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THE SIMULATION OF THE BEST SPOT FOR DEWATERING AND DESALINATION WASTE DISPOSAL OF BUSHEHR (IRAN) BY USING MIKE21 SOFTWARE

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ABSTRACT
One way of providing drinking water, is building dams that compared to seawater desalination, the high cost and the time spent is made for it. Then it was considered cheaper and faster way base on this background. And that was the construction of a sea water desalination plant. This study aimed to obtain the optimal placement of the inlet pipe and the output of piping effluent water desalination plant in Bushehr coastal Mike 21 software was provided. During studies on the two dominant winds direction was set to places. Directions were: West and South East. Applying this data to the Software, the flow pattern was formed and then the four proposed locations were considered for the study. And the prevailing wind directions for each location, two scenarios were evaluated. After reviewing the results, it was found that the fourth place, the dehydration of the inner edge of the outer estuary and out of the water at the edge of the estuary of the most optimal place. The inlet duct had the lowest salinity impact of effluent and environmental standards are met.

KEYWORDS: Bushehr, Desalinations, Environment, fresh water, MIKE 21, Sea water, Wind.

INTRODUCTION

One of the most important issues in the study and design of Water (Water Desalinations) understands of the aquatic environment, hydrodynamic conditions, waves and changes in temperature and salinity, which is very important. Seawater desalination on the aquatic environment, particularly the sea edge is made of the environmental and social effects. The waves can be used to evaluate the hydrodynamic environment desalination facilities with regard to the effects of a nearly optimum design, in such a way that also with the proper functioning, the nature of the impact is the lowest.

The issue of water scarcity and water scarce regions is not limited only to the country but also in other areas such as coastal areas that are densely populated and traditional methods of water supplying in the near future, will not meet the needs of what was isolated and used for drinking and industrial water supply, will be essential. In some cases, the only option remaining to supply the needed water, desalination of sea water reverse osmosis is mainly done. The Increasing need to provide fresh water, especially in arid and semiarid regions of the country, increases the sea water desalination units. Desalination process includes removing the particles of salt and fresh water is brackish and marine products. As a result of this process is a very high salinity wastewater that must be disposed of in the environment. Usually these types of waste in the salty water, such as sea or brackish lakes are emptying.

With the introduction of evaporative methods such as multi-stage evaporation or multiple distillations in the 50s and 60s, and then Tran’s membrane methods such as reverse osmosis technique on the 80s, the host of technical Desalination The sea water is created. Using methods of desalination, as one of the most important tools for increasing supply of fresh water is considered. According to statistics published in 2012, about 150 countries have used this technology. The plant has a total production capacity of 4.77 million cubic meters per day that have been reported and the population covered for drinking water supply, approximately 300 million people. Desalination technology in the recent is rapidly progressed. Obtained results by Morton and colleagues found that There is in 1991 more than 65 percent of the global de-salinization plants, the multi-stage evaporation process Used There. Brine wastewater from the process is much warmer than other processes (Morton, 1996).

Tulharam and Aylahy in their research note that the past decade, multi-stage evaporation process, was the most common and most widely accepted method for removing salt in the Middle East region. The main reason for this is to being rich in fossil fuels, and the cost and availability of energy (Tulharam and Ilahee, 2007). Using various methods of modeling the phenomenon, is in order to improve the design of the most appropriate methods to minimize the effects of the discharge of waste water that is salty. Model results show that the design is inappropriate for disposal of saline effluent, wastewater discharges on the coastal shores of some of the greatest changes in the depth of the sea tide as well as the discharge effluent surface. In these conditions, the dilution of the effluent is to be accepted (Alameddine and El-Fadel, 2007).

Similarly, in semi-enclosed marine environments such as the Persian Gulf and Red Sea, are more receptive to the increased salinity of the water resources in the vicinity of the effluent discharge of saline-treated. Over the years, according to the proposed standards for design submerged jet, salt-water disposal of de-salinization plants, with an angle of 60 degrees to the sea floor was done (Roberts and Associates, 1997). However, the recent review showsthat the highest dilution of saline water at the beach with a gentle slope in the discharge angle will occur between 30 to 45 degrees.

Since the main purpose of this study is to simulate best spot for dewatering and disposal of waste water from sea water desalination plant in Bushehr, therefore, considered the following hypotheses:

- The minimum water depth at the disposal of saline effluent at sea with regard to the marine environment is 5.1 meters.
- Waste water from the sea to the distant location so that the local council waste effluent affected the location does not be more than 10% of the sea salt.
- The best way to dispose of waste at sea salty, the increase in the initial mixing with seawater, is using a submerged jet density at sea level.
- Across the border by the effluents discharged into the sea salty, the salt until it is fully equal to the salinity of the effluent of the disposal.

Thus, in studies where Water access beaches in Bushehr, the scrutiny of pollutants discharged effects of anions and cations temperature and sea current conditions will be discussed with mathematical modeling and the effect of changes resulting from the scenarios of possible contaminants has been studied. The used model in this study is modeling software MIKE 21.

MATERIALS AND METHODS

Mathematical modeling

The model used in these studies, is the Danish Hydraulic Institute product (DHI) that a long history in various offshore projects around the world have been applied.
In this model, an integrated software engineering expertise to model stream flow is the two-dimensional hydraulic modeling and related phenomena in lakes, estuaries, bays, coastal areas and the sea that the stratification (Stratification) is not applicable.

Numerical methods in MIKE 21 model

The application of the hydrodynamic equations, heat transfer, and wave finite difference method is used. Hydrodynamic equations are solved using an implicit method with a variable direction (ADI) with errors of the order in which the central difference approximation to the discrete equations is represented by the coefficient of consolidation and phase angle, the stability of analyzed. Transport equation by explicit QUICKEST Tuesday to dismiss the error, the order of stability is analyzed by the method of von Neumann. Euler's method for solving the wave equation in two dimensions once through Marching equations are then solved lasting relationships relevant to the choice of the model limitations and gaps in the network will be presented.

Modeling MIKE 21

MIKE 21 models are two-dimensional modeling system for free a surface flow that is capable of simulating peripheral hydraulic phenomena in lakes, estuary and coastal areas and the sea is regularly updated. MIKE 21 model can simulate a wide range of phenomena acting hydraulic as follows:

- Currents and tidal changes (Altayaran and Madany, 1992)
- Heat (Safrai and Zask, 2007)
- Water quality

Hydrodynamic module (HD), the module is the basis for the principles of hydrodynamic flow model MIKE21 that provides for the calculation and can change the water level in the lake, coastal areas and effective factors in the entrance of the stream to simulate changes include:

- Bottom shear stress
- Wind shear stress
- Pressure gradient
- Coriolis Force
- Momentum distribution (Höpner, 1999)
- Wave radiation stresses (Alameddine and El-Fadel, 2007)

Flow Model

Basic parameters

The basic parameters for the simulation of flow model MIKE 21are as follows: (Latteman and Höpner, 2003)

Bathymetry

Determining the exact depth of water in the Hydrodynamic model of the process of modeling is to spend more time in this area, we can answer more precise (Morton *et al.*, 1996). MIKE 21 model grid can contain a maximum of 9 of the first, the main part of the standard.

Much less information is required for the following:

1. Grid reference location (main level) (Höpner and Windelberg, 1997)

If you are in the Southern Hemisphere, it should be considered negative values for longitude.

Figure (1) the geographic grid clockwise from the north to the northern model.

1. Area map projection zone

In making far less, should be considered the minimum real values for the specified field.

If the area map projection is defined, it is possible to order the Coriolis force.

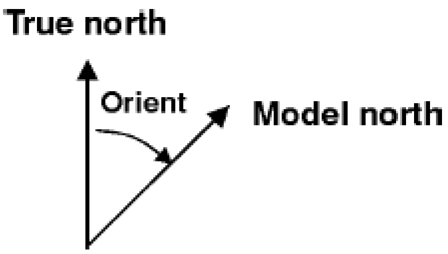

Figure 1.How to determine the model

The first step is to create a digital map of the sea floor, choose a scope of work that needs to be given to the following points:

- The model should be vertical quadrilateral (rectangle or square), in other words, the calculation should be square or rectangular nodes that intervals have been fixed.
- Range or desired position should be located on the inside surface of the model (at least 10 grid points from the boundary)
- As the magnitude of the changes in water level or flow is specified at the open boundaries, across borders points or information should be located at the available points.
- Although the MIKE 21 drought and floods can run on a contour line, but are not too close to the borders of the current level of shallow (it is possible to complete drought) place.
- If possible, you should rotate the model so that the model is roughly parallel to the main flow direction of the coordinate axes.
- Origin of the coordinate system is placed at the bottom left of the grid.
- Figure (2), sudden expansion and contraction should be avoided unless the velocity of flow in the vicinity of an open border in these areas is small.

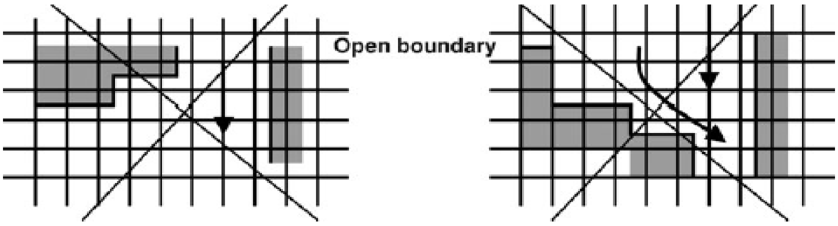

Figure 2.Sudden contraction and expansion flow near an open boundary

The second step is to select an appropriate distance for networks which, except for the first and last points, all depend on the Courant number. The grid spacing should be considered include:

- In many network can meter all changes to the current simulation will consider.
- If you have a bump or indentation in far less possibility of instability MIKE 21 There is, however, if the flow direction parallel to the grid lines Courant number greater than one, a series of ridges and troughs in the network path will lead to instability.

Compliant Figure 3 -Figure, step time and space in the channels that are 45 degrees in the network can be obtained from the following formula (g gravity and h the depth):

$$\Delta t = \frac{a.\Delta x}{\sqrt{gh}} \quad (1)$$

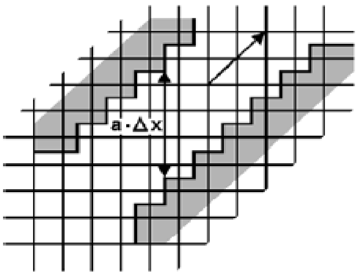

Figure 3.Flow in channels with an angle of 45 degrees

RESULTS AND DISCUSSION

Simulation period

To select the simulation time step, the following steps were performed:

1. The grid spacing (Δx)
2. Maximum allowable Courant number.

Determine the maximum time step (max Δt that the Courant number is obtained).

$$\Delta t_{max} = \Delta x \frac{C_r}{C} \quad (2)$$

The C rateis the Courant number.
The number Courante should be revised based on the current speed.
In the first dialogue about the scope of simulation time steps, the interval between time steps (which Simulation "" Hot Started this distance is unchangeable), the beginning and the end of the simulation is completed.

Borders

To solve the model MIKE 21, the need to determine the flow or level in all parts of the border is open.
Level and current density in the direction of x, y,unknowns are the model that we need two of them across the open border system (in time) specified. In most cases the level and direction of flow or total flow to know it. So we have two cases:

Determining the water levels and flow direction
Due to the time change (fixed or variable cycle), water level along the boundary line is fixed or variable. By default flow direction (perpendicular to the boundary) is or may be of the first type of data file should be to specify that the data file for each grid point along the flow direction.

Determining the direction of current flow across the border
Total flow time can be fixed or variable sine of zero that is defined in the data file. The velocity distribution at each point of the grid boundary by MIKE 21 (based on depth) is calculated.
The usual open border for the entry and exit point to be considered is when the long open border and the border of the island or to shrink the size of the model and calculation open border should be defined.

Mass Budget
The parameters for the modulus of AD, WQ, EU, and MTare applied.

Hydrodynamic parameters
Hydrodynamic module of MIKE 21is a mathematical modeling system to calculate the hydrodynamic behavior of water in different variations (eg wind, waves, water levels, etc.). MIKE 21 flows models are used to simulate hydrodynamic parameters:

The Initial Surface Elevation
The simulator select "" Cold Start screen digital map of the sea floor, the initial water level data should be prepared and given to the figure, the initial water level is determined for each of the following two methods:

- Fixed amount for the relevant range
- A second type of data file

Values should be determined according to the boundary conditions; the initial level shall be equal to the value at the beginning of the simulation to be considered borderline.

Borders
Hydrodynamic module of MIKE 21, level or flow (discharge per unit width) for all points of the boundary requires that information must be specified in this section.
Type specified the border (border or frontier of current balance) of the "" Formulation.
Five ways to changes in water level or flow of boundary can be identified:
Constant in time and space frontier for all network nodes during simulation
During a simulated sine wave that changes the balance point should be about, phase and its duration (see N Number of time steps and Δt Time step)

$$\text{Value} = \text{Reference .level} + \frac{1}{2}.\text{Range}.\sin(2\pi.\frac{N.\Delta t - \text{phase}}{\text{Period}}) \quad (3)$$

Time series data file of zero is obtained and if the time steps of the simulation are time step in the file with a different model, then cubic interpolation is done.
The first type of data file is defined to change the time to any point of the network boundary. If the time steps of the simulation are time step in the file with a different model, then linear interpolation is performed. This capability allows are introduced the variation of the boundary conditions along the open boundaries.
Boundary values are obtained from another simulation results and the data file is of the first type and density of water levels and flows in the direction of x, y.

Resistance
Bottom friction can be determined in one of two states:

- Constant value for the whole range of applied
- The second type of data file from anywhere in the network has its own friction

Wave radiation stress
Since there is a significant surge in the river, but was not effective in this model, the effect of this part of the model, the three stress components (S_{xx}, S_{yy}, S_{xy}) In the momentum equation is affected by the wave radiation stress MIKE 21 NSW Or MIKE 21 PMS The second type of information is stored in the file.

(4) X-momentum $\frac{\partial S_{xx}}{\partial x} + \frac{\partial S_{xy}}{\partial y}$

(5) Y-momentum $\frac{\partial S_{yy}}{\partial y} + \frac{\partial S_{xy}}{\partial x}$

Wind Conditions
The wind model is studied in the following four ways:
1. No wind (no wind, no function)
2. Is constant in time and space
3. Is a constant in space but varies in time (file no type information)
4. The place and time is the variable (the second type of data file)

Clockwise from the north direction should be geographically and are measured in degrees.
A wind effect is obtained from the following quadratic equation calculation:

(6) $$C_w \frac{\rho_{air}}{\rho_{water}} W^2$$

The C_w, is wind friction coefficient, ρ Density and W Wind speed at 10 m height above sea level.

Initial conditions for simulations
Due to the hydrography of the region, regional and local digital map, the sea floor for the two areas were identified. Extracting digital map the sea floor by a range of satellite images and ground-based calibration was done with the data. Due to environmental information available in the current model research for two main prevailing winds and waves for the North West (W) and South East (SE) was prepared.

According to the winds, flows and recorded waves by buoys of wind-rose and wave-rose and maritime organization, the study area were identified. Wave-rose and wind-rose got ready to analyze, four were chosen for the W and SE. Wave height of 0.625 m and period of 6.5 seconds was considered. The first modeling module for modeling regional NSW will be prepared and implemented. NSW module output results were applied in radiation tensions of hydrodynamic module (HD) of regional model. It is worth noting wind speed of 6 meters per second that was considered to be applied in above three directions.
Following the implementation of regional hydrodynamic model, the local hydrodynamic model range will be available for the port of Bushehr. Boundary conditions of the local models were extracted from the regional model. After running the local hydrodynamic model for the three above-mentioned results were obtained and flow patterns were studied.

After this step, diffusion and dispersion model (Advection Dispersion) will be to spread salt and temperature for all three of the above-legged (Setup).
The modeling of temperature and salinity are two objectives in mind:
1 -no Warm water intrusion and discharge of saline effluent from the dehydration and lack of ability to process recirculation
2-Meet environmental regulations effluent discharge into the sea
According to environmental regulations in order to control wastewater discharges subject to the marine environment, at radius of 200 meters from the center of any contamination, thermal and salinity of the sea, the temperature difference with the ambient temperature must be less than 3 °C differences and salinity should be less than 10%.
Thus, in all four scenarios, the prevailing winds and waves four major North West (W) and South East (SE) was measured at various harvesting and hauling water to the optimal locations for each of the above scenarios, taking into consideration the environmental standards set.

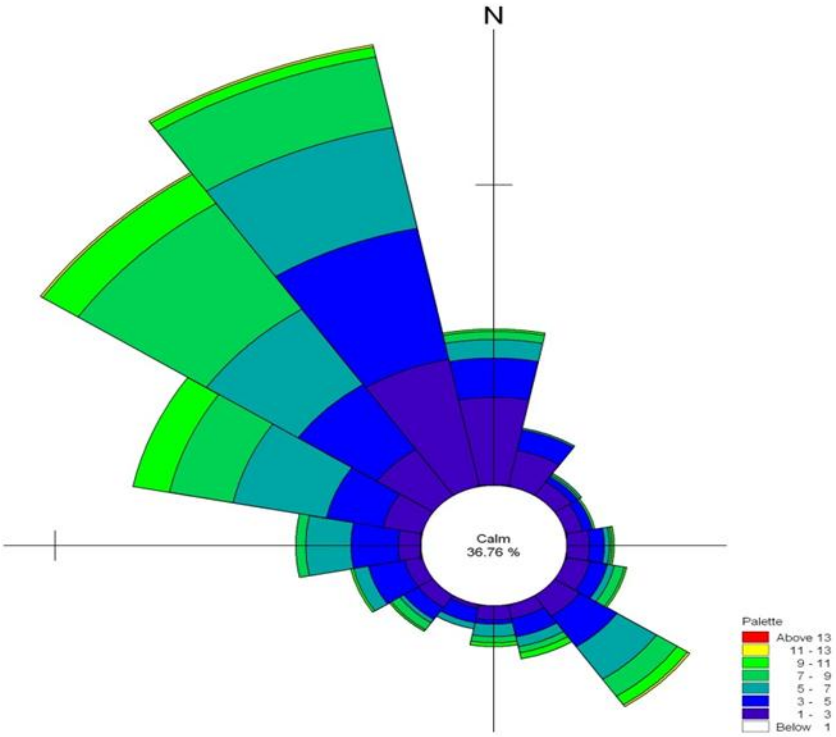

Figure 4.Wind-rose map of the study area

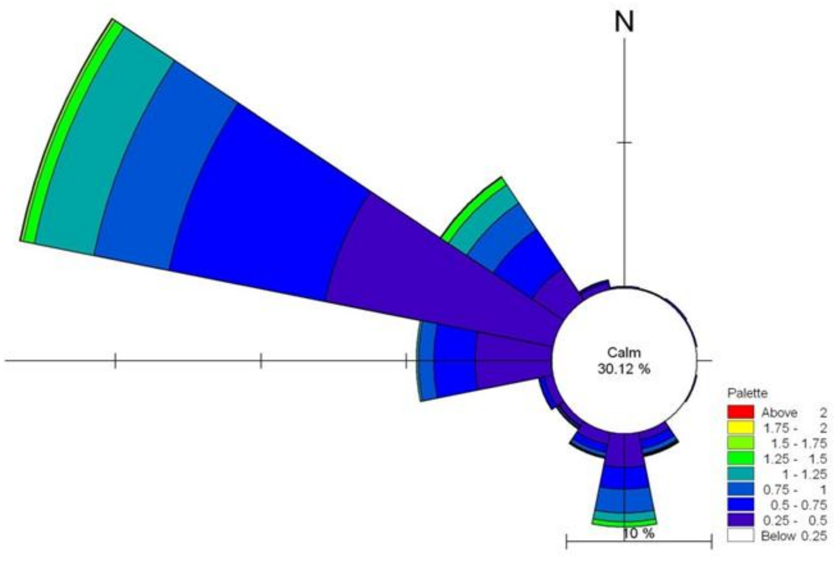

Figure 5.Wave-rose Map of the study area

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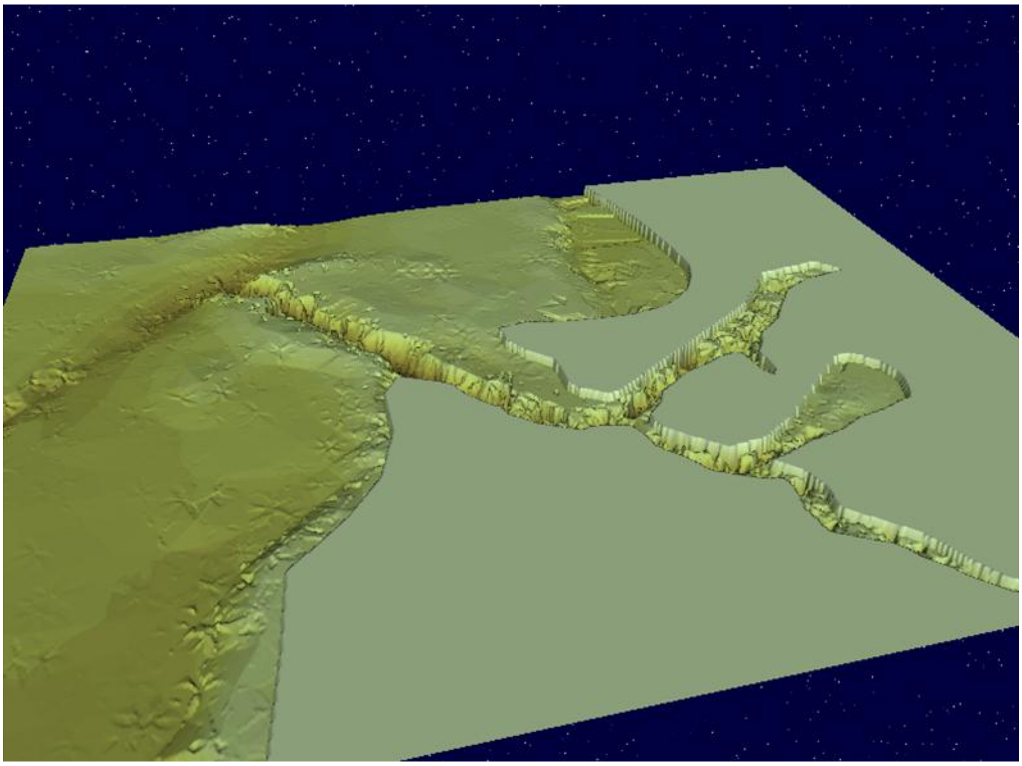

Figure 6.Three-dimensional map of the sea floor in the area of simulation

Table 1.Summary of simulation scenarios

Number of impressions	Position of sea water	The desalination plant wastewater discharging into sea water	Direction of the prevailing wind and wave	Scenario
1	(240, 227)	(221, 225).	West	3
1	(240, 227)	(221, 225).	South East	4

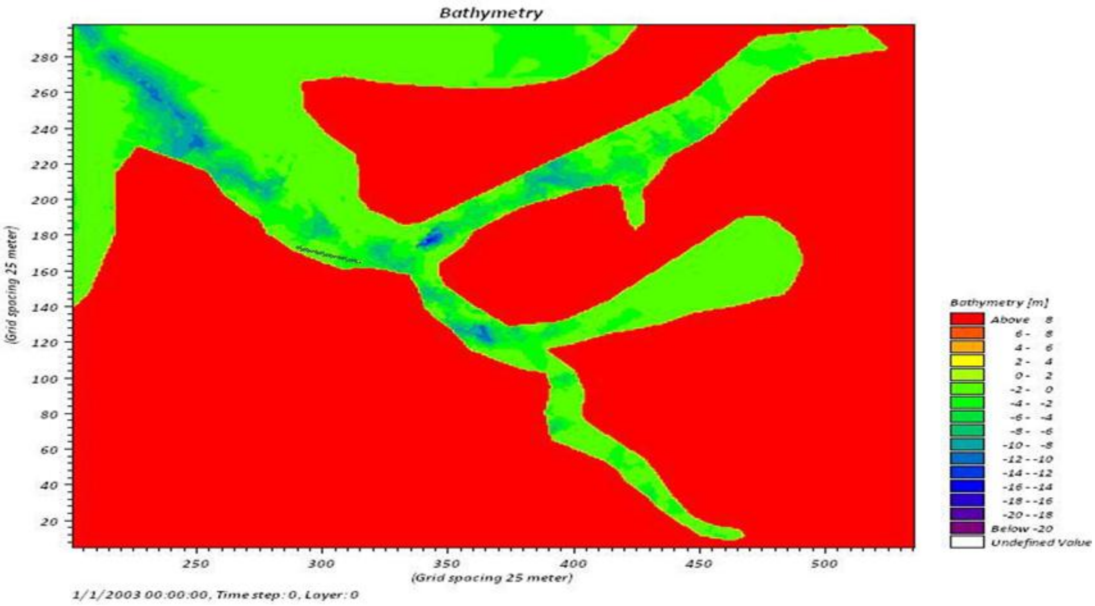

Figure 7. Location of water withdrawal and effluent discharge scenarios

Scenario 1 at location 4

This scenario corresponds to the prevailing wind and wave conditions West (W) the layout is in place. The simulation results for the temperature in the water and wastewater disposal in Figure 8, Figure9, Figure 10 and Figure 11 is presented.

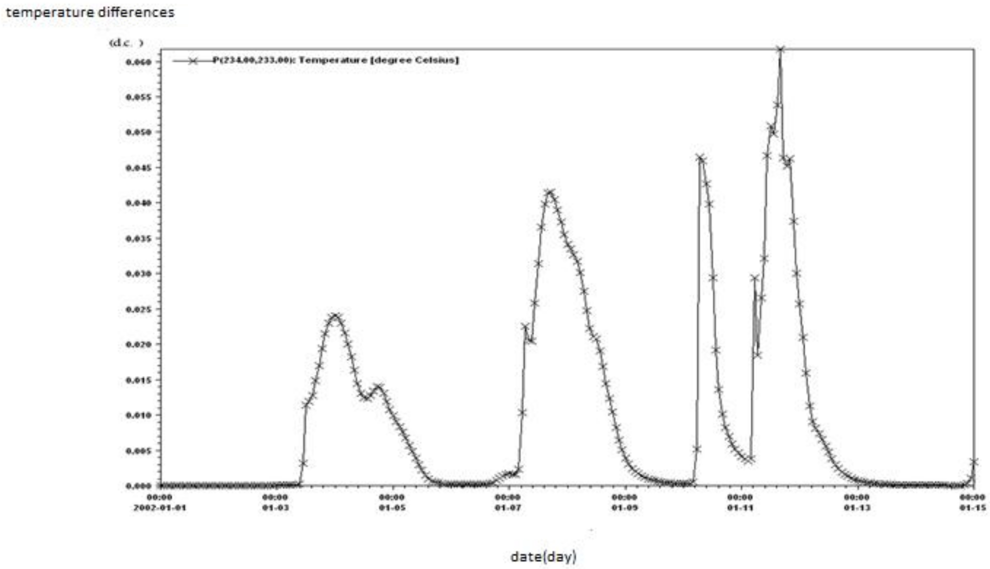

Figure 8 .Temperature simulation results for a radius of 200 meters of water for a period of 15 days

From the time of discharge wastewater simulation scenario 1 (a distance of 477 meters harvesting and hauling the prevailing conditions of wind and wave) of the West

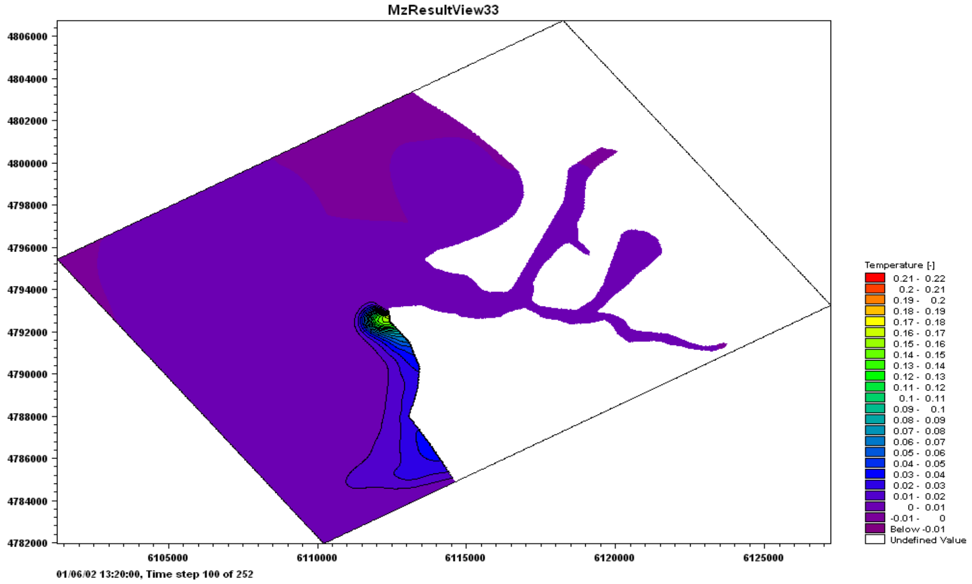

Figure 9.The simulation results of temperature at discharge, six days after the execution of the model

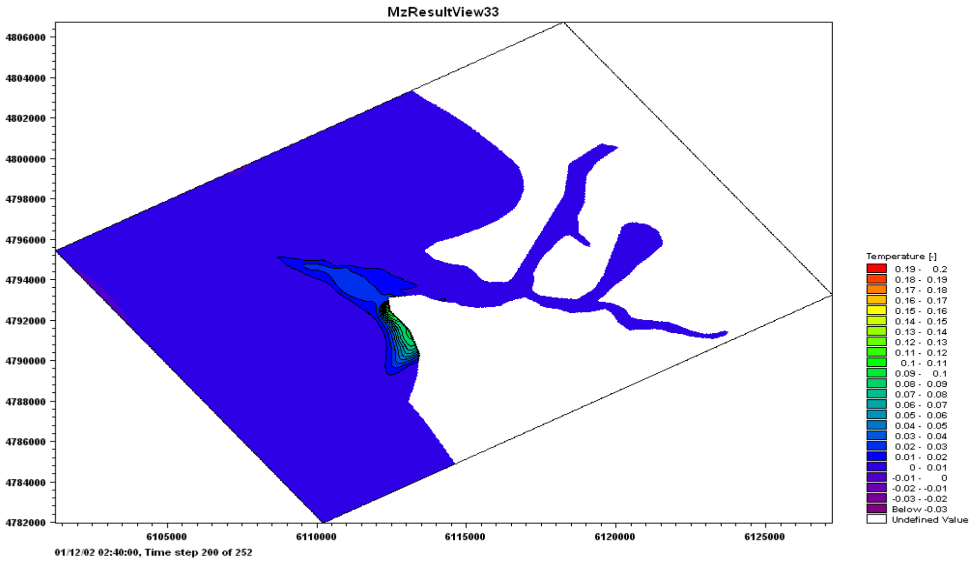

Figure 10.Simulation results of the evacuation temperature, twelve days after the execution of the model

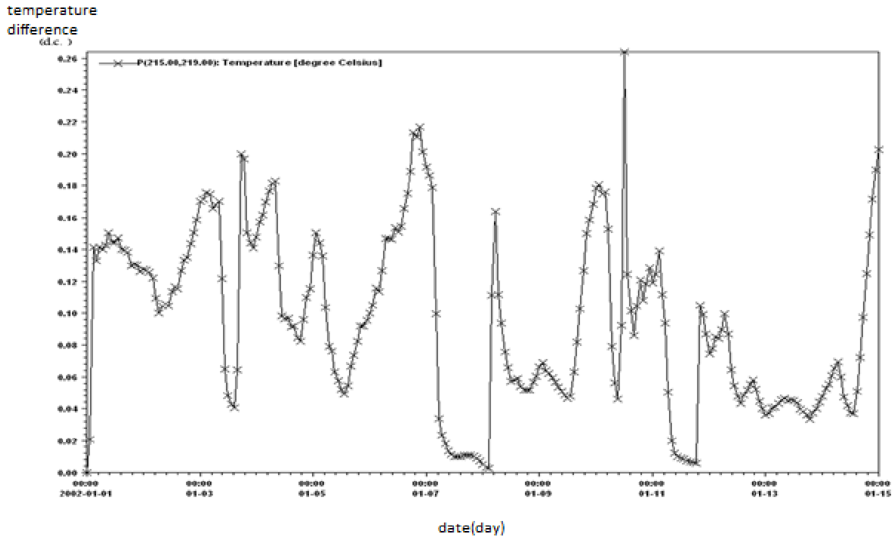

Figure 11.Within 200 meters of the discharge water temperature simulation results for a simulation period of 15 days from the effluent discharge scenario 1 (a distance of 477 meters and the prevailing conditions of wind and wave harvest and off-West)

The results of the simulation of salinity in the water and disposal wastewater in are Provided Figure 12 and Figure 13 and Figure 14 and Figure 15.

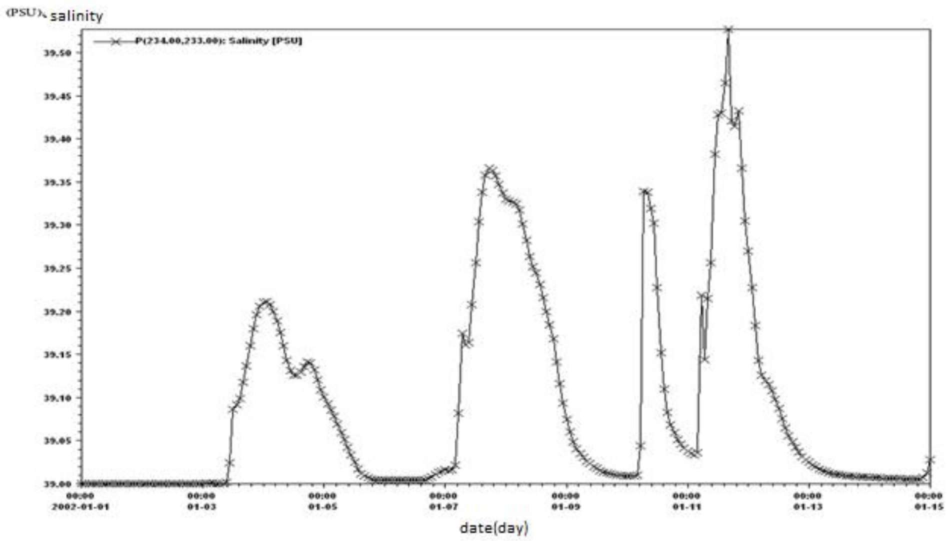

Figure 12.Simulation results in a radius of 200 meters of salt water for a period of 15 days from the time of discharge of effluent in simulation scenario 1 (a distance of 477 meters harvesting and hauling the prevailing conditions of wind and wave West)

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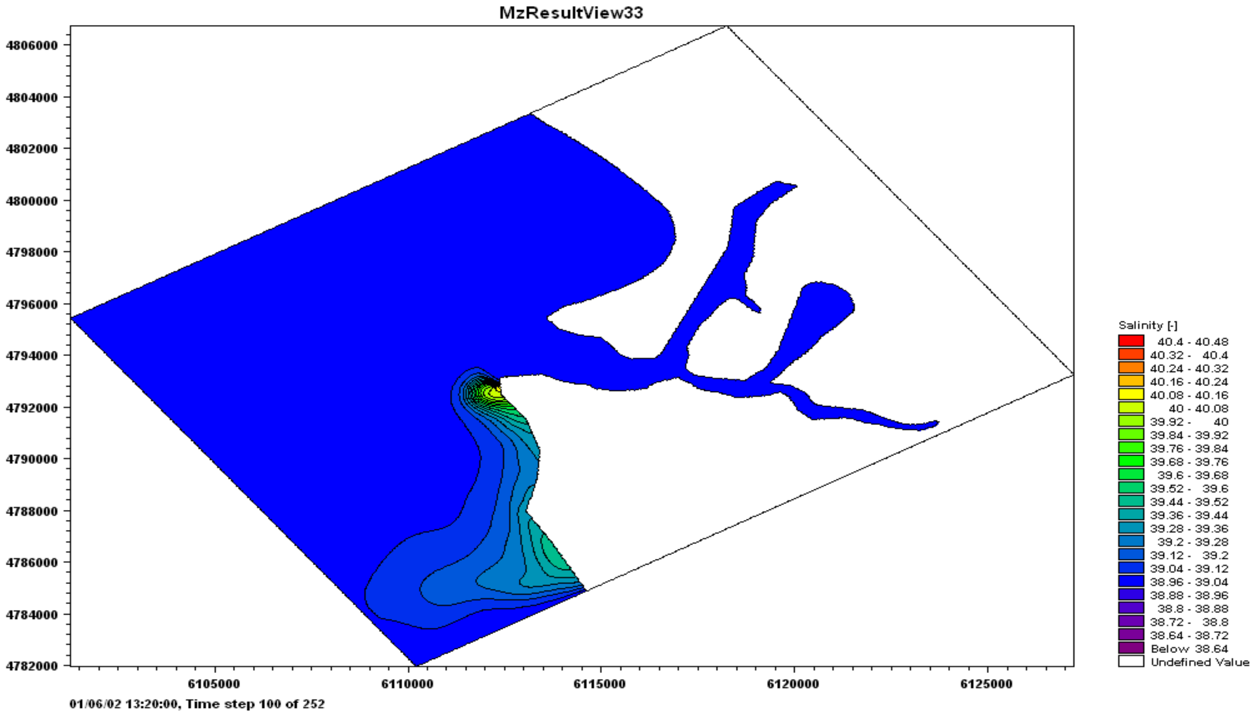

Figure 13.Simulated results of salinity at discharge, six days after the execution of the model

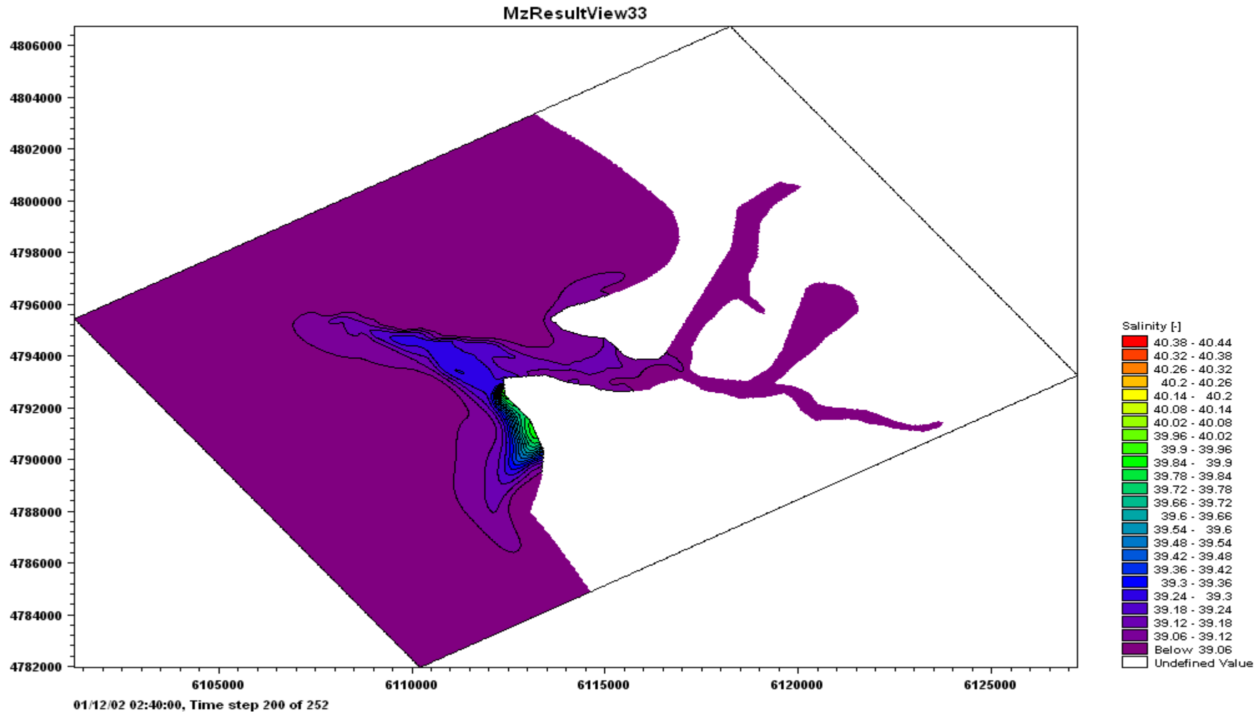

Figure 14.Simulation results in the depletion of salt, twelve days after the execution of the model

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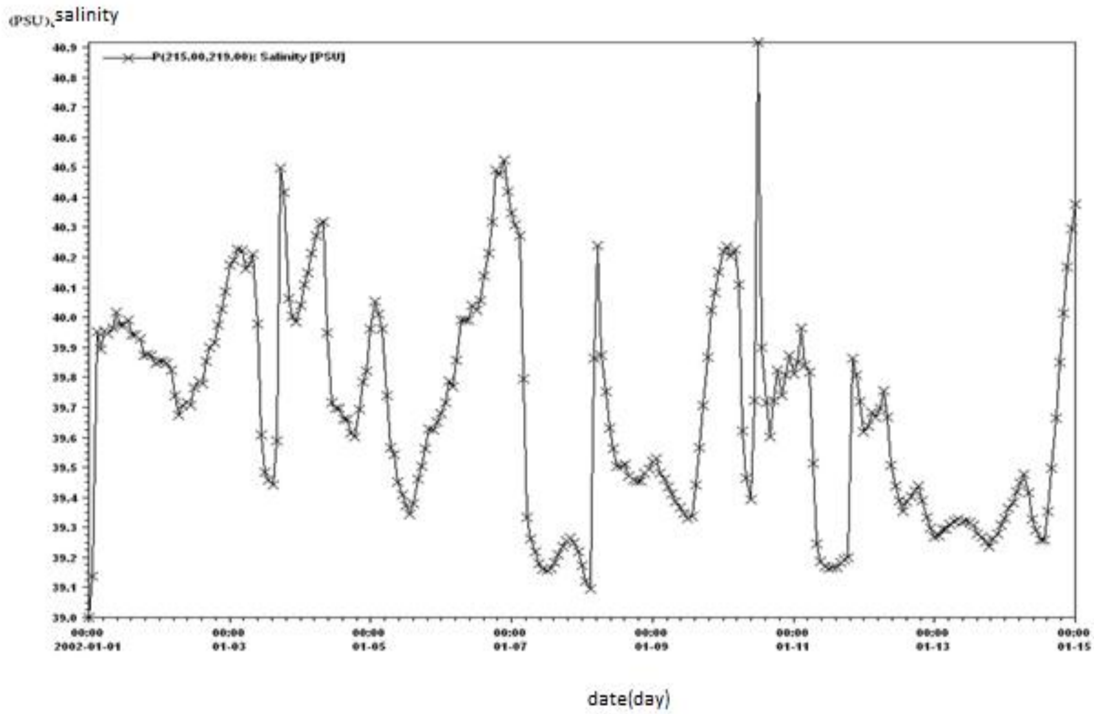

Figure 15.Simulation results in a radius of 200 meters of salt water discharge for a similar period 15 days from the date of discharge of effluent in scenario 1 (the distance between the harvesting and hauling 477 M and wind and wave prevailed conditions West)

In scenario 1 at location 1, according to the conditions Stream and location, environmental conditions can be satisfied and the effect, There will be a point of harvest. Meanwhile, the economy is also observed.

Scenario 2 is at layout

This scenario corresponds to the prevailing wind and wave conditions south East (SE) The location is allocated. The results of the simulation the temperature in the water and wastewater disposal is provided in Figure 16 and Figure 17 and Figure 18 and Figure 19.

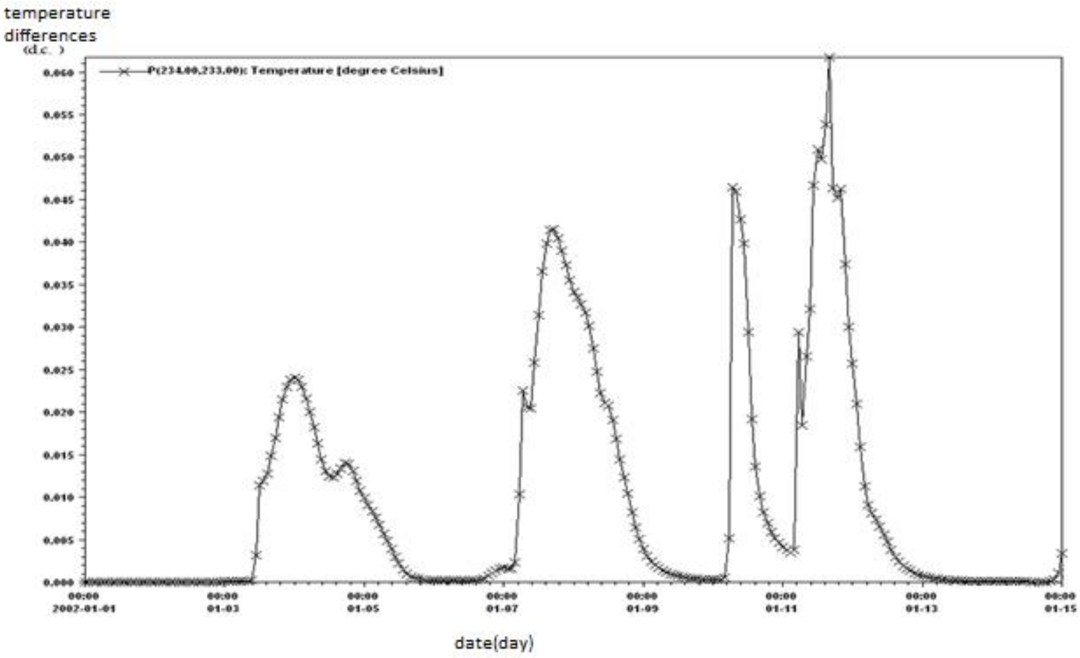

Figure 16. Temperature simulation results in a radius of 200 meters of water for a similar period 15 days from the date of discharge of effluent in scenario 2 (the distance between the harvesting and hauling 477 M and the prevailing wind and wave conditions South East)

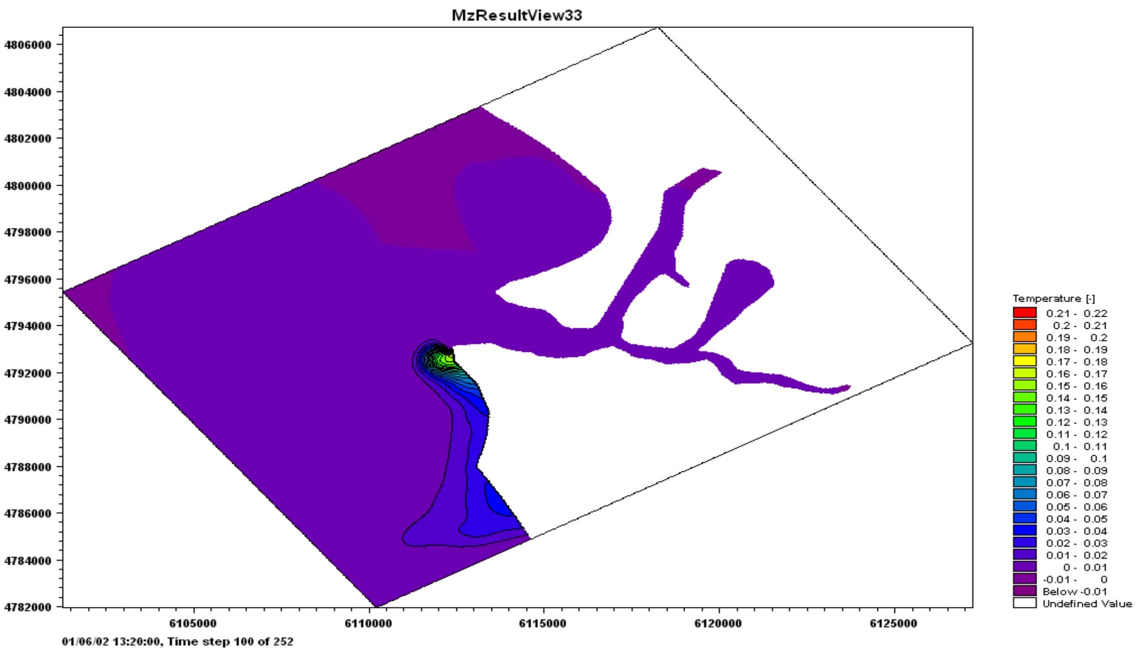

Figure 17.The simulation results of temperature at discharge, six days after the execution of the model

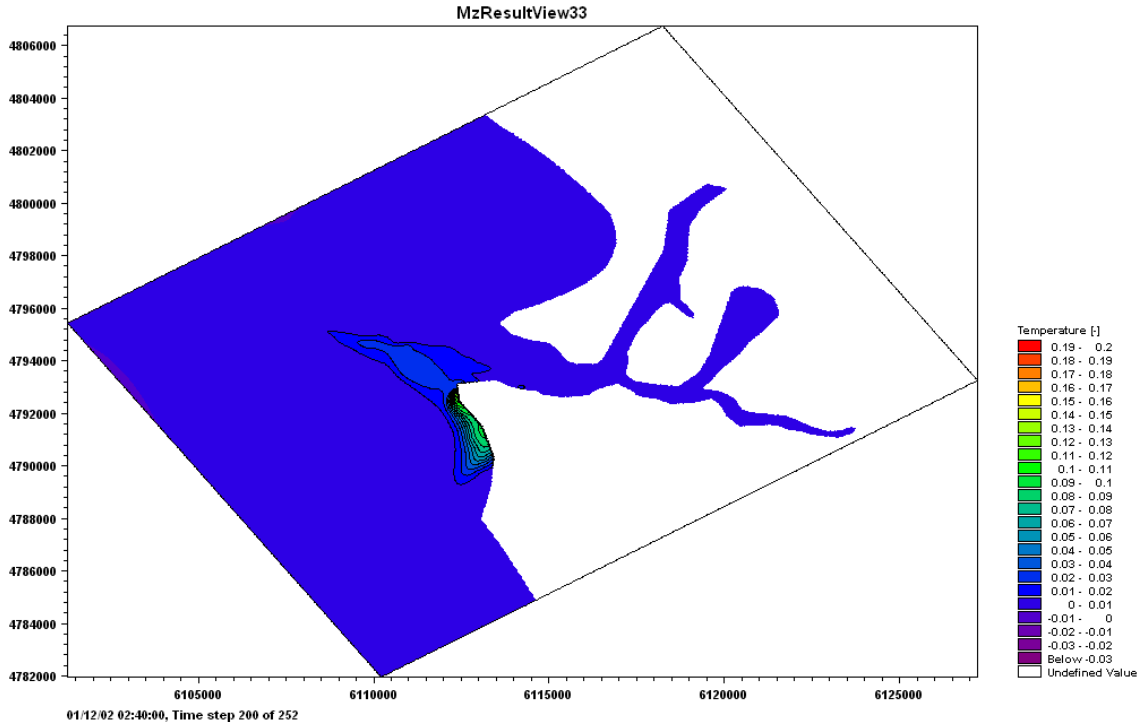

Figure 18.Simulation results of the evacuation temperature, twelve days after the execution of the model

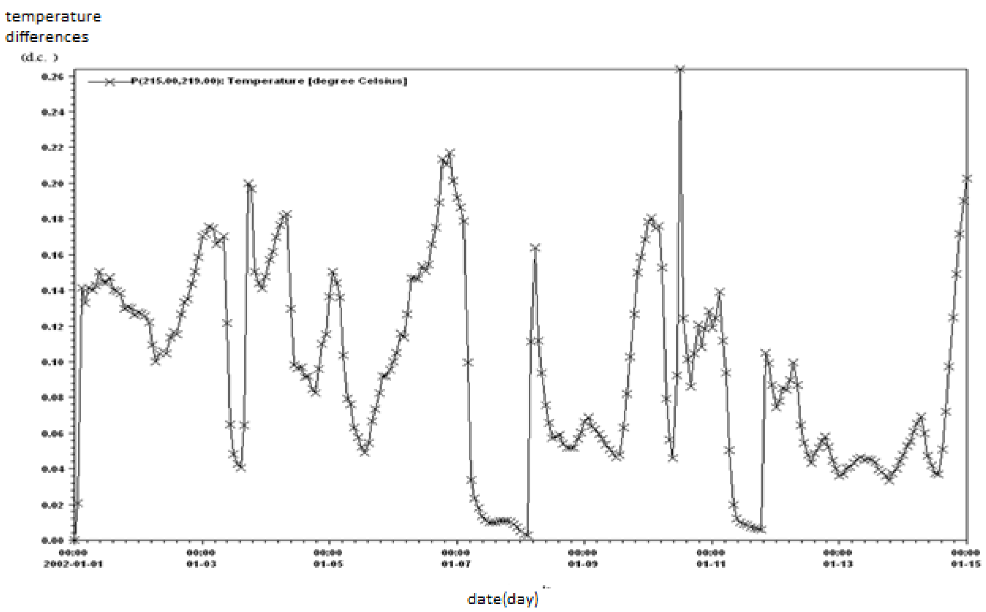

Figure 19.Within 200 meters of the discharge water temperature simulation results for a similar period 15 days from the date of discharge of effluent in scenario 2 (the distance between the harvesting and hauling 477 M and the prevailing wind and wave conditions South East)

The results of the simulation of salinity in the water supply and wastewater disposal is presented on Figure 20 and Figure 21 and Figure 22 and Figure 23.

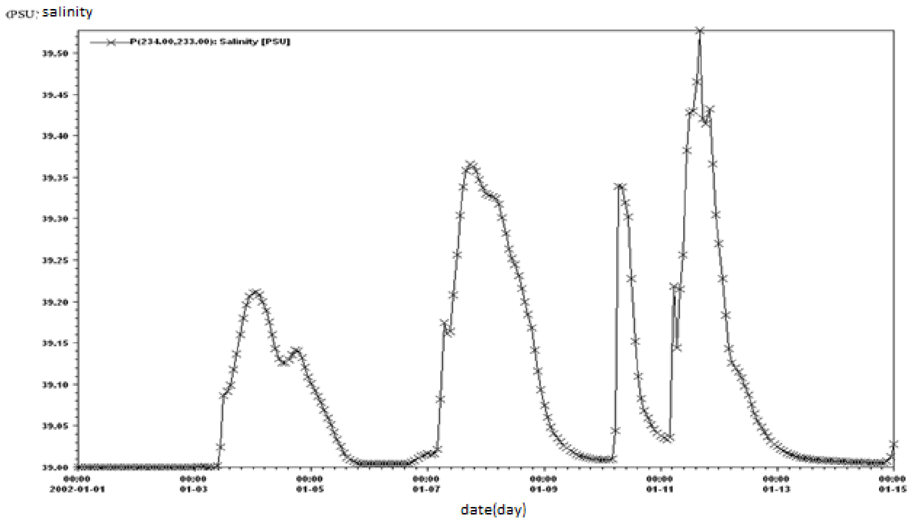

Figure 20.Simulation results in a radius of 200 meters of salt water for a similar period 15 days from the date of discharge of effluent in scenario 2 (the distance between the harvesting and hauling 477 M and the prevailing wind and wave conditions South East

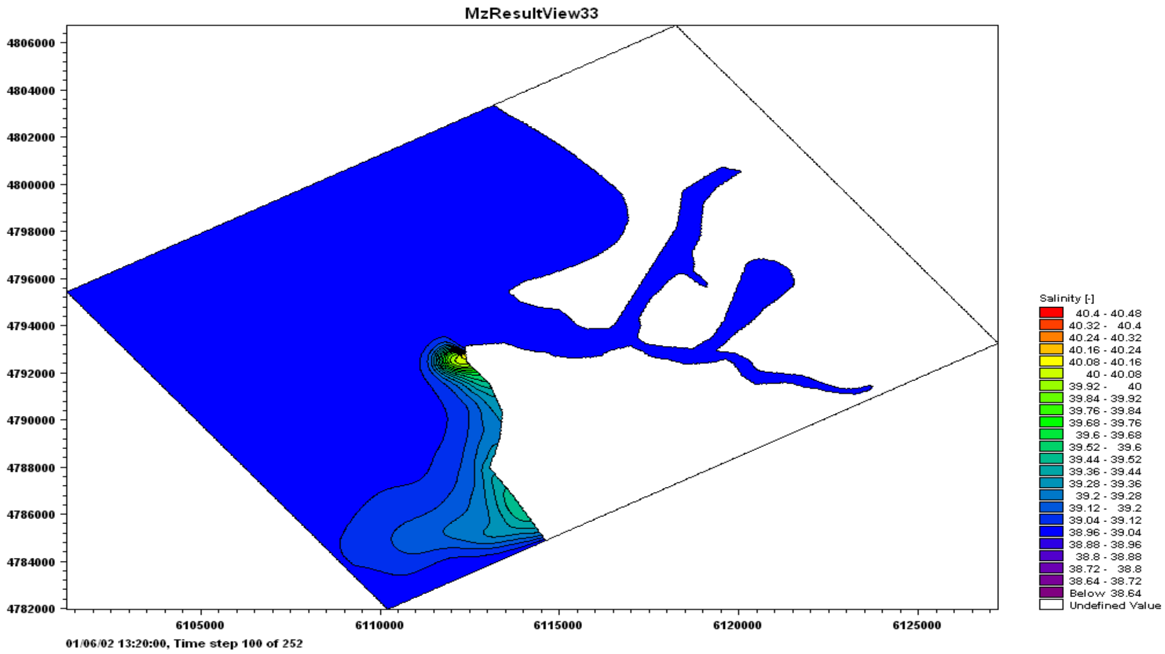

Figure 21.Simulated results of salinity at discharge, six days after the execution of the model

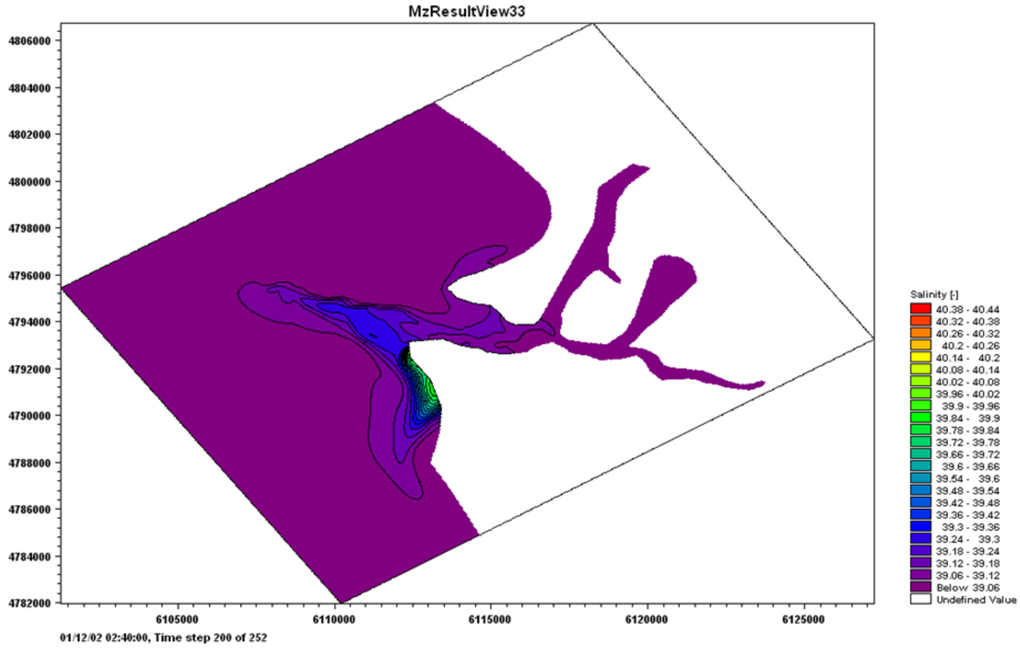

Figure 22.Simulation results in the depletion of salt, twelve days after the execution of the model

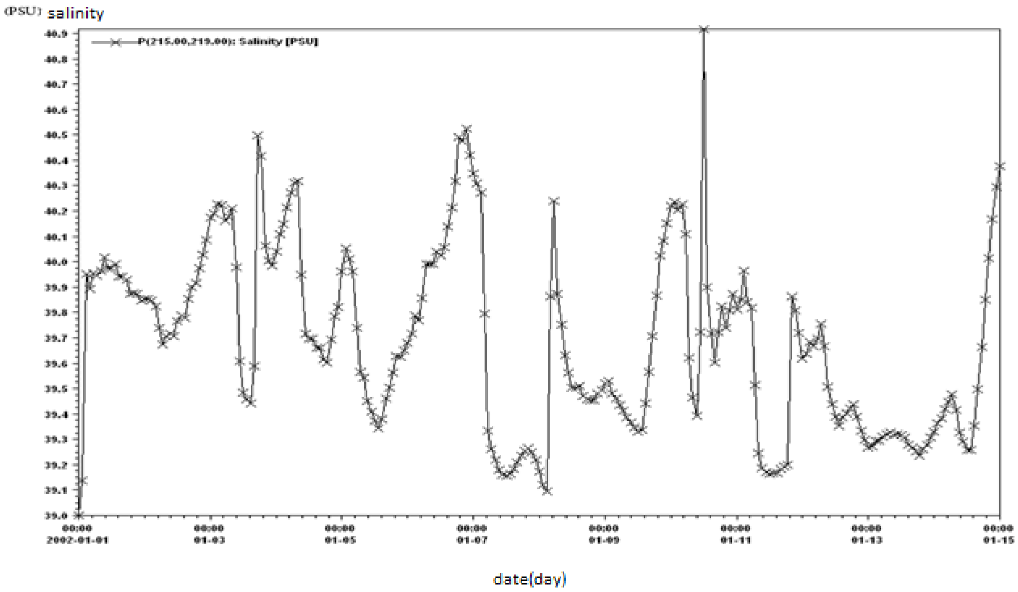

Figure 23.Simulation results in a radius of 200 meters of salt water discharge for a similar period 15 days from the date of discharge of effluent in scenario 2 (the distance between the harvesting and hauling 477 M and the prevailing wind and wave conditions South East)

In scenario 2 at the location, according to the conditions stream and location, environmental conditions can be satisfied, and the impact exists on taken point. Meanwhile, the economy is also observed.

CONCLUSION

Typical Persian Gulf of aquatic systems is undoubtedly attended to environmental issues and the problems that will cause in the process to exit normal. Cooling water effluent discharge from industries such as power plants due to excessive heat and high salinity of the water environment on the beach is one of the contaminants that cause major disruptions in the balance of the ecosystem. Obviously, due to the thermal emission, the large number of aquatic is not able to comply with the new conditions and new circumstances which cause permanent immigration that they are out of place. New species adapted entering to the environment causes to face upset the ecosystem in general. Other effects are named impaired reproduction, feeding and other habits of aquatic biological. The salinity and thermal pollution caused by the discharge of water, a warm sea water desalination plant in Bushehr coasts are ordered by using software MIKE 21, the distribution of salinity and temperature were measured at Bushehr coast and estuary. The Range Affected by salinity and heat pollution Be EPA regulations and standards were compared and the best option was selected. The Environmental protection agency proposed standards In 1998, the temperature of the surface water discharge of Clause Four Such that the temperature should be much more than 3 within a radius of 200 meters from the entrance, the temperature of the source acceptor does not increase or decrease. The radius of the amount of salinity over 10% does not increased compared to saline environments. The scenario in fact has the same standards environmental and economic cost for water and salt water draining in Environment. A look at scenarios 1 and 2, the water inside Estuary and its discharge into the sea and the drain is far from clear which may be best met the environmental impact of water return to the warm sea flooding is minimal. If the scenario has compliance with environmental standards, but the adverse effect of salinity and temperature on pollution where water is taken from the following options are not acceptable .This condition will cause the efficiency of seawater desalination in a very short continued time to drop and seawater desalination is not possible.

Back to comply with environmental issues and the impact of effluent It is recommended that the discharge of dewatering in deep water and at the bottom be emptied to reduce the effects of water due to mixing of the water back into the environment, These places are limited to a range of environmental conditions. But in where the slope has less drain pipes to transfer water to distance areas to reach the required depth of technical and administrative difficulty of the economic is not useful. In this study, due to tilt Low Substrate is almost within walking distance to the beach and was discharged at depths of 1 to 3 meters. In this study due to the low volume of water withdrawals and wastewater discharges less marine environment conducive to the implementation of two scenarios could almost make the water drain to choose the warm sea. But if the volume of effluent with high concentrations of pollutants is larger than the capacity of the environment should think of other measures. Capacity of the medium drains the water flow conditions and mixing. In such circumstances, you need to place deeper discharge selected the top 10 meters below sea level, or effluent before dilute the discharge to the sea. To do this is to design a set of channels Snake pit on the beach that are trying to get as much as possible before discharging the effluent temperature ,The marine environment is reduced and eventually be diluted in a pool with sea water and then It is pumped by a pumping station to the wastewater discharge. Looking at the extracted results from modeling, Sheet (2), Becomes clear warm water effluent due to low water volume and temperature difference of 5 ° and Heat capacity above the sea, the warm water is discharged into the ambient seawater rapidly damped.

Table 2.Summary of simulation results

Scenario	Between the drain and harvest	Direction of the prevailing wind and wave	Satisfy the environmental requirements for water temperature within 200 meters of wastewater discharge	Satisfy the environmental conditions within a radius of 200 meters of salt water effluent discharge	Satisfy the environmental requirements for water temperature within a radius of 200 meters of water	Satisfy the environmental conditions within a radius of 200 meters of water to salt water	Economic conditions are satisfied Scheme
1	477	West	√	√	√	√	√
2	477	South East	√	√	√	√	√

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