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Complementary report on the

EIA of Phase B of Larnaca Sewerage System

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1 Introduction

The following report is a complementary document to the Environmental Impact Assessment relating to the construction and operation of Phase B of Larnaca Sewerage System. The assessment relates to the relocation of Pumping Station X1 form the initially proposed location, as well as the setting up of two additional pumping stations.

The Report was prepared by Atlantis Consulting Cyprus Ltd.

Description of the Pumping Stations

All the pumping stations shall be constructed with C30/20 reinforced concrete, and submerged pumps will be used. All pumping stations will function automatically.

All pumping stations are designed with the following equipment:

- Backup pumps
- Backup generator
- Ultra sonic and float level switch
- Automatic alarm systems providing warning signals both at the site and at the control centre established in the waste treatment plant, as well as text messages to the telephones of in-service technicians.

The smaller pumping stations will have one main and one backup pump. Under normal operating conditions, the pumps will function on an alternative basis. This will also help achieve control of the backup pump function. Any change to the function shall be notified to the control room, operating in the waste treatment plant, as an alarm signal.

The larger pumping station will have two or more main pumps plus one backup pump, and they will function automatically using a similar system. Therefore, if there is an outage in one pump, there will always be a backup pump available.

Standard pumping station drawings are presented in Annex 1.

The sewerage system is fitted with a telemetry system also identifying problems to the pumps. The information is transmitted to the control room. The telemetry system also notifies the in-service engineer through a text message concerning any pump function problem identified. The system aims at identifying problems immediately so as to enable timely performance of corrections and repairs, thus preventing any interruption in the flow of waste.

To ensure protection against possible power outage, all pumping stations have generators with an automatic switchover capability. This process includes cutting off power supply to the pumps, starting the backup pumps and connecting them to the generator. The system shall continue its function on power from the generator, just as it functioned previously on normal power supply.

1.1 Pumping Station X1

Pumping station X1 will collect the flow from the Makarios III neighbourhood and two discharge basins in the west (Annex 1, Map 1). There are three alternative locations for pumping station X1 (Annex 2).

The first alternative location is at the western administrative boundaries of the area of Larnaca, and the second one is at the northern boundaries of the area of Dromolaxia. Both locations are adjacent to the administrative boundaries of the area of Aradippou. In the EIA of Phase B of Sewerage System, a proposal was made for setting up the pumping station in block 1654, which is at the administrative boundaries of Aradippou (pumping station PSBH-6).

Blocks have been separated and the required roads have been constructed in the area in question. The adjacent block in the west of the project has been reserved as an open greenery area. There is also a park area approximately 100 m in the west, which has not been arranged yet. Moreover, the Department of Antiquities is said to intend to set up lights in the ancient aqueduct and arrange the surrounding area.

Residential buildings and small blocks of flats are emerging in this gradually developing area.

The first alternative (X1 alt. 1) is at Lapithou Street, in block 2356 (Annex 1, Map 01).The block is within the protection Zone of Alyki (Da2), which also coincides with the boundaries of the RAMSAR area of Alykes of Larnaca.The block has been affected greatly by human activity and has very few wild plants (Photo 01).The northern part of the block proposed for

setting up the pumping station is a natural hill.With regard to setting up the pumping station, it is proposed that it is positioned at a depth of approximately 2 m.

Photo 01

The second alternative (X1 alt. 2) is in block 226, which is also within the protection Zone of Alyki (Da2).The block is adjacent to a dirt road, which branches off Lapithou Road (Annex 1, Map 01). The proposed area is covered by cereal crops.The block is on a small hill, approximately 3 m high, and there is a small stream at the foot of the hill flowing towards the old aqueduct, where there are reed colonies.In Photo 2, the block is behind the reed colonies.

Photo 02

Waste from alternatives 1 and 2 will be flowing initially under pressure, via a pipe routed along Acharnon Road up to the crossroads with the Agiou Polykarpou Road and then it will flow by gravity.

The third alternative location (X1 alt. 3) is at the south-western boundaries of the Makarios III neighbourhood. The proposed location is within Zone Ca4, which is adjacent to the protection Zone of Alyki (Da2) in the south and to the residential zone Ka5 in the north-northwest (Annex 1, Map 01). Due to the higher altitude of this location, it is inappropriate for collection of discharges from the area of Aradippou. The proposed project site is covered by cereal crops.

The pumping station locations are presented in Annex 2, Drawing 1 and in Annex 1, Map 01.

There is part of an ancient aqueduct approximately 200 m far from the proposed location (Photo 03).

It should be noted that the area lies at a lower altitude and is the natural discharge area of waters from the lands in the area of Larnaca, which will be served by the pumping stations. It is also appropriate for collection of discharges from the area of Aradippou. That is why the Larnaca Sewerage Board feels that the pumping station should be set up at one of the alternative locations 1 and 2, so that it can serve the area of Aradippou too in the future, should the need arise. Should one of these locations be chosen, the Board intends to design the project so as to be able to serve additional loads from the area of Aradippou.

1.2 Pumping station S11

This pumping station will be set up in block 873, beside Tasou Konstantinou Road. The block is in Zone Ka4 (Annex 2, Drawing 2). The surrounding area is marked with intense residential development, consisting mainly of independent two-storied houses.

It should be noted that the block is large enough to host the construction site. Moreover, under current conditions it creates an ugly picture and therefore it is necessary to carry out face-lifting and landscaping works during construction.

1.3 Pumping station X2

The pumping station will be set up in block 1706, between Palmyros and Thasos roads (Annex 2, Drawing 3). The block is in zone Ka5 and is adjacent to the protection Zone of Alyki (Da2) in the east. It should be noted that currently there is no road to connect Alyki and the project block. There is Megara Road, however, which is vertical to Palmyros and Thasos roads and stretches parallel to Alyki and is interrupted in front of the project block.It is possible, however, that a connection between the two sections of the road is constructed at a certain stage, with an extension in front of the block in question.

2 Description of the Environment

2.1 Aesthetics and landscape

Both the three alternative locations proposed for pumping station X1 and the area of pumping station X2 are at the boundaries between the residential development area and the protected area of Alyki.

In the south and east of pumping station X1, there is an open view to cereal crop areas (Photo 01).A very important parameter relating to the aesthetics and character of the landscape in the area of alternative locations 1 and 2 is the presence of part of an old aqueduct, which is approximately 200 m away (Photo 03).

Photo 03

Alternative area 3 has an open view to agricultural crops and Alyki (Photo 04).

In the pumping station area there are mainly weeds (*Plantago lagopus, Hordeum murinum, Bromus intennedius, Bromus sterilis, Polygonum aviculare, Phalatis minor, Calendula arvensis, Capsella busra-pastoris).*In the north of the pumping station area there is Kamares (Photo 05).In the west, the area is surrounded by one-storied and two-storied houses (Photo 06) and in the east there is an open view to the northern parts of the area of Alyki (Photo 07).

Photo 05

Photo 07

Pumping station S11 is in a residential area in Larnaca, consisting mainly of two-storied houses and blocks of flats with residential apartments.

The pumping station area appears to be downgraded and creates an ugly picture in the area.The area is presented in Photos 08 and 09.

Photo 08

Photo 09

Photo 10

2.2 Flora

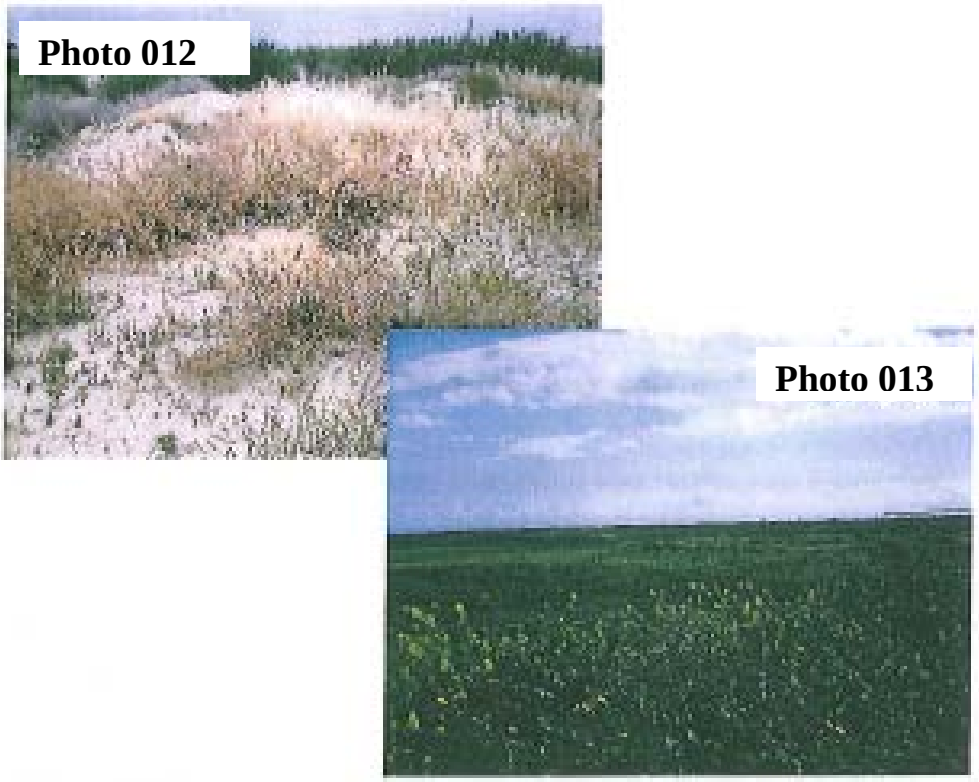
The area of pumping station S11 is in a residential block within the residential areas of Larnaca and is of no interest at all in terms of flora.In the area there are, inter alia, individual plants of the following species: *Plantago lagopus, Hordeum murinum, Bromus intermedins, Bromus*

sterilis, Polygonum aviculare, Phalaris minor, Calendula arvensis and *Capsella busra-pa* **Photo 11** as planted trees, mainly olive trees **(Photo 010).**

The proposed areas for pumping stations X1 and X2 are at the boundaries of residential areas and are marked with significant human intervention.Therefore they are of no interest in terms of the flora hosted therein.

In the area of the alternative locations 1 and 2 proposed for pumping station X1, there is a small stream flowing to the aqueduct.Human intervention is obvious, mainly through the presence of cereal crops.The bed of the stream has been reduced significantly due to the separation of plots of land and the cultivation of cereal crops, and is also crossed by a dirt road.There are reed colonies in certain small parts **(Photo 011).**

Block 2356 has been affected and has not plants other than weeds, as a result of stress and disposal of debris, whereas block 226 is covered by cereal crops **(Photos 012-013).**



The area of alternative location 3 is also covered by cereal crops (Photo 014).

2.3 Acoustical environment

With a view to assessing the acoustical environment in the areas proposed for the pumping stations, onsite visits were paid and the analysis contained in the EIA for Phase B of Larnaca Sewerage System was also used. Pumping stations X1 and X2 are at the outskirts of the protected Zone of Alyki, Larnaca, in areas marked with low density residential development. Pumping station S11 is in a residential area in Larnaca and is marked with residential development of suburban nature and density. The areas in question have no central roads and are marked with limited road traffic volumes. No other significant sources of noise have been identified in any of these areas.

In accordance with the above, noise in the areas assessed is due to local road traffic and therefore they can be designated as suburban low-noise areas. Noise in these areas is expected to reach Lden levels of the order of 45-50 and Lday levels of the order of 50-60 dBA, whereas the area of pumping station S11 will be at the upper noise levels given. Noise levels at night are expected to reach 40 dBA (Lnight).

2.4 Antiquities / protected areas

Immovable antiquities designated as Ancient Monuments, relating to the wider pumping station areas are Kamares at Larissis Road, which are approximately 500 m far from the location of pumping station X2 and parts of the remains of the Aqueduct which is less than 200 m far from the alternative locations 1 and 2 of pumping station X1.

The locations of pumping stations X1 (alternatives 1 and 2) are within protected zone Da2.

The protected zones are presented on the Zones Map (Map 01) in Annex 2.

3 Impact Assessment

3.1 Aesthetics, landscape and flora

The pumping stations are small-size structures, typically as big as a small house or even smaller. However, industrial type structures and the practice used for covering the perimeter of pumping stations with plants created a negative picture at the site. In Phase B, high architectural specifications were used, in compliance with the aesthetics of pumping station sites, which minimises the negative impacts of projects. Following is a more detailed assessment of the aesthetic intervention relating to the proposed pumping stations.

3.2 Pumping station X1, *Alternative Locations 1 and 2*

This area is at the boundaries between the residential development area in the north and west and the protected area of Alyki in the south and southeast. The project block is adjacent to an open greenery area, and a park has been positioned at a distance for approximately 100 m, which has not been constructed yet.

Despite not being of interest in terms of biodiversity, block 3356 is within zone Da2, and therefore its use for the purposes of the project constitutes an intervention to the protected area of Alyki. However, the block has already been affected by human activity to a significant degree. At the same time, there is a dirt road at its southern boundaries which tends to block it both visually and functionally from the rest of Zone Da2. In view of the above, it is estimated that the construction of the pumping station in the area will not impose a substantial additional burden on the protected area of Alyki. Block 226 is covered by cereal crops and is of no interest in terms of flora. Nevertheless, the presence of the stream in the south tends to isolate it from the residential development zones and constitutes a more direct intervention to the protected area.
In addition to flora, special attention should be given to the presence of the remains of the ancient aqueduct. The project cannot have any impacts on the integrity of the aqueduct. The presence of the pumping station, however, may affect the aesthetics of the area and may be incompatible with the future plans of the Department of Antiquities for installing lights in the aqueduct and carrying out face-lifting works on the site. It may also partially block the view to the aqueduct from the residential areas.

Block 3656 is adjacent to the residential area and is also adjacent to Lapithou Road, which tends to reduce the aesthetic sensitivity of the site and makes it easier for integrating the pumping station in the residential area. On the contrary, it is believed that the presence of the pumping station in block 226 will result in a greater intervention to the landscape. First, it will be on an isolated small hill, which will make it conspicuous. Moreover, the fact that it is in the south of the stream will isolate it from the residential development zones and will strengthen the impression of an intervention to the protected area. It is also believed that it may have a greater impact on any future efforts made to face-lift the area and promote the aqueduct.

3.3 Atmospheric pollution

Odours may be the most significant source of disturbance during the operation of the project. That is why the Sewerage Board takes significant measures with a view to reducing and monitoring odours, which tends to reduce the impacts. Nevertheless, the area of pumping station S11 appears to be particularly sensitive as it is surrounded by a densely developed residential area.

Pumping station X1 will collect fresh waste, which tends to reduce the putrescibility of waste and therefore odours. It should be noted, however, that the Board has stated that, should one of the alternative locations 1 or 2 be chosen for pumping station X1, the pumping station will be constructed so as to be able to serve possible additional loads from the area of Aradippou in the future. In that event, the amounts supplied up to that connection will be clearly lower than the design flow capacity of the pipeline, which will result in the waste staying in the pipeline for a longer period of time. Therefore this is expected to increase the putrescibility and odour of waste. The frequent northeast winds blowing at night and early in the morning will possibly reduce the odours carried towards residential areas. A certain amount of disturbance is expected though.

Dust may constitute a possible cause of disturbance for limited periods of time during construction.

3.4 Water and soil pollution

The possibility of overflowing of the pumping station is deemed to be very remote, given the telemetry systems, automations and backup pumps and generators installed. It cannot be excluded altogether though. The following risk assessment on the basis of a worst-case scenario.

In such an improbable case, the maximum possible amount of waste which can possibly leak into the environment has been estimated in accordance with a worst-case failure scenario.

The following assumptions were made for the calculations:

- A maximum malfunction time of 1 hour.
- An hourly flow of waste during failure estimated at 100% of the maximum flow capacity of the pumps. Given the above, the maximum

hourly flow of waste to the pumping station is 143 m^3 at X1 and 50 m^3 at X2.

- The sewerage system is independent of the stormwater discharge system and it will be impossible for stormwater to enter the sewerage system.
- Pumping station S11 is a stormwater pumping station with a maximum hourly flow of 2880 m^3 at S11.
-

In the event of failure and acknowledging that the gravity pipelines are full by 35% of their capacity, the maximum volume of waste to escape will be equal to 65% of the hourly maximum supply capacity, i.e. 90 m^3 at X1 and 32 m^3 at X2. Given the large volume of discharges, stormwater may cause flooding in the surrounding areas in the event of such an accident in the area of pumping station S11. No backup pumps are provided for pumping station S11. It should be noted, however, that the scenario being examined here, is a very improbable worst-case scenario and, besides, the possibility of a failure is also remote as there are three pumps in this pumping station, plus other failure detection and handling measures. Due to the relatively small volume of waste at pumping stations X1 and X2 and taking into account the low frequency of such accidents, it is estimated that temporary soil pollution will be caused, but there will be no significant permanent impacts on the quality of water or the environment in the area. In the case of alternatives 1 and 2 for pumping station X1, however, it is expected that in the event of accident the waste will gather in a nearby stream, which will make it stay in the area for a longer period of time.

It should be pointed out that the possibility of linking the areas of Aradippou to pumping stations X1 has not been studied.

No significant risk of escape of pollutants during construction has been identified. The escape of building materials and debris to nearby roads and houses, however, is a frequent phenomenon in construction sites operating in urban areas.

The escape of building materials and debris and the disposal of materials at pumping station X2 and at the alternative locations of pumping station X1 will downgrade the aesthetics of the sites. Any disposal and sedimentation in the stream flowing near alternative locations 1 and 2 will further downgrade any natural environment still left in the area.

A possible escape of materials at pumping station S11 will increase the disturbance caused to local residents due to the vehicle and pedestrian traffic difficulties, the downgrading of the aesthetics and quality of the urban area, the transportation of earth and other materials to nearby properties and the increase of dust. It should stressed, however, that the block is large enough to set up a controlled storage site for materials and debris.

3.5 Noise

The projects under examination are not expected to create sources of noise-related disturbance.

There will be noise will in the construction phase, both during the movement and operation of machinery and during dewatering procedures, which will have to continue on a 24-hour basis, in the areas of pumping stations X1 and X2 in particular.

The noise from the construction works was estimated according to the English Standard BS 5228:84 "Noise Control on Construction and Open Sites" during preparation of the EIA for Phase B of Sewerage System. The conclusions of the assessment, under worst-case noise emission conditions, are presented in Table 5.2.

Table 5.2: Expected noise levels from construction works on the facades of nearby developments at source-receptor distances of 80.20 m and 10 m [1]

Description	Distance 80 m	Distance 20 m	Distance 10 m
$L_{Aeq(9\ hour)}$, BS 5228, total noise from works at a distance of 10 m, in dB	90	90	90
Noise reduction/increase due to distance, in dB	-18	-6	-0
Noise reduction from obstructions (e.g. buildings), in dB	0-15	0-15	0
Noise increase from facade reflections, in dB	0	0	0
Final noise level at facade, in dB LAeq(9 hour)	59-44	84-72	90

[1] Noise levels at night are estimated to be approximately 5-7 dB lower than the above levels, as the dewatering equipment creates noise of the order of 85-87 dB(A).

The respective levels at night are expected to be 5-10 dB lower, given that only dewatering pumps will function.

In all project areas there are houses at a distance of 20 m or more from construction works. Pumping station S11 is in the most developed area. Therefore, in accordance with the above method, average hourly noise levels will be created ranging between 84-72 dB at the closest receptors, and disturbing noise levels are s expected to be experienced at a distance of up to 60 m.

As referred to above, noise levels in the project area will range between 40-50 Lnight and 65 Lday. Given the above, it is expected that during dewatering activities, the noise at the facade of the closest houses will range approximately between LAeq 70-85 dB (Fixed level). Therefore there will be an additional increase of the order of 20 dBA at the closest houses, and any increase by more than 10 dBA is deemed to be a “significant” impact on the acoustical environment.

The impacts of construction works on fauna will include only temporary removal of animal species. None of the areas in question is deemed to be important for birds.

4 Minimisation measures

For the purposes of the project, the measures proposed in the EIA for Phase B of Sewerage System should be implemented.

In addition, it should be noted that the siting of the projects is an important parameter in terms of environmental impacts. The location of pumping stations is largely determined by technical criteria and is also restricted by appropriate land availability considerations. Three alternative locations have been proposed for pumping station X1. Based on environmental criteria alone, alternative location 3 is better than the other two as it will help prevent any impact on the aqueduct and the setting up of the pumping station in area Da2. Moreover, setting up X1 at the alternative locations 1 and 2 will result in higher energy consumption and carbon dioxide emission levels. Finally, the increased flow capacity of the pumping station at the locations 1 and 2, with a view to making provision for connecting the areas of Aradippou in the future, may possibly create increased odours in the area.

Account should also be taken, however, of the fact that setting up the pumping station at the locations 1 or 2 will help prevent the need for constructing an additional pumping station and

pipeline in the event of connecting the area of Aradippou to the sewerage system of Larnaca. In that event, it is preferable to set up the pumping station at alternative location 1 in the first place. The exact location should be chosen so as to ensure that the pumping station will cause the minimum possible visual disturbance to visitors to the ancient aqueduct. The assessors hold that this can be achieved by positioning the pumping station at the furthest possible location in the northwest.

All pumping stations should be designed in conformity to the aesthetics and architectural principles proposed in the EIA of Phase B of Sewerage System. The following should also be stressed:

- It is proposed that the area of pumping station S11 should be face-lifted and landscaped. Since the block is large, a part thereof could be outside the pumping station fence so as to be used as an open greenery area.
- It is proposed that the pumping station building and fence are delimitated in alignment with the houses at Megaron Road, thus ensuring integration thereof in the area. Furthermore, if there are no plans for constructing a road at the western boundary of the plot, it is proposed to construct a footpath to link the two sections of Megaron Road.
- Should alternative location 1 be chosen for pumping station X1, it is proposed that the pumping station is positioned in the northeast part of the plot. Given the fact that it is close to the ancient aqueduct and within zone Da2, it is proposed that the architecture of the area should conform to a typology that is compatible with the aqueduct, rather than with the nearby residential area.

5 Conclusions

Construction of pumping stations is necessary for the operation of the sewerage system of Larnaca and will help improve the operation of the system, generally with positive impacts on the environment, human health and comfort. No environmental parameters have been identified at the pumping station locations assessed which would require relocation of the stations.

Inevitably, each project will cause disturbances and environmental impacts. In view of this, it is expected to take all required measures during the design, construction and operation of the project with a view to minimising the negative and maximising the positive impacts of the project.

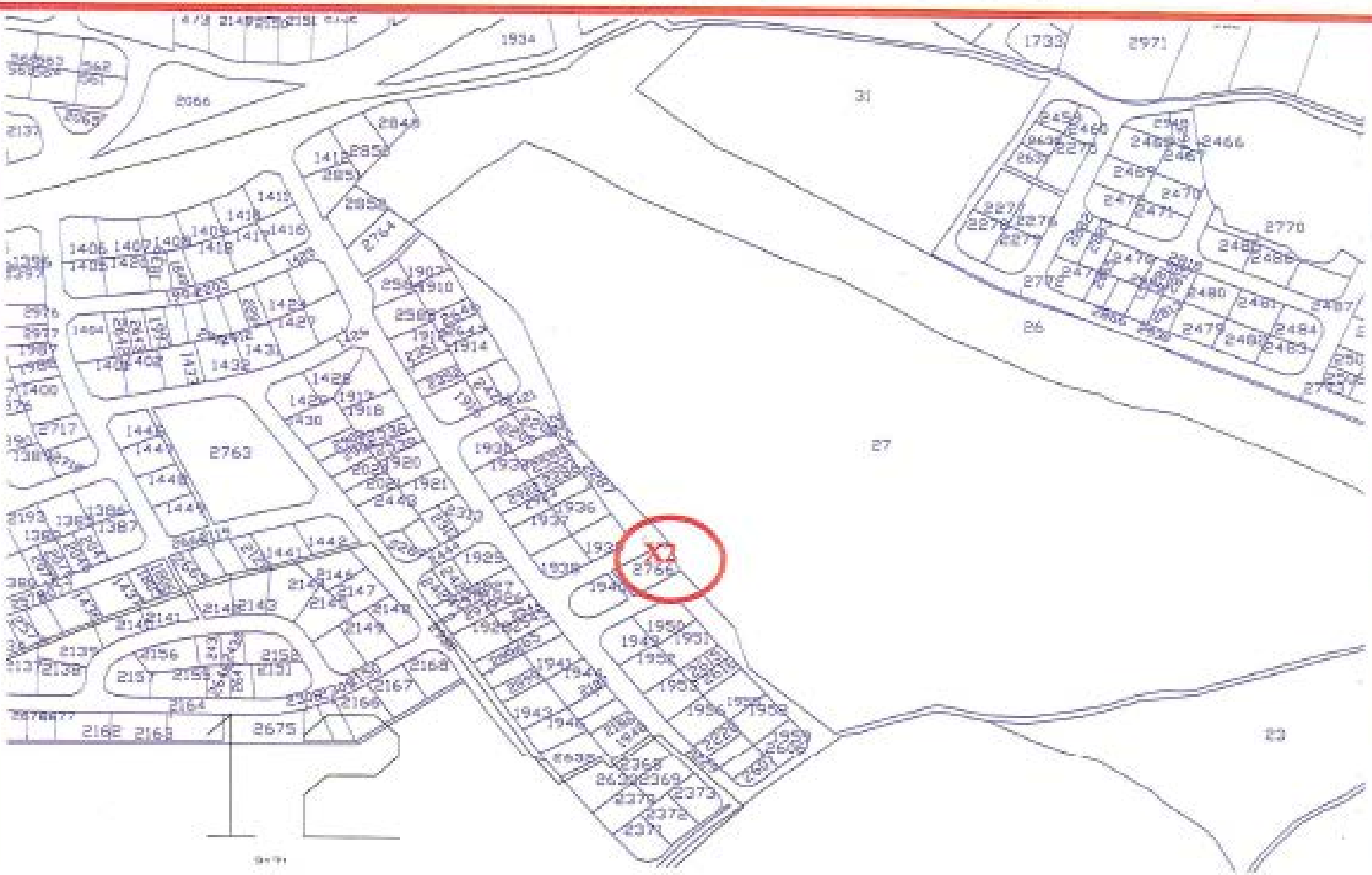
With regard to pumping station X1, as referred to above, alternative location 3 is the preferred one. The Sewerage Board will have to take into account, however, the possibility of connecting the area of Aradippou to the Sewerage System of Larnaca. If this connection is expected to be implemented in the next few years, alternative location 1 should be chosen as it is the most appropriate one.

6 ANNEX 1:

SITING OF THE PUMPING STATIONS

Drawing 1

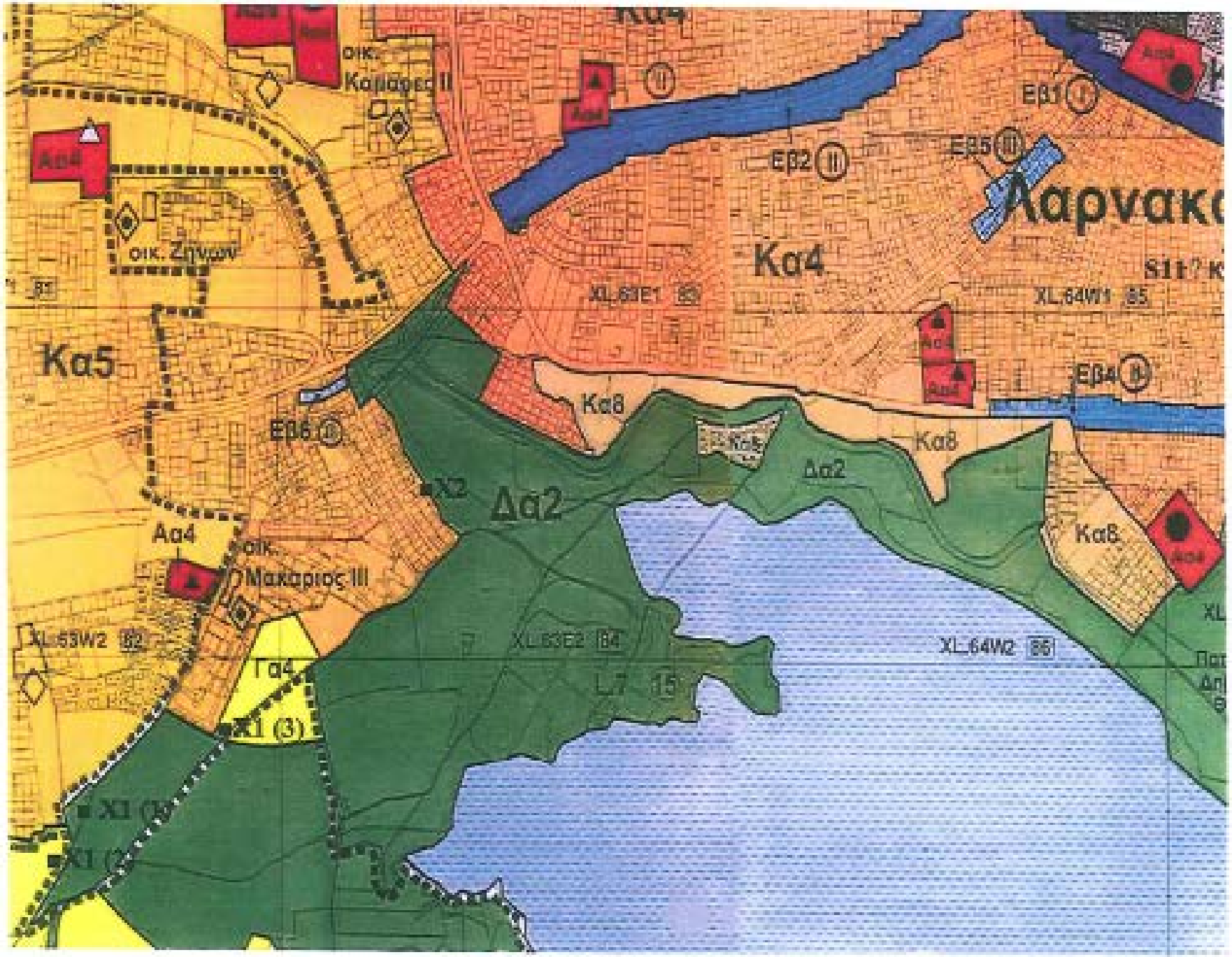
Drawing 2



Drawing 3

7 ANNEX 2:

TOWN PLANNING ZONES MAP



Project :
Complementary report on the EIA of Phase B of Larnaca Sewerage System

Map Title:
Town Planning Zones

Person in charge:
Charalambos Panagiotou

Map No.: 01

Project owner:
Larnaca Sewerage Board

ΑΤΛΑΝΤΙΣ
ΣΥΜΒΟΥΛΕΥΤΙΚΗ