Definition of Terms

- **Beach Well** - A series of vertical cylinders sunk into the ground along the coastline for the purpose of gathering seawater, while using the earth to pre-filter particulates from the incoming flow. The preferred construction will include a top cap finished below grade which will be covered by earth, but still contain an access hatch for maintenance. Multiple Beach Wells will be connected to a common pipeline or penstock, to increase the total flow to required levels.

- **Coastal Conduit** - A pipeline that will connect the Beach Wells to the underground desalination plant located some distance from the coastline. The difference in elevation between the sea level and the underground seawater reservoir will allow this system to be powered by gravity.

- **Stormwater Capture** - Climate Change is known to increase the number of intense storms which can dump large amounts of rainfall in a short amount of time. Intakes along various surface water runoff locations will be used to divert this sudden influx of water into underground reservoirs. This water may be used independently or blended with seawater to produce brackish water.

- **Reverse Osmosis Desalination** - The process of extracting fresh water from salted water by using a fine filter or membrane. The salted water is pressurized in order to force it through the membrane, thus leaving the salt behind. Fresh water is produced from the low pressure side of the membrane. The concentration of salt in the water left behind (on the high pressure side) continues to increase as it moves along, producing a product called brine. The typical product ratio of fresh water to brine is about 50:50. The typical membrane required Pressure Differential (DP) for seawater is between 800 to 1000 psi; for brackish water it is between 250 to 400 psi.

- **Differential Pressure (DP)** - The difference in pressure between the inlet and outlet fluid of a machine or apparatus.

- **Million Gallons per Day (MGD)** - The flow rate commonly used to measure capacity of desalination plants. The Sorek plant in Israel is currently the world's largest Reverse Osmosis Desalination plant with a capacity of approximately 165 MGD.

- **Haiwee Reservoir Headworks** - A system designed to deliver water from the Haiwee Reservoir to the Super Conduit intakes. Intakes will be able to be filled or isolated independently, without the need to drain the reservoir. The Headworks will also insure that only clean water can enter the system, all while maintaining constant atmospheric pressure at the intake.

- **Super Conduit** - Multiple pipelines or penstocks designed to convey water from an upper reservoir to a lower elevation, thus increasing its pressure for the purpose of energy conversion. Ideally, the conduit design would minimize resistance to flow (or head loss) and allow the maximum pressure drop to occur at the Water Engine. Safety devices such as bypass valves, or accumulators will be in place to protect the conduit from over pressure or under pressure events.

- **San Andreas Fault Crossing** - The proposed Los Angeles Super Conduit would need to cross the San Andreas Fault line (as does the Los Angeles Aqueduct). Seismic activity poses a substantial threat to the LA Conduit and thus, measures must be taken to prepare for such an event. Flexible joints on either side of the fault line will allow for longitudinal or lateral movement of the conduit without damage.

- **Transformed Hydraulic Power (THP)** - An energy system utilizing a Super Conduit and a Water Engine-Pump to extract energy from the primary water (from the Super Conduit) and input it into the secondary water. When used for desalination, the secondary water would be seawater. Therefore, fresh water would drive the Engine and the Pump would drive seawater through membranes.

- **Water Engine** - A machine that extracts energy from a flow of water by undergoing a drop in pressure. This is a general term, as opposed to other machines that may accomplish the same thing under more narrow terms. Reaction Turbines or Impulse Turbines are both part of the Dynamic family. Positive Displacement machines are yet another family. It should not be assumed that a Water Engine belongs to any particular family or type.

- **Water Pump** - A machine that inputs energy into a flow of water in order to increase its pressure.

- **Water Engine-Pump** - A combination of a Water Engine and a Water Pump.

- **Blending** - Mixing more than one source of water together may provide many benefits. For example; the LA Aqueduct water contains low levels of arsenic, and seawater contains low levels of boron. Blending may reduce toxins to safe levels without energy intensive systems or expensive chemical treatments. Also, membranes are known to strip water of some vital minerals, which must be added back in. Blending may eliminate the need for this extra step.

- **Overall Pumping Efficiency (OPE)** - Since most water pumps are driven by electricity this is also known as the wire-to-water efficiency. It is the measure of water power from the pump as a percentage of wire power input to the motor. This accounts for energy losses at the motor-pump, but does not account for energy losses at the power plant nor by electrical transmission.

- **Overall System Efficiency (OSE)** - This measures energy efficiency starting from the producer, to the end user. Consider the OSE of pumping water using electricity generated at a coal fired power plant. Coal is burned to boil water, which drives a steam turbine, which drives a generator, which is transmitted over power lines, which powers the motor-pump. Assuming that the power plant efficiency is 50% (coal-to-wire), and the transmission efficiency is 50% (wire-to-wire), and the OPE is 80% (wire-to-water), that would make the OSE 20% (coal-to-water). THP is an attempt to increase OSE by minimizing the number of steps in the energy conversion process.

- **Net Zero Grid Impact** - Water Conveyance consumes energy to move water. Desalination consumes energy to generate new water. The Los Angeles Desalination Project will generate new water from THP, and electricity. Therefore only a percentage of the new water would use electricity. When the electrical energy per volume (MW*hr/Acre*ft) for Conveyance and Desalination are the same, the source of a communities water will have no net impact on the electrical grid.

- **Megawatt*Hour (MW*hr)** - The quantity of work equal to 1 million Watts consumed for 1 hour.

- **Acre*foot (Acre*ft)** - The volume of water equal to covering 1 Acre to a depth of 1 foot.

- **Static Head** - The pressure of water equal to a standing column of water measured in feet taken from a port while the water in the pipeline is at rest or stationary.

- **Dynamic Head** - The pressure of water equal to a standing column of water measured in feet taken from a port while the water in the pipeline is flowing or in motion.

- **Friction Head** - The difference between Static Head and Dynamic Head measured in feet. Also known as head loss. For a Water Engine, the Dynamic Head is less than the Static Head. For a Water Pump, the Dynamic Head is greater than the Static Head. Friction Head hurts the performance of either machine. The Water Engine will produce less power, and the Water Pump will consume more power because Dynamic Head is used to calculate Water Horsepower.

- **Water Horsepower** - The quantity of energy in a flow of water measured in horsepower. The formula is: Water HP= (Gallons per Minute*Dynamic Head)/3960.

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