RAPID ENVIRONMENTAL ASSESSMENT AND MANAGEMENT PLAN

For Seawater Basin and Batching Plant

STELCO, Malé, Maldives

(Second Addendum to Environmental Impact Assessment for the Fourth Power Project)

January 2010

Sandcays

STELCO

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1 Introduction

1.1 Introduction

This is the second addendum to the Environmental Impact Assessment report prepared for the ongoing Fourth Power Development Project proposed for Malé, Maldives. This report covers the ongoing works of seawater intake basin and the batching plant. The initial EIA report had not covered these as these details were not available at the stage and was not within the scope of the EIA at that time. The initial report and addendum that followed had been focussed on the change to heavy fuel and back to diesel respectively. Therefore, atmospheric pollution from fuel and noise emissions was the primary concern addressed in these reports. The actual civil works have been only recently started as it took several years for the project approval and funding. The EIA report was done in 2005/2006, the addendum was done in August 2007.

This report has been prepared on the instructions from the Environmental Protection Agency (EPA) after the Agency stopped the project components on 14 January 2010 following public complaints. Public complaints arose when the dewatering for the foundation works of the seawater basin had caused visible discolouration of the receiving environment and the sensitive areas in the vicinity namely the swimming track area behind State Electric Company (STELCO) site. Immediate public and media attention complicated matters. Therefore, dewatering was immediately stopped at around 1730hrs on the same day. STELCO met the Director General and senior staff of EPA in STELCO Head Office at 1640 to discuss a way forward (see Appendix for minutes). The EPA decided that an Addendum to the EIA for the Fourth Power Project be submitted in order to seek approvals.

This report discusses the outcomes of the several consultations with relevant parties and findings of the rapid environmental assessments and mitigation measures.

1.2 Scope of the Report

The report covers an audit of the works that have been undertaken under the construction of a seawater basin for the power plant and batching plant for the construction of the different facilities proposed under the Fourth Power Project. Dewatering has been identified as the main activity affecting the environment and is the only reason for stopping the project. This is probably the first report of this kind prepared for dewatering and concrete batching, and there is limited data on past construction activities of this sort and mitigation and monitoring would be the main focus of this report. This report, therefore, mainly covers a compliance and performance audit and management plan for further mitigation of potential environmental impacts of the seawater basin and batching plant.

1.3 Aims and Objectives

This report provides an overview of the environmental performance and compliance of two particular components of the proposed Fourth Power Development Project namely seawater basin and batching plant. The objectives of the primary project, i.e. the Fourth Power Project are to cater for the increasing electricity demand in the city of Malé, the capital of the Maldives. Further objectives of the project are discussed in the main EIA report. This report aims at further environmental compliance by STELCO, who were not aware of the requirement that dewatering and sheet piling should be addressed in particular in the EIA report or that specific environmental clearance is required for these activities. As soon as issues arose, STELCO was willing to comply and assure their commitment to environmental protection and public health and safety.

While the EPA understands the importance of the project, the Agency was not able to put forth any solution other than to prepare an addendum to the proposed EIA for the Fourth Power Project in order to assure compliance with environmental protection requirements under the Environmental Protection and Preservation Act (Law No. 4/93).

2 Project Description

2.1 General context of the study

This addendum to the EIA report has been prepared as a result of the Environmental Protection Agency ordering to stop the dewatering for the construction of a 7.5m x 12m x 4.5m seawater basin under the proposed Fourth Power Project. The order was carried out by the EPA following public complaints of contamination of the swimming area and track in the vicinity of the discharge location. This report therefore provides a compliance and performance audit and proposed measures to address the concerns of the EPA and the public. Compliance Audit or review will assess how well the project implementation complied with the approved Environmental Impact Assessment (EIA) report or other environmental permits and requirements whereas the Performance Audit will assess what the actual environmental impacts of the project are and how well the impacts have been mitigated during the construction as well operational phase.

This section will provide a brief description of the seawater basin and batching plant, which are under consideration in this report. The other details of the project including project proponent and similar project details have been given in the main EIA report. There are probably minor changes in the study area and sensitive areas within, which will be looked at in this report.

2.2 Study Area

The study focuses on the seawater basin that is being constructed close to the southern periphery of the STELCO site immediately inside the periphery wall on Boduthakurufaanu Magu and the concrete batching plant on the high ground behind the peripheral seawall of Malé (see Figure 2-1 and). The dewatering pipeline crosses Boduthakurufaanu Magu and through the area designated for the batching plant and discharging onto the tetrapod breakwater placed immediately behind the concrete seawall. This is a wave breaker zone with constant wave action as a result of which extending the pipeline beyond the breakwater would be very expensive.

Dewatering is considered to be the one of the main environmental components of the project. The study area, therefore, extends to the areas that may be impacted from the dewatering, both suction and discharge. These areas have been looked at under the audit and impacts sections.

Figure 2-1: Project Location: STELCO site and vicinity, Malé

2.3 Project Details

This Addendum covers the details of the seawater basin and batching plant proposed under the Fourth Power Project, currently under implementation in Malé. The seawater basin is a 12m x 7.5m basin with a depth of about 4.5m from the ground or about 3.5m from the water table at mean sea level. The batching plant will produce ready mix concrete for concreting works necessary for the seawater basin and the proposed powerhouse.

2.3.1 Seawater Basin

A new seawater intake basin is being installed in the new powerhouse. It will be connected to the existing seawater intake system of the existing engines Nos. 1-7 so that cleaning of the intake basin is possible without taking more than one of the new engines out of service at a time.

The seawater basin has a capacity of about 350m^3 of seawater used for the cooling system to run the engines. The details of the cooling system do not fall within the scope of this EIA. This report covers a rapid assessment of the environmental impacts of the construction of the seawater basin, including the sheetpiling, earthworks and concrete works. The sheet piling has been completed on 23 November 2009 but the excavation work was started on 13 January 2010 along with dewatering. The sheet piling constitute about 9m long sheet piles (400mm wide) being piled into earth using backhoe excavator. The sheet piling works did not have any adverse environmental impacts. The earthworks and the concrete works require dewatering and the discharge of the effluent into the nearby marine environment, which caused discolouration of the swimming area and track in the immediate vicinity. Consequently, EPA ordered to stop the pumping on 14 January and pumping has been temporarily suspended.

It is estimated that the turbid water would be present for the first four days. Most of the sand that need to be excavated had been excavated on the single day of excavation. The next three days of silty/turbid water would, however, have similar level of visible discolouration although the total amount of sediment would be much less. The discolouration would be completely gone after the first few days until the formwork for the foundation has been completed. The dewatering works that follow will discharge clear water. The total duration of the dewatering is estimated to be 60 days until the foundation works are completed.

The excavated soil is currently placed on the site. Two-third of the excavated sand would be used for backfilling while the remaining third would be transported in trucks to the official construction waste dump yard on the west of STELCO site.

2.3.2 Batching Plant

The batching plant facilities are established on the high ground on the south of STELCO site. This used to be a recreational area; however, due to lack of space inside STELCO site, this location has been allocated for the purpose of the batching plant by the Malé Municipality. The batching plant will produce high quality ready-mix concrete for the concreting of seawater basin, proposed powerhouse structure, stack and generator foundations and other minor concrete works. Such a plant helps to minimize the storage of basic raw materials for the concrete as well as wastage and labour. Noise and dust pollution is also reduced and site management is better and more efficient.

The batching plant will utilize a 25-ton crane with a boom length of 28.5m, a standby crane of similar size for specific intermittent use, two concrete truck mixers of 2.5 and 5m^3 capacities, 1 wheel loader, 3 vibrators, 6x50mm pokers and one concrete bucket of volume 0.5m^3. The batching plant area would have cement storage, aggregate mixing area, and an area for different sizes of aggregate. The area will be well kept and vehicular access to the plant will be provided from the main road in such a way that pedestrian and vehicular movements would not be affected.

Wastewater from the site would be small as there will be some degree of recycling. The wastewater would be highly alkaline consisting of cement, sand and petroleum products. Therefore, they will not be allowed to flow into the existing drains on the roadside or into the surrounding waters but will be collected into small containers kept at the discharge point and disposed to the waste disposal site appropriately. The waste drain and other components of the batching plant are shown in Appendix 3.2. Appendix 3.3 gives the details of the different arrangements for the concrete works.

2.3.3 Project duration

The implementation of the project components began in November 2009 with the sheet pile works for the seawater intake basin. Dewatering works to enable the concrete foundation for the seawater basin was started on 13 January and stopped by the order of Environmental Protection Agency on 14 January 2010. For further environmental clearance, this EIA Addendum is being prepared. It is estimated that the EPA will give the environmental clearance within a week and the dewatering will restart immediately after that. The dewatering is expected to take about 60 days, the first three days of which will discharge muddy water and then upon completion of part of the bedding for the concrete layer, water will be clear. The total duration of the proposed project components is 80 days. However, the batching plant will remain until all concrete works are completed, the dates of which are not exactly known at this stage. It is expected that all concrete works would be completed in 8 months.

3 Audit of Completed Works

3.1 Methodology

A compliance and performance audit of the completed works was carried out based on the previous EIA report and technical and administrative discussions with stakeholders. Compliance was assessed by understanding the extent to which the project implemented followed good environmental practices and performance was assessed by gathering environmental data specific to the project in order to demonstrate the level of environmental performance or degradation caused by the project.

Based on a review of EIA report and actual project site information, the compliance and performance audit findings discussed below have been compiled.

3.2 Environmental Compliance

Generally, for building and construction projects involving dewatering, consent has to be sought from the Environmental Protection Agency. Such consent is provided to all parties on the condition of taking necessary steps to control floodwater on the roadside, etc and ensuring groundwater wells in the zone of influence are not severely affected by monitoring neighbouring wells and compensating for anyone or environmental component (such as mature trees) who may be affected by the dewatering process. This practice has been adopted by STELCO in implementing this project and all measures were put in place to ensure public grievances will not arise. To that effect, stakeholder consultations have been held throughout the project, from October 2009. During the initial discussions, Municipality, Swimming Association, Ministry of Human Resource, Youth and Sports were involved and later Ministry of Housing, Transport and Environment were also involved (see Appendix). One

important point to note is that the time of the initial discussions when the setout of the pipeline was discussed coincided with a time when the winds were in the easterly direction and it was believed that the sediment will flow away from the swimming area. However, when the dewatering did actually happen, the winds have changed and sediment plume flooded the swimming area leading to public complaints as a result of which the EPA had to order to stop the dewatering. EPA required STELCO to consider mitigation measures before dewatering can be allowed to continue and submit an addendum to the EIA report to gain approval.

It must be noted that whether a project had environmental clearance or not, the EPA reserves the right to stop a project that has adverse impacts on:

(a) the neighbourhood or the wider community around a discharge location and may include cultural and socio-economic effects

(b) physical effects on the locality, including landscape, amenity and visual effects

(c) ecosystems, including effects on marine and terrestrial habitats (mainly mature trees in the case of Malé)

(d) natural and physical resources having special significance (e.g., recreational, cultural, or aesthetic)

(e) risks to the neighbourhood or environment

Environmental Protection Agency has a mandate to monitor compliance of all development projects, however, due to several constraints and lack of an Environmental Performance Evaluation Criteria at present, the EPA only monitors and take necessary steps if a complaint regarding the project arises. For instance, some of the well-known environmentalists grieved over the impacts of dewatering from some major building projects in the vicinity of the famous *Hukuru Miskiiy* and *Munnaaru* on the mosque and the minaret but there were no formal complaints. On the other hand, several complaints were filed by public in the case of the 15-storey building at Athireege-aage resulting in immediate halt to the project, compensation issues, and the government formally requiring Environmental Assessments to be done for all high-rise buildings above 10-stories. Since the EIA process in the Maldives is still in infancy, it is not the intention of the EPA to stop and fine developers but to ensure that vital environmental, social and economic aspects of the project are given adequate consideration in project planning, design and especially implementation. Where there are sensitive environments such as swimming track in the case of the project under consideration herein, it is important to ensure that these sensitive environments are not affected by the project. In the case of this project, it is apparent that efforts have been made to ensure that public concerns did not arise and that adequate stakeholder consultations were held. However, errors occurred resulting in failures or impacts which are reversible. Furthermore, an EIA was carried out for the entire project, which did not cover these constructional activities as they were not within the scope of the EIA since these details have not been formulated at the time. The EIA Decision Statement for the EIA for the project has been issued possibly

taking into consideration that such small components of the project would not result in major environmental concerns. Therefore, it is safe to say that there was high level of environmental compliance in the planning, design and implementation of the overall Fourth Power Project but the level of compliance was poor only in the monitoring side in that adequate monitoring and supervision did not occur during the implementation stage.

3.3 Environmental Performance

Generally environmental performance is assessed based on the impact assessment report. However, for those components of the Malé Fourth Power Project under consideration here, there has not been any impact assessment so far. Yet, impacts have occurred as a result of which the project was halted. Therefore, the impacts that have occurred and the level or significance of those impacts are considered here.

3.3.1 Site Selection

The STELCO site is located in a mixed residential, commercial, industrial and recreational zone with the Children's Park, Dharubaaruge, Kalaafaanu School with residential plots on one side and swimming area and swimming track with two fuel service centers, construction waste dumpsite and residential plots on the other. These details have been given in the EIA report.

The proposed components are in the vicinity of the swimming area/track and recreational area on either side of the batching plant. The seawater basin is located inside the STELCO site while the batching plant is located on the high ground in the recreational area on the south of STELCO site. The site for the batching plant is a good choice given the accessibility and closeness to STELCO site and most importantly batching plants should be sited on high ground that is not flood prone. The selected location certainly ensures this. In terms of proximity to sensitive landuses, especially recreational use, there is nothing STELCO could have done to avoid that in the heavily congested and poorly planned city of Malé.

Given that dust and noise are the key potential impacts associated with the batching plant, it is in a location whereby winds will blow the dust away into the open ocean. Again, this applies to the current climatic conditions in which the winds are predominantly from the north and northeast. If winds change southeast, the dust may be an issue to swimmers but the level of the dust will be very small and would not cause damage to health of the swimmers due to intermittent use. Workers working at the batching plant would be more vulnerable. The greatest impact or the highest dust loads on to the immediate vicinity would be when the winds blow from the south, southwest and westerly directions, when recreational use may be affected. Given the constraints, the siting of the seawater basin and the batching plant can be considered to be appropriate. It is worth mentioning that the batching plant is a temporary structure and would be removed upon completion of concrete works under the Fourth Power Project.

3.3.2 Site Access

Vehicle access route to the batching plant area has been provided and the plant is kept in a confined area demarcated for restricted public access. However, public access to recreational amenities in the area has not been restricted. Easy access to the seawater basin is also provided and the discharge pipeline running from the site across the road is properly laid under the road so that vehicular and pedestrian movement is not affected at all. The discharge end of the pipe is also properly anchored and no visible impacts would arise.

3.3.3 Topography and Oceanography

The discharge of silty water from the dewatering of the seawater basin would be the only aspect which would require topographic and oceanographic concerns to be considered. The topography of the area is low with about 2.5m at the highest point, where the batching plant is located. The silt water is currently discharged on to the tetrapod breakwaters where the breaking waves will splash and clear the dirt and silt off the structure. This can be seen following the first day of dewatering. However, given that the water body flows in the southwesterly-westerly direction and with the force of the constant wave action in the discharge environment, the silt is moved along the peripheral breakwater and directed through the nearby channel into the swimming area and swimming track. On that day when the EPA stopped the dewatering due to public complaints, the whole area became murky and the murkiness was observed at about 300m distance from the point of discharge. The extent of sedimentation from the dewatering discharge is shown in the following figure.

The depth of the reef flat area in which the sediment travelled was less than 1.5m. Due to high wave activity in the area there was no siltation on the reef flat (see Figure 3-4). The depth at the location of discharge was about half a meter at mean tide. The mouth of the opening from which sediment moved into the swimming track area was also very shallow. This helped in the rapid spread of the sediment plume, which eventually would have settled in the deepened areas of the track and beyond.

3.3.4 Water Quality Degradation

Visible siltation resulting in public dismay was the main reason for stopping the project. The possibility that there could be contamination other than silt was taken into consideration and water tests were carried out at three locations as shown in Figure 3-4. Water quality data for these locations is given below.

Location	Swimming area	Near discharge	Basin	Basin
Date sampled	**21-Jan-10**	**21-Jan-10**	**21-Jan-10**	**18-Jan-10**
Physical Appearance	CWSP	CWSP	PYWSP	CWSP
Turbidity (NTU)	0	0	1	8
Total Dissolved Solids (mg/l)	27780	27900	15780	27000
Nitrate (mg/l)	3	0	0	0
Ammonia, Nitrogen (mg/l)	2.44	2.15	0.01	0.4
Iron (mg/l)	0	0	0.34	N/A
Chemical Oxygen Demand (mg/l)	104	104	51	107
Sulphate (mg/l)	3000	2900	1700	107
Chromium (mg/l)	0.001	0	0.001	N/A
Suspended solids				2
CWSP=clear with suspended particles	PYWSP = pale yellow with suspended particles			

Table 3-1: Water quality from different project areas

The results of the water quality tests indicate that all three samples have no or low chemical contamination. In fact there is no chemical contamination in any of the samples. The chemical oxygen demand (COD), however, is high in the two marine samples from the track area as well as the discharge location compared to the seawater basin. This is not representative of contamination but salt concentration. It can be seen that the sample taken from seawater basin on 18 January after the dewatering was stopped shows similar levels of COD as the two marine samples. This is because the 18 January sample from the basin has similar salinity as the other samples. So, COD in this case is dependent on the salts in the sample rather than any other form of chemical contamination.

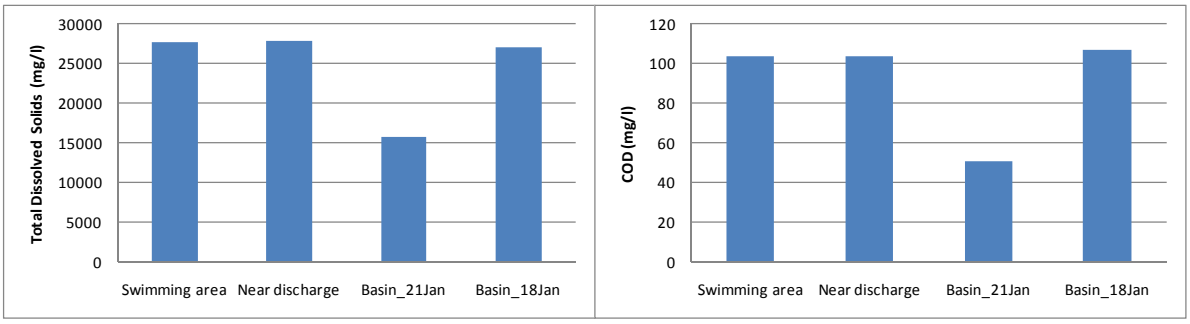

Figure 3-1: COD in the samples varied according to salinity (TDS) indicating no chemical pollution

Given that there is little or no chemical contamination in the samples, turbidity or silt is the main cause, which again cleared up quite fast given that there is a good level of circulation within the swimming area. In fact, Haveeru (16 Jan 2010) reported that the swimming area was clear when the reporter checked at noon that day and that some swimmers were in the area too. The following figure shows the photo from Haveeru daily on the day of pumping and the photo taken a week later. The photos show that the clarity of the water returns to normal within a week or less.

Figure 3-2: Photos comparing the turbidity in the area a week after pumping was stopped.

The photo taken by Haveeru reporter (shown above) also indicates that there is a stronger flow nearshore. This is also seen from the drogue studies that were done later. The drogue studies indicated that the flow was stagnated in the lee of the breakwater and water moved along the shore towards the next opening.

Biological analysis has not been done as no biological contamination is expected. However, if biological analysis was done, the results could indicate high levels of faecal contamination in the track area, which may be a greater cause for concern in terms of public health. In fact, the results indicate that the nitrogen levels in the samples were higher in the two marine samples, which could be attributed to the sewage outfalls in the vicinity.

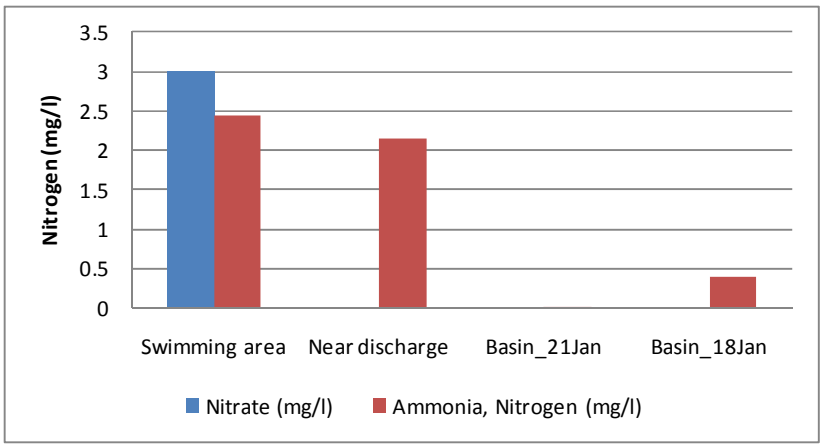

Figure 3-3: Comparison of nitrogen levels in the samples

3.3.5 Existing Environmental Concerns

There have not been any public concerns related to the STELCO power plant so far apart from the recent discolouration due to sedimentation of the track area from the discharge water. The batching plant, however, affects the aesthetics and the recreational amenities of the area to some extent. There is little information given to the public as to what it is and whether it will be temporary or permanent. Apart from this, there are no major concerns relating to the batching plant at the moment.

The seawater intake pipes for the existing seawater basin at STELCO site is located on the reef in the area where the discharge pipe is located. Therefore, any sediment deposition on the reef could cause sediment to be drawn into the intake pipes, thereby creating clogging and other issues. This was one of the reasons why the discharge pipe for the dewatering works was not extended to the bottom and laid on the reef flat.

The existence of the swimming track in this predominantly industrial area is a cause for concern. Fuelling operations have been separated only by a seawall between the swimming track and fuelling and mooring area on the other side of the track. The sewage outfalls discharging raw sewage and wastewater from pumping stations PS2 and PS9 are also located in this area slightly away from the dewatering pipeline discharge point. These outfalls have a high risk potential for biological contamination of the swimming track during the northeast monsoon. The high level of nitrogen in the swimming track water sample given in Table 3-1 is probably indicative of sewage contamination.

Figure 3-4: Project site with photos and environmental conditions

4 Potential Impacts

There would be the potential for the same impacts of sedimentation or siltation or discolouration of the water in the swimming track area during the first three days of dewatering. Without further mitigation measures, the project cannot continue as public concerns would arise. The other potential impact of the project would be the drawdown on the water lens caused by the pumping. According to the Ghyben-Hertzberg principle for every feet of groundwater drawn from the surface of the water lens, salt water from below the lens pushes the water lens or the freshwater-seawater transition zone by 40feet (Freeze and Cherry, 1979). Some argue that the coning effect and saltwater intrusion depends on the geology of the site. It is believed that the push on the lens in the case of low lying islands would be smaller, somewhere around 20m (Lew Thorstensen 1996). This effect would be even smaller in the STELCO area where it is really close to the sea and the influence of the sea is constant. It should also be noted that the freshwater lens in Malé has been thinned over the years and the thickness of the lens in the inland areas near the STELCO site would be less than 1m. As the geologist working with STELCO under this project, Mr. Friedrich Leithoff also pointed out, there is hardly be any freshwater lens in the STELCO site and the area surrounding it and also since there is 9m deep sheet piling around the dewatering area, the drawdown of the water table would be slowed down. However, the coning effect or saltwater intrusion is obvious from the water quality results given in Table 3-1. The results indicate that between 18 January and 21 January, the salinity (or TDS) reduced from 27,000mg/l to 15,780mg/l (which is way above the freshwater limit of 1,500mg/l) in the samples taken from the basin. Therefore, the zone of influence shown in Figure 4-1 is based on the effect of normal drawdown expected of pumping from a depth of 3.5m below the water table, assuming a worst case scenario. It can be seen from Figure 4-1 that only the already salty aquifer in the STELCO site is expected to be affected. Therefore, sensitive elements in the area including the trees in Kudakudhinge Bageecha and Dharubaaruge are not affected from the dewatering. Yet, it is recommended to continue to monitor during the period of dewatering in order to assure compliance as well as to take mitigation measures if necessary.

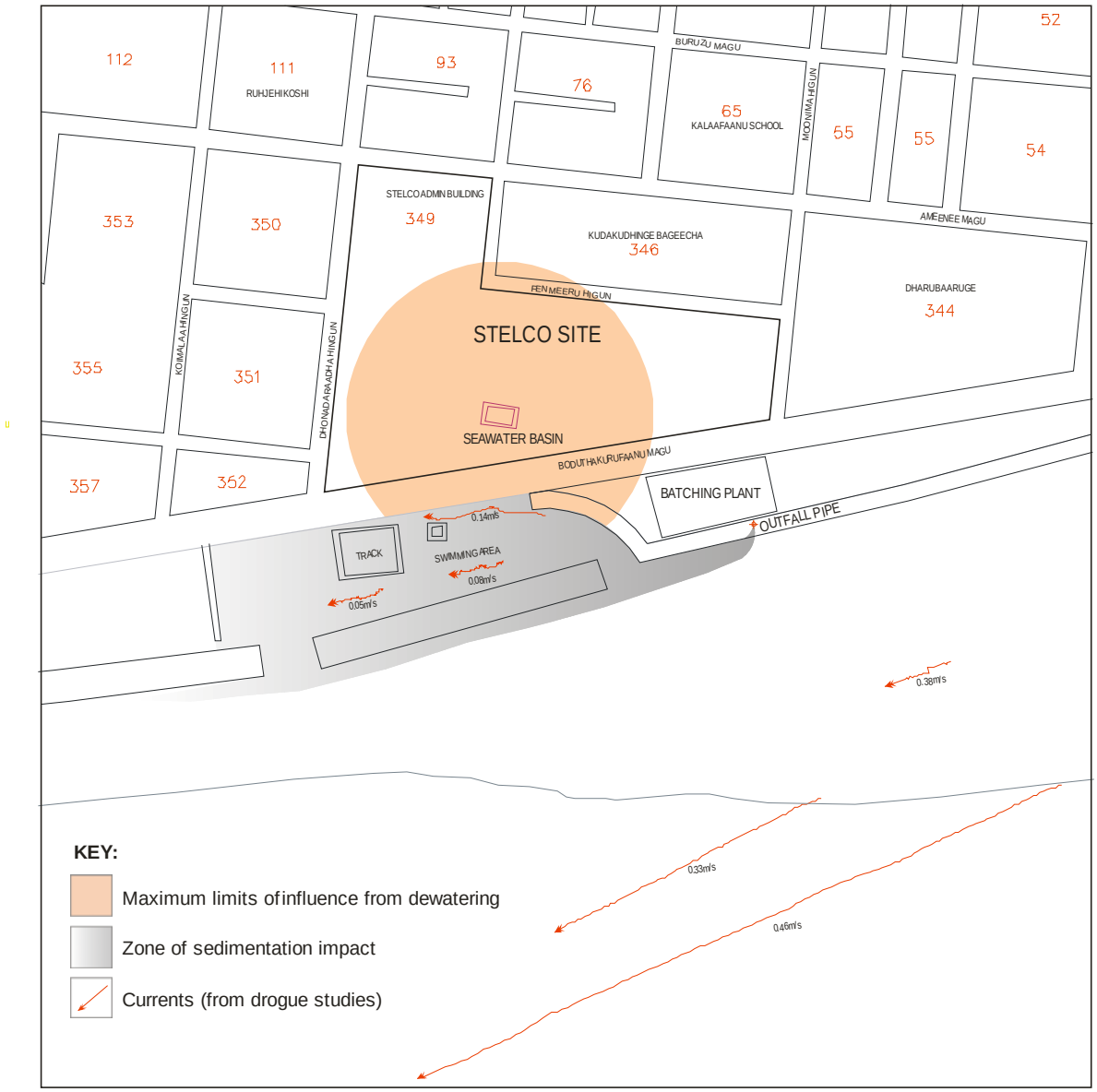

Figure 4-1: Zone of influence of the drawdown on water lens and sediment plume dispersion pattern

There are very few potential impacts of the batching plant. These include noise, dust and wastewater runoff. If properly managed and operated, these concerns can be minimized. Potential pollutants in batching plant wastewater include cement, sand, aggregates and petroleum products. These substances can adversely affect the environment by increasing soil and water pH and increasing turbidity of the discharge environment. However, the quantities are quite small and can be easily disposed of in an appropriate manner.

Apart from the above negative concerns or environmental impacts, the project brings about a lot of social and economic benefits. These have been discussed in the EIA report. A summary of the project's impacts using component vulnerability and activity potential indices indicate that the project has a high positive impact overall considering the longterm socio-economic benefits of the project and has little or few negative environmental impacts.

Table 4-1: Project's impact indices - component vulnerability (CPVI) and activity potential (API)

	KEY COMPONENTS																	
	Environment							Socio-Economic										
PROJECT ACTIVITIES	Reefs	Live Bait	Erosion/Accretion	Lagoon/seawater	Soil and groundwater	Land/seascape	Air/Noise	Resource allocation	Recreation and aesthetics	Services and Infrastructure	Health and Safety	Employment	Economic Diversification	Property Value	Landuse	Costs to consumer/tax payer	Quality of Life	TOTAL API
Construction and operation phases																		
Sheet piling and excavation	0	0	0	0	0	0	0	0	0	0.44	0	0.01	0.44	0	0	-0.07	0.44	126
Dewatering	-0.01	0	0	-0.02	0	-0.01	0	0	0	0.44	0	0.01	0.44	0	0	-0.07	0.44	122
Batching Plant	0	0	0	0	0	0	-0.01	0	-0.02	0.44	-0.01	0.01	0.44	-0.01	0	-0.07	0.44	121
Workforce management	0	0	0	0	0	0	0	0	0	0.44	-0.01	0.01	0.44	0	0	-0.07	0.44	125
Maintenance and repairs (technical)	0	0	0	0	0	0	0	0	0	0.44	-0.01	0.01	0.44	0	0	-0.02	0.44	13
TOTAL CPVI	-0.01	0	0	-0.02	0	-0.01	-0.01	0	-0.02	2.2	-0.03	0.05	2.2	-0.01	0	-0.3	2.2	6.24

It shall be noted that in the above table, the positive impacts are given as indirect benefits of the proposed activities, which are direct benefits of the overall Fourth Power Project. Also, some of the negative impacts such as costs to consumer are given as direct effects of the overall Fourth Power Project.

5 Mitigation Measures

The main environmental impact from the project is the discharge of turbid waters from the dewatering process into the marine environment, which lead to turbidity in the swimming area nearby. Therefore, steps to mitigate turbidity or sedimentation of the swimming area and track are the primary focus of this report. There are a few options that can be considered, of which few options would work given the environmental conditions of the site. The available options are:

1. Move the pipeline to the leeward side off the swimming track
2. Silt screening at the discharge location
3. Silt screen at the mouth of the breakwater opening leading water flow into the swimming area
4. Extend the discharge pipe offshore away from the influence of the wave action
5. Sedimentation tanks in the project site
6. Close the area for swimmers for a week or two.

It has been estimated that the volume of sand remaining in the basin is about 54m^3, which represents about 0.6m of sand at the bottom. It is assumed that less than 10% of this material would be sucked into the pipe, which represents less than 5.4m^3 of fine sediment.

5.1.1 Move pipeline to lee of swimming track

This option involves moving the discharge line to the lee of the opposite side, which is the lee of the swimming track during the Northeast monsoon, i.e. during the proposed duration of the works covered under this Addendum. This option is considered by the contractor as the most practicable option, although it may be more expensive than option 2 discussed below. This option has long term benefits as there would be additional components of the project that would require dewatering and the uncertainties and changes in wind and currents over the life of the main project, i.e. Fourth Power Project. For the project components under consideration, the use of alternative pipeline directed into the leeward side of the swimming area would greatly minimize the level of sedimentation inside the swimming track area, which is the sensitive amenity in the area. Therefore, this option is both practicable and provides adequate mitigation for the sedimentation or siltation impact. Also, this may be easier to implement given that the contractor is already mobilized. The layout of the pipeline for this option is given in Appendix 3.5.

5.1.2 Silt screening at discharge location

Silt screening at discharge location involves the provision for collecting silt which will retain a high percentage of the silt and let the water out. After checking the availability of silt screens, two options are proposed. In both options, ELCOMax 600R with pore size less than 75um and filtration rate of 80litres/m^2/s has been considered as an appropriate material. However, small amounts of finer silt that will pass through may be seen to discolour the receiving waters in the immediate vicinity of the discharge location. Yet, the visibility would be small and the discolouration is not expected to be visible inside the swimming area, which is the sensitive area.

Option 2A: Geotextile containers of 2.5m^3 size

Based on the above filtration rate and assuming 5.4m^3 of sediment, it is estimated that about four or maximum of five geotextile containers (or bags) of size 2.5m^3 placed at the end of the tube would be sufficient to filter the water. Given that the volume entering the container is 31litres per second and the container is able to filter 80litres/m2 in every second, two bags at a time may be sufficient or all four bags can be placed at the same time with four outlets, i.e. the two pipes split in two each. However, due to the small size of each bag, siltation on the inside of the bag is expected to affect the overall performance over time and may be problematic.

Option 2B: A geotextile frame of appropriate size

Instead of using geotextile containers, a frame of appropriate size made from the same material can be used to drain the water and separate the sediment. This is expected to be slightly cheaper than the containers and more effective in that the side walls are expected to filter quite effectively even with some level of silt settling on the side walls. It has been estimated that a box frame of 5mx2mx1m into which the existing two pipes can discharge

the water would be quite efficient. Even a 3mx1.5mx1m is expected to work, however, due to uncertainties, the most efficient size has been established. The frame can be placed on the tetrapod arrangement at the discharge location.

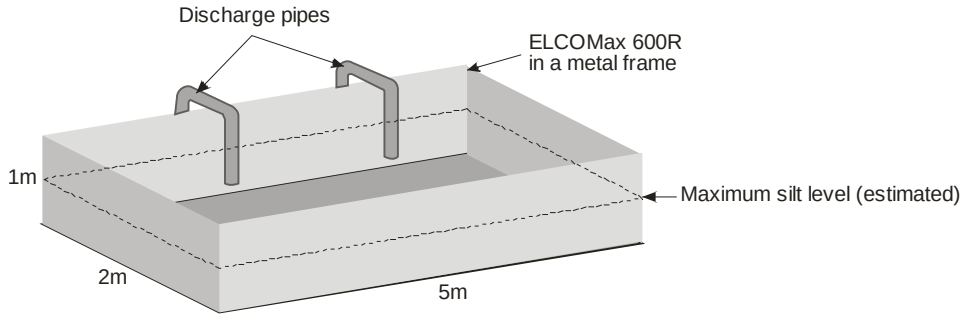

Figure 5-1: Conceptual layout of geotextile frame for silt containment

5.1.3 Siltscreen at opening to swimming track

A silt screen can be placed on the seaward side or landward side of the submerged tetrapods at the gap in the breakwater though which sediment enters the swimming track. However, from past experience in using silt screens in the Maldives, it appears that this option would not be practicable. It may be possible to draw a silt curtain and anchor it at the opening or openings at the low tide but with high tide and with the level of wave activity, and even without wave activity, the silt screen would not last. If high strength materials were to be used, very strong anchoring would be required and that would be an impossible cost given the scale of the project. Furthermore, this option will not completely screen the sediment entering the swimming area.

5.1.4 Extend discharge pipe offshore

Extending discharge pipe offshore is also cost prohibitive given the scale of the project. More importantly, this option would discharge sediments on the reef which may be drawn into the existing saltwater system of the STELCO power plant. This could clog the system and accrue additional burden including disruption to electricity services. Therefore, this option is not recommended.

5.1.5 Sedimentation tank

Given that 110m^3 per hour of water will be discharged from the dewatering, a large sedimentation tank would be required. There is a lack of space within the project site for such provisions. Therefore, sedimentation tank is not recommended. Also, it would involve earthworks to a greater extent that it would be a much messier operation.

5.1.6 Close the Swimming Area

Shutting down the swimming area without additional sediment control measures would not be feasible as there will be some degree of sedimentation that will not wash off in a week, which is the maximum period for which the Swimming Association prefers to close the swimming track. Therefore, this option alone cannot be considered. Even if the other options are considered, it would be ideal to close the swimming area for a week or two given the potential for any of the workable options given above to have some degree of sedimentation impact during the first three days of discharge of turbid or murky waters.

5.2 Recommended Option(s)

There are three options that can be recommended. They are options 1, 2 and 6 discussed above. Of these, option 1 (alternative discharge location in the lee of the swimming area) combined with option 6 (closing the swimming area for a week) is recommended as these are preferable to the contractor and Swimming Association and has little or no impact of sediment in the swimming area. Option 2B is cheaper than the recommended option and controls silt to a great degree and is recommended if cost is a factor that the Proponent wishes to take into consideration. However, the contractor is not happy with this option as the option is questionable in terms of practicability as the contractor is not familiar with the geotextiles proposed.

In fact, closing the swimming area for two weeks would be the most practicable solution for the project components considered in this report given that only about $5m^3$ of sediment would be pumped and that it is less than the sediment that was pumped earlier and would clear up much faster than the previous sediment load. However, the Swimming Association has said that closing the swimming area for two weeks could not be afforded as it will affect their schedules severely. Therefore, unless Swimming Association agrees, this cannot be done.

Hence, the proposed alternative pipe route with closing of the swimming pool for a week is recommended.

6 Environmental Monitoring

There is a long list of monitoring parameters indicated in the EIA for the Fourth Power Project. In addition, water quality at the discharge location, swimming track and the seawater basin has to be done on a regular basis as part of the monitoring proposed under the project components considered in this report. Given the sensitivity of the dewatering component, it is recommended that the following monitoring programme is undertaken separately from the overall monitoring programme for the project outlined in the main EIA report.

6.1 Recommended Monitoring Programme

Outlined here are minimum project specific monitoring requirements that should be considered. This monitoring programme for the proposed project includes at least three monthly monitoring and covers the three stages of the project implementation.

Stage 1: Immediately before starting works

Stage 2: During civil works

Stage 3: After civil works

The monitoring needs of each stage are discussed in detail below:

Stage 1

A single data set for water quality immediately prior to construction must be done. The locations given in Figure 6-1 shall be covered. The parameters to be done for the three locations for which water quality is given in this report and the additional marine sample are pH, turbidity, Dissolved Oxygen, Nitrate, Ammonium, COD, and E-Conductivity/salinity. For the groundwater samples, dissolved oxygen, pH, E-Conductivity/salinity/TDS and depth shall be done.

In addition to water quality, drogue study shall be done for the alternative discharge location given in this report in order to establish the direction of water flow before pumping is started.

Stage 2

During dewatering for the construction of the seawater basin, daily water quality tests shall be done on the locations given in Figure 6-1. Tests shall be done for the same parameters as above.

Stage 3

Upon completion of the dewatering for the construction of the seawater basin, water quality tests shall be done twice within the first two months. Tests shall be done for the same parameters and locations described under stage 1 above.

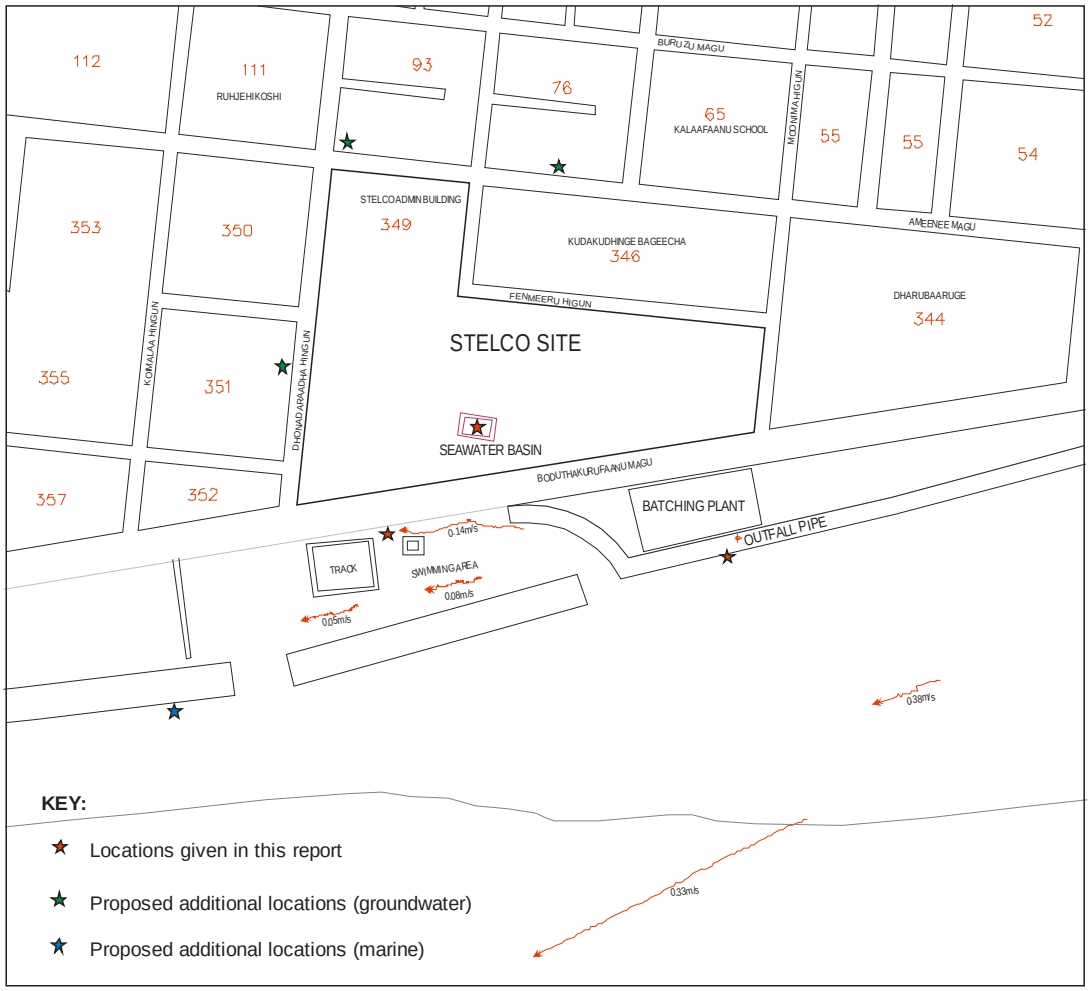

Figure 6-1: Water quality monitoring locations

6.2 Monitoring Report

A detailed environmental monitoring report will be prepared and submitted to the EPA within three months from completion of dewatering works for the seawater basin. Location description and sampling procedures and site conditions shall be given for each sample. The monitoring report shall provide an analysis of the data and provide recommendations.

7 Declaration of the consultant

I certify that the statements in this Addendum to the Environmental Impact Assessment for the Proposed Fourth Power Development Project proposed by State Electric Company (STELCO) are true, complete and correct to the best of my knowledge and abilities.

Name: Ahmed Zahid (EIA 08/07)

Date:

8 Sources of Information

Comin Asia (Nov 2009), *Procedure for Operating Manual of Concrete Batching Plant*, Fourth Power System Development Project Phase IV, Malé, Maldives

EPA Victoria (June 1998), *Environmental Guidelines for the Concrete Batching Industry*, Environment Protection Authority, State Government of Victoria, Australia

Freeze, R.A., and Cherry, J.A. (1979), *Groundwater*, Englewood Cliffs, N.J., Prentice-Hall Inc., 604 pp

Kenchington, R.A., The Republic of Maldives, pp 184-204. *Managing Marine Environment*, Taylor and Francis New York Inc. (1990)

OLP (2009), *Method Statement for Earthworks at Seawater Intake Basin*, Fourth Power Development Project, Malé, Maldives

MWSA (2007), *Dewatering Guidelines*, Maldives Water & Sanitation Authority, Malé, Maldives

Appendix 1: Minutes of Meetings

بسم الله الرحمن الرحيم

State Electric Company Limited (STELCO) – Environment Protection Agency (EPA): Meeting regarding Dewatering and Sheet piling Works of the Fourth Power Development Project 2 x 8 MW

Date: Thursday 14th January 2010

Time: 16:40 – 17:15 hrs.

Place: STELCO Head Office 4th Floor Meeting Room

Attendedees:

NAME	DESIGNATION	OFFICE	CONTACT NUMBER
Mohamed Zuhair	Director General	EPA	7776800
Ibrahim Naeem	Director	EPA	7781461
Ibrahim Mohamed	Assistant Director	EPA	7471873
Ibrahim Athif	Senior Engineer	STELCO	7773514
Azzam Ibrahim	Senior Engineer	STELCO	7782574
Aboobakuru Mohamed	Deputy Director	STELCO	7784826
Ahmed Iqbal	Senior Engineer	STELCO	7778995
Ibrahim Rauf	Engineer	STELCO	7902201

The Environmental Protection Agency (EPA), headed by Director General, Mr. Mohamed Zuhair, has the mandate of overseeing all environmental aspects in the country. The EPA is run under the Ministry of Housing, Transport and Environment.

Purpose of the Meeting:

The meeting was called as a measure to solve the consequences of the following:

1. The Environmental Impact Assessment (EIA) of the 4th Power Development Project failed to mention any thing about either Dewatering or Sheet Piling works;
2. As a direct result of the above, as of 14th January 2010 (Thursday) STELCO had not officially submitted any papers to the relevant Government Authorities (either to MHTE or to the EPA) for permits to carry out the Dewatering or the Sheet piling Works that had already been carried out.
3. To continue the existing works by informing the EPA of the current situation and to avoid consequences to STELCO and the Government of Maldives of halting the works of this International Project from the Contractor.
4. To get clear instructions and a direction from the EPA to address the above issues.

Minutes of Meeting

Senior Engineer Ibrahim Athif opened the meeting by welcoming the participants to the meeting. After which he detailed out the current status of the project and detailed out the purpose of the meeting.

- Mr Mohamed Zuhair, in charge of EPA, stressed the importance of following the rules and procedures prior to carrying out such acts of concern to the EPA and STELCO's failure to do so.

- Participants from STELCO explained to the EPA that STELCO is never aware of the requirement that Dewatering and Sheet Piling should be addressed in the EIA. STELCO could have them done otherwise in order to adhere to the rules and procedures governing this to prevent a situation of this development. After this, Mr Ibrahim Athif stressed the importance of the project and the stakes involved unless the works can be carried forward. And hence, requested from the EPA to propose a way forward without halting the project.

- Mr Mohamed Zuhair ordered to stop the Dewatering with immediate effect. And then, in reply to the Mr Athif's request, mentioned that the EIA is the most important document in such a project. Mr Zuhair also highlighted that the failure to mention such (Dewatering and Sheet Piling) in the EIA cannot be accepted by the EPA and unless it is been done and submitted Sheet Piling cannot be approved. However, the Dewatering can be started as early as Sunday (17th January 2010), pending approval from the EPA, on application of the required permits by STELCO.

- Participants from STELCO then explained to the EPA that prior to the Dewatering process, a meeting was held with the Government bodies in order to discuss and sort out the methodologies to carry out the works. This meeting was held on 18th October 2009 and attended by participants from Male' Municipality, MHRYS, The Swimming Association and MWSC. As a result of the meeting there were changes proposed by the participants and STELCO completely followed them. However, no participant in that meeting mentioned about the requirement for a separate permit from the EPA to have the Dewatering process to start. And hence, STELCO carried out the works as per the outcome of that meeting. A copy of the "Minutes of the Meeting" was given to EPA for reference.

- Mr Mohamed Zuhair then informed the participants that his agency (the EPA) will send an official letter to STELCO ordering to stop the Dewatering with immediate effect. He also warned STELCO that unless these instructions been strictly followed and implemented the EPA can subject STELCO to fine Mrf.100,000,000.00 (Rufiyaa: One Hundred Million Only) under the existing laws on the protection of environment.

- Participants from STELCO then assured the EPA that the Dewatering will be stopped with immediate effect as directed by the EPA.

- Mr Mohamed Zuhair then assured STELCO that it is not his intention to propose such harsh measures, yet the absence of such permits and documents do not allow him otherwise.

- The EPA then proposed STELCO to complete the documentation, by adding necessary addendums to the EIA, and then to apply for the required permits in order to start the Dewatering. Mr Zuhair stated that he cannot assure STELCO when be can issue the go ahead, but mentioned he will do it as soon as it possibly can be.

- Since there was no other business, Mr Ibrahim Athif adjourned the meeting at 17:15 hrs.

Recommendations:

1. To complete the following Addendums to the EIA of the 4th Power Development Project:
   (a) Dewatering Process and Methodology;
   (b) Sheet piling Process and Methodology.
2. Submit the above as soon as possible to EPA for approval.
3. To stop the Dewatering with immediate effect.

Immediate Actions Taken:

1. Dewatering Works stopped.
2. The participants of the EPA had a look at the work site.

Ibrahim Athif (Senior Engineer)	Azzam Ibrahim (Senior Engineer)	Ahmed Iqbal (Senior Engineer)	Aboobakuru Mohamed (Deputy Director)
Mohamed Zuhair (Director General / EPA)	Ibrahim Naeem (Director / EPA)		Ibrahim Mohamed (Assistant Director / EPA)

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بسم الله الرحمن الرحيم

Environmental Protection Agency

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EPA

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4th Floor, Jamaaluddeen Complex
Nikagas Magu
Male', Republic of Maldives
Tel: 333 5949 / 333 5951
Fax: 333 5953
E-mail: admin@erc.gov.mv
Website: www.erc.gov.mv

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بسم الله الرحمن الرحيم

Environmental Protection Agency

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EPA

Minutes of the Meeting held to "Discuss way forward regarding the dewatering and sheet piling works of the Fourth Power Development Project"

Date: 17th January 2010, Sunday

Time: 11:00 - 12:00

Venue: Environmental Protection Agency

Invitees: State Electric Company Limited (STELCO)
Environmental Protection Agency (EPA)

Agenda:

- Welcome & introductory remarks
- Discussion
- Other Matters

1. The meeting was chaired by Director General Mohamed Zuhair from EPA. In the introductory remarks' Mr. Zuhair, stated that the purpose of this meeting was to discuss the issues of sheet piling, excavation and dewatering activities carried out by STELCO as part of the Fourth Power Development Project. A prior meeting was held with STELCO on 14th January 2010 and an order to stop the ongoing construction works was given in terms of the public concern over the related environmental impacts from the project. Today's meeting was held to find a solution and to discuss how STELCO can proceed on with the construction through EPA approval.

2. Mr. Athif expressed his concerns and enquired about the most quick and feasible manner to obtain a permit to continue with the construction work. He briefed the aim of the current construction was to obtain and store sea water for cooling and the current construction is carried out to build a seawater storage tank for this purpose. He emphasized that the excavation and sheet piling as well as dewatering being not addressed fully in the Environmental Impact Assessment Study carried out in 2005, for the project. EPA inquired whether the construction was going as scheduled in the EIA decision statement and was informed that all construction is carried out as scheduled.

Mr. Zuhair, from EPA informed that the way forward in this issue is to address the construction and dewatering issues as an addendum to the EIA study. He emphasized that all technical details are being presented by the STELCO and it needs to be

4th Floor, Jamaaluddeen Complex
Nikagas Magu
Male', Republic of Maldives
Tel: 333 5949 / 333 5951
Fax: 333 5952

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countervailed with mitigation measures which can be taken during the construction and dewatering to minimize the impacts on the Environment. He stated one of such measures could be to contain the water until sediments are settled and then to pump it out or to confine the area and pump out the water to a contained area. He suggested that more alternatives can be included in the Addendum prepared by the EIA consultants.

4. Mr. Athif also suggested that other phases of construction in this Project such as Foundation for power house and Chimney will be discussed and included in the EIA study. In addition he also agreed to include the permit given by Male' Municipality for the temporary construction site built on the High grounds on the south of the Track Area and to address this phase of construction also in the Addendum.

5. Mr. Zuhair further requested to obtain Environmental Approval for any construction under the project and Dewatering permit will be given after reviewing the Addendum prepared and submitted to EPA by the EIA consultants.

6. STELCO reiterated their environmental commitments and their procedures to abide by Environmental Safety Standards. As such their ways of handling used oil and rigorous monitoring to minimize environmental impacts from their operations was emphasized.

7. EPA also acknowledged their commitments and thanked STELCO for their kind cooperation to solve this issue.

an EPA approved

Recommendations:

- An Addendum has to be prepared by the EIA consultants to address mitigation measures which can be taken to minimize environmental impacts from dewatering, excavation and sheet piling. Terms of Reference for the Addendum will be discussed through a stakeholder meeting once the Application is submitted to EPA.
- The Addendum to include any construction activities which will be undertaken during this project and how the excavated material will be utilized.
- To submit an application for an addendum to the EIA study
- To halt the construction until a decision statement is given by EPA

The meeting ended at 11:50

ENVIRONMENTAL PROTECTION AGENCY Male, Republic of Maldives

4th Floor, Jamaaluddeen Complex
Nikagas Magu
Male', Republic of Maldives
Tel: 333 5949 / 333 5951
Fax: 333 5953

UNite to combat climate change

Attended by:

1. Mr. Ibrahim Athif, Senior Engineer, STELCO
2. Mr. Azzam Ibrahim, Senior Engineer, STELCO
3. Mr. Ahmed Iqbal, Senior Engineer, STELCO
4. Mr. Aboobakuru Mohamed, Deputy Director, STELCO
5. Mr. Mohamed Zuhair,Director General, EPA
6. Mr. Ibrahim Mohamed, Assistant Director- Assesment, EPA
7. Mr. Ishaq Ahmed Naseer, Assistant Administrative Officer, EPA
8. Ms. Wafiyya Abdulla, Sanitary Assistant, EPA

Documents shared:

1. A hard Copy of the Environmental Impact Assessment Regulations, 2007, by EPA
2. Application for Dewatering with technical documents prepared by STELCO
3. EIA application

Minutes adopted by:

Mohamed Zuhair
(Director General, EPA)

Ibrahim Athif
(Senior Engineer, STELCO)

Azzam Ibrahim
(Senior Engineer)

Ahmed Iqbal
(Senior Engineer)

Aboobakuru Mohamed
(Deputy Director)

Ibrahim Mohamed
(Assistant Director, EPA)

ENVIRONMENTAL PROTECTION AGENCY
Maldives

4th Floor, Jamaaluddeen Complex
Nikagas Magu
Male', Republic of Maldives
Tel: 333 5949 / 333 5951
Fax: 333 5063

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بسم الله الرحمن الرحيم

MINUTES OF MEETING

PROJECT TITLE: 4TH POWER DEVELOPMENT PROJECT 2 X 8 MW MALE' POWER SATATION
SUBJECT: EXCAVATION / DEWATERING
PLACE OF MEETING: STELCO HEAD OFFICE 4TH FLOOR
DATE OF MEETING: Sunday, 18th OCTOBER 2009
TIME: 13:30 -14:10
PARTICIPANTS: As per the following attendance list

Name/Title	Representing Office	Contact No.
Ibrahim Athif/ S.Engineer	STELCO	7773514
Aboobakuru Mohamed/Deputy Director	STELCO	7784826
Ibrahim Shafeeu/Assistant Engineer	STELCO	7785945
Abdhul Hameed Ali /Director General	MALE' MUNICIPALTY	7774690
Ishaaq Ahmed/Director	MALE' MUNICIPALTY	7782656
Ismail Ali/Vice President	SWIMMING ASSOCIATION	7947802
Hussain Rasheed/SDO	SWIMMING ASSOCIATION	7788613
Ali Zaki Ahmed/Deputy Director General	MHRYS	7772017
Gnegonio Alefon/ Senior Engineer	MWSC	7642027
Adam Ismail/NMO	MWSC	7752874
Ibrahim Muammair	MWSC	7787548

General

- STELCO's Senior Engineer, Mr. Ibrahim Athif, opened the meeting and welcomed the participants.

- Mr. Athif explained the purpose of the meeting to the participants and presented the proposed piping layout of dewatering.

Points Discussed

- Mr. Ali Zaki from MHRYS raised the issue of the safety as the dewatered water may have been contaminated.

- Mr. Athif assured the participants that STELCO shall carry out regular water testing in liaison with Government Authorities. Further to this, Mr. Athif informed the participants the existing procedure in the power plant (i.e., that the drinking water and engine water is testeded on a regular basis).

- Mr. Abdul Hameed from Male' Municipalty, queried if the participants have any problem or issues, in case the water clarity of swimming area may change, as a direct consequence of dewatering. The participants expressed no objection to this, yet stressed measures to be taken to keep the water are safe for the swimmers. In this regard, Mr. Ismail from the Swimming Association asked the possibilities of

discharging water to an area as far as possible from the designated swimming area. After discussion, it was finalized that the piping layout of dewatering should be changed and the water outlet to the sea should inline with the lane between STELCO and Dharubaaruge.

- Mr. Adam Ismail from MWSC highlighted their experience of diesel contamination in this area and urged to be cautious during dewatering. Representatives from MWSC assured that none of their bow hole is located in this area and as a result their system will not be affected by dewatering.

Actions

- Mr. Athif assured that the new proposed piping layout will be informed to the contractor.

- All the parties agreed that STELCO may start the dewatering process without delay. As the participants expressed no objections from their side, Mr. Athif insisted on instructing the Contractor to start the dewatering process. All parties agreed to this.

- All representatives assured that they will be available for possible assistance.

- Mr. Hameed from Male Municipality promised that the official reply for STELCO's request will be provided within next two days.

Others

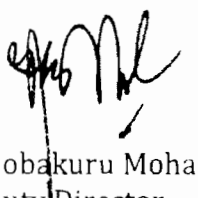
- Mr. Ibrahim Athif thanked all the participants for attending the meeting

The meeting adjourned at 14:10 by Mr. Ibrahim Athif

Minutes Approved by:

Signature:
Name: Ibrahim Athif
Title: Senior Engineer
Date: 19th October 2009

Minutes Checked by:



Signature:
Name: Aboobakuru Mohamed
Title: Deputy Director
Date: 19th October 2009

Appendix 2: Commitment letter from the proponent

بسم الله الرحمن الرحيم

STELCO
STATE ELECTRIC COMPANY LIMITED

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STATE ELECTRIC COMPANY LTD

Ref No: 6-C/203/2010/03

04th February 2010

Mr. Mohamed Zuhair
Director General
Environmental Protection Agency
Male',
Republic of Maldives

Dear Sir,

As the proponent of Addendum 2 of EIA report to Fourth Power Development Project, we are pleased to incorporate the recommendations in the implementation of works on the seawater basin and the batching plant.

We wish to assure our commitment to follow the necessary mitigation measures and continue to undertake monitoring according to the recommendations in the Addendum.

Yours faithfully

Ibrahim Athif
Senior Engineer

AMEENEE MAGU, P.O.BOX 2184, MALE', 20349, REPUBLIC OF MALDIVES. REG/1997/83 TEL:(960) 332 0982 FAX:(960) 332 7036 Email: admin@stelco.com.mv

Appendix 3: Drawings

Appendix 3.1: Site Layout

Appendix 3.2: Layout of the Batching Plant Land

Appendix 3.3: Attachment #01, Attachment #02, Attachment #03, Attachment #04

Appendix 3.4: Seawater Basin details

Appendix 3.5: Layout of the alternative route of discharge pipeline

334960.000 E | 334980.000 E | 335000.000 E | 335020.000 E | 335040.000 E | 335060.000 E | 335080.000 E | 335100.000 E

461140.000 N | 461120.000 N | 461100.000 N | 461080.000 N | 461060.000 N | 461040.000 N | 461020.000 N

N W E S

REMARK
1. Plant North is 5.7384° East of Survey North
(as shown on Site Survey date 28 May 09 by Sudarman Siripala).

2. Coordinates of Plant South West conner point are:
X (Easting) = 335006.57
Y (Northing) = 461069.78
Related to National grid.

3. Building locations are for reference only.Exact locations are to be verified onsite

PRODUCT WATER TANK
BUILDING
FUEL TANK AREA
FILTER ROOM
PAVED WITH CEMENT BLOCKS
POWER HOUSE BUILDING
ENGINE FLOOR 2
DG VI
ENGINE FLOOR 1
DG VII
SEA WATER INTAKE BUILDING
ANTENA
Pipe Rack
MARINE DRIVE
PIPE LINE
Pavement
Walk Way
PIPE TRENCH
STEPS
FH.1 FH.2 FH.3 FH.4 FH.5 FH.7 FH.8 FH.9 FH.10
BH.1 BH.2 BH.3 BH.4 BH.5 BH.6
335006.57 E
461069.78 N

REV.	DATE	REVISION STATUS	INITIATORS APPROVAL	PROJECT APPROVAL	ENGINEERS APPROVAL

PLACE RESERVED FOR STAMPS:

EMPLOYER: STELCO
STELCO
STATE ELECTRIC COMPANY LTD

ENGINEER: OLP
OLP
OEZEN LEITHOFF POWER AG

CONTRACTOR: CONSORTIUM
MAN DIESEL - SEMCO MARITIME

CIVIL WORK: HASKONING VIETNAM
ROYAL HASKONING
A COMPANY OF ROYAL HASKONING

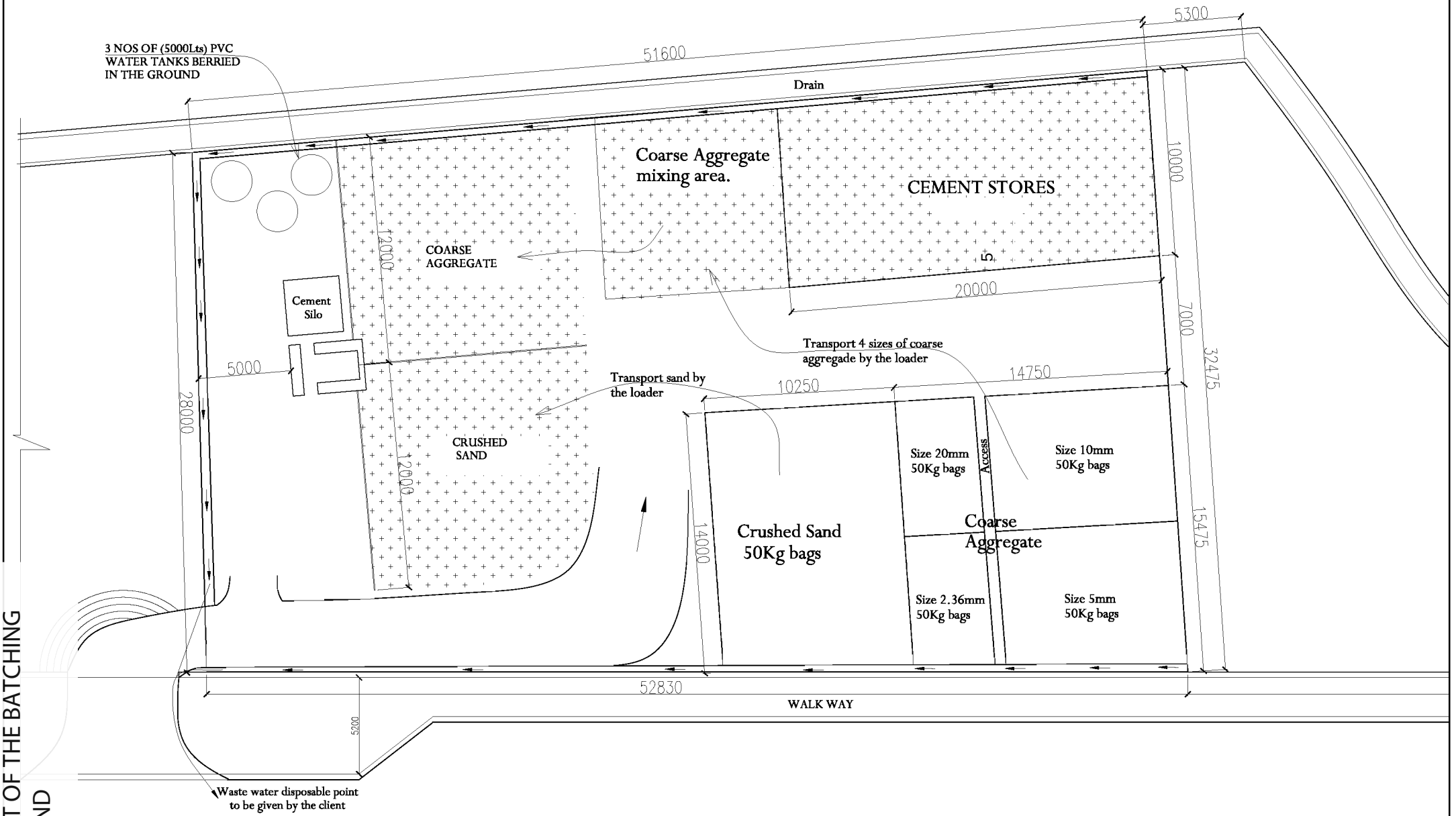
PROJECT:
4 th Power Development Project 2 x 8 MW
Male' Power Station
Contract No. TEB / 2008 / 38

	NAME:	DATE:
MADE BY	TNH	18/06/09
CHECKED	HN	18/06/09
APPROVED	MN	18/06/09
SUPERSEDES DRWG. NO.		

TITLE:
SITE LOCATION PLAN
(OPTION 1)

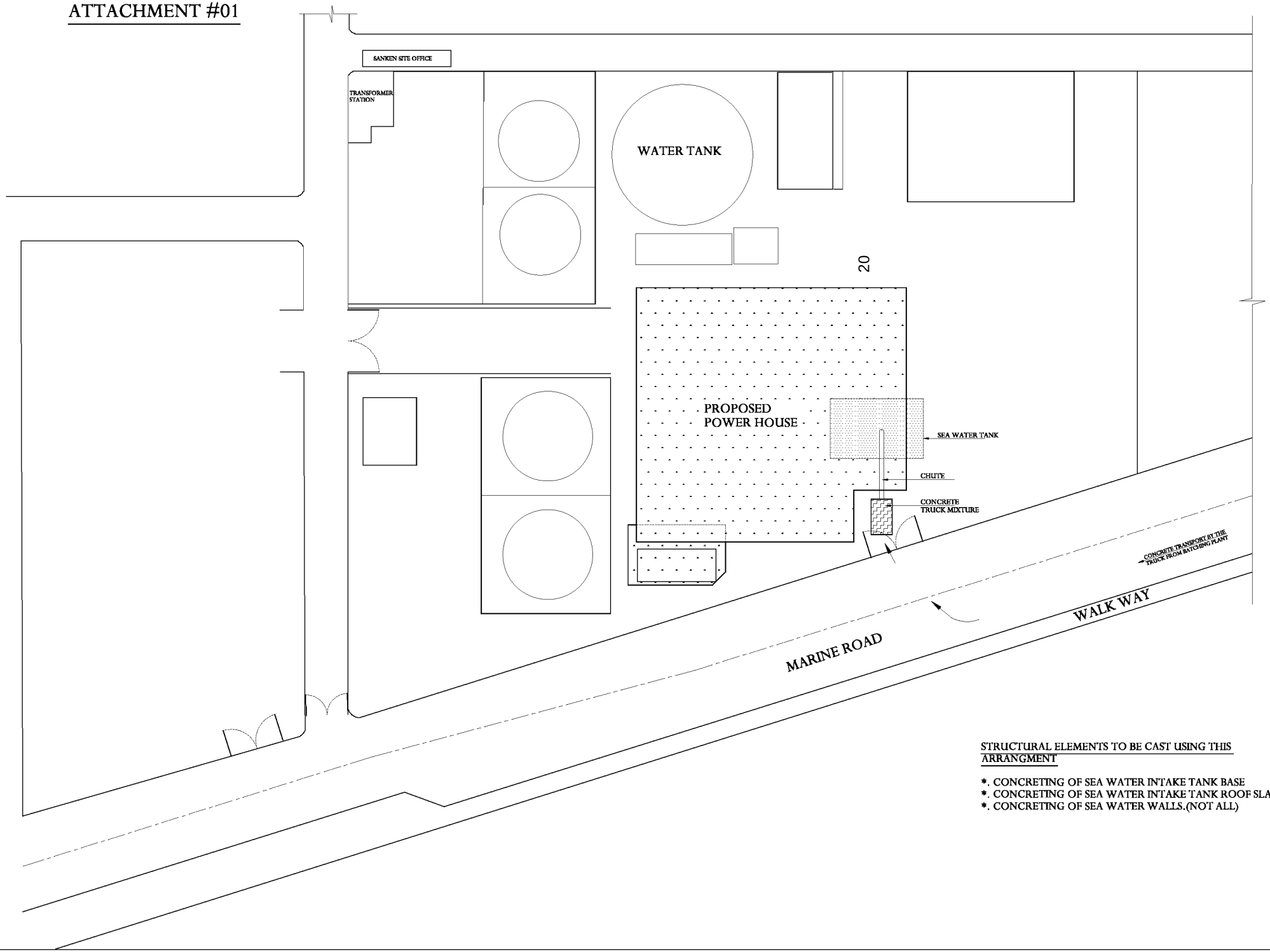
CAD FILE:	SCALE	DRWG. NO.	REV.
–	–	9505-001-001a	A

CONCRTE BATCHING PLANT FOR STELCO PROJECT



4) LAY OUT OF THE BATCHING PLANT LAND

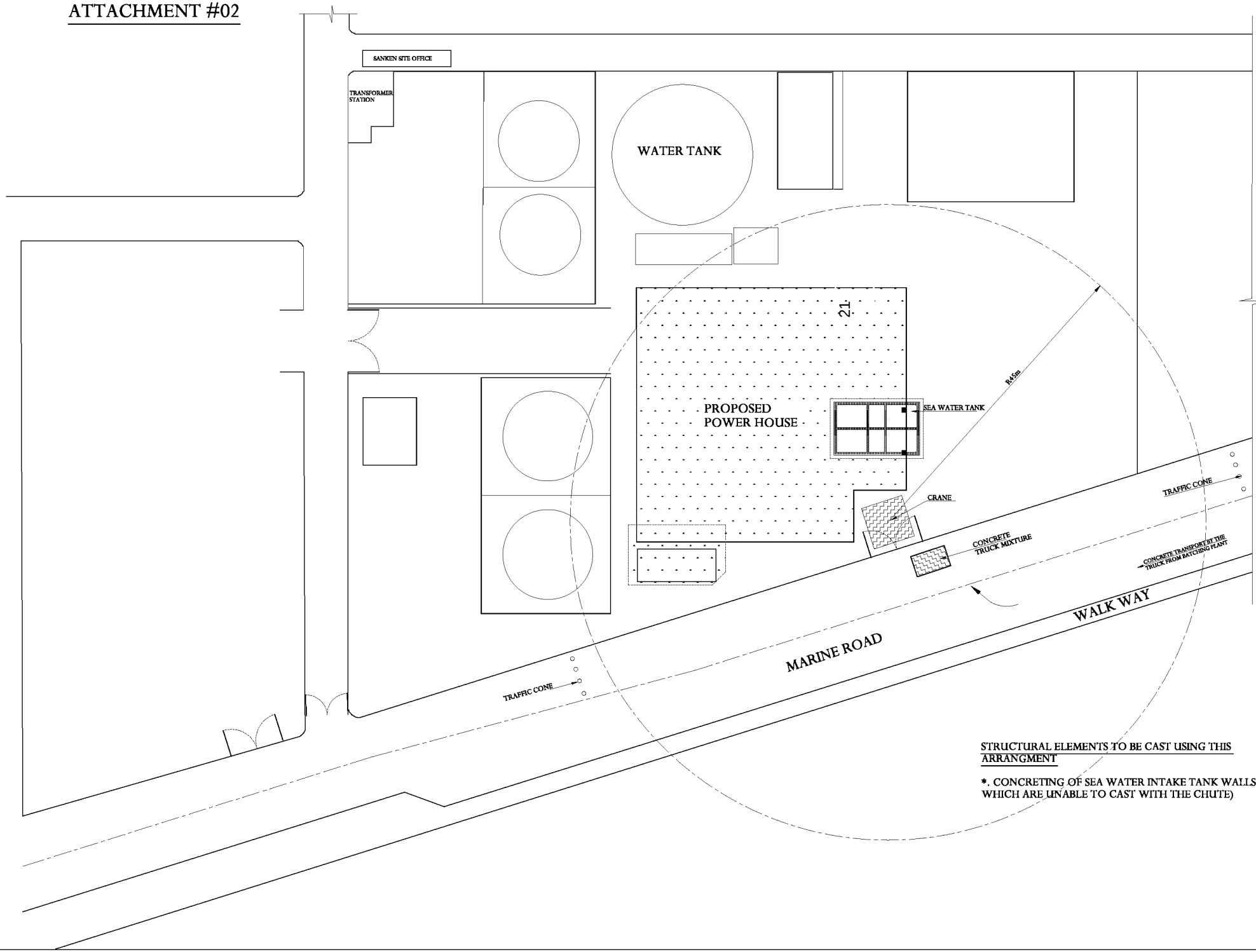
ATTACHMENT #01



STRUCTURAL ELEMENTS TO BE CAST USING THIS ARRANGMENT

*. CONCRETING OF SEA WATER INTAKE TANK BASE
*. CONCRETING OF SEA WATER INTAKE TANK ROOF SLAB
*. CONCRETING OF SEA WATER WALLS.(NOT ALL)

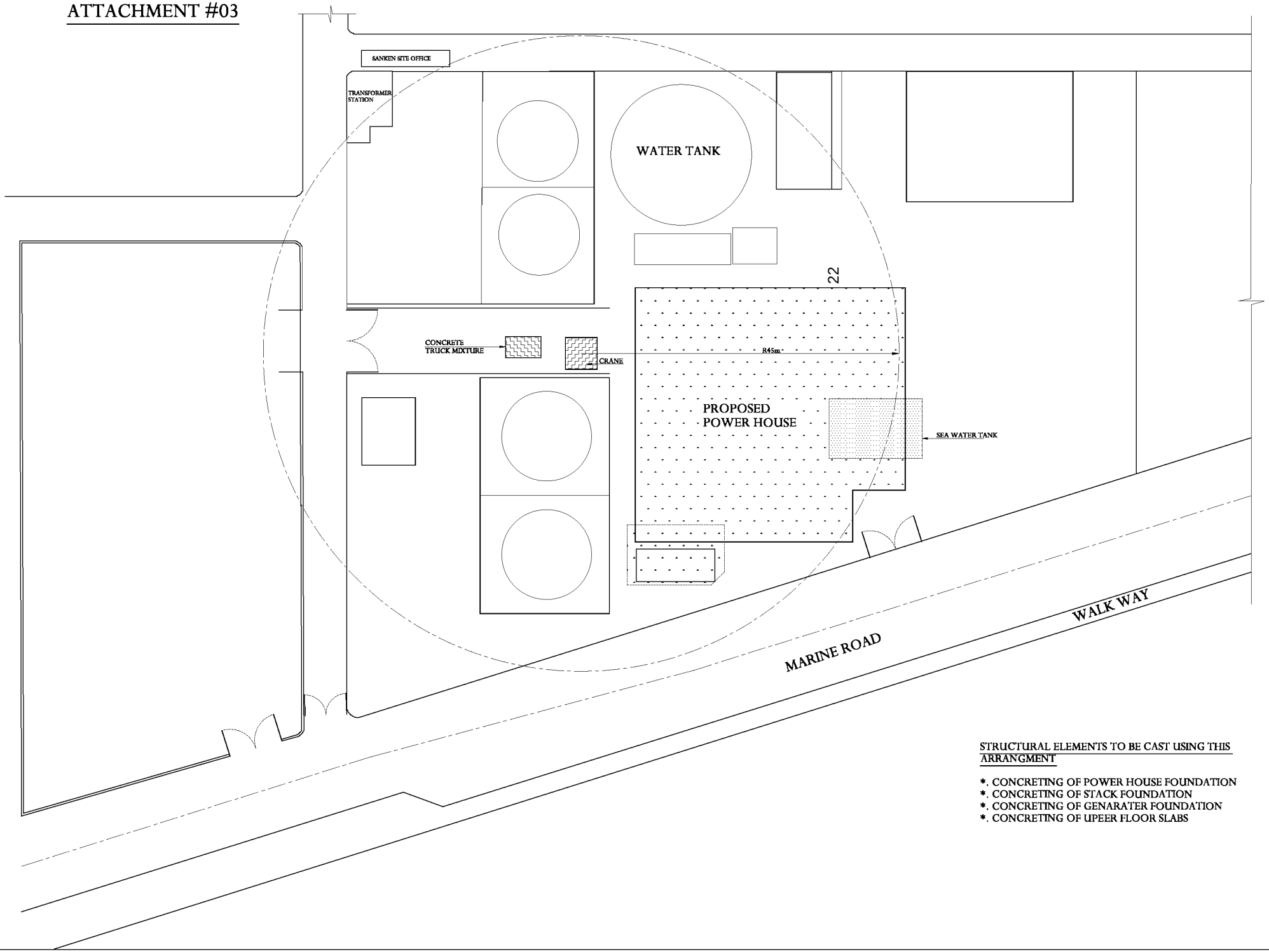
ATTACHMENT #02



STRUCTURAL ELEMENTS TO BE CAST USING THIS ARRANGMENT

*. CONCRETING OF SEA WATER INTAKE TANK WALLS (WALLS WHICH ARE UNABLE TO CAST WITH THE CHUTE)

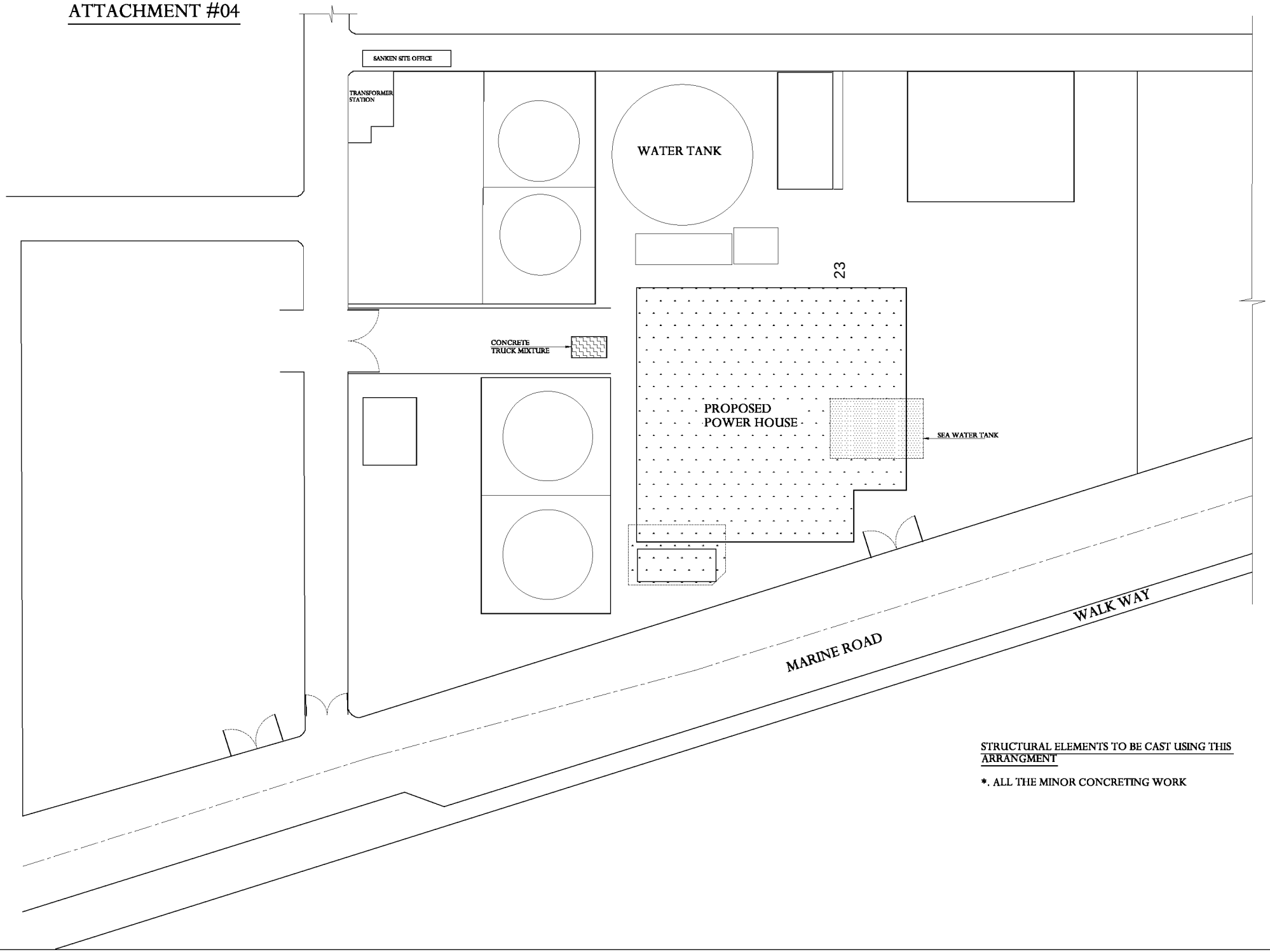
ATTACHMENT #03



STRUCTURAL ELEMENTS TO BE CAST USING THIS ARRANGMENT

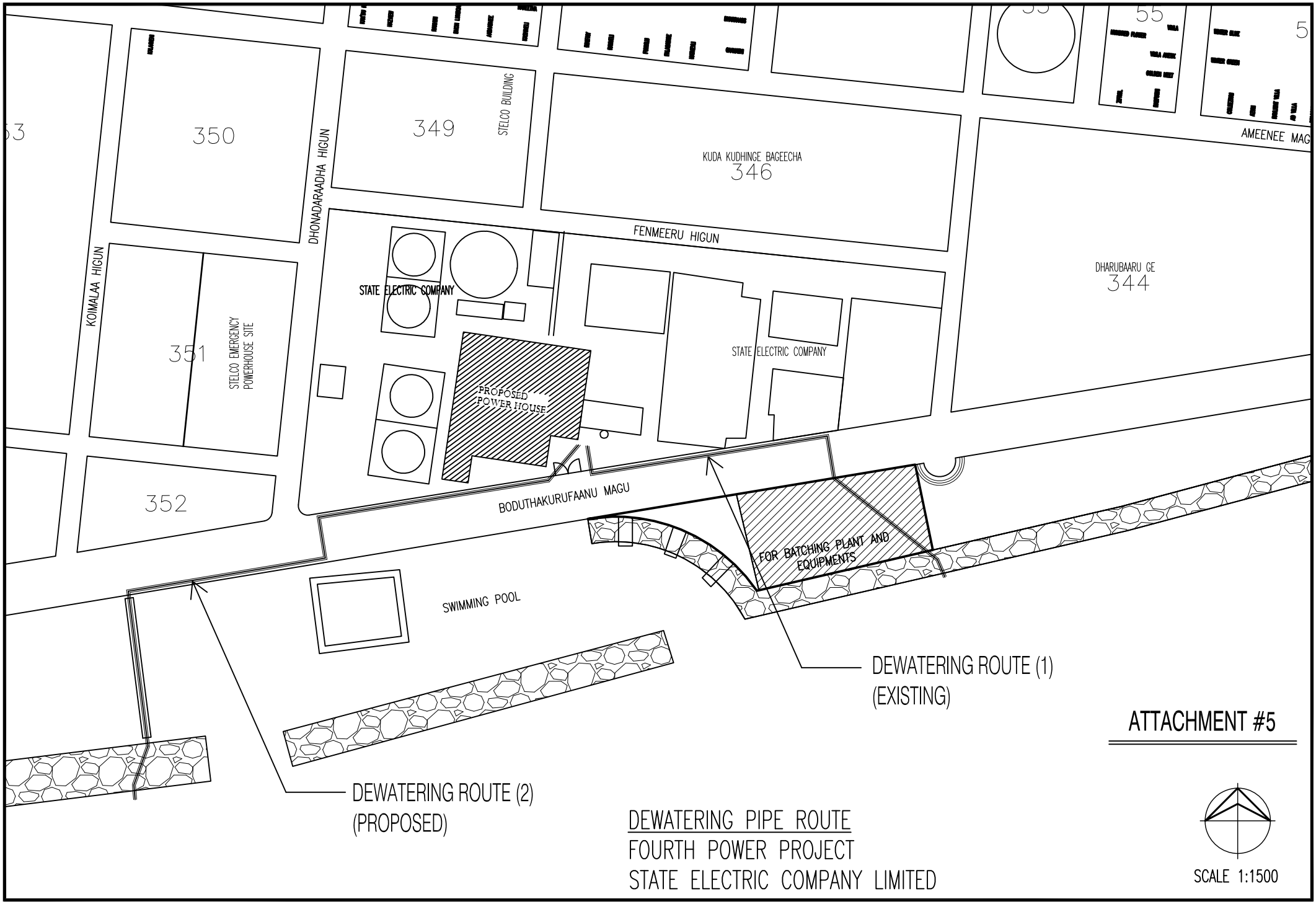
*. CONCRETING OF POWER HOUSE FOUNDATION
*. CONCRETING OF STACK FOUNDATION
*. CONCRETING OF GENARATER FOUNDATION
*. CONCRETING OF UPEER FLOOR SLABS

ATTACHMENT #04



STRUCTURAL ELEMENTS TO BE CAST USING THIS ARRANGMENT

*. ALL THE MINOR CONCRETING WORK



ATTACHMENT #5

DEWATERING PIPE ROUTE
FOURTH POWER PROJECT
STATE ELECTRIC COMPANY LIMITED

SCALE 1:1500