

## Harnessing Energy and Water in the Salton Sea

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### ABSTRACT

The Salton Sea in California is a terminal lake with reduced inflow from the Colorado River and is facing environmental disaster. In several decades had been mentioned several proposal for the restoration of the Salton Sea by importing seawater, but they all failed to address: (i) salinity balance of the lake – proposing expensive processes such as reverse osmosis and distillers which require substantial amount of electricity, maintenance of filters, etc.; (ii) continuation of pollution from nearby farmland; (iii) practicality of the projects - implementing canals, tunnels, etc., and extreme cost which could not be repaid.

The presented proposal is quite different – it includes an architectural element which harmoniously incorporates several new (patented) technologies into a self-sustaining organism. The presented proposal includes several options based on the same concept: 1) Dividing lake into three sections; 2) Importing seawater from the Ocean and 3) Harnessing prevalent geothermal energy. By dividing the lake into three sections (central and two smaller northern and southern sections) and importing seawater into the central section of the lake it prevents continuation pollution of the Lake and provides a condition for tourism (exclusive real-estate, beaches, resorts, hotels, etc.), and vast wildlife sanctuary. Presented proposal also implements several breakthrough technologies such as a) Harnessing hydropower during import of seawater; b) Harnessing solar energy in combination with pipeline system; c) Harnessing prevalent geothermal energy which is accessible in the Salton Sea area by using a completely closed-loop heat exchange system for generation of electricity; d) Desalinization of the lake and production of the potable water as a free by-product; e) Providing source for extraction of lithium and providing depot for waste material. Presented proposal transforms the situation of the Salton Sea from the liability which would exceed \$70 billion (incoming environmental disaster – toxic dust storms, health issues, and economic fold) - to the tremendous assets (clean environment and hundreds billion dollars in revenue) – costing only about \$10 billion.

### 1. INTRODUCTION

#### 1.1 Note:

Presented paper with the title “Harnessing Energy and Water in the Salton Sea” is a segment of the comprehensive design for the long-term solution for the restoration of the Salton Sea (Lake in California). The solution for the restoration of the Salton Sea includes an architectural element which harmoniously implements several breakthrough technologies into a self-sustaining organism. There are five phases (segments) of the project including harnessing solar and hydro energy which are excluded for this occasion as not relevant to the geothermal issue. Each of the phases (segments) is essential for the final result of the project. The presented paper “Harnessing Energy and Water in the Salton Sea” is a fundamental segment of the comprehensive design on which function of other segments depend.

For this occasion, the paper “Harnessing Energy and Water in the Salton Sea” is marked as a (Segment I). For complete understanding of this segment it is necessary to review the other two integral parts of the comprehensive design with titles “Harnessing Geothermal Energy with the Self Contained In-Ground Geothermal Generator and Self Contained In-Ground Geothermal Heat Exchanger” as a (Segment II), and “System for Drilling Deeper and Wider Wellbores” as a (Segment III).

#### 1.2 Overview of the contemporary situation:

a) The Salton Sea in California is a terminal lake formed accidentally in 1905-1907 after levy at Colorado River has been breached after a storm. The inflow from the Colorado River has been reduced as a result of the water transfers related to the Quantification Settlement Agreement (QSA). The Lake is shrinking and exposing the receding shoreline (playa) to the elements precipitating higher salinity levels and facing incoming environmental disaster, health issues of the nearby communities, as well as a serious threat to its multibillion-dollar tourist trade.

b) The lake is 35 miles long, 15 miles wide, and is located south of Palm Springs in a basin 230 feet below sea level and is relatively shallow Lake.

c) The Earth's crust at the southern end of the Salton Sea is relatively thin. The temperature in the Salton Sea Geothermal Field can reach 680 °F (360 °C) less than a mile below the surface. (See FIG. 1)

d) On the southern part of the Lake, there is a known geothermal reservoir.

- e) The Salton Sea is California's largest lake and is presently over 50 % saltier than the Ocean. The Salton Sea is a "terminal lake," meaning that it has no outflow and salts, nutrients, pesticides, and other contaminants have concentrated in the Lake. Water flows into Lake from several limited sources, but the only way water leaves the Lake is by evaporation.
- f) Geothermal energy in the Salton Sea area is prevalent and topography is unique - the lake is 230 feet below the sea-level and is about 160 miles from both - the Ocean and Gulf of California.
- g) Under the terms of the Quantification Settlement Agreement (QSA) the lake's decline is set to accelerate starting year, 2018. About the 1/3 of inflow water from the canal will be diverted to San Diego and Coachella Valley.
- h) Runoff water from nearby agricultural fields which contains fertilizers, pesticides and other pollutants such as partially treated sewer from Mexicali contaminate the Salton Sea and make it an undesirable tourist destination especially for beachgoers.
- i) There have been many studies and complains about consequences for the nearby community if a solution for the Salton Sea is not found.
- j) In several decades had been mentioned several proposals for the restoration of the Salton Sea proposing importing seawater, but they all failed to address: (i) salinity balance of the lake – proposing expensive processes such as reverse osmosis and distillers which require substantial amount of electricity, maintenance of filters, etc.; (ii) not addressing continuation of pollution with pesticides and fertilizers from nearby farmland; (iii) practicality of the projects - proposing canals, tunnels, dozen pipelines - without addressing the practicality of its implementation - extreme cost with difficulties attracting investors for such projects that cannot generate revenue to pay-off initial investment, therefore, deemed unfeasible.

### **1.3 Five Phases of the Proposal for the Restoration of the Salton Sea:**

Phase I - Connecting the Salton Sea with the Ocean with a pipeline 48" (5 pipelines on the uphill routes and 1 pipeline on downhill routes) for importing seawater into the central section of the Lake (several options for pipeline corridors are provided (See FIG. 2 and 9);

Phase II - Dividing lake into three sections by building two main dikes (two-lane roads) strategically positioned - One in northern and one in the southern part of the Salton Sea (See FIG. 4, 5 and 8).

Phase III - Building one power plant using a completely closed-loop heat exchange system the (SCI-GHE system) at one of the selected sectors (Fig. 4, 5 and 7).

Phase IV - Building several more power plants using the (SCI-GHE) system - one in each additionally selected sector; and

Phase V - Continuing build-up of many additional power plants using the (SCI-GHE) system at each selected sector;

### **1.4 The key elements of the presented proposal are:**

- 1) Dividing the Salton Sea into three sections with two main dikes (two-lane roads) to prevent pollution of the larger central section of the lake which would provide the condition for tourism (beachgoers) and wildlife sanctuary in smaller northern and southern sections.
- 2) If Route 1 (Gulf of California, Mexico - Salton Sea, USA) is selected: To negotiate a treaty with Mexico's officials about diverting the flow of the New River and Alamo River back to Mexico and in return getting corridor for a pipeline for importing seawater from the Gulf of California. The pipeline with maintenance road can have several underpasses to preserve the integrity of Mexico's territory.
- 3) If Route 1 is selected – then, diverted flow of New River and Alamo Rivers can be treated and used for refilling Laguna Salada or for farmland (See FIG. 2, 3, and 4); (Tips for negotiations with Mexico's officials – in summary: It is in the interest of Mexico to have the flow of New River and Alamo Rivers. It is in the interest of the US to have a corridor for importing seawater from the Gulf of California).
- 4) For any accepted Route of importing seawater from the Ocean in the central section of the Lake – It is recommended to use In-Line-Pump/Generator system which generates electricity in downhill routes which can be used as a supplement to the energy needed for horizontal and uphill routes.
- 5) Optionally, the US can treat water from the New River and Alamo River and use it for farmland or sell it to Mexico;
- 6) Generation of the electricity by using the pipeline as a foundation for solar panels assembly for the generation of additional electricity and increasing revenue for several hundred million dollars per year. Solar energy is prevalent in the area averaging 280 sunny days per year.
- 7) Implementing pipeline with sprinkler system for farmland (Northern and Southern area of the Lake) to conserve limited source of water from Colorado River, received through All-American Canal, and to prevent the formation of runoff waters from nearby farmland. (See FIG. 4 and 8);
- 8) Generation of electricity by harnessing prevalent geothermal sources with new technology using a completely closed-loop system that is not limited to a known geothermal reservoir. (See Segments II & III);

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9) Desalinization of the lake by using gravity - pumping out higher salinity water - which tends to accumulate at bottom of the lake - and pumping it into the boilers of a new Power Plants for the generation of electricity and production of potable water as a free by-product (See also Segments II and III);

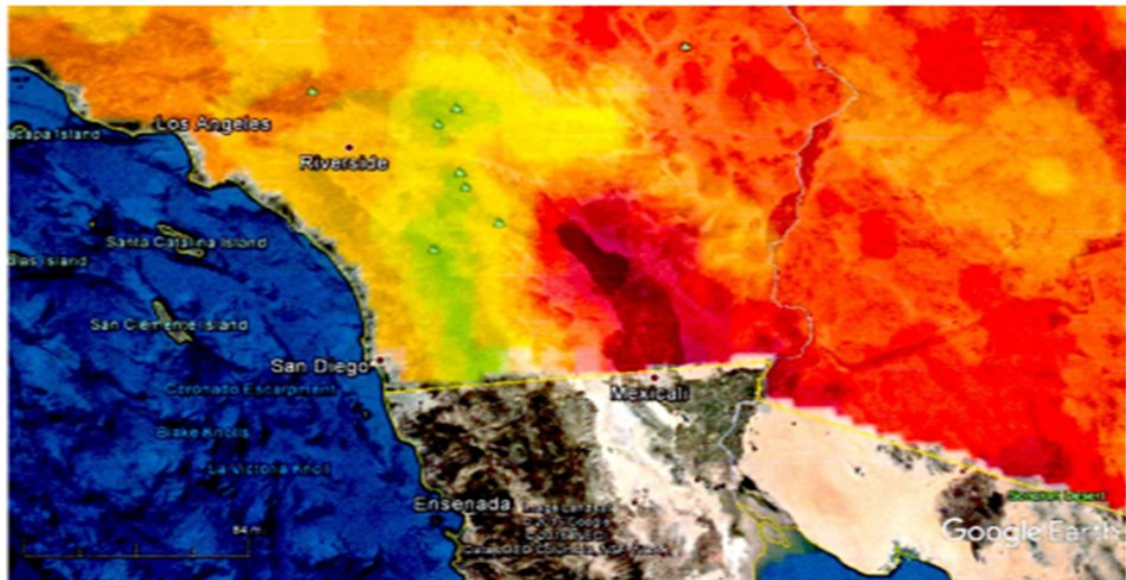
10) Providing a source (brine) for extraction of lithium (See Segments II and III).

11) Providing vast wildlife sanctuary (See FIG. 4, 5, and 8); and

12) Providing condition for tourism - exclusive real-estate, beaches, resorts, hotels, etc.- (Not included in this presentation).

## **2. DISCLOSURE - ILLUSTRATIONS - HARNESSING ENERGY AND WATER IN THE SALTON SEA (SEGMENT I)**

Segment (I)

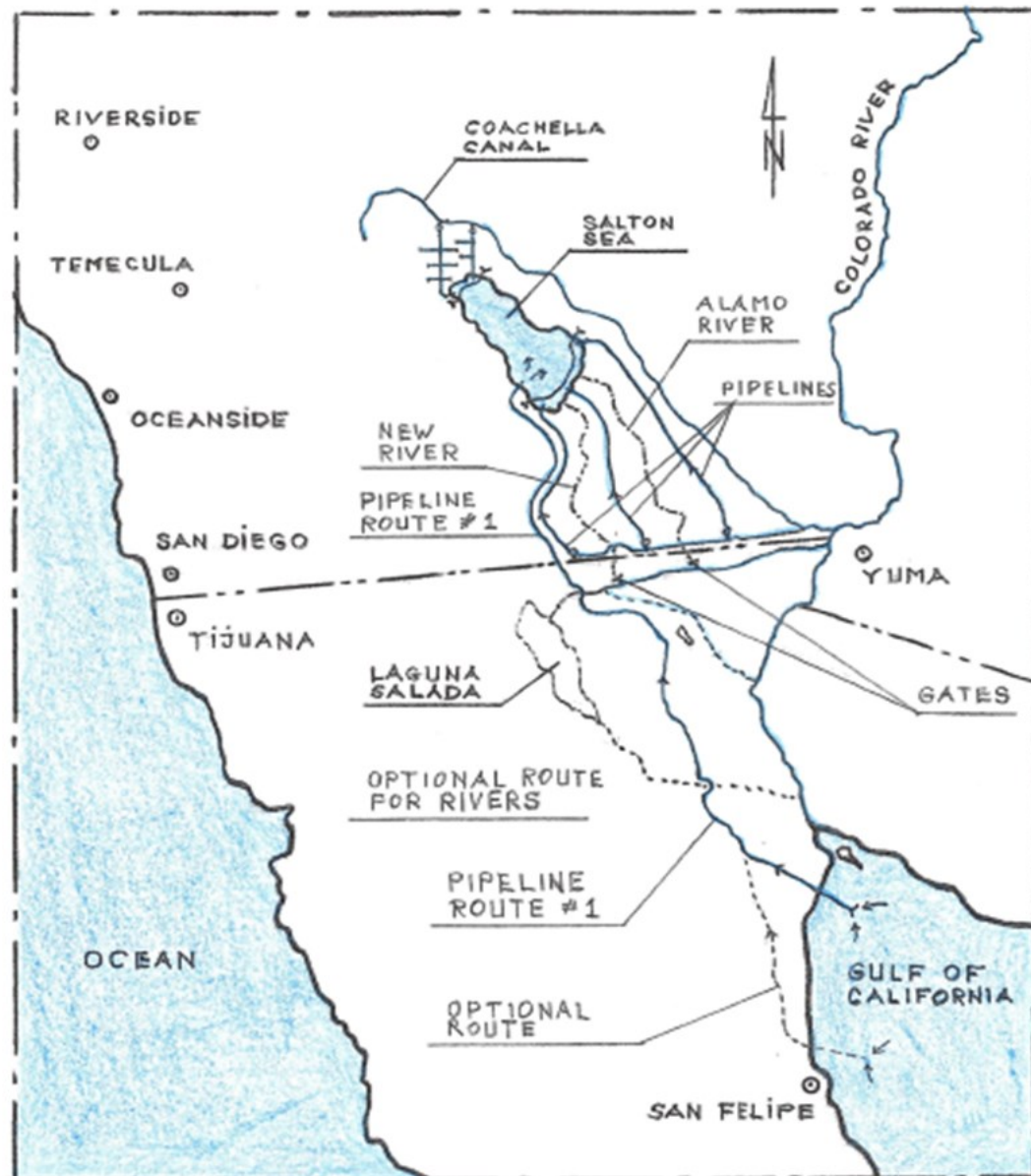


**FIG. 1** – Map of Southern California – Temperatures at dept of 3.5 Km

Segment (I)



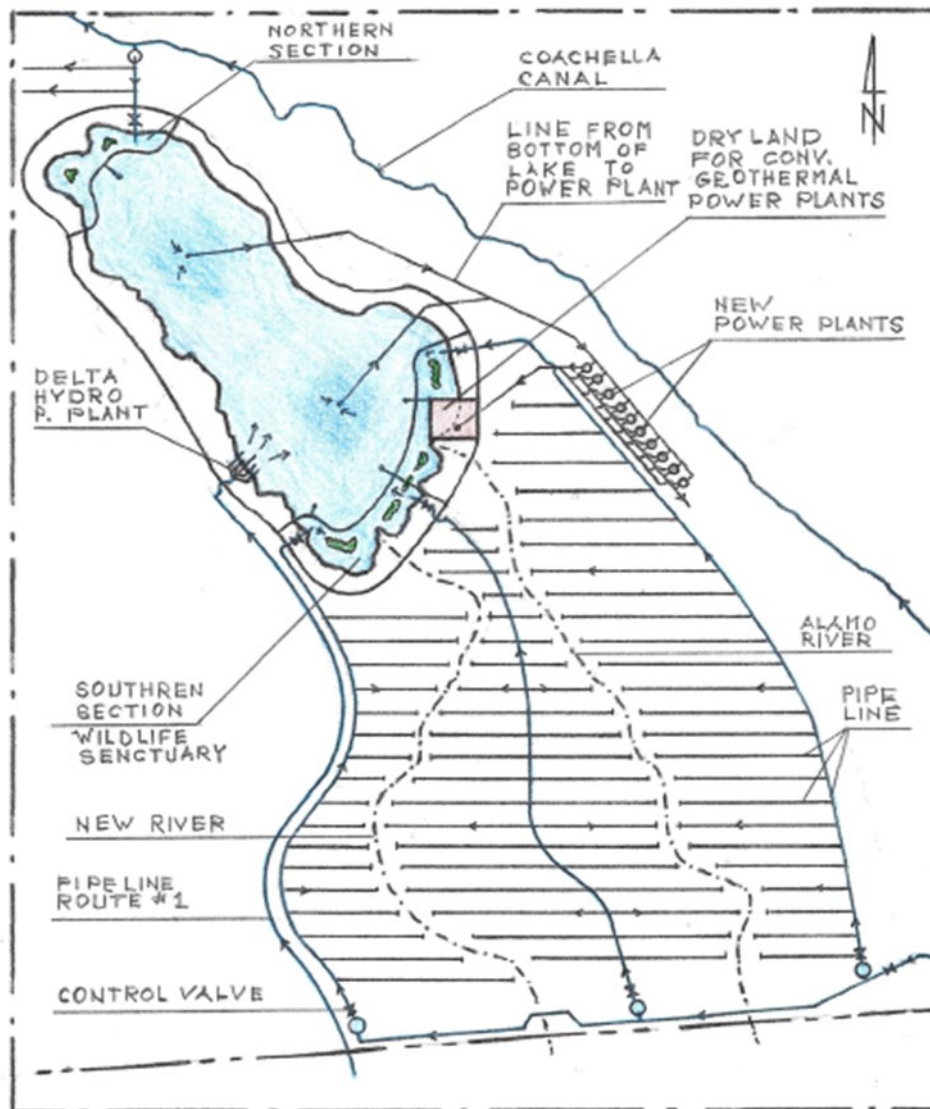
**FIG. 2** – Map of the Route #1



**FIG. 3** – Map of redirecting New and Alamo Rivers

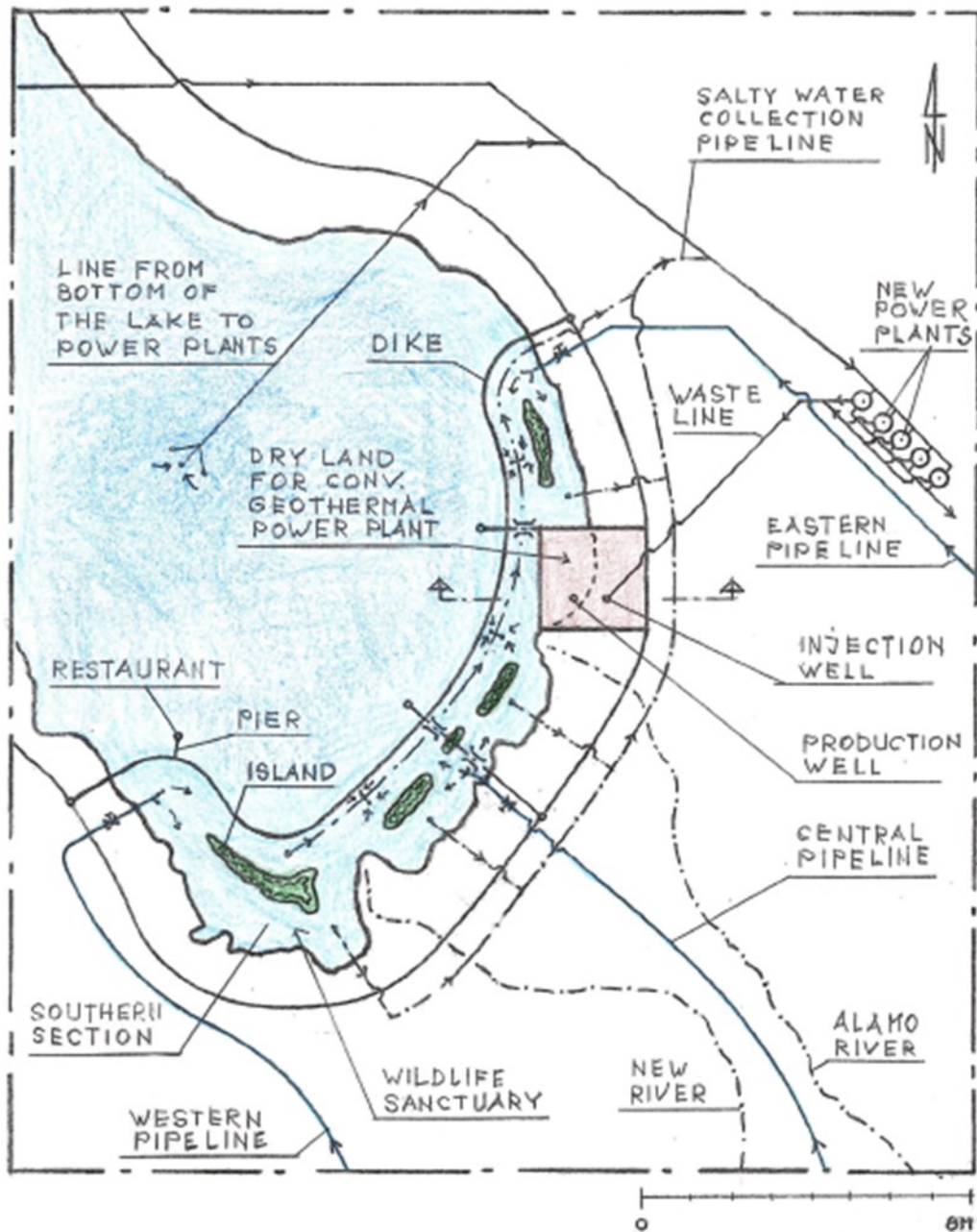


Segment (I)



**FIG. 4** – Map of redirecting New and Alamo Rivers – South of the Lake

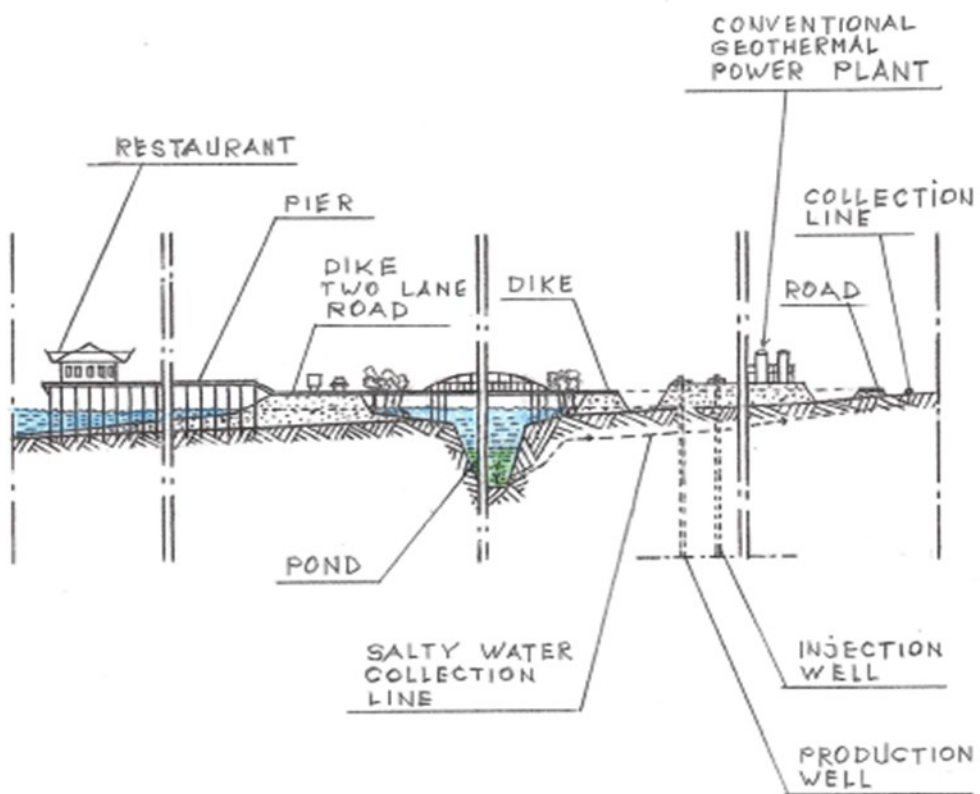
## Segment (I)



**FIG. 5** – Enlarged Southern Part of the Salton Sea –  
Wildlife Sanctuary

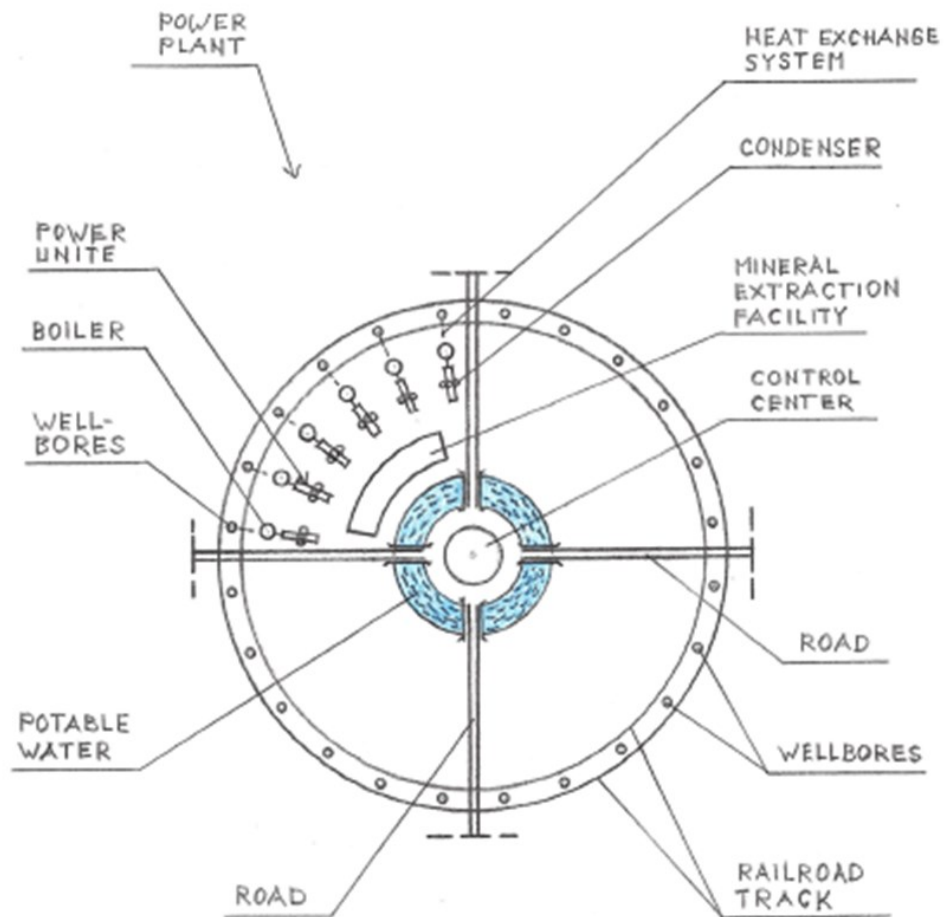


Segment (I)



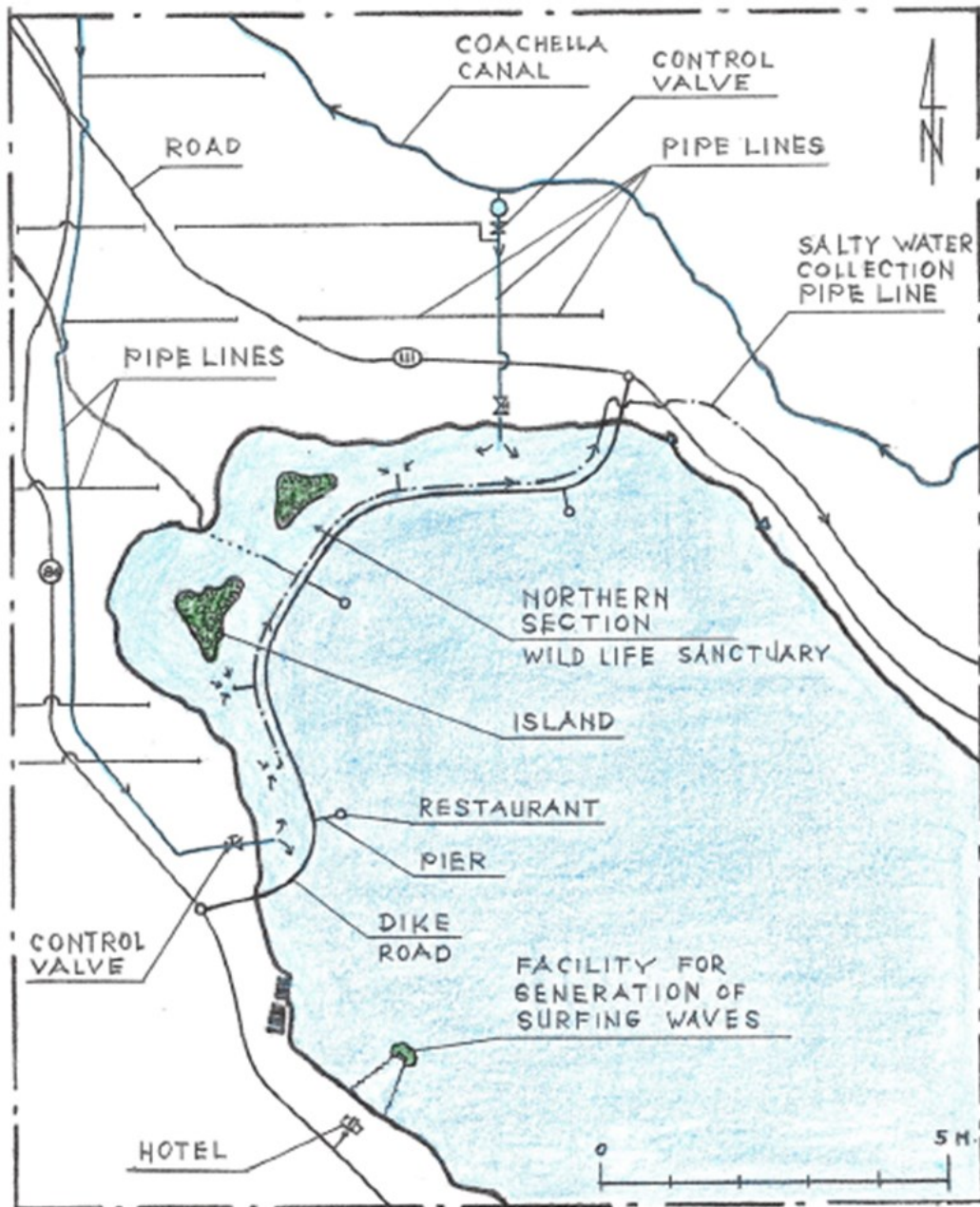
**FIG. 6** – Cross-sectional view taken near a typical dike-pier intersection

Segment (I)



**FIG. 7 – Plain View of a typical Power Plant**

## Segment (I)



**FIG. 8** – Enlarged northern part of the Salton Sea  
– Wildlife Sanctuary -

Segment (I)



**FIG. 9** – Map of the Route #2

## **2. CONCLUSION**

Importing seawater is a fundamental phase of the presented comprehensive proposal on which other phases depend. Also, importing seawater is an essential element in providing the necessary water for harnessing geothermal energy in the area for refilling depleting known geothermal reservoir, and is an essential element for the restoration of the Salton Sea.

Presented pipeline with a diameter of only 48" through Route #1 can import about 1 million acre-feet per year which is enough for the balancing evaporation of the Lake. The pipeline through Route #2 can import about 2 million acre-feet per year meaning that 1 million acre-feet can be used for other purposes including replenishing geothermal reservoirs.

Presented proposal for the restoration of the Salton Sea is a long-term solution which includes an architectural element which harmoniously implements several breakthrough technologies into a self-sustaining organism. Each of the segments (phases) is essential for the final result.

Presented proposal transforms the situation of the Salton Sea from the liability which would exceed \$70 billion (environmental disaster – toxic dust storms, health issues, and economic fold) - to the tremendous assets (clean environment and hundreds billion dollars in revenue) – costing only about \$10 billion for building it.

## **3. REFERENCE**

U.S. Patent No. 7,849,690; Entitled: "Self-Contained In-Ground Geothermal Generators" (SCI-GGG); Issued on Dec.14, 2010;

U.S. Patent No. 8,281,591; Entitled: "Self-Contained In-Ground Geothermal Generators" (SCI-GGG); Issued on October 9, 2012;

U.S. Patent No. 8,713,940; Entitled: "Self-Contained In-Ground Geothermal Generators"; Issued on May 6, 2014;

U.S. Patent No. 9,206,650; Entitled: "Apparatus for Drilling Faster and Wider Wellbore; Issued on December 8, 2015;

U.S. Patent No. 9,978,466; Entitled: "Self-Contained In-Ground Geothermal Generator and Heat Exchanger with In-Line Pump; Issued on May 22, 2018;

U.S. Patent No. 9,982,513; Entitled: "Apparatus for Drilling Faster and Wider Wellbore with Casing; Issued on May 29, 2018;

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## **ACKNOWLEDGMENT**

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