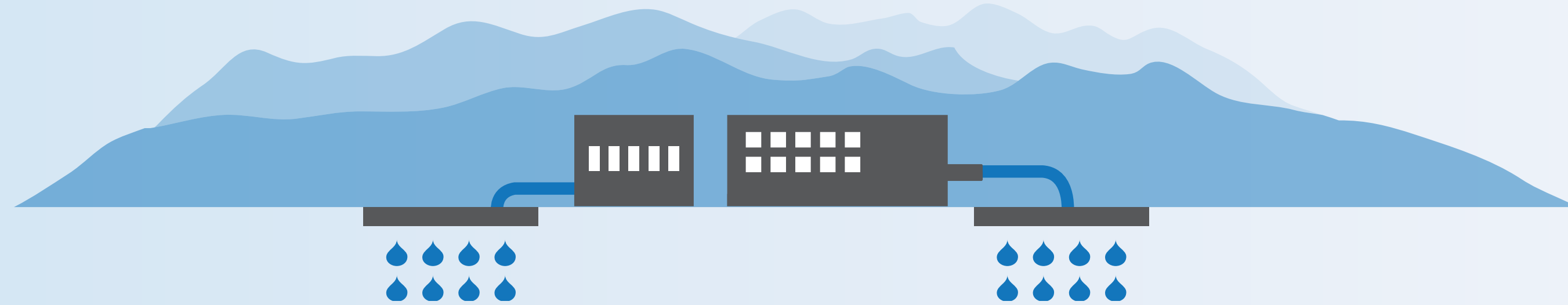


# Site History

## 1940s-1970s INDUSTRIAL CONTAMINATION



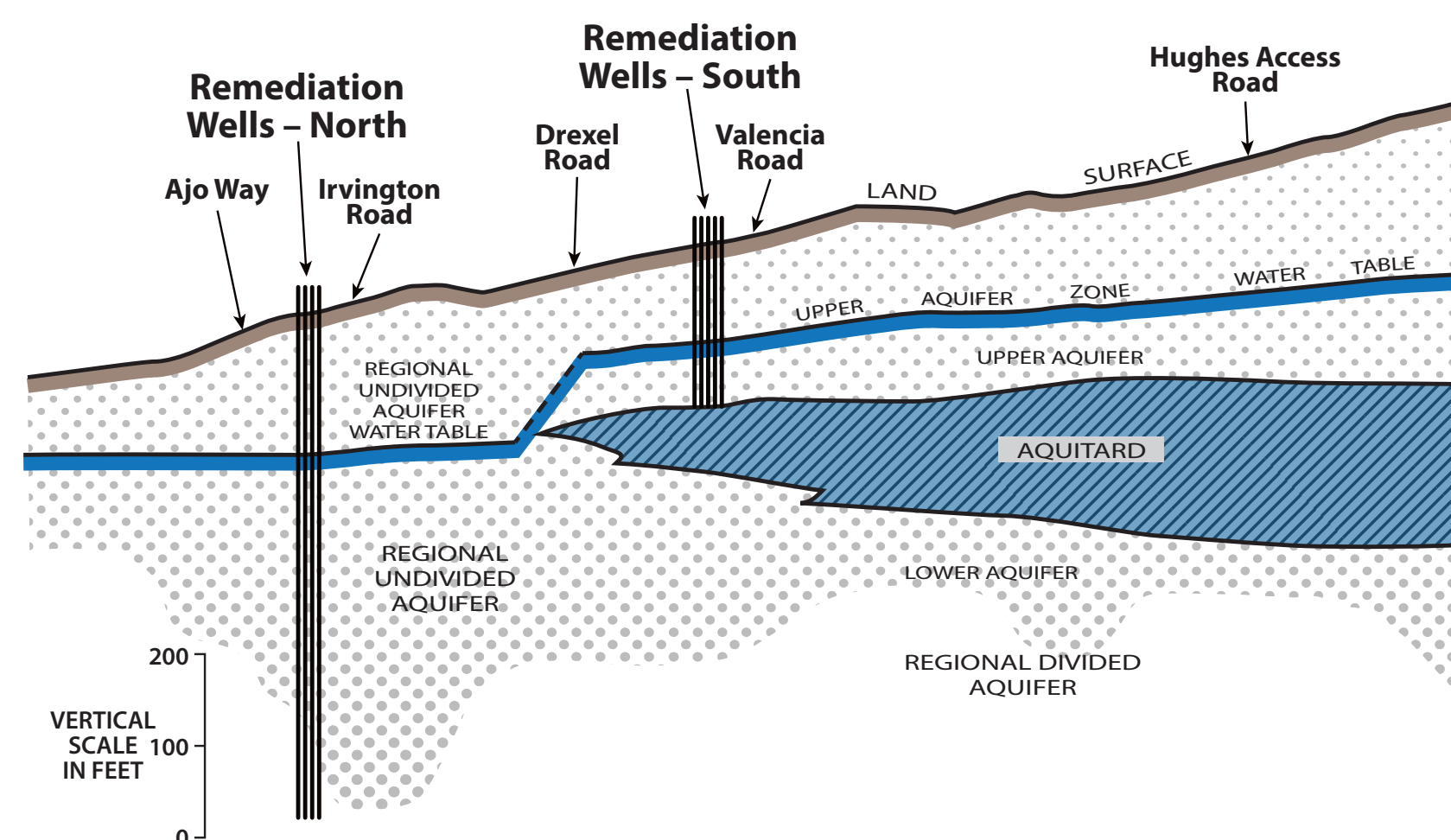
From the 1940s-1970s, industries near the Tucson International Airport released trichloroethylene (TCE), 1,4-dioxane, solvents and other contaminants as by-products of manufacturing. These hazardous wastes went into pits, which seeped into the ground and contaminated an area of the underground water table or aquifer.



## THE CONTAMINATION PLUME

The main and largest area of underground water contamination – the plume – is located in southwest Tucson. The regional groundwater flow is in a northwesterly direction, and is reflected in the shape of the plume.

This area became a federal Superfund site in 1983. The Environmental Protection Agency (EPA) and the Arizona Department of Environmental Quality (ADEQ), in tandem with Tucson Water and other stakeholders, have been working to contain, remediate, and monitor the plume.

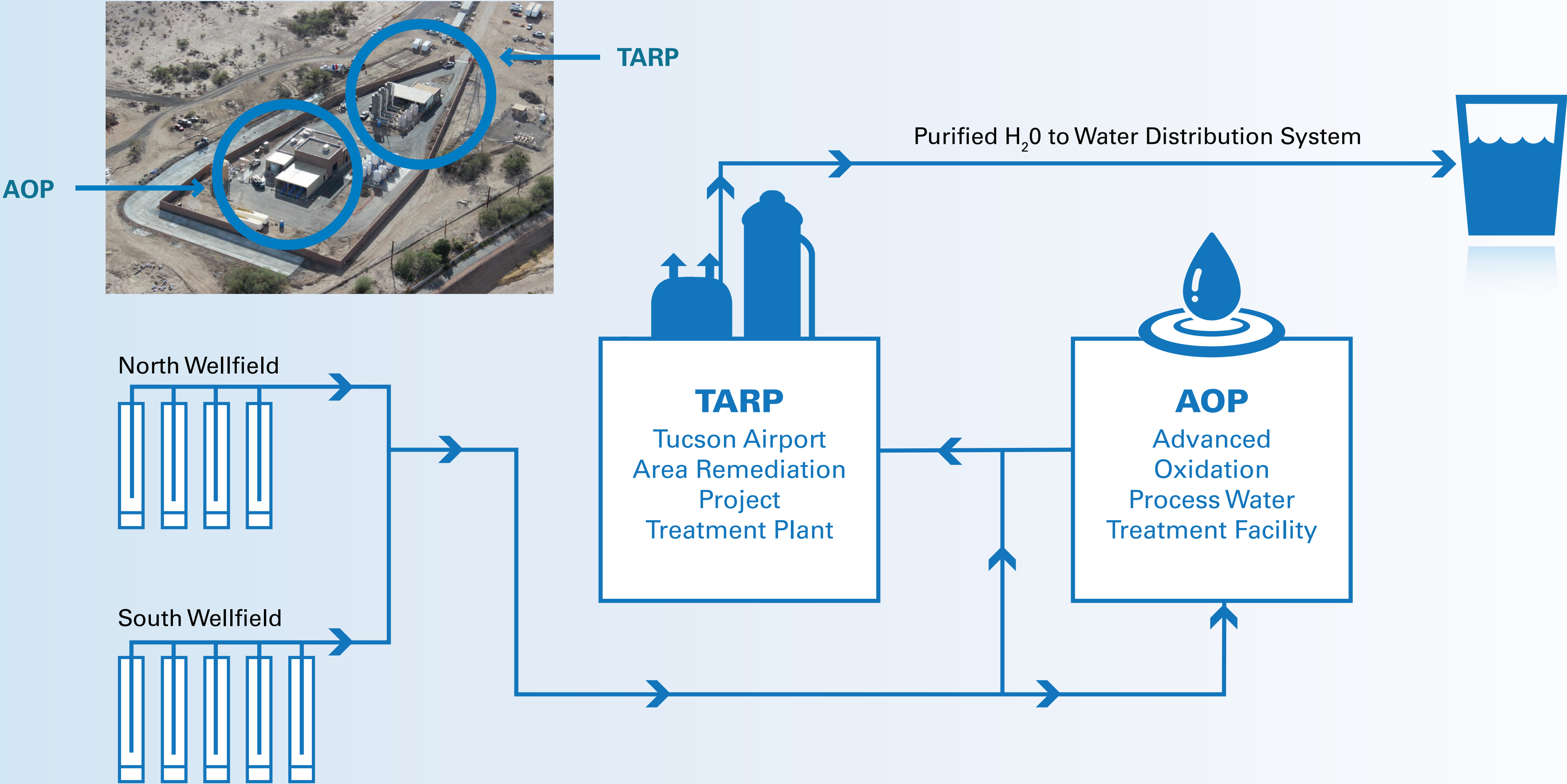


## THE REGIONAL AQUIFER

The main contamination plume is in the deeper regional aquifer. Tucson Water remediation wells located on the plume pipe water to two nearby treatment facilities: the Tucson Airport Area Remediation Project (TARP) and the Advanced Oxidation Process (AOP) Water Treatment Facility. The TARP and AOP Treatment Facilities remove TCE, 1,4-dioxane, and other contaminants from drinking water.



# Two Water Treatment Facilities



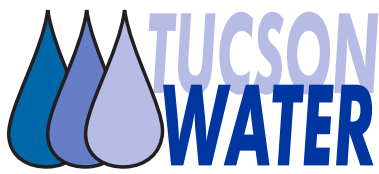
## HISTORY

- 1940s–1970s** Industrial and defense related industries use and release hazardous wastes in TIA area
- 1981** The United States Environmental Protection Agency (USEPA) & the City of Tucson sample groundwater from City of Tucson wells and find high levels of TCE and other wastes – 11 City wells and several private wells are shut down.
- 1983** USEPA declares TIA area a Superfund site
- 1991–1994** Design and construction of the TARP Treatment Facility
- 1994** Tucson Water begins operating the TARP Treatment Facility
- 1995** USEPA- sponsored Unified Community Advisory Board (UCAB) forms to monitor remediation
- Early 2000** 1,4-dioxane identified as a containment of concern
- 2002** 1,4-dioxane levels discovered in the TARP groundwater plume
- 2010** USEPA publishes revised Toxicological Evaluation that indicates 1,4-dioxane is more likely to cause cancer than was previously estimated
- 2010** Tucson Water pilots different technologies to remove 1,4-dioxane
- Jan 2011** USEPA issues a revised lower drinking water health advisory level for 1,4-dioxane of 0.35 parts per billion (ppb) from 3.0 ppb
- Early 2011** Tucson Water selects Advanced Oxidation Process (AOP) technology to remove 1,4-dioxane
- Jul 2012** Groundbreaking to kick-off the construction of AOP Water Treatment Facility
- Sept 2012** Begin construction of the AOP Water Treatment Facility
- Jan 2014** Construction of AOP Water Treatment Facility complete
- Jan 2014** AOP Water Treatment Facility operating in tandem with the TARP Treatment Facility



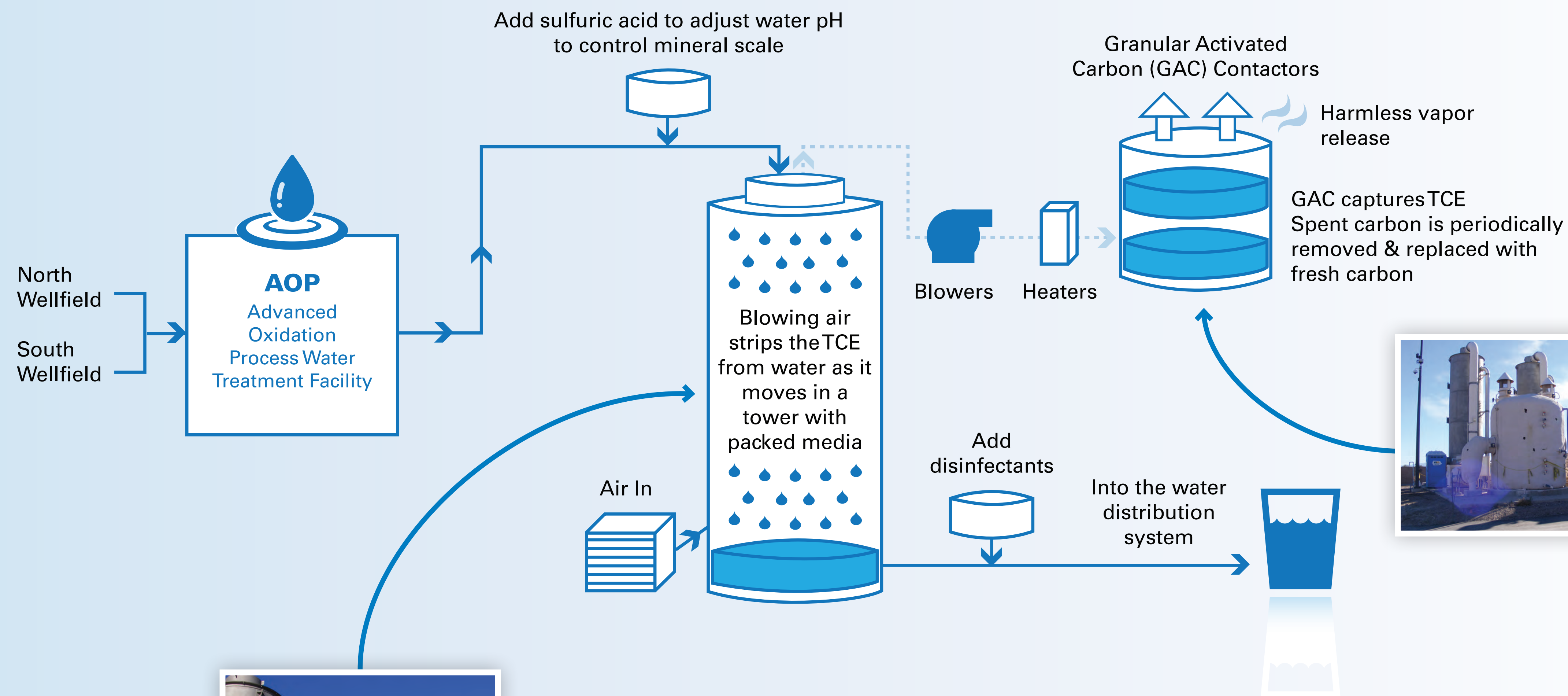
**OUR WATER IS SAFE**

Water produced from the TARP and AOP treatment facilities meets all federal drinking water standards and is safe for drinking, cooking and bathing.



# How the TARP Works

## AIR STRIPPING AND CARBON FILTERS REMOVE TCE AND OTHER CONTAMINANTS



## WHAT IS TCE?

Trichloroethylene (TCE) is a byproduct of manufacturing and defense-related industries used from the 1940s to the 1970s. TCE is primarily used to remove grease from fabricated metal parts and in the production of some textiles.

## REMOVING TCE

The TARP Plant uses air stripping to remove TCE from water which is then purified and introduced into Tucson Water's distribution system. Once removed from the water, the TCE is absorbed into the carbon and harmless vapors are all that are released. Spent carbon is periodically removed and replaced with fresh carbon. The spent carbon is regenerated by a thermal process for re-use off-site at the carbon supplier's facilities.

## SINCE 1994, THE TARP PLANT HAS:

- Purified more than 41+ billion gallons of water
- Removed 4,000+ pounds of TCE

## SAMPLING, TESTING & REPORTING

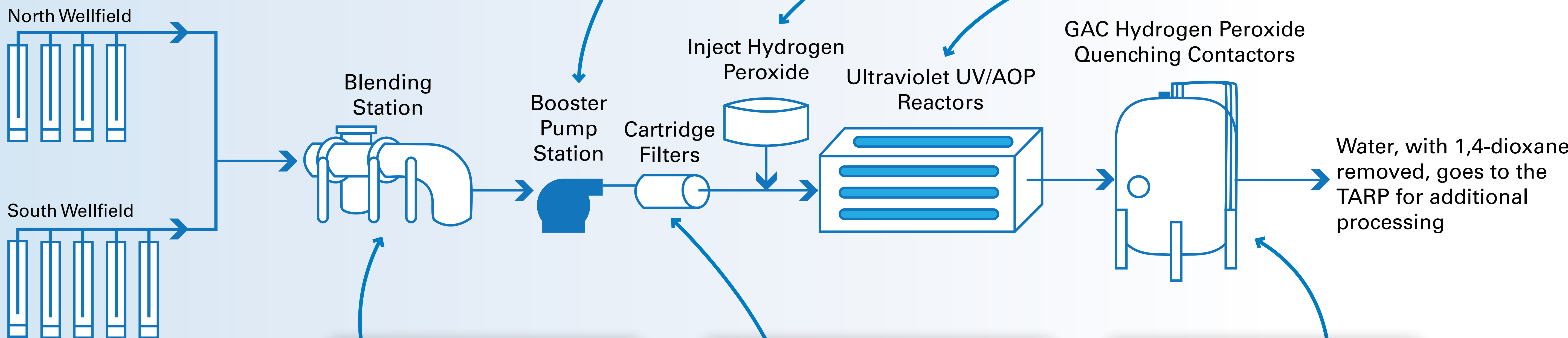
Tucson Water performs thousands of tests each year on water samples and reports the results to our customers, elected officials, and the Arizona Department of Environmental Quality (ADEQ). The ADEQ is responsible for overseeing and enforcing all EPA Safe Drinking Water Quality regulations in Arizona.



# How the Advanced Oxidation Process (AOP) Water Treatment Facility Works

## AOP TECHNOLOGY

The AOP Water Treatment Facility uses hydrogen peroxide and ultraviolet (UV) light to remove the contaminant 1,4-dioxane. Tucson Water selected AOP technology after pilot tests identified this as the most cost-effective and proven method of removing 1-4-dioxane. The Arizona Department of Environmental Quality approved the final AOP Facility design and construction.



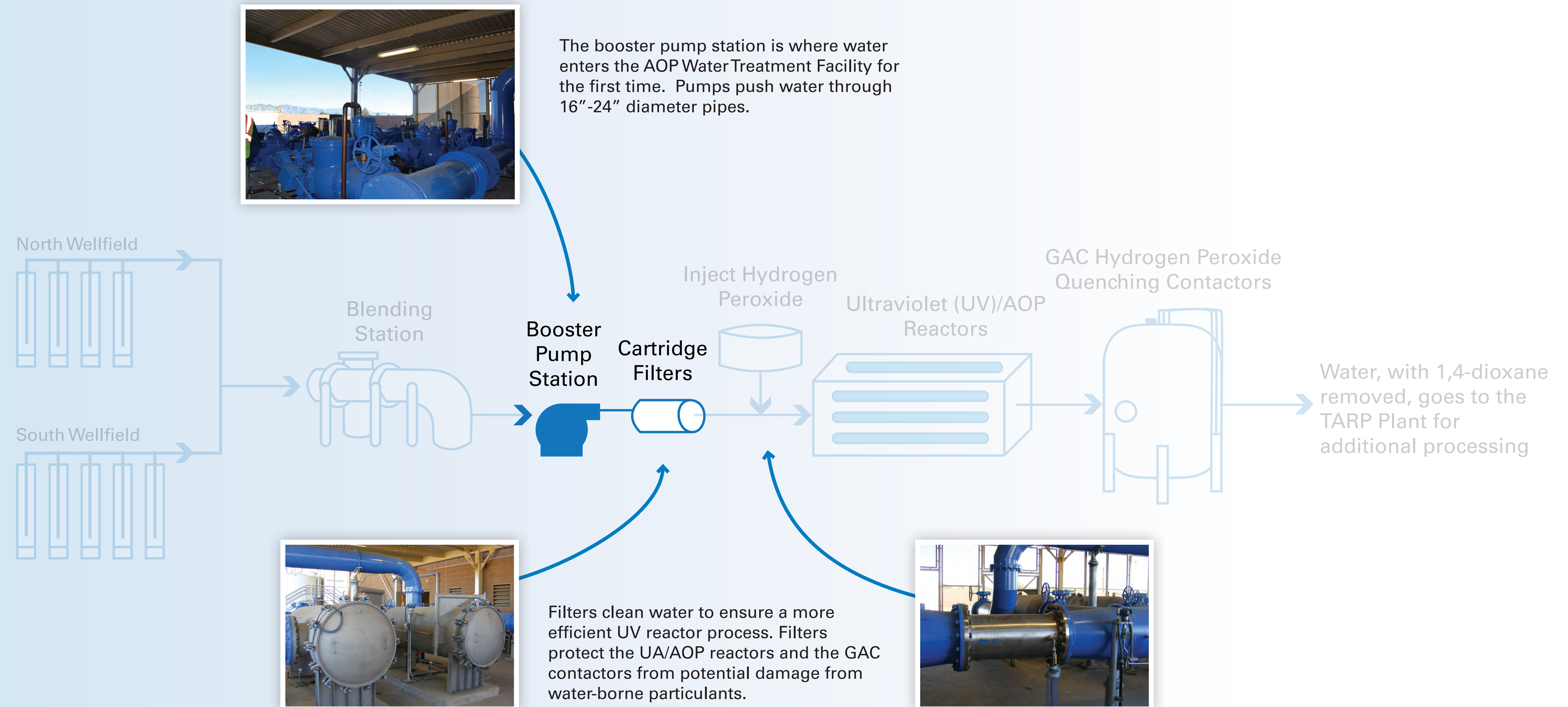
Water from nine wells located on the underground plume travels approximately 3 miles to the AOP Water Treatment Facility. The AOP Blending Station combines water from the south and north wellfields and feeds it to the AOP booster pumps.



Granular Activated Carbon (GAC) removes any remaining hydrogen peroxide



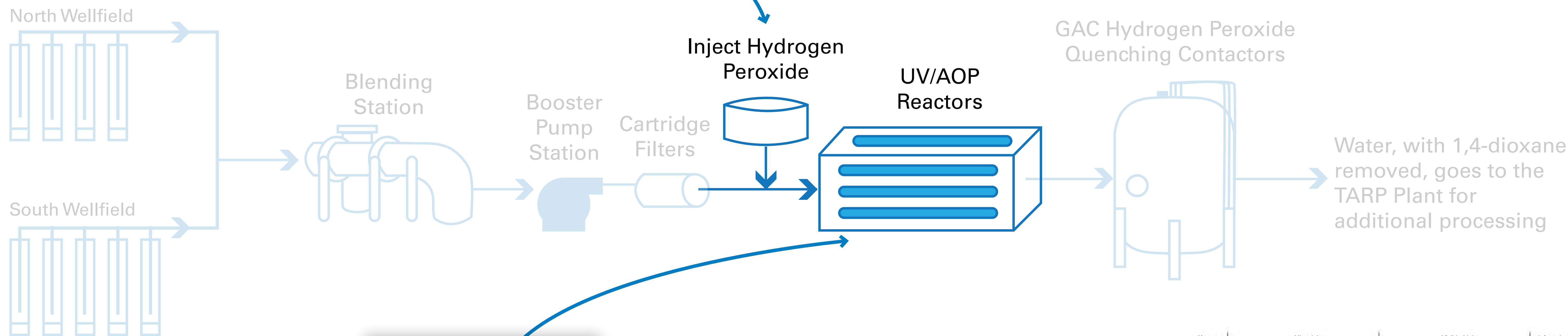
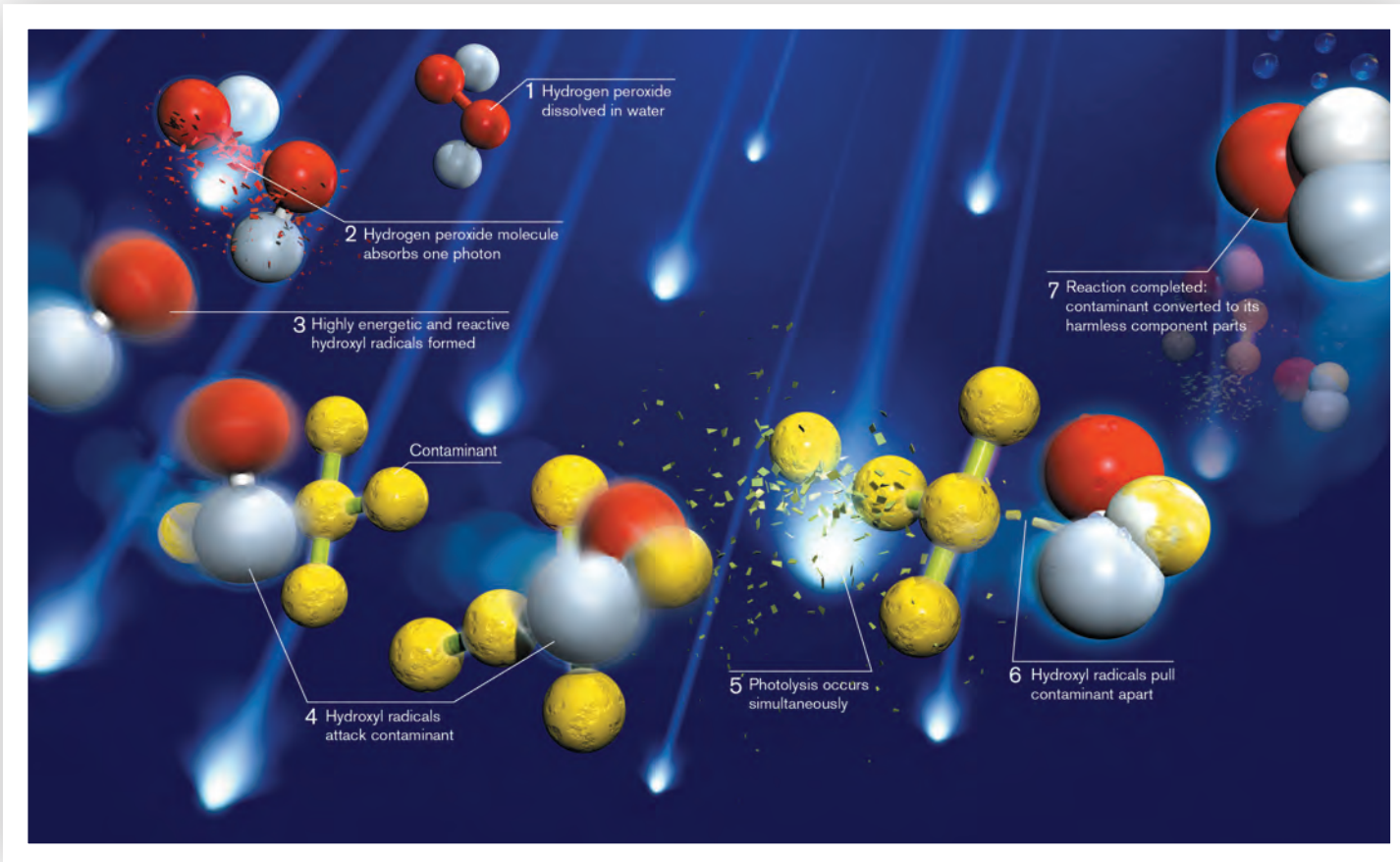
# The Booster Pump Station and Cartridge Filters



# Understanding the UV/AOP Reactors

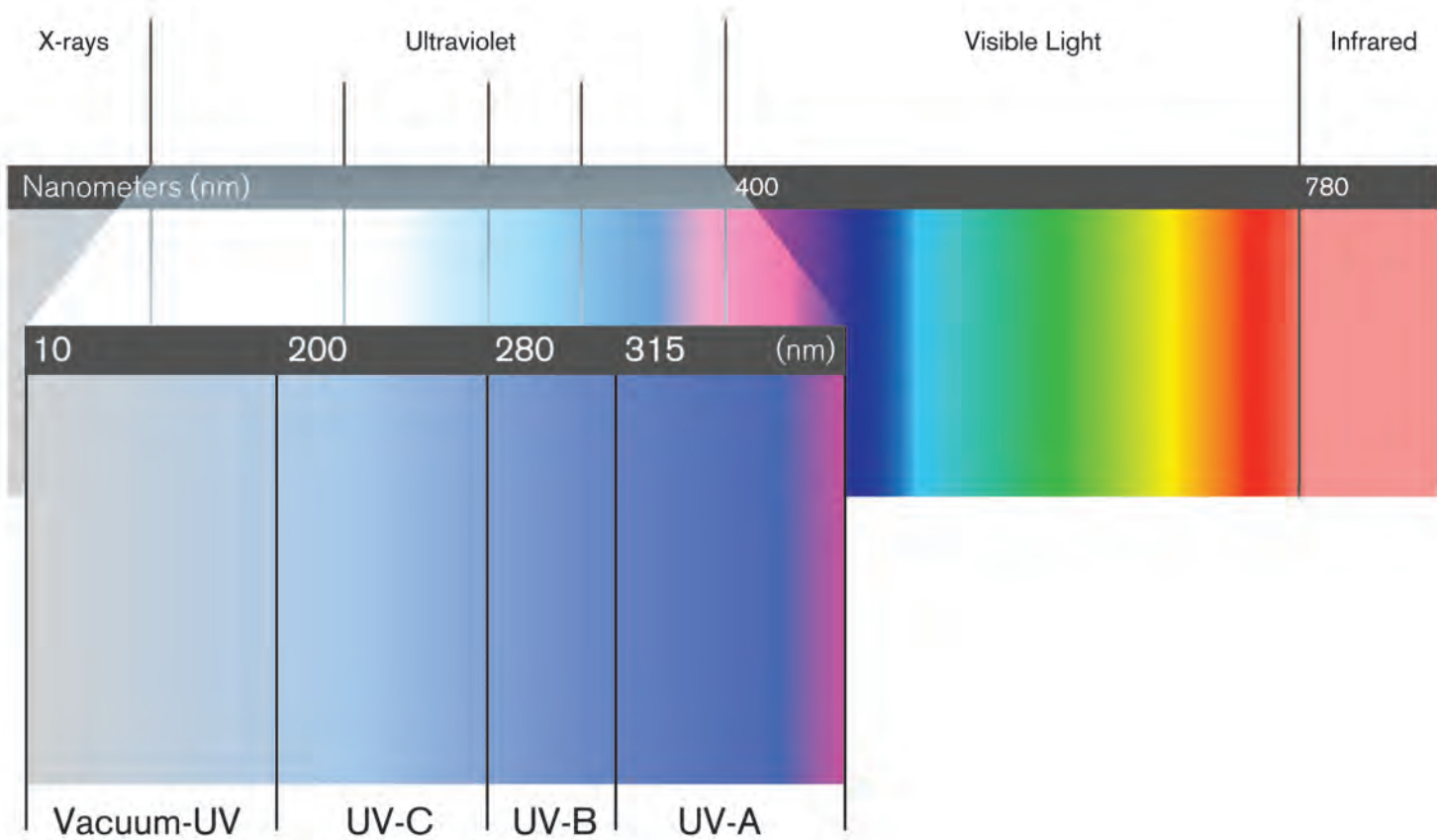


Small amounts of hydrogen peroxide are added and radiated with UV light, causing the formation of hydroxyl radicals that break the bonds of the 1,4-dioxane molecule.



Lamps inside the six UV/AOP reactors use UV light, a form of light invisible to the human eye. Specific wavelengths, between 200 and 300 nanometers, destroy 1,4-dioxane, viruses, bacteria and other contaminants.

UV light and hydrogen peroxide create a powerful photochemical process that breaks down contaminants into their harmless components almost instantly.

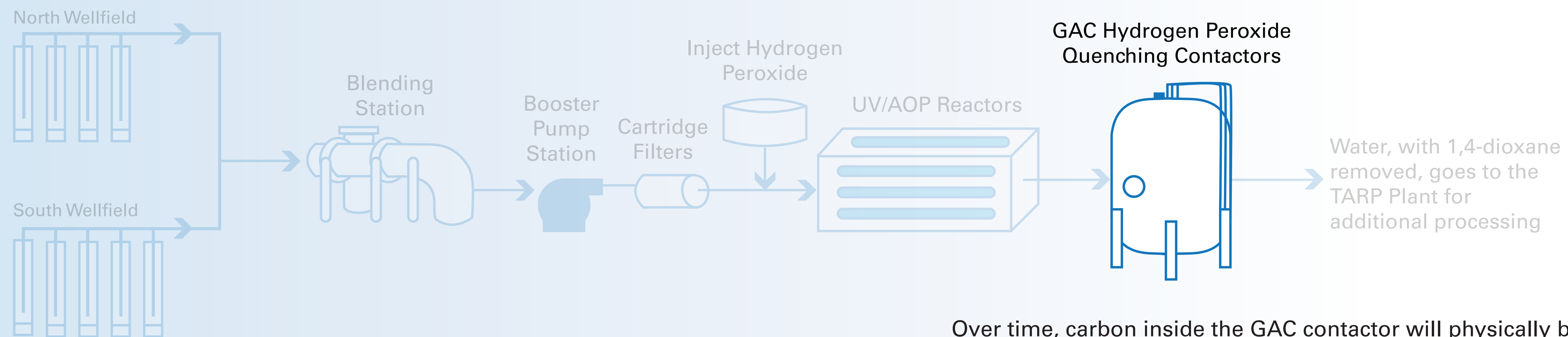


# The Last Step in the AOP

## GRANULAR ACTIVATED CARBON (GAC) CONTACTORS

Eight, 15-foot-high towers that contain granular activated carbon (GAC) are the last step in the advanced oxidation process. The GAC removes any remaining hydrogen peroxide from the UV-treated water, a process referred to as “quenching.”

This AOP purified water – with 1,4-dioxane removed to non-detectable levels – is delivered via pipe lines to the nearby Tucson Airport Area Remediation Project (TARP) facility for additional treatment.



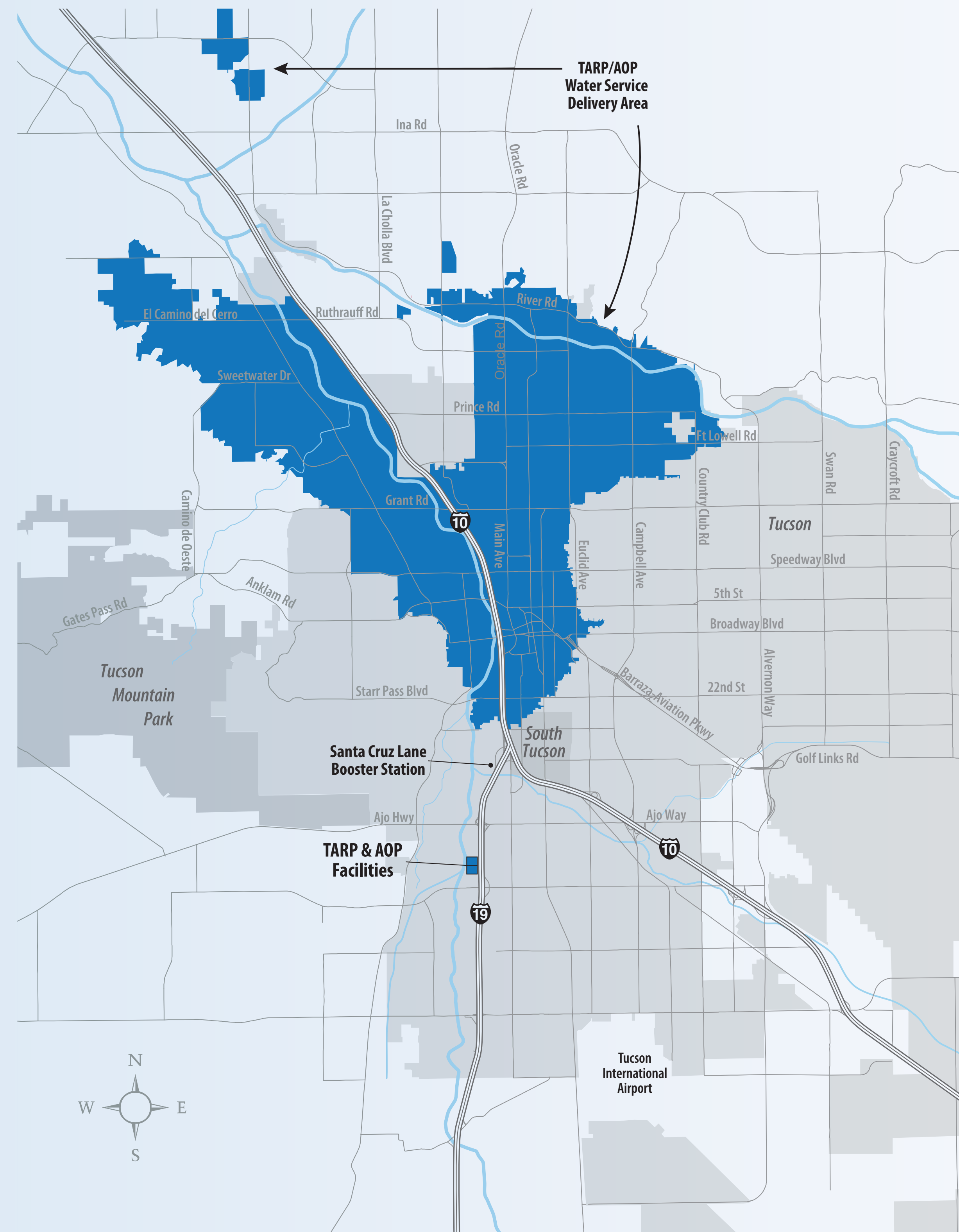
Over time, carbon inside the GAC contactor will physically break down and its effectiveness as a catalyst will diminish. This carbon will be replaced with fresh carbon.



# Distribution and Control of Purified Water

## DELIVERY AREA FOR AOP-TARP WATER

Purified and treated water from the City of Tucson's AOP and TARP facilities is delivered to the west-central and northwest portions of Tucson Water's service area. Tucson Water regularly collects samples and tests specifically for 1,4-dioxane and TCE at locations throughout the service delivery area.



## SCADA: TUCSON WATER'S CENTRAL CONTROL SYSTEM

Tucson Water's Supervisory Control and Data Acquisition (SCADA) System is the software and hardware technology that works remotely to:

- Move water efficiently throughout Tucson Water's service area
- Monitor and control TARP and AOP processes and equipment.
- Maintain water pressure and flow rate
- Collect water system data
- Regulate water quality
- Monitor system security

The SCADA monitors the drinking water system 24/7 from the utility's Hayden-Udall Water Treatment Facility in Avra Valley.

New SCADA technology, slated for implementation in 2018, will consolidate all operations and features into one master system. The benefits of this next generation, smart SCADA system will be increased efficiencies, reduced energy use and lower operations costs.

