

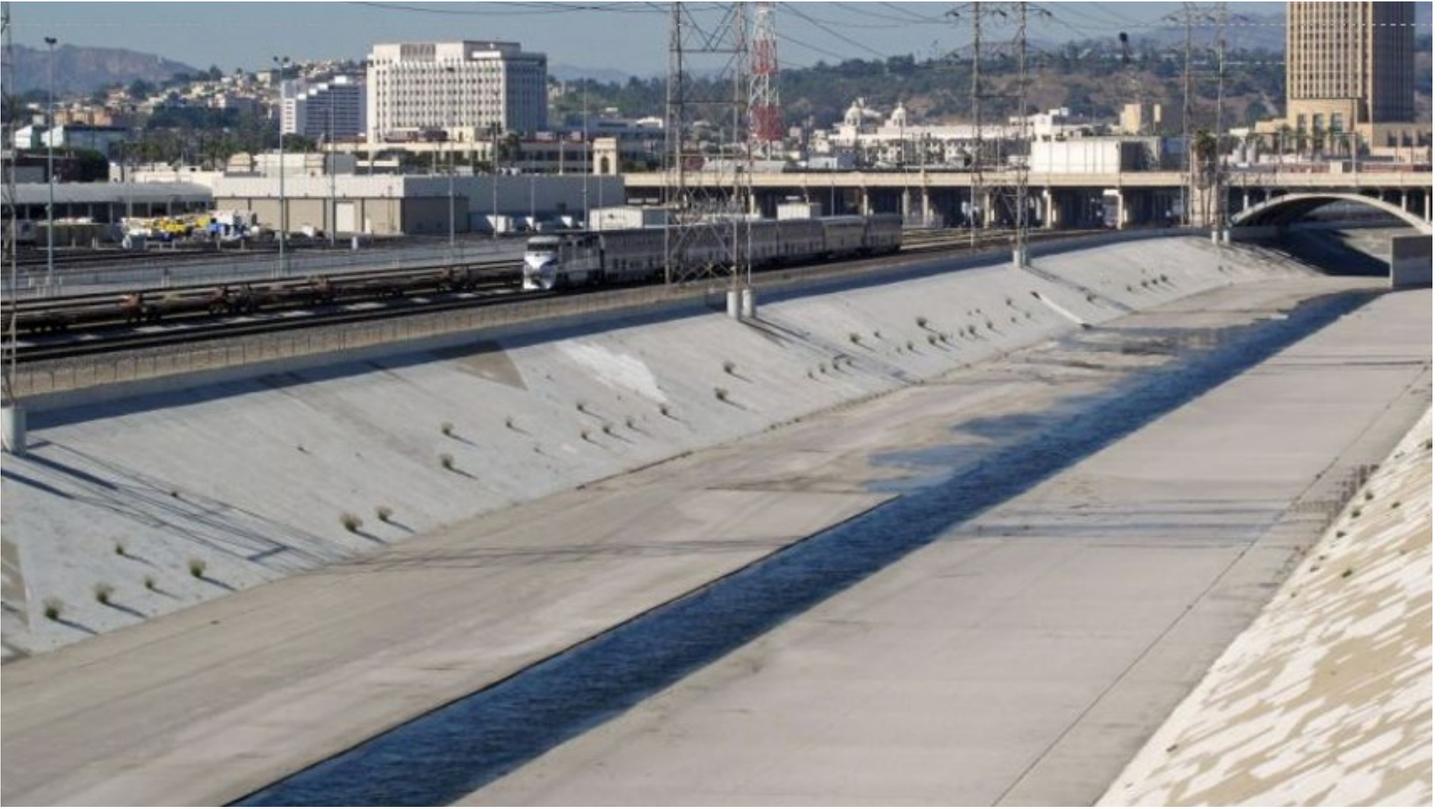
Keeping the Los Angeles River Clean The Technology to Make it Possible



Figure 1 San Pedro Bay Plume Area – Arrow pointing to installation location

The Environmental Challenge

The Los Angeles River, made famous in many Hollywood movies, has its origin in North East Los Angeles and flows south to the City of Long Beach and into San Pedro Bay. It is essentially a concrete lined river with a typical flow rate as seen below.



During rain or storm events the river rises, is filled to capacity and changes color as seen below.



The river flows south into the San Pedro Bay. Note the change in color in the Bay as this storm surge plume passes by the Queen Mary Ship docked at the mouth of the river.



The Challenge faced by the river as seen in the plume above is “Storm & Urban Water Run Off”. Storm water and everyday urban water run off sends a host of chemicals, oil and grease, pathogens, and solids of many kinds from the urban environment, into the river.

Urban Run Off and Water Contamination

Urban Run Off water contamination has unusual challenges. This comes from typical Urban practices such as washing cars, applying pesticides & herbicides to lawns or servicing pools. There is also additional challenges from unauthorized wastes which include motor oil from leaking cars, pathogens from pet feces, cleaning chemicals, paint, and other man-made synthetic compounds which find their way into storm sewers and eventually flow into the river.

One of these unusual challenges in the urban water run off are “pool chemicals” which are added to prevent heavy metals such as iron, manganese and copper from precipitating and staining pool liners. These heavy metals, are complexed by these pool chemicals and then become extremely difficult to remove in a purification process.

Urban runoff adds toxicity and biological threats as shown below. Currently this urban run off water is pumped directly to the LA River, which compromises many of the well known beaches in the Long Beach area.



City of Long Beach Storm Drain – Collection Site for Storm Water & Urban Run-Off Water

Resolution & Requirements

The key to protecting the Bay and beaches of Long Beach is to purify the storm and run-off water before it enters the LA River. To resolve the challenges of contaminated urban water run off, it must be intercepted before it gets to the river. This is easily accomplished using the existing storm drains and collection systems as shown above. Additionally, the effective purification of storm and urban water run-off of its contaminants also lends itself to “Reuse” opportunities such as irrigation, wetlands, and aquifer management.

The process to clean (purify) the water must be; Capable, Robust and be an Environmentally Attractive or Green solution.

1/ Capable: The purification process must be capable of **removing**; pathogens, silt, heavy metals, complexed metals (Mn, Fe & Copper), oils and greases, dissolved synthetic chemicals such as soaps, personal care products, endocrine disruptive chemicals, pharmaceuticals, and a wide array of industrial chemicals like BTEX from gasoline, 1,4 dioxane and many more. Not only is there a wide array of contamination, the contaminants in the run-off water are highly variable and change with the time of day, day of week, and the season.

2/ Robustness: The purification process must be tolerant to changes and respond to sudden changes in flow rate, surges in silt, constantly changing contaminants and concentrations, temperature, turbidity & color, etc..

4/ Green: The purification process must minimize or eliminate the need for chemicals, consumables, foot print, energy and complexity.

Water Purification Method

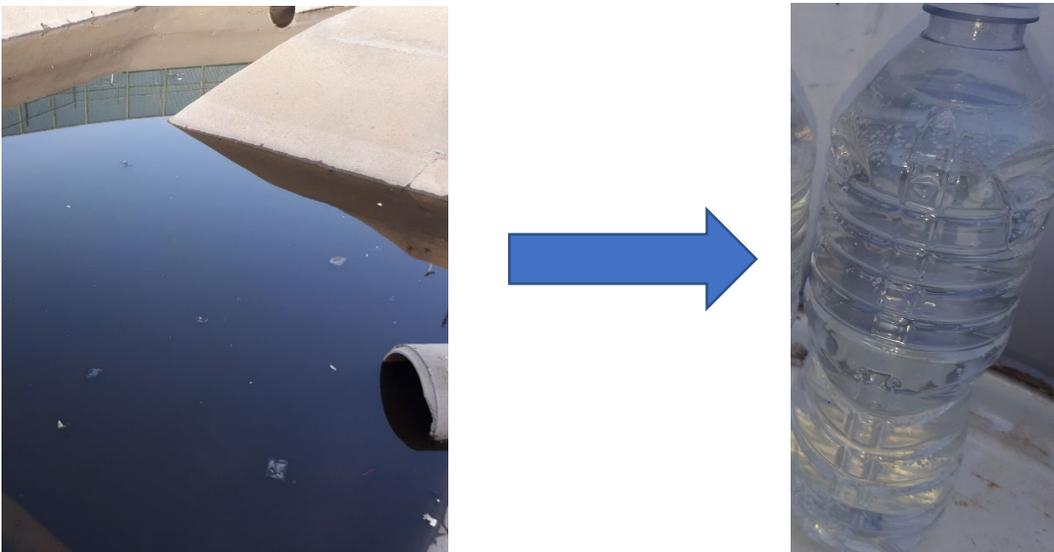
Ideally it is preferable to purify water as opposed to treat water. When water is Purified the contamination is removed from the water, whereas when water is treated the contamination may be mitigated or modified. An example is bacteria in water. It is better to remove (filter) the bacteria out of the water than to disinfect (UV) or Chlorinate (modify) the bacteria, both of which processes leaves the bacteria in the water and creates residual issues.

The Urban Water Run off collected from storm drains SD23-B, SD03-B and SD06 and is purified using the following process train before it flows into the LA River or is reused.



This process train above has been effectively applied by Purifics in other applications since 2013. This process train was validated at pilot scale directly on a storm drain in Long Beach, purifying actual urban run off water over many months. The CUF process (continuous ultrafiltration - filter) removes oil and grease, suspended solids, complexed copper and other heavy metals, and pathogens. The media is a specific media that targets and removes the complexed iron and manganese, and lastly the Photo-Cat (chemical free advanced oxidation) destroys the dissolved organic and synthetic chemicals.

The process train is extremely effective and efficient, purifying urban water in the storm drain into clear and colorless bottle water looking as shown below.



After a successful onsite pilot verification program, the full-scale system was purchased by the City of Long Beach. The picture below shows Purifics' CUF platforms being fabricated and tested prior to delivery. Each of the two platforms have a 1,000,000 gallon per day capacity, and each platform can be increased to 2,000,000 gallons per day in the future

simply by adding another ceramic membrane module to each platform, replacing the adjacent pipe spool. This is very much like 'High-Tech Lego'.



CUF Platforms Under Production

Unique features of the CUF technology is that it eliminates the need for pretreatment, eliminates irreputable fouling, eliminates the need for back wash and CIP. Another unique feature of the CUF process is that is has very high specific flux (in the range of 30gfd/psi) which is ~5 times that of conventional membrane technology and has no end of life. This all translates to very low energy, very low operating cost, low parts count, simplicity and a very Green Solution.



These membrane modules contain patented Silicon Carbide ceramic membranes like those shown below. These are true ceramic membranes with no end of life and should not be confused with composite membranes which contain a mixture of ceramic and organic materials.



The Photo-Cat technology shown below has a nominal 4 MGD capacity to destroy chemicals of concern in the Urban Water run off. There is nothing to dispose of as the chemicals are destroyed. This industry proven Photo-Cat technology is a photocatalytic process uses a light driven TiO_2 catalyst which makes this a "chemical free" Advanced Oxidation

Process. The Photo-Cat Technology is not impacted by color, UV transmittance or turbidity of the water making this a Green Solution with Durability and Robustness.



Photo-Cat System

The treatment building that will house the equipment is currently under construction and plant start up is scheduled for late 2023. This program also will have an Outreach Program to allow the public to tour the facility and inspect state of the art storm and urban water runoff.

Purifics has been developing, designing and building integrated water purification system based on its ceramic membrane technology since 1993 and has build over 70 plants globally. The company has over 30 patents & patents pending along with other IP and is actively involved in Advance Research with Nano-technology Enabled Water Treatment (NEWT), Universities and other entities.

Why CUF: https://www.purifics.com/files/ugd/098e51_10d8cbb6ffb94618b708858084b09691.pdf

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