Bella Machines

Feasibility Study Plan

Los Angeles Desalination Project

Brian Nissen
Bella Machines
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Background

The Los Angeles Desalination Project is a proposal to construct a new underground desalination plant in Sylmar to help provide for the water needs of Los Angeles and Southern California. The project would be unique because it would be the first desalination plant in the world to have a built-in renewable energy power supply. There are a number of issues that need to be studied to determine whether the project should move forward to construction. The technology needs to be analyzed, the cost-benefit analysis needs to be determined, and environmental impacts need to be studied.

Goal

The goal of the Feasibility Study for the Los Angeles Desalination Project is to determine the viability of the project. The study will evaluate the technical aspects of the project and the financial costs. For each physical section of the project, engineering, construction and environmental reviews need to be completed.

The Project has seven unique sections:

1. Haiwee Reservoir Headworks
2. Los Angeles Super Conduit System
3. San Andreas Fault Crossing
4. Brine Conduit
5. Coastal Conduit
6. Beach Well Series
7. Sylmar Underground Facility

In addition to the engineering, construction and environmental reviews, a financial analysis needs to be completed. An accurate project budget must be developed that would be weighed against the output of new water and the environmental impacts of the project. The Feasibility Study may also identify improvements that can be made to the project. The Feasibility Study is designed to determine whether it is in California's and the nation's best interest to move forward with the Los Angeles Desalination Project.

1. Haiwee Reservoir Headworks

Description; Make needed upgrades to the Haiwee Reservoir earth fill structures and build a new headworks facility or facilities to house intakes that will accept water from the reservoirs and deliver it to the LA Super Conduit System. The intakes will include a screening system to prevent fish or debris from entering the LA Conduit System. A sand trap will also be used to capture any sand or debris that makes its way past the screens. An isolation system will be able to stop the filling of the conduits independently. This will also eliminate the need to drain the reservoir during future maintenance of the conduits. Exposure to atmospheric pressure at the intakes must be maintained at all times. Loading of the screens, or use of the isolation system will have no impact on conduit water pressure.

Engineering Review;

- Verify the elevations of the upper and lower reservoirs, and measure the total flow leaving the reservoirs.
- Design seismic upgrades to the earth fill structures in order to restore the reservoirs to be used at full capacity.
- Design the headworks structure(s) with intakes and integrate them into the split reservoir system. It may be necessary to build two headworks facilities, one for the upper and one for the lower reservoir.
- Design an isolation system that maintains atmospheric pressure at the intakes at all times.

Construction Review; Determine the best methods to make the needed improvements and upgrades, while not impacting water deliveries to the Los Angeles Aqueduct (LAA). Since the Haiwee Reservoir has an upper and lower section, it may be possible to dry one section during construction and use the other to maintain deliveries. Obtain detailed cost estimates from qualified contractors.

Environmental Review; Fish hatcheries in the Owens Valley are there to introduce fish back into the environment. The goal is to minimize impact to these facilities and improve habitat through improved design and determining best practices. Geothermal activity in the Owens Valley introduces small amounts of arsenic into the water supply. It is important to know the concentration at the reservoir to be able to measure the benefits of blending in new water from desalination at the Sylmar plant.

2. Los Angeles Super Conduit System

Description; Design and build a continuous conduit from the Haiwee Headworks to the Sylmar Well for the purpose of energy conversion. Four conduits will run the 137 mile distance, each with an inside diameter of approximately 10 ft. Having multiple conduits is seen to have many advantages. During the charging stage of the project, filling one conduit at a time will have less of an impact to deliveries to the LAA until switchover is complete. Redundancy will also minimize impacts to power production during scheduled maintenance of the system.

It is recommended that “cut and cover” be used for the majority of the 137 miles because it is the most economical approach. A survey will be completed to determine the ideal pathway to keep each conduit as straight as possible, the slope as constant as possible, and buried deep enough to prevent tampering from outsiders. Each conduit will be equipped with pressure protection bypass valves along its' length, approximately every 15 miles. The bypass valves will protect against under pressure, as well as over pressure events. Rapid changes in water pressure could damage the conduit. Such devices are critical to protecting this investment.

Engineering Review; Safety devices and smart design will protect the conduits from harm by; pressure surges, seismic activity and terrorism. Under pressure events (mostly in the upper regions) and over pressure events (mostly in the lower regions) could occur in the conduit if there is a rapid change in flow. Bypass valves along the length of the conduit will protect against such an event. It may be cost effective to connect the bypass system to the existing LAA and/or its reservoirs in order to supply water from (for under pressure events), or discharge water to (for over pressure events). The LAA consists of 2 aqueducts between the Haiwee Reservoir and Sylmar.

- Designers will decide what should be done with these aqueducts and reservoirs to maintain deliveries during construction, and to ensure reliability of the new system when completed.
- Design the conduits to minimize head loss and allow the maximum pressure drop to occur at the freshwater engine (located in Sylmar).
- Investigate using different materials to achieve the required strength of each super conduit section as it changes over the length of the system.
- Determine the value of LA Conduit benefits such as; renewable energy, increased water storage, protection from evaporation, protection from contamination, and decreased dependence on the grid.

Construction Review; Determine the best materials and methods to build a buried conduit system designed to endure for 100 years. It may be necessary to build a pipe manufacturing plant on site in order to minimize the cost and delivery time of the conduit sections. It is understood that the inside diameter of each pipe section will be constant though its entire length, but the wall thickness will change as the water pressure demands. Also some sections will have ports to connect the bypass valve protection system. Therefore each section will be assigned a number to ensure assembly in the correct order. The number will include conduit and section identification. It is preferred that the sections be welded rather than bolted together. This will eliminate the cost of flanging the ends of each section. It may be economical to invest in automatic welding machines. The weld of each section will need to be x-rayed to confirm weld quality. Accurate record keeping will ensure section assembly in the correct order, and that each section has passed x-ray inspection. Obtain detailed cost estimates from qualified contractors.

Environmental Review; The 137 mile distance between the Haiwee Reservoir and Sylmar poses substantial challenges to overcome. The conduit pathway will play a major role in acquiring permitting of the conduit system. Locating all conduits below ground and in close proximity to the LAA may limit the need to purchase new land, and allow use of existing right-of-way laws. Locating the conduits underground will allow the land to heal completely, and with care, be restored to its natural state. Many sections of the LAA are exposed to the surface, which many see as unsightly. The new system will be invisible when completed. Impacts to wildlife along the conduit pathway will be studied, and measures will be determined to mitigate these impacts.

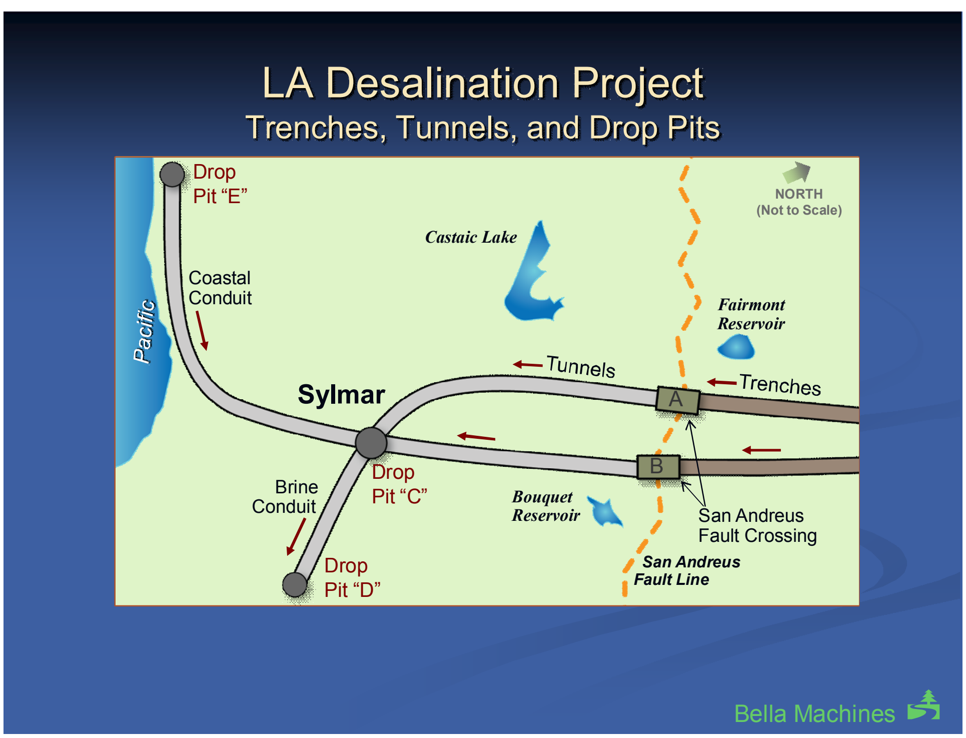
3. San Andreas Fault Crossing

Description; The Los Angeles Super Conduits will need to cross the San Andreas Fault line, as does the LAA. Seismic activity poses a substantial threat to the conduits, and measures must be taken to prepare for such an event. Flexible joints on either side of the fault line will allow for movement of the conduit without damage. A primary shutoff valve will be in place for each conduit to shut off flow should the need arise. An accumulator and bypass valve will also be in place for each conduit to redirect the flow to the Fairmont Reservoir if necessary. Bringing the flow to a stop in a slow controlled fashion is vital to preventing damage to the conduit, in the event of an unscheduled shutting of the primary valve.

The conduits will be contained within underground crossing structures “A” and “B” to be protected from seismic events or terrorism. The crossing structures will also be a transition point for the conduit construction method; from “cut and cover”, to “tunnel containment”. A tunnel boring machine (TBM) will be placed inside each crossing structure, and then proceed to bore lined tunnels to the Sylmar Well "C". The TBM from crossing “A” will continue on (past Sylmar) to make the Brine Conduit in a downward slope toward the coastline, terminating miles south of the Beach Wells. Miles of separation between the Sea Water intakes (near Topanga Beach) and the Brine Treatment facility (near Long Beach) will prevent cross-contamination of the two. Determining the correct elevation where the TBMs intersect the Sylmar Well is important because it will impact other design aspects of the project.

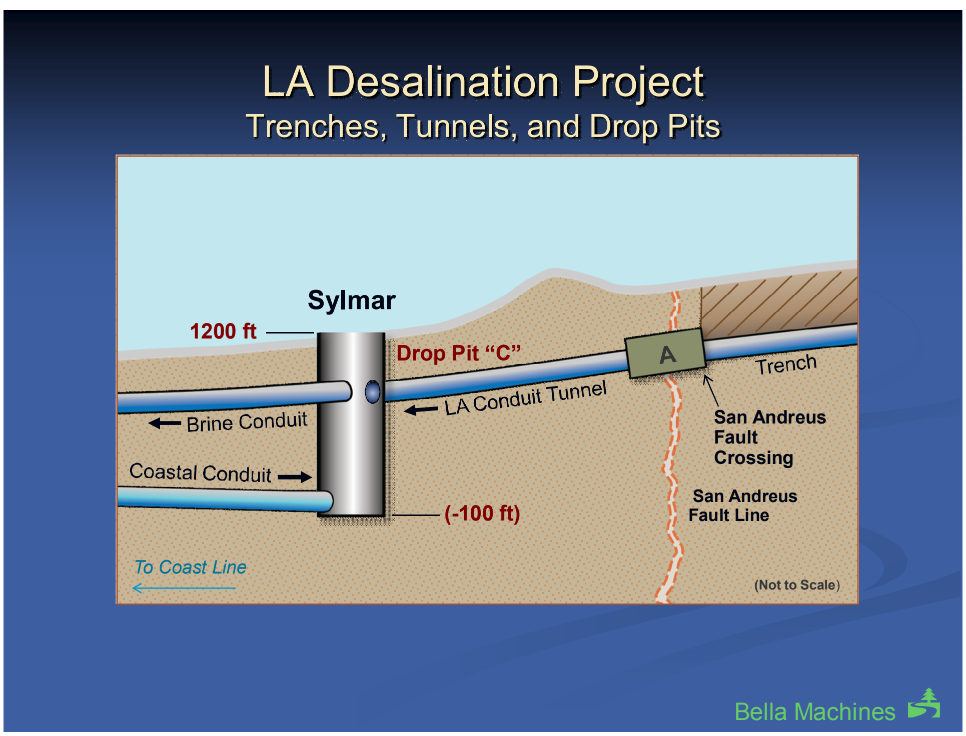
Engineering Review; Safety devices and smart design will protect the super conduits from; pressure surges, seismic activity and terrorism. Underground crossing structures "A" and "B" will be designed to withstand seismic events without failure, and include secure access to allow only authorized persons into the facilities. Design of the valves and accumulators must ensure the protection of the LA Conduit system. It is recommended that weight loaded accumulators will have piston rods only subjected to tensile forces, and be equipped with a progressive weight system. Progressive weights will simulate a spring loaded accumulator without concern for spring fatigue. The bypass valves will need to be connected to the Fairmont Reservoir by an additional pipeline system. A preliminary design schedule will need to be completed for all of these safety systems to be housed within the crossing structures.

Please refer to the diagrams for the proposed pathways of the LA Super Conduits, the Brine Conduit and the Coastal Conduit. Two views are shown; an overhead view showing pathways relative to known landmarks, and a cross sectional view showing conduit slopes and relative elevations. Drop pits will allow means to lower and retrieve the TBMs.



Construction Review; Determine the best materials and methods to build 2 underground crossing structures to protect the super conduits and surge protection systems for 100 years. It is recommended that "cut and cover" be used from the Haiwee Headworks to the San Andreas Fault Crossing, and "tunnel containment" be used from the San Andreas Fault Crossing to the Sylmar Well. Investigate the use of 2 TBM's to construct 2 parallel tunnels, each with an inside diameter of 30 ft. Each tunnel will contain 2 super conduits, for a total of 4 super conduits spanning the 137 mile distance. Obtain detailed cost estimates from qualified contractors.

Environmental Review; The proposed site of the crossing structures may require additional land acquirement along with new permitting because it is not as closely aligned with the LAA pathway (as would be most of the LA Conduit). The use of the Fairmont Reservoir as an emergency storage facility for LA Conduit water may require special permitting. The old Fairmont Reservoir has been decommissioned because it was determined to be no longer capable of withstanding seismic events. It may be necessary to make seismic upgrades to the old Fairmont Reservoir rather than using the new Fairmont Reservoir because it may not have the capacity to handle this additional burden.



4. Brine Conduit

Description; Brine disposal is a concern to the stakeholders of the LA Desalination Project. Many believe that simply dumping brine back into the sea may be harmful to marine life. An analysis will explore ways to convert brine into useful products such as table salt and hospital grade saline solution through business partnerships. Salt is mined in many parts of the world and has market value. Coupling desalination plants with salt production facilities may prove to be cost effective as well as carbon neutral. The Brine Conduit will use gravity to convey the brine from the Sylmar Well to the brine treatment facility once the ideal location is determined. The tunnel's lining may serve as the conduit (unlike the LA Conduit tunnel with super conduits placed inside). Special considerations for brine will be made when selecting the Brine Conduit material. An analysis will determine the ideal pathway to maintain a constant slope, and avoid impacts to existing structures (above ground and below). Other brine disposal methods will be explored, in order to satisfy stakeholder requirements to minimize impact to the environment.

Engineering Review; Converting brine into useful commercial products requires energy. Although the partner will bear the cost of this energy, it is still a concern to the project stakeholders. An analysis will study proposed processes of this new facility such as; concentrated solar, and vacuum evaporation. These will then be compared to existing processes like salt mining to determine; net cost, net energy, and net carbon of salt production.

Construction Review; The same TBM that will bore the LA Conduit tunnel from crossing "A" to the Sylmar Well "C", will continue on to complete the Brine Conduit (also lined with a 30 ft inside diameter). Once the Brine Conduit termination point is known, it must be determined how to extract the TBM. It may be driven through the surface at the proposed site, or it may be retrieved from Drop Pit "D". The slope of the Brine Conduit will be as constant as possible and the pathway will avoid impacting existing structures on the surface or underground (i.e. building foundations and subways). Obtain detailed cost estimates from qualified contractors.

Environmental Review; The Brine Conduit pathway must not damage property or the environment. Running a TBM under LA near the surface requires careful planning. It may be necessary for the pathway to closely follow the pathway of the LA River above. If this is indeed the case, the most likely location for the new brine treatment facility would be Long Beach, California. Special permits will be needed to ensure that impacts to property and the environment will be mitigated. It will be necessary to have brine treatment backup systems in place at the new facility. An analysis will research methods to dilute brine concentration back to safe levels when discharging into the sea is necessary. Blending brine with; seawater, LA River water, or water recovered during the salt production process, will be explored for their effectiveness to mitigate impacts to marine life.

5. Coastal Conduit

Description; Design a system that will use gravity to convey seawater from the Pacific to the Sylmar Well. The distance from Topanga Beach to Sylmar is approximately 20 miles. The Coastal Conduit may actually be longer than 20 miles because it may also run parallel to the coastline for more miles, terminating at Drop Pit “E”. The seawater reservoir located at the bottom of the Sylmar Well has a proposed dynamic elevation of 50 ft below sea level. In order for the desalination facility to produce 1 BGD of freshwater, the Coastal Conduit will need to convey approximately 2 BGD of seawater. The tunnel’s lining may serve as the conduit (unlike the LA Conduit tunnel with super conduits placed inside). Special considerations for seawater will be made when selecting the Coastal Conduit material. The inside diameter of the tunnel lining is recommended to be 50 ft in order to minimize resistance to flow. Although some may stipulate that an inside diameter of 40 ft is adequate, a larger tunnel will allow for future extensions up the coastline to add more beach wells, or to add storm water capture from Ventura County. Planning for these extensions now may be a cost effective way to increase future capacity while minimizing impacts to ongoing production. Using a TBM near the surface and near the coastline will require special planning. The proposed pathway follows the mountains and hills to minimize risk to the environment and property above. A temporary pumping system will be in place at the bottom of the Sylmar Well to keep it dry and ensure the safety of the Coastal Conduit TBM crew during construction.

Engineering Review; Blending seawater with freshwater produces brackish water. Brackish water is known to require substantially less energy for desalination. The Coastal Conduit may be designed to allow fresh groundwater to enter the conduit by giving the section running along the coastline a porous lining. An analysis will study how fresh groundwater use would impact water production and energy use at the Sylmar Well. If the data shows that the water and energy benefits of using fresh groundwater are too little, then the idea of using a conduit with a porous lining may be abandoned. The slope of the Coastal Conduit will be near zero along the coastline, and then slightly pitching downhill between Topanga Beach and the Sylmar Well. The Coastal Conduit and the Sylmar Well will both be considered part of the seawater reservoir. The dynamic water level will rise and fall together, with little elevation difference along its length. The primary driver for this gravity system is the difference in elevation between the Coastal Conduit and the sea. The slope of the Coastal Conduit will allow construction seepage water to effectively drain away, but not allow standing water to block worker egress (water reaching the tunnel ceiling) if the temporary pumping system should fail.

Construction Review; The safety of the TBM crew will be paramount, especially when tunneling near the sea. A safe distance and depth must be determined to achieve the objective while minimizing risk. Emergency evacuation procedures will be drawn up to safeguard the TBM crew. The TBM will be placed at the bottom of the Sylmar Well "C" and proceed to Drop Pit "E". Drop pit "E" will be completed before the arrival of the Coastal Conduit TBM. The slope of the tunnel will allow any seepage water that enters during the boring process to drain toward the Sylmar Well. A temporary pumping system will keep the Sylmar Well dry during construction. It may be necessary to complete the Brine Conduit prior to starting the Coastal Conduit, in order to properly dispose of seepage water. The rate of seepage must be known in order to correctly size the temporary pumping system. An analysis will determine the Coastal Conduit seepage rate if the coastline section has a porous lining, or if no section has a porous lining. If the data shows that a failure of the temporary pumping system will allow seepage water to block the egress of the tunnel workers, then the idea of using a conduit with a porous lining may be abandoned. It may be necessary to bore vertical holes between the tunnel and the surface for emergency egress, and future maintenance needs. Obtain detailed cost estimates from qualified contractors.

Environmental Review; Blending seawater with freshwater produces brackish water. Brackish water is known to require substantially less energy for desalination. Several freshwater sources will be researched to blend with seawater such as; A) fresh groundwater, B) treated waste water, and C) storm water. All of these options will need to be studied for their impacts to the environment before permitting is allowed. A) An analysis will study how fresh groundwater use may impact salt water intrusion. If the data shows that salt water intrusion into fresh groundwater supplies will accelerate, then the idea of using a conduit with a porous lining may be abandoned. B) Recycling treated waste water back into the water supply is not a new idea. Blending treated waste water with seawater may be a more efficient way to convert waste water back into potable water when using this new underground system. C) Future extensions of the Coastal Conduit into Ventura County may include storm water capture along the Santa Clara River. An analysis will compare the benefits of increasing the water supply and fighting soil erosion, to the environmental impacts of installing a storm water capture system. Other surface waterways near the Coastal Conduit pathway will also be explored as possible storm water capture resources.

6. Beach Well Series

Description; Design a series of perforated 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. Each Beach Well will include an access hatch for maintenance or the removal of sand. A series of Beach Wells will run parallel to the coastline and each will be connected to the Coastal Conduit by an additional pipeline. Multiple Beach Wells will be needed in order to obtain the total required seawater flow. The most ideal way to orient each individual Beach Well cylinder must be determined. A vertical Beach Well sunk deep into the earth may tap into the "transition zone", where both fresh groundwater and salty groundwater overlap. Tapping into fresh groundwater may require special permitting. A horizontal Beach Well may be more difficult to bury, however the connection to the Coastal Conduit may be less expensive than the vertical version. The flux of each Beach Well will be determined by a number of factors; the resistance (to flow) of the cylinder walls, the resistance (to flow) of the earth, and the well's distance to the Pacific. The flux and the cylinder surface area will be used to calculate the total number of Beach Wells required to gather 2 BGD and deliver it to the Sylmar Well by gravity.

Engineering Review; Blending fresh groundwater with salty groundwater is seen as beneficial to water production. It may be difficult to prevent some fresh groundwater from entering the Beach Well even if it was not desired. An analysis will estimate the total fresh groundwater entering the system from the Beach Wells (if any), and how it impacts the Sylmar Well water production and energy requirements. These facts will be used to decide whether the Beach Wells should be oriented vertically, horizontally or perhaps a hybrid of the two. It is recommended that a water gate be installed between each Beach Well and the Coastal Conduit. The water gate will hold back water prior to each Beach Well coming online, and can also be used for maintenance later on.

Construction Review; The safety of the Beach Well crew will be paramount, especially when using heavy equipment on unstable soil or sand. Careful planning will be needed to create a stable work surface for heavy equipment and to hold back the earth while digging. It may be necessary to build a machine to insert Beach Well cylinders into the earth, while maintaining crew safety. The crews will need to be aware of how tides will impact their work, and stay current on tidal charts. All Beach Wells must be buried deep enough so that 100 years of anticipated beach erosion will not expose the cylinder wall to open water. It may be necessary to wrap each cylinder with fabric to impede the flow of sand and soil into the well. Other methods to resist sand infiltration will be investigated. There will be access to each Beach Well for maintenance and cleaning. Obtain detailed cost estimates from qualified contractors.

Environmental Review; Beach Wells were chosen to gather seawater in order to prevent marine life from entering the system, as opposed to “lagoon style” desalination facilities or facilities that place intake pipes directly into the sea. An analysis will compare the expense of installing Beach Wells, to the benefits of protecting marine life, and eliminating the pre-filtering process costs. There are similarities between the Coastal Conduit (section 5) and the Beach Well Series (section 6) environmental concerns for fresh groundwater supplies. Saltwater intrusion has been a growing problem in areas close to the coastline for some time. The environmental focus on this section is to prevent that problem from getting worse. The Coastal Conduit may or may not have a perforated lining. However the Beach Well cylinders must always be perforated. The orientation of the Beach Well cylinders is what must be determined. An analysis will decide the most ideal way to orient to the Beach Well cylinders in order to maximize seawater recovery while minimizing negative impacts to fresh groundwater supplies near the coastline. If it is determined that a significant amount of fresh groundwater from the "transition zone" will indeed be entering the system, then special permits may be required.

7. Sylmar Underground Facility

Description; Design an underground desalination facility that will force seawater through membranes and lift the freshwater to the surface (approximately 1250 ft above the seawater reservoir). The desalination facility will use built-in renewable energy and electricity. It is preferred that the plant should still be able to desalinate water and lift it to the surface without electricity, although not at full capacity. This will ensure a dependable water supply in the event of grid failure. A desalination capacity of 1 BGD in Sylmar would reduce water deliveries to Southern California from the California Aqueduct and maximize energy savings from the “Valley String”.

Sylmar was selected for many reasons. Sylmar allows access to existing infrastructure such as; two treatment facilities and their delivery systems, the Pacific Intertie, local water storage and their treatment and delivery systems, and other reasons which will be mentioned. The LA Filtration Plant (owned by the LADWP with a capacity of 600 MGD), and the Joseph Jensen Treatment Plant (owned by the MWD with a capacity of 750 MGD) are both located in Sylmar. The Pacific Intertie is a long distance DC power line that originates at the Bonneville Power Administration (BPA) and terminates in Sylmar. Exporting Sylmar water to Castaic Lake may be possible with upgrades to the Newhall Tunnel. Pyramid Lake is already connected to Castaic Lake by the Castaic Pump-Gen facility. Further, modifications to the California Aqueduct’s west branch would allow desalinated water to reach the east branch. This would allow desalinated water to be distributed to the majority of Southern California. Since Sylmar is 18 miles inland from the coastline, it will also be better prepared for 100 years of anticipated sea level rise.

Sylmar is also the termination point of the LAA which would allow the proposed LA Super Conduit System to supply renewable energy to the new facility. This new facility will also need electrical power to achieve a total plant capacity of 1 BGD. The capacity of the “free water” generated from THP will be determined and weighed against the cost of the LA Conduit systems (sections 1,2 and 3). The capacity of the “electric water” generated from the Pacific Intertie will be determined and weighed against the cost of the remainder of the project (sections 4,5,6 and 7). The project as a whole “The Los Angeles Desalination Project” will have a cost-benefit analysis that will be compared to other projects such as the “Delta Tunnels”. The value determining factors will be; net cost, net water, net energy, and net carbon.

Engineering Review; Determining the location of the Sylmar Well “C” as well as designing all of the mechanical, electrical, and structural systems contained within will make this section the most complex of all. Since horizontal space is limited, designers are encouraged to take advantage of the nearly unlimited vertical space within the Sylmar Well. It may be necessary to stack power components using a common drive shaft; the seawater pump, the brine engine, the freshwater pump, the motor-gen, and the freshwater engine. Installing multiple stacked units will give the system redundancy, and will minimize impacts to production during scheduled maintenance. The use of gearboxes and throttling valves should be avoided in order to minimize energy losses.

The design of the mechanical systems will explore all machines in order to maximize overall system efficiency, reduce parts inventory, and enhance brine concentration control. If the rotary vane-type machine could be used as an engine or a pump, then all the engines and pumps in each stacked unit could be designed to hit their best efficiency point at the same rpm. Parts inventory could be reduced because many engines and pumps would have interchangeable parts. Using a variable-volume rotary brine engine with a variable-volume rotary freshwater pump, will allow the brine and freshwater flow exiting the Membrane Bank to be manipulated during production while maintaining a constant total flow. This will allow the brine discharge concentration to be tightly controlled, even when the seawater reservoir salinity changes.

Limited horizontal space will also drive the design of the Membrane Bank. Typical membranes have an outer casing (to contain pressure), are stacked horizontally in bundles, and are connected to each other with flexible lines. This all must change in order to save space, and minimize labor. Increasing individual membrane diameter and length will increase the surface area. Eliminating the outer casing will allow more membranes to fit into a smaller space. Using a common vessel will eliminate the need for labor intensive flexible lines. Baffles within the common vessel (Membrane Bank) will direct flow over the membranes so that the desired brine concentration is reached prior to exit. The membrane flux, surface area, and differential pressure will be used to calculate the number of membranes required to achieve a system capacity of 1 BGD. The Membrane Bank elevation must be carefully chosen to result in the best overall system efficiency, and use of costly underground space. It may be necessary to have the Sylmar Well diameter increase at the elevation of the Membrane Bank in order to account for its space requirements.

Special attention will be paid to system reliability. Redundant safety systems and control systems will be in place to keep the facility operational in the event of component failure. These systems will not be vulnerable to water, grid failure, or online attacks. The safety systems and their ability to provide emergency egress to workers will not be dependent on the grid. The control systems and their ability to open and close valves will not be compromised under any conditions. A preliminary design schedule will need to be completed for all of the mechanical, electrical, and structural systems housed within the Sylmar Well in order to get an accurate assessment of this phase of the project.

Construction Review; Once the location and diameter per depth of the Sylmar Well is known, digging can begin. Special considerations for seismic events will determine the methods and materials used in its design. Careful planning will be needed to coordinate the depth of the Sylmar Well with the arrival of the 2 TBM's from crossing structures "A" and "B". TBM "B" should arrive at the Sylmar Well first and be extracted before TBM "A" arrives. Once TBM "A" has passed by (now digging the Brine Conduit), digging of the Sylmar Well may resume. The tailings from TBM "A" may continue to be conveyed to the crossing structure "A" and the tailings from Sylmar Well "C" may now be conveyed to the crossing structure "B". When the final depth of the Sylmar Well is reached, a larger TBM will be lowered down to start the Coastal Conduit. Once the Brine Conduit is complete, both tailing conveyors "A" and "B" may be dedicated to the Coastal Conduit TBM. A temporary pumping system will be installed and connected to the Brine Conduit to dispose of any seepage water that collects in the Sylmar Well. When all digging operations are complete, installing the desalination machinery can begin. The safety of the workers will be paramount in construction decisions. Moving materials and people in and out of a 1300 ft deep well poses substantial challenges. Several landings and delivery systems at different elevations, approximately every 250 ft, will aid in the staging and delivery of materials and people. Emergency egress systems will be in place to allow people to flee to safety, even in the event of grid failure. Obtain detailed cost estimates from qualified contractors.

Environmental Review; The environmental impacts of the Sylmar Well itself are confined to the surface footprint and the impacts to groundwater. The surface impacts to the environment will be studied, and measures will be determined to mitigate these impacts. The impacts to fresh groundwater are already covered under the Coastal Conduit (section 5) and the Beach Well Series (section 6). The impacts of brine disposal are already covered under the Brine Conduit (section 4). The seepage water gathered during the digging process will need to be disposed of in a way that will not harm the environment. The Brine Conduit may be used to deliver the seepage water to the sea with the help of the temporary pumping system. The quality of the seepage water will determine the treatment processes required prior to disposal. The Sylmar Well site location will be chosen to best deliver new water to the Sylmar treatment facilities and minimize impacts to the environment.

Water from the Owens Valley is known to contain small amounts of arsenic. Water from the sea is known to contain small amounts of boron. Although the current concentrations are below the EPA limits, these standards may change. Blending water from the Owens Valley with new water from desalination may be an effective way to reduce concentrations of toxins without expensive chemical treatments or energy intensive processes. Membranes are known to strip vital minerals from water during the reverse osmosis process. These minerals must be added back in later at great expense. Blending water from the Owens Valley with new water from desalination may be a way to eliminate this extra step. These methods will need to be studied for their effectiveness.

The "Los Angeles Desalination Project" as a whole will be analyzed for its overall net impact to the environment. Bella Machines has made a claim that this project has the lowest carbon footprint of any plan to solve the California water crisis. This claim, as well as many others, will need to be verified or denied based upon scientific evidence and mathematical proof.