. Thus, check the volume of sludge transported.	Operator (MoE/PDE, PPWSA)	PPWSA may benefit from it (selling the wastes to buyer)

6-4-2 ENVIRONMENTAL MONITORING PLAN

Table Environmental Monitoring Plan

Monitoring Parameter	Monitoring Location	Monitoring Parameter	Compliance Standards	Monitoring Frequency	Implementing & (Inspection) Organization	Estimated Cost (USD/year)
Pre & During Construction Phase						
Traffic	(1) at the entrance of the WTP (2) at the entrance of the Intake facility	Visual observation	-	During working hours of each day	Contractor (PPWSA, Traffic Police Office)	Included in construction costs
Accidents	(1) at the WTP (2) at the Intake facility	Items on the checklist	-	Each day during construction	Contractor (PPWSA)	Included in construction costs
Air quality	(1) at the WTP boundary (2) at the Intake facility boundary	CO, NO_2, SO_2, O_3, TSP, PM10 and PM2.5	Sub-Decree No. 42 on Air Pollution Control and Noise Disturbance (MOE)	Once, preconstruction: Once/6 months during construction	Contractor (MoE/PDE, PPWSA)	1,500 USD / time x 2 places x (1+2) times = 9,000 USD / year
Water pollution	(1) at downstream of the Intake	pH, DO, SS, turbidity, COD, NH_4-N, Coliform	Sub-Decree No. 103 on Water Pollution Control (MOE)	Once, preconstruction: Once/6 months during construction	Contractor (MoE/PDE, PPWSA)	500 USD / time x (1+2) times = 1,500 USD / year
Waste	(1) at the WTP (2) at the Intake facility	Volume of wastes	-	Once/week	Contractor (MoE/PDE, PPWSA)	Included in construction costs
Noise	(1) at the WTP boundary (2) at the Intake facility boundary	Equivalent continuous A sound level ($L_{aeq, 10}$)	Sub-Decree No. 42 on Air Pollution Control and Noise Disturbance (MOE)	Once, preconstruction: Once/6 months during construction	Contractor (MoE/PDE, PPWSA)	1,500 USD / time x 2 places x (1+2) times = 9,000 USD / year
During Operation Phase						
Water usage	(1) at the Intake facility	Water level	-	Each day during operation	Operator (PPWSA)	Included in operation costs
Accidents	(1) at the WTP (2) at the Intake facility	Items on the O/M manual	-	Each day during operation	Operator (PPWSA)	Included in operation costs
Water pollution	(1) WTP discharged water	pH, DO, SS, turbidity, COD, NH_4-N, Coliform	Sub-Decree No. 103 on Water Pollution Control (MOE)	Once/3 months	Operator (MoE/PDE, PPWSA)	500 USD / time x 4 times = 2,000 USD / year
Waste	(1) at the gate of the WTP	Volume of wastes	-	In each case of disposal	Operator (MoE/PDE, PPWSA)	Included in OM costs of the WTP

資　料 6-5　環境モニタリングフォーム

M-1: [Pre-Construction Phase]

M-1-1　Air Quality

Monitoring Frequency: Once / **Implementation Schedule:** Before construction activities

Time and Date of the measurement (WTP) :_____

Time and Date of the measurement (Intake) :_____

No	Parameter	Unit	Result		Cambodian Standard (MoE)	International Std (WHO Guideline)
			WTP	Intake		
1	Carbon monoxide (CO)	mg /m^3			20 (8h ave.)	-
2	Nitrogen dioxide (NO_2)	mg /m^3			0.1 (24h ave.)	0.2 (1h ave.)
3	Sulphur dioxide (SO_2)	mg /m^3			0.3 (24h ave.)	0.02 (24h ave.)
4	Ozone (O_3)	mg /m^3			0.2 (1h ave.)	0.1 (8h max.)
5	Dust (TSP)	mg /m^3			0.33 (24h ave.)	-
6	Dust (PM10)	mg /m^3			-	0.05 (24h ave.)
7	Dust (PM2.5)	mg /m^3			-	0.025 (24h ave.)

M-1-2 Noise

Monitoring Frequency: Once / **Implementation Schedule:** Before construction activities

Time and Date of the measurement (WTP) :_____

Survey Period		Noise Level dB(A)			
		Standard (Leq)	**LAeq**	**Lmax**	**Lmin**
Day	6:00 - 7:00	**75 (MOE, Cambodia)** **Int'l Std*(55-70)**			
	7:00 - 8:00				
	8:00 - 9:00				
	9:00 - 10:00				
	10:00 - 11:00				
	11:00 - 12:00				
	12:00 - 13:00				
	13:00 - 14:00				
	14:00 - 15:00				
	15:00 - 16:00				
	16:00 - 17:00				
	17:00 - 18:00				
Average					
Evening	18:00 - 19:00	**70 (MOE, Cambodia)** **Int'l Std*(55-70)**			
	19:00 - 20:00				
	20:00 - 21:00				
	21:00 - 22:00				
Average					

*:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines (values are ranged because the conditions cannot be applied)

Time and Date of the measurement (Intake) :_____

Survey Period		Noise Level dB(A)			
		Standard (Leq)	LAeq	Lmax	Lmin
Day	6:00 - 7:00	75 (MOE, Cambodia) Int'l Std*(55-70)			
	7:00 - 8:00				
	8:00 - 9:00				
	9:00 - 10:00				
	10:00 - 11:00				
	11:00 - 12:00				
	12:00 - 13:00				
	13:00 - 14:00				
	14:00 - 15:00				
	15:00 - 16:00				
	16:00 - 17:00				
	17:00 - 18:00				
Average					
Evening	18:00 - 19:00	70 (MOE, Cambodia) Int'l Std*(55-70)			
	19:00 - 20:00				
	20:00 - 21:00				
	21:00 - 22:00				
Average					

*:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines (values are ranged because the conditions cannot be applied)

M-1-3 Water Quality

Monitoring Frequency: Once / **Implementation Schedule:** Before construction activities

Time and Date of the measurement (Intake) :_____

No.	Parameters	Units	Downstream of Intake Site	Cambodia Std*[1]	International Std*[2]
1	pH	-		5.5-9	6-9
2	Dissolved Oxygen	mg/L		-	-
3	Suspended Solids	mg/L		100	50
4	Turbidity	NTU		-	-
5	COD	mg/L		120	125
6	Ammonia	mg/L		10	-
7	Total coliform	cfu/100mL		-	-

*1:Sub decree 103 on Water Pollution Control (MOE)

*2:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines

M-2: [Construction Phase]

M-2-1 Traffic

Monitoring Frequency: During working hours of each day / **Implementation Schedule:** During construction activities

Time and Date of the measurement (WTP) :_____

Monitoring Item	Descriptive details	Measures to be Taken
Traffic disruption		1) Arranging specific person for control the flow of traffic, 2) completing the construction works at the sections with high traffic flow as short time.

Time and Date of the measurement (Intake) :_____

M-2-1 Traffic

Monitoring Item	Descriptive details	Measures to be Taken
Traffic disruption		3) Arranging specific person for control the flow of traffic, 4) completing the construction works at the sections with high traffic flow as short time.

M-2-2 Accidents

Monitoring Frequency: Each day / **Implementation Schedule:** During construction activities

Safety Check Sheet

Project: Project for Expansion of Phum Prek Water Treatment System	
Site:	Operator:
Date:	Time:

No.	Item	Eval	No.	Item	Eval
1	**Site Security/Safety**		**5**	**Earthwork**	
1-1	Perimeter fencing		5-1	Earthwork arrangement/planning	
1-2	Signage		5-2	Shoring	
1-3	Lighting		5-3	Site security/signage	
1-4	Other		5-4	Other	
2	**Site cleaning/hygiene**		**6**	**Scaffold**	
2-1	Site		6-1	Condition of scaffolds	
2-2	Office		6-2	Condition of foundation	
2-3	Road		6-3	Condition of supports	
2-4	Latrines		6-4	Site security/signage	
2-5	Other		6-5	Other	
3	**Environment**		**7**	**Heavy equipment**	
3-1	Erosion prevention		7-1	Equipment condition	
3-2	Dust prevention		7-2	Wire condition	
3-3	Dust bins/waste collection		7-3	Hoist work procedure condition	
3-4	Other		7-4	Site security/signage	
4	**Protective Equipment**		7-5	Other	
4-1	Helmet		**8**	**Other Items**	
4-2	Protective eyewear				
4-3	Mask				
4-4	Protective wear				
4-5	Safety harness				
4-6	Protective footwear				
4-7	Work gloves				
4-8	Other				

EVAL:	Good	○	To be improved	△	NA	／

Notes:

M-2-3 Air Quality

Monitoring Frequency: Once/6 months / **Implementation Schedule:** During construction activities

Time and Date of the measurement (WTP) :_____

Time and Date of the measurement (Intake) :_____

No	Parameter	Unit	Result		Cambodian Standard (MoE)	International Std*
			WTP	Intake		
1	Carbon monoxide (CO)	mg /m^3			20 (8h ave.)	-
2	Nitrogen dioxide (NO_2)	mg /m^3			0.1 (24h ave.)	0.2 (1h ave.)
3	Sulphur dioxide (SO_2)	mg /m^3			0.3 (24h ave.)	0.02 (24h ave.)
4	Ozone (O_3)	mg /m^3			0.2 (1h ave.)	0.1 (8h max.)
5	Dust (TSP)	mg /m^3			0.33 (24h ave.)	-
6	Dust (PM10)	mg /m^3			-	0.05 (24h ave.)
7	Dust (PM2.5)	mg /m^3			-	0.025 (24h ave.)

*:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines

M-2-4 Water Quality

Monitoring Frequency: Once/6 months / **Implementation Schedule:** During construction activities

Time and Date of the measurement (Intake) :_____

No.	Parameters	Units	Downstream of Intake Site	Cambodia Std*[1]	International Std*[2]
1	pH	-		5.5-9	6-9
2	Dissolved Oxygen	mg/L		-	-
3	Suspended Solids	mg/L		100	50
4	Turbidity	NTU		-	-
5	COD	mg/L		120	125
6	Ammonia	mg/L		10	-
7	Total coliform	cfu/100mL		-	-

*1:Sub decree 103 on Water Pollution Control

*2:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines

M-2-5 Waste

Monitoring Frequency: Weekly / **Implementation Schedule:** During construction activities

Time and Date of the measurement (WTP) :_____

Monitoring item	Measurement point	Monitoring period & estimated volume	Monitoring result during report period	Countermeasure (for improvement)
(Domestic waste) Designate temporary locations for garbage collection service	a-1		Good / To be improved	
	a-2		Good / To be improved	
			Good / To be improved	
(Construction waste) Designate waste disposal point			Good / To be improved	

Time and Date of the measurement (Intake) :_____

Monitoring item	Measurement point	Monitoring period & estimated volume	Monitoring result during report period	Countermeasure (for improvement)
(Domestic waste) Designate temporary locations for garbage collection service	a-1		Good / To be improved	
	a-2		Good / To be improved	
			Good / To be improved	
(Construction waste) Designate waste disposal point			Good / To be improved	

Note of monitoring sites:

a: Contractor's Office (a-1)/Contractor's Employees' Camp (a-2)

M-2-6 Noise

Monitoring Frequency: Once/6 months / **Implementation Schedule:** During construction activities

Time and Date of the measurement (WTP) :_____

Survey Period		Noise Level dB(A)			
		Standard (Leq)	**LAeq**	**Lmax**	**Lmin**
Day	6:00 - 7:00	**75 (MOE, Cambodia)** **Int'l Std*(55-70)**			
	7:00 - 8:00				
	8:00 - 9:00				
	9:00 - 10:00				
	10:00 - 11:00				
	11:00 - 12:00				
	12:00 - 13:00				
	13:00 - 14:00				
	14:00 - 15:00				
	15:00 - 16:00				
	16:00 - 17:00				
	17:00 - 18:00				
Average					
Evening	18:00 - 19:00	**70 (MOE, Cambodia)** **Int'l Std*(55-70)**			
	19:00 - 20:00				
	20:00 - 21:00				
	21:00 - 22:00				
Average					

*:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines (values are ranged because the conditions cannot be applied)

Time and Date of the measurement (Intake) :_____

Survey Period		Noise Level dB(A)			
		Standard (Leq)	**LAeq**	**Lmax**	**Lmin**
Day	6:00 - 7:00	**75 (MOE, Cambodia)** **Int'l Std*(55-70)**			
	7:00 - 8:00				
	8:00 - 9:00				
	9:00 - 10:00				
	10:00 - 11:00				
	11:00 - 12:00				
	12:00 - 13:00				
	13:00 - 14:00				
	14:00 - 15:00				
	15:00 - 16:00				
	16:00 - 17:00				
	17:00 - 18:00				
Average					
Evening	18:00 - 19:00	**70 (MOE, Cambodia)** **Int'l Std*(55-70)**			
	19:00 - 20:00				
	20:00 - 21:00				
	21:00 - 22:00				
Average					

*:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines (values are ranged because the conditions cannot be applied)

M-3: [Operation Phase]

M-3-1 Water level

Monitoring Frequency: Each day / **Implementation Schedule:** Throughout operation stage

Monitoring item	Time and Date	Water level	Report (In case of abnormality)
Water level at the Intake			

M-3-2 Water Quality

Monitoring Frequency: Once/3 months / **Implementation Schedule:** Throughout operation stage

Time and Date of the measurement (WTP discharged water) :_____

No.	Parameters	Units	Downstream of Intake Site	Cambodia Std*[1]	International Std*[2]
1	pH	-		5.5-9	6-9
2	Dissolved Oxygen	mg/L		-	-
3	Suspended Solids	mg/L		100	50
4	Turbidity	NTU		-	-
5	COD	mg/L		120	125
6	Ammonia	mg/L		10	-
7	Total coliform	cfu/100mL		-	-

*1:Sub decree 103 on Water Pollution Control (MOE)

*2:International Finance Corporation Environmental, Health, and Safety (EHS) Guidelines

M-3-3 Waste

Monitoring Frequency: In each case of disposal / **Implementation Schedule:** Throughout operation stage

Monitoring item	Measurement point	Date & estimated volume	Monitoring result during report period	Countermeasure (for improvement)
Designate waste disposal point	PPrWTP		Good / To be improved	

M-4: [Any Phase]

M-4-1 Complain resulting from the Project

Monitoring Frequency: As needed / **Implementation Schedule:** Throughout the Project

Subject of Complain	Content of Complain	Action Taken and Result
Component _____ Date/Period _____ By Mr./Ms._____ Contact information _____		