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Criteria and procedure for selecting a site for a desalination plant

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Abstract

Desalination plant site selection is very vital for the design, financing construction and operation of desalination plants under a public private partnership or a Turnkey basis. The site, comprised of inland and offshore parts, (i) must be located in a place where access and interconnections to the power supply grid, (or independent power production) and to the water supply networks are technically and economically feasible, (ii) the area extent and shape (size and geometry) must be the appropriate so that the marine intake head structures, the marine pipelines, the inland pit the seawater pumping station, the inland pipelines, the main facility structures, the post treatment system, the product delivery sub-system, and the power supply system (IPP or national grid substation) are adequately accommodated and optimally located so that civil, electrical, piping interconnections and other works costs are minimized, (iii) be suitably located in a marine environment where adequate quantity of feed water with a reasonable good, uniform and steady quality of feed seawater is abstracted at a reasonable cost, (iv) be at a location where the brine, backwash wastewater and other wastes are disposed without environmental adverse effects, (v) geologically and topographically are suitable for the construction and erection of the various structures at reasonable costs, (vi) environmental, town planning and rural planning regulations, law requirements and restrictions are met, (vii) the desalination plant shall have the social acceptance of the neighboring communities and other authorities and finally (viii) the local taxes are not prohibitive and the existing infrastructure shall make easier and cheaper the project implementation.

This paper presents and analyses the site needs to accommodate a desalination plant, the need for the early site selection, the identification of the concerned partners, the composition and set up of the special committee, the terms of reference to the special committee, the criteria that should be taken into consideration, the time period, and the procedure to be followed for the selection of the most appropriate site. The selection of a technically, economically, environmentally and socially accepted site shall reduce the risks involved in the design, construction, the operation and maintenance of the project and generally decrease the unit cost of water.

Keywords: Site selection procedure; Special committee; Concerned partners; Environment impact assessment studies; Technical criteria; Economic criteria; Environmental criteria; Social criteria

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1. Introduction

Desalination is becoming an alternative water supply source in many Mediterranean countries, whose natural water resources are not enough to satisfy the increasing demands for sustainable development. Countries like Cyprus, Israel, Malta, Italy, Spain and others, constructed and put into operation seawater reverse osmosis desalination facilities for meeting the growing water demands or for making up the reduced supplies from their decreasing natural water resources due to climatic changes. With the desalination process becoming less expensive due to technological advances, it is obvious that more and more plants shall be constructed in the future. Since the raw water for desalination is in most cases abstracted from the sea, the plants are located on the coastal areas provided they are fulfilling certain technical, environmental and economical requirements and they are accepted by the local populations. Coastal areas in many parts of the Mediterranean region and of the world are densely populated, with high quality tourist development and in other cases with high water demand industries such as power stations, turning the land a very valuable pieces of property. The desalination plants are usually viewed as factory like constructions, causing the negative reaction of the population and the communities claiming that such works cause environmental degradation, and affect negative the commercial value of their property, neglecting the fact that water is a basic requirement for a sustainable development for their own benefit and the country in general. This paper proposes a procedure that involves the local communities, the regional authorities and all concerned with environmental, social and economic issues safeguarding a rational approach so the site selected fulfills the technical criteria and takes into account the environmental, social, and economic concerns.

2. Area requirements for the construction of the desalination

A desalination project is usually made up of eight subsystems such as the (i) the seawater intake system (open sea intake including intake structures and marine pipelines, beech wells or infiltration galleries); (ii) the intake pumping station and seawater pipelines (underground intake pit, pumps and pipelines); (iii) the pretreatment plant (gravel filters, micronic filters, chemical feeding system, the booster pumps to the RO building); (iv) the RO building (which houses the high pressure pumps, the energy recovery system, the membrane's pressure vessels trains, the membrane cleaning system etc.); (v) the intermediate treatment reservoirs (degasifier tanks and post treatment plant with storage tanks and product supply pipelines; (vi) the brine discharge sub-system; (vii) the office and control building and storage areas and (viii) the power supply sub-system. Fig. 1 shows a schematic layout of the projects subsystems, subdividing the desalination plant site into sub-sites A to H as follow.

(a) *Sub-site A*: This is the land on which the main components of the desalination facility shall be constructed, and include the sub-systems of pre-treatment plant, the reverse osmosis building, the intermediate treatment tanks, the post treatment and product pipeline, the office and control system and if required the power supply system. The extend of land for this sub-area required varies according to the size of the plant and the process (pre-treatment, reverse osmosis building, the post treatment, the office and control rooms, the spare parts storage area, the power supply substations and in some cases the independent power production plant, the pipelines within the site and the various tanks etc.). This land should be preferably flat, have good foundation properties, easily excavated, slightly elevated above the mean sea level and hydro-geologically

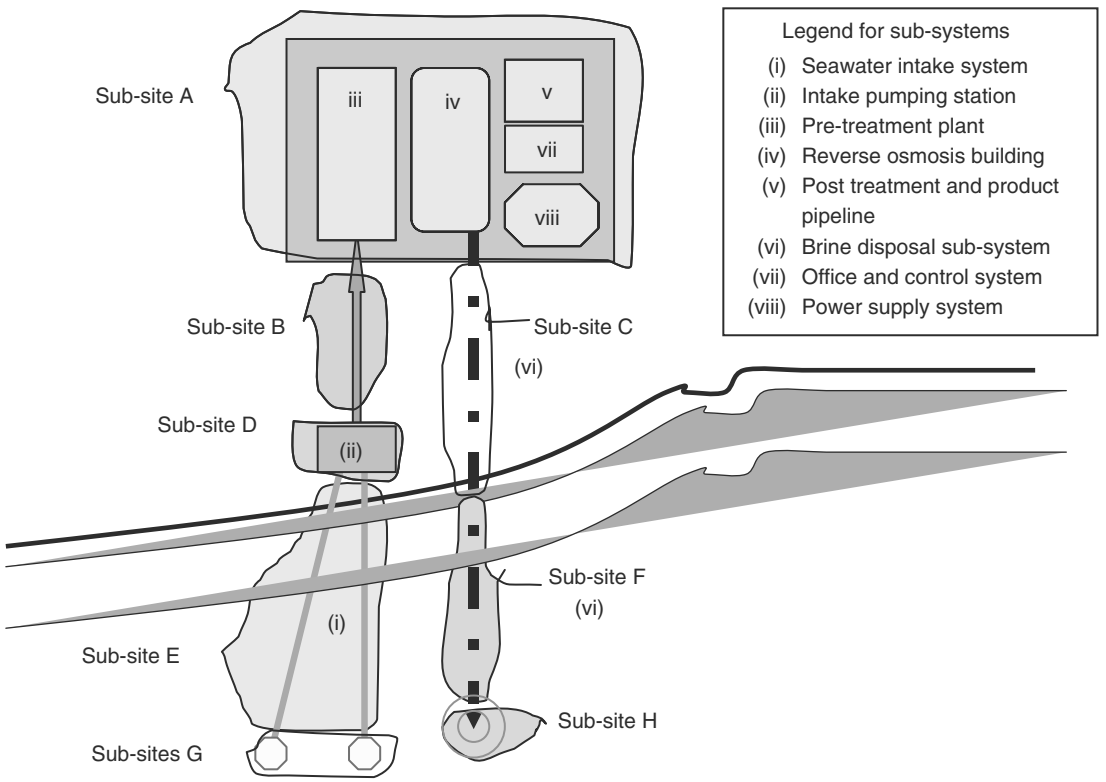

Fig. 1. Sub-site components of a reverse osmosis desalinations plant.

should not pose a danger for pollution to the underground aquifer. From the environmental point of view it should not have rare species of flora, or declared as an environmentally conservation area, and should not be part of an archeological area, relatively away from inhabited areas, easily accessed, closed to the main water supply pipelines and easily fed with power in case the power shall be from the national grid or easily fed with fuel in case an independent power plant is provided.

(b) *Sub-site B*: This is the land on which the inland seawater-in pipelines shall be installed. This land is usually a strip of land extending from the intake pumping station to the pre-treatment plant. This land shall be suitably excavated for the installation of the pipelines and should not be part of an environmental conservation area.

(c) *Sub-site C*: This is the land on which the inland brine-out pipeline shall be installed. This land is usually a strip of land extending from the reverse osmosis building to the brine disposal outlet if outlet is situated on the shore or to the marine pipeline. In some cases sub-site B and sub-site C are running partly parallel for some length, where in other cases where the desalination plants are collocated with power stations this is usually the same as the heating water return flow conduit of the power station. This land, where needed shall be suitable for trenching and installation of the pipelines and should not be part of an environmental conservation area.

(d) *Sub-site D*: This is the land on which the intakes pit and the pumping station shall be constructed and it is usually located next to the seashore line. The intake structure requires an underground pit (up to a depth of 10–12 m), for which special operations shall be carried out during the construction phase such as deep excavation, sheet piling or concrete wall piling and dewatering etc. The geology of the area should be examined and the excavation should not be through hard rock.

(e) *Sub-site E*: This is a strip of seabed on which the marine intake pipeline(s) shall be installed. In many cases the installation of the marine intake pipelines is done in a trench for pipeline protection purposes, which means that the bottom of the seabed must be excavated. Therefore the seabed must have certain characteristics to facilitate the installation and anchoring of the marine pipelines. Environmentally this site should not be of great importance and special precautions may be needed during construction to reduce adverse environmental impacts.

(f) *Sub-site F*: This is a strip of seabed on which the marine brine-out pipeline(s) shall be installed. In many cases the installation of the brine out pipelines is done in a trench for their protection purposes, which means that the bottom of the seabed must be excavated. Therefore the seabed must have certain characteristics to facilitate the installation and anchoring of the marine pipelines. Environmentally this site should not be of great importance similar conditions must be valid as in sub site E.

(g) *Sub-site G*: This sub-site may include one or more plots at the bottom of the sea, at the outer end of the marine intake pipelines for the installation of the open intake structures. Since the intake head structure may be made from a heavy concrete structure the geological structure of the seabed should be suitable for security and stability of the head structure. The head intake structure should not be closed to point pollution areas, or in port, or much closed to a port or oil unloading areas, neither in marine line routes, in sea cross current areas, or near the brine disposal point. The head intake structure location is very critical for the quality of the seawater abstracted for desalination. Environmentally this site should not be of great importance.

(h) *Sub-site H*: This sub-site, of-shore at the outer end of the submarine brine-out pipeline, situated at the bottom of the sea is required for the installation of the brine discharge structure if required. In some cases where the desalination plant is collocated with power stations this sub-site is not needed. For the direct discharge of the brine directly in the seawater body, the conditions should be suitable for quick mixing of the brine, dilution and diffusion of the salt with the water body, avoiding the creation of high salinity pockets. Environmentally this site should not be of great importance.

Each sub-site has its own physical, technical and environmental characteristics such as the elevation from the sea, distance, slope, land cover, surface soil and subsoil structure and foundation capabilities, ease of excavation for trenching, seabed slope and seabed soil and subsoil formation, seawater quality, marine life and vegetation, direction of waves and undercurrents, other structures in the vicinity, outfalls to the sea environment etc. These characteristics have to be evaluated and checked to find out if they meet the technical, environmental and socioeconomic requirements of the plant.

3. Importance of the plant site

The site on which the desalination facility shall be constructed has to fulfill certain criteria and requirements set by the various stakeholders. For the designers, and the owners of the plant it should meet certain technical, economic and

environmental criteria to make the project technically feasible and economically viable, for the central government to meet certain minimum environmental and social criteria, for the local communities to secure their social environmental and economic concerns, where for the rest of the stakeholders to fulfill general environmental, town planning and social requirements. Beyond these general requirements the national and local governments are imposing specific technical, environmental and social requirement for the issue of the relevant permits and licenses for the construction and operation of the facilities. The nature of demands and setting of the criteria and the role of each stakeholder in the selection of the desalination site should be clearly defined from the beginning, so that they are well stated and taken into account in the process. Therefore it is important to draw a list of the stakeholders to be involved in the process of the site selection, define their role and set up the procedure for taking decisions during the process. The procedure to be adopted should be practical, non time consuming, transparent and each step has to be completed within certain time period, during which all concerned stakeholders should give their views irrevocably and in a responsible manner. The early selection of the plant site shall enable the client (government) to invite tenders for the installation of the plant on a site whose capabilities are well known limiting the risks of the tenderer and making easier and quicker the evaluation and comparison of the tenders submitted.

4. Proposed procedure for the selection of the most optimum plant site accepted by all

With the above in mind a procedure is proposed which shall safeguard the following:
(i) The participation of those stakeholders' having a legal, social, economic and social interest in the decision making process for the selection of a suitable site for the installation of a desalination plant "Concerned Parties".

(ii) A step by step procedure with time limits and involvement of all stakeholders in a constructive and transparent manner, providing the environment for active participation at each step of the procedure and decisions taken in agreement between the partners.

(iii) The appointment of a special committee made up of specialists on their subject, capable of expressing an expert opinion on the various issues, whose composition and appointments shall be at the approval of all "Concerned Partners".

(iv) The setting up of criteria approved by all parties for the selection of the potential sites, the execution of preliminary site selection studies, the selection of the most potential sites and finally the execution of the detail site selection studies for the most potential sites, and finally the preparation of the final site selection study for the selection of the most optimum site accepted by all.

(v) The preparation of environment impact assessment studies (EIAS) by an independent consultant, selected jointly by the concerned parties, in accordance with the terms of reference proposed by the special committee and approved by the "Concerned Partners". The final selection of the site is done jointly by the client and the "Concerned Partners" based on the evaluation study of the final site selection study prepared by the special committee.

In the procedure "Concerned Partners" means the client the institutions, organizations, NGO's and authorities that have legal, technical, economic, environmental and social interest in the execution of the desalination plant. The concern parties are the following: (a) The client, the entity for whom the plant shall be constructed i.e. government or local authority; (b) local authorities on whose land perimeter the plant shall be constructed; (c) the environmental organizations government and NGO's; (d) the local communities; and (e) the physical or legal persons whose economic interests are at stake. Each of the parties shall be

a partner in the concerned parties who shall collectively decide on each step of procedure.

Before the procedure is implemented the client shall form the "Concerned Partners" team by inviting all parties having interest in the construction and operation of the desalination plant to appoint a representative in the team. The proposed ten steps procedure for the selection of the site is the following (see Fig. 2):

Step 1: The "Concerned Parties" team shall set up a special committee and define its terms of reference. This committee shall carry out all the studies, except the environmental impact assessment study. (Time T0).

Step 2: Set the criteria for selecting the "potential sites". The criteria shall be proposed by the special committee and shall be approved by the "Concerned Partners" team. (Finish time, T1 = T0 + 1 month.)

Step 3: Based on the criteria select a number of "potential sites" (by the special committee). (Finish by T2 = T1 + 1 month.)

Step 4: From the "potential sites", based on the preliminary site selection studies, carried out by the special committee, select the "most potential sites", around three sites. These sites should meet the technical requirements, have the minimum environmental impacts and be acceptable by the "Concerned Partners". (Finish by T3 = T2 + 1.5 months.)

Step 5: For each of the "most potential sites" the special committee shall carry out detail site selection study. (Finish by T4 = T3 + 2 months.)

Step 6: The special committee shall draft the terms of reference for the environmental impact assessment study. These have to be approved by the "Concerned Partners". (Finish by T5 = T0 + 3 months.)

Step 7: Invite tenders and select an independent consultant to carry out the environmental impact assessment study. (Finish by T6 = T0 + 4 months.)

Step 8: For the "most potential sites" (3) the independent consultant shall carry out the environmental impact assessment studies (EIAS). (Finish by T7 = T0 + 6 months.)

Step 9: Using the SSS and the EIAS Studies the special committee shall be prepare and submit to the "Concerned Partners" the final site Selection report containing in summary the advantages and disadvantages of each of the most potential sites and the ranking of the sites starting with the most suitable to the less suitable from the point of view of environmental impacts. (Finish by T8 = T0 + 8 months.)

Step 10: The final selection of the site shall be taken by the client with the consent of "Concerned Partners" based on the final site selection study of the special committee, taking into consideration the economical and technical issues and after further considerations (Finish by T9 = T0 + 10 months.)

The above procedure should follow very closely the time limits so that the procedure ends on time. The total period required is estimated to vary from 6 to 12 months depending on the details required and the number of sites to be examined.

5. Composition and terms of reference of the special committee

The special committee shall propose the criteria for selecting the potential sites carry out the "Site Selection Studies" and prepare the final site selection study based on the site selection studies and the environmental impact assessment studies. The committee shall be made up from a water engineer, a process and desalination engineer, a rural or town planner, a geologist, a pedologist, a marine biologist, a mechanical engineer, an electrical engineer, a geo-hydrologist, a marine engineer, an environmentalist, an economist a

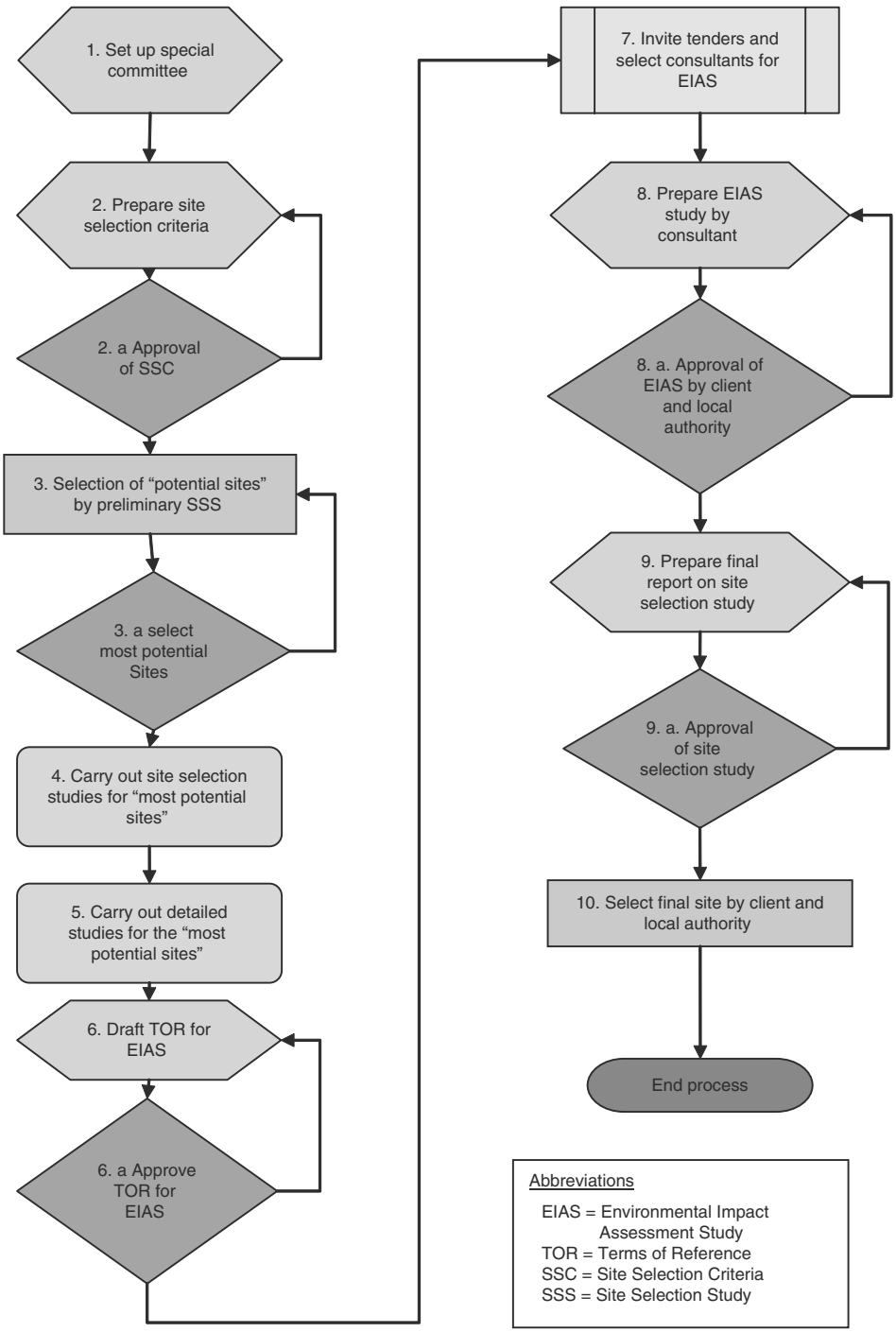

Fig. 2. Flow chart indicating the proposed process for site selection.

quantity surveyor and other specialists according to the need. The committee shall be proposed by the client and its final composition should be accepted by the "Concerned Parties". The terms of reference of this team shall be drafted by the client, approved by the "Concerned Parties" and shall include the drafting of the criteria for the site selection, the selection of the "potential sites", the execution of the preliminary site selection studies and the proposal for the selection of the "most potential sites" the execution of the detailed site selection studies for each of the most potential sites, the drafting of the terms of reference for the environmental impact assessment study (to be carried by an independent consultant) and the final report containing proposals for the selection of the site.

6. Technical requirements of seawater reverse osmosis desalination plant

The design and operation of a seawater reverse osmosis desalination plant requires the supply/connection to the following.

(a) *Good quality clean raw seawater*: Seawater for desalination may be taken through an open sea intake or beech wells or infiltration galleries. Generally the quality of the seawater abstracted through beech wells is much better than the quality of the water abstracted through an open intake, but the choice between open intake or beech wells shall depend on the geo-hydrology of the area, (whether there is connection between the sea and the coastal aquifer), the seabed topography and the relative location of the intake. For big volumes of seawater the open sea intakes are better suited since the beech wells have a high risk of upsetting the balance between the sweet and seawater balance. The quality of the seawater should be good and uniform to safeguard the continuous operation of the plant.

(b) *Connection to the sea for brine discharge*: One of the by-products of the SWRO plants is the brine with salt content usually twice that of the seawater. Periodically the brine contains chemicals that are discharged during the backwashing of the pre-treatment plants, during the membranes cleaning and during the post treatment backwash of the lime reactors. The brine containing the usual seawater salts and periodically the other chemicals has to be discharged to the sea, at a certain depth and in a location so the effect on the marine environment is minimized. In some cases where the desalination plant is collocated with power stations the discharge of the brine is made much easier.

(c) *Supply of power*: Since the desalination process requires a lot of energy the plant should be located in the vicinity of a power plant or high voltage power lines. In case the plant shall have its own independent power plant (IPP) the requirements of the power plant for fuel, cooling water and others should be considered together with those of the SWRO plant.

(d) *Connection to the public water supply system*: The desalination plant has to be connected to the public water supply system for the discharge of the desalinated water. The public water supply system should have the necessary capacity (flow and pressure) to accept and transfer the desalinated water.

(e) *Access to the public road network*: For the construction and operation of the desalination plant an adequate access to the public road network is required. Therefore the land on which the plant shall be constructed should not be in a "remote area" but in an area close to an existing high quality public road network.

7. Environmental and other requirements

Although environmental issues in connection with the construction and operation of the desalination plant are not very critical it is known that the plant produces high level noise, and treats high volumes of chemicals with a very small risk of chemical hazard. These attributes of the plant

cause concern to the communities in whose boundaries the plant is build and either object to the construction of the plant in their boundaries or demand that special measures are taken to mitigate or minimize the adverse impacts and hazards. Another concern is the requirement of high electric energy whose production increases the CO_2 emission to the atmosphere at the power plant. The environmental impacts during the construction and during the O&M may be different and the processes should be carried out with due diligence.

8. Criteria for selecting the site

The site selection committee shall propose the criteria for selecting the potential sites based on the technical, environmental, economical and social requirements and shall be approved by the concerned parties. These shall include among others the following.

Plant site to be out of built-up areas or inhabited areas for safety and environmental reasons: Although high level noise emission equipment and machinery should be housed in closed structures reducing the noise outside, the emission of odors and air pollution are very remote and although the chemicals should be transported, stored, handled, processed and disposed in accordance with the internationally accepted safety procedures, the plants should be out of built-up or inhabited areas for minimizing the danger of exposure of the public to any danger. The plant site should also be out of built-up areas or inhabited areas for aesthetic reasons since in most cases the desalination facilities have a factory like appearance.

Plant site not to be within environmentally sensitive areas: In many cases coastal areas for mere environmental reasons are declared as environmentally protected areas for some specific reason such as for the protection of wetlands or special flora. Therefore the plant should not be located in such areas and should be located in some safe distance.

Plant site to be closed to clean and steadily uniform good quality raw seawater source: The site must satisfy the technical requirement for good, steady and uniform quality seawater. For the location of the site from seawater quality aspect preliminary special studies should be carried out to characterize the seawater quality and the sea behavior with respect to time and depth of water, or to investigate the probability of having beech wells. Seawater should have low silt density index for most of the time of the year, temperature should be steady and within the range defined by the membrane manufacturers (consider the effect of proximity of the intake structure with the cooling water from power plant generations) and the seawater intake structure should not be affected considerable by sea-waves and storms. Intakes should be away from ports, or ports entrances, contamination sources or points of discharge of questionable quality liquids, and the risk of pollution or contamination should be very remote. Open intakes are usually more suitable for large desalination plants.

Plant site to be near to a suitable brine discharge area: Brine is a major byproduct of the desalination process whose quantity is equal or more than the volume of the desalinated water product and with almost double in total dissolved solids (depending on the recovery) and has to be safely disposed. The most commonly used method for brine disposal is the discharge of the brine to the sea for dilution. Since the brine has a salt concentration in most cases twice that of the sea and periodically during backwash and membranes cleaning operations contains additional chemicals used in the pre-treatment (ferric acid poly etc.), in the post treatment and in the membrane cleaning processes (antiscalants), it is important to take care for reducing or minimizing the risk of adverse impacts to the marine environment. In evaluating the vulnerability of the marine environment studies should include submarine coastal profile and steepness, the geomorphology,

the biotic life survey and study (vegetation and benthic marine life), the surface and underwater currents (frequency, direction, and velocity) the composition of the brine salts and chemicals as well the method of discharge. The target is to provide dilution of the brine within very short distance from the discharge point minimizing the adverse effects on the marine environment and in many cases to succeed the quick and effective dilution the brine has been diluted with the cooling water coming from nearby power plant. The physical and biotic characteristics of the marine area at the discharge point and the presence of a cooling water outlet pipe are very important considerations.

Plant site to be close to the electric power supply lines or source: Since the desalination process is a high energy consumer it would be advisable that it is located very close to the power supply lines or the power plant itself. The installation of a desalination plant in the vicinity of a power plant shall decrease the cost of power supply and increase the reliability of supply of power. In case an Independent power plant (IPP) is provided, additional technical requirements concerning the power plant (cooling water supply and disposal) must be considered.

Plant site to be close to the water supply system main conveyor: The product water has to be transferred to the water supply system for conveyance and distribution. To achieve this, the discharge pipeline from the plant must be connected to the clients water supply system and the closer they are the two the cheaper it is. Therefore the plant site must be in the vicinity if possible of the existing water supply system with feasible technical and economical connection of the plant with the water supply system. In many cases technical and economic access to towns through routes parallel to the coast present problems due to the existence of a densely build up area or great activity for development and because of the very high cost of the land.

Plant site to be close to a high level road network: Access to the plant site during the construction and operation and maintenance phases should be easy and quick and for this reason it should be located close to an existing road network or provided with the proper road network. It is not necessarily to be very close but it should be both technically and economically feasible to build an all weather access road.

Local and environmental restrictions: Special local and environmental restrictions should be taken into account in the site selection and the environmental impact assessment studies.

9. Select the potential sites fulfilling the criteria and then choose from these sites the most potential sites

Using the site selection criteria outlined above plus any other specific criteria and requirements that the plant under consideration has, the special committee shall locate the "potential sites" and mark them on the map. For each of these "potential sites" the special committee shall carry out a preliminary "Site Selection Study". Based on the findings of the study the special committee shall choose the three "most potential sites", which meet the site selection criteria and are acceptable by the local authorities and the client. For each of the "most potential sites" a detailed site selection study shall be carried out by the special committee. Additional for each of the "most potential sites" an environmental impact assessment study (EIAS) shall be carried out by the independent consultant acceptable to all parties.

10. Content of the environmental impact assessment study

The terms of reference for the EIAS should be proposed by the special committee and approved by the client and the local authorities

and should cover among others the following topics.

- Plant geometry (area extent and height).
- Plant materials of construction and their conformity with the special character of the environment.
- Methods of seawater abstraction from the sea, and proposed the sea intake structures most probable location, marine pipelines size, route and installation structure.
- Intake structure and intake pumping station location and general layout, including probable methods of construction.
- Seawater pipelines size and route and proposed construction method.
- Plant emissions (brine, chemicals used for pre-treatment, post treatment, corrosion control, anti-scaling, anti-fouling, anti-foaming, sewage etc.). These have to be given preliminarily by the client as shall be included in the tendering specifications.
- Impacts of the above to the air, land and sea environment. The study should examine air pollution, land pollution, marine pollution, adverse effects on the marine and biotic life, noise pollution, public safety, chemical hazards etc.
- Energy considerations. Estimate of the additional energy requirements and its impact on the environment because of additional gas emissions.
- Benefits from the construction of the plant (on the water supply balance, on the economy, on the social life etc.).
- Evaluation of the impacts on the environment
- Evaluation of the sites from the point of the environmental importance both the inland as well the marine seabed and marine biotic life and the impacts during the construction and O&M phases of the project implementation.
- Proposed mitigation measures for minimizing the adverse effects on the environment and other sectors. Such measures shall fall into two categories (a) the structural measures, which shall be applied during the construction phase and may include the plant's architecture, materials of construction, the depth and location of the sea intake and sea brine outfall, pipelines route (marine and inland) methods of construction etc. and (b) the operational measures, which shall be applied during the operation of the plant and may include prohibition for using certain chemicals, maximum noise level production, monitoring of impact on the air, groundwater, marine and biotic life, and disposal of certain special products such as antiscalants and backwash water if specific chemicals are used.

11. Selection of the site

The selection of the "site" shall be made by the client in consultation with the local authorities, based on the recommendations of the special committee and with the consent of the "Concerned Parties". The special committee shall base its recommendations on the detailed site selection study and the environmental impact assessment study. The recommendation by the special committee shall include remarks and recommendations for each of the most potential sites. The sites shall be ranked according to their adverse effects on the environment with and without the mitigation measures. The client using the environmental impacts assessment study and the recommendations shall carry out his own studies including costing of the mitigation measures for each site to determine whether the project as modified for environmental reasons is financially, economically and technically viable.

12. Legal and institutional framework and good will

The site selection criteria, the site selection studies, the environmental impact assessment studies and the proposed mitigation measures shall be in accordance with and shall comply

with the existing national, district and regional legislation and standards. Institutions responsible for the implementation of the legal framework shall be continuously informed or advised and requested to give their approvals, consent or issue the relative permits and licenses as required. Strict compliance with the provisions of the laws and regulations and implementations of the lawful decisions of the institutions shall create the proper environment for smooth cooperation and coordination for resolving differences and implementation of the agreeable decisions. The "site selection" procedure, acceptable by the "Concerned Parties" is not an easy task since it involves high value land and in many cases large economic interests. Politicians at the local and national level as well affected citizens shall use different leverages to accelerate or slow down the process and the only guidance under such conditions are the legal and institutional frameworks, the agreed procedures and time schedules but above all, cooperation, coordination and good will to resolve big or small problems for the national and regional benefit. Those adversely affected should be generously compensated and those favorable benefited should generously contribute to the success of the process.

13. Conclusions

Desalination is becoming one of the alternatives for water development and sites like every type of development are viewed by the local authorities and populations as affecting their interests and way of life. A rational method is proposed for the objective and acceptable studies and procedures in a transparent and democratic environment, which safeguard the selection of a "site" acceptable to the client and the local authorities and meeting the technical, environmental, economic and social requirements. A multidisciplinary "Special Committee" to be appointed by the client and the local authorities and accepted by the concerned parties, with the assistance of an independent consultant for carrying out the environmental impact assessment study is proposed to operate within certain agreed terms of reference and within time limits to propose the most probable suitable sites for constructing the desalination plant. The final selection of the site shall be made by the client with the consent of the concerned parties. This procedure and parts of it partly or fully have been applied successfully for the selection of the sites of the two desalination plants in Cyprus.