Emerging Contaminants and Suffolk County Water Authority

Jeffrey W. Szabo, *Chief Executive Officer*
Timothy J. Kilcommons, **P.E.**, *Chief Engineer*

Suffolk County Water Authority

- The Suffolk County Water Authority is an independent public-benefit corporation operating under the authority of the Public Authorities Law of the State of New York. Serving approximately 1.2 million Suffolk County residents, the Authority, which was began operations in 1951, operates without taxing power on a not-for-profit basis. The Authority is one of the largest groundwater suppliers in the country.

Suffolk County Water Authority

- SCWA tests for approximately 250 more contaminants than required by regulators, tests with greater frequency than required and maintains internal standards for water quality that are more rigorous than state and federal regulations.

Why We Are Here: What are 1,4-Dioxane, PFOS and PFOA?

- 1,4-dioxane is a synthetic chemical historically used as a stabilizer for industrial solvents, predominantly 1,1,1-trichloroethane, which was banned in the 1990s.

- It is also used in inks and adhesives and is present in trace amounts in consumer products such as detergents, shampoos and cosmetics as a by-product of the manufacturing process.

- Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) are fluorinated organic chemicals used in treatments to protect carpets, clothing, furniture fabrics, paper packaging for food and non-stick cookware. They are also used in firefighting foams.

SCWA Action on 1,4-Dioxane

- SCWA began voluntarily testing for 1,4-dioxane in 2003.
- In 2016, Suffolk County Water Authority engineers designed and piloted the first full-scale pilot 1,4-dioxane treatment system in NYS, an advanced oxidation process (AOP) system (1,4-dioxane *cannot* be removed effectively using traditional treatment methods.)
- Results show AOP destroys 1,4-dioxane molecules to virtually non-detect levels.

Regulating 1,4-Dioxane

- This summer, NYSDOH began the process of adopting the NYS Drinking Water Quality Council's recommended maximum contaminant level (MCL) of 1 part-per-billion for 1,4-dioxane (there is currently no chemical-specific regulation for 1,4-dioxane, however NYS has an MCL of no greater than 50 ppb for all unspecified organic contaminants).

- A 60-day public comment period on the proposed regulations began on July 24. Following the assessment of public comments, the proposed regulation will either be revised or submitted for adoption by state health officials.

- The regulation will go into effect upon publication of a Notice of Adoption in the New York State Register. Once adopted, public water systems would need to test water within specified timeframes, as outlined in the regulation, and comply with the new MCLs.

Regulating 1,4-Dioxane

- All water suppliers will need to submit their first round of test results within three months of when the regulation is adopted.

- When the regulation is adopted, SCWA will take the necessary steps to comply with the regulation and has proactively developed an action plan in anticipation of the regulation being enacted.

- In June of 2019, the NYS Legislature passed (A.6295A – Englebright / S.4389B – Kaminsky) banning 1,4-dioxane from common household products.

Levels of Detection

- SCWA's state-of-the-art laboratory instruments can detect compounds in the water down to parts-per-**million**, parts-per-**billion,** or in some cases even parts-per-**trillion**.

- For reference:
  - 1 Part-per-million = 1 second in 12 days
  - 1 Part-per-billion = 1 second in 32 years
  - 1 Part-per-trillion = 1 second in 32,000 years

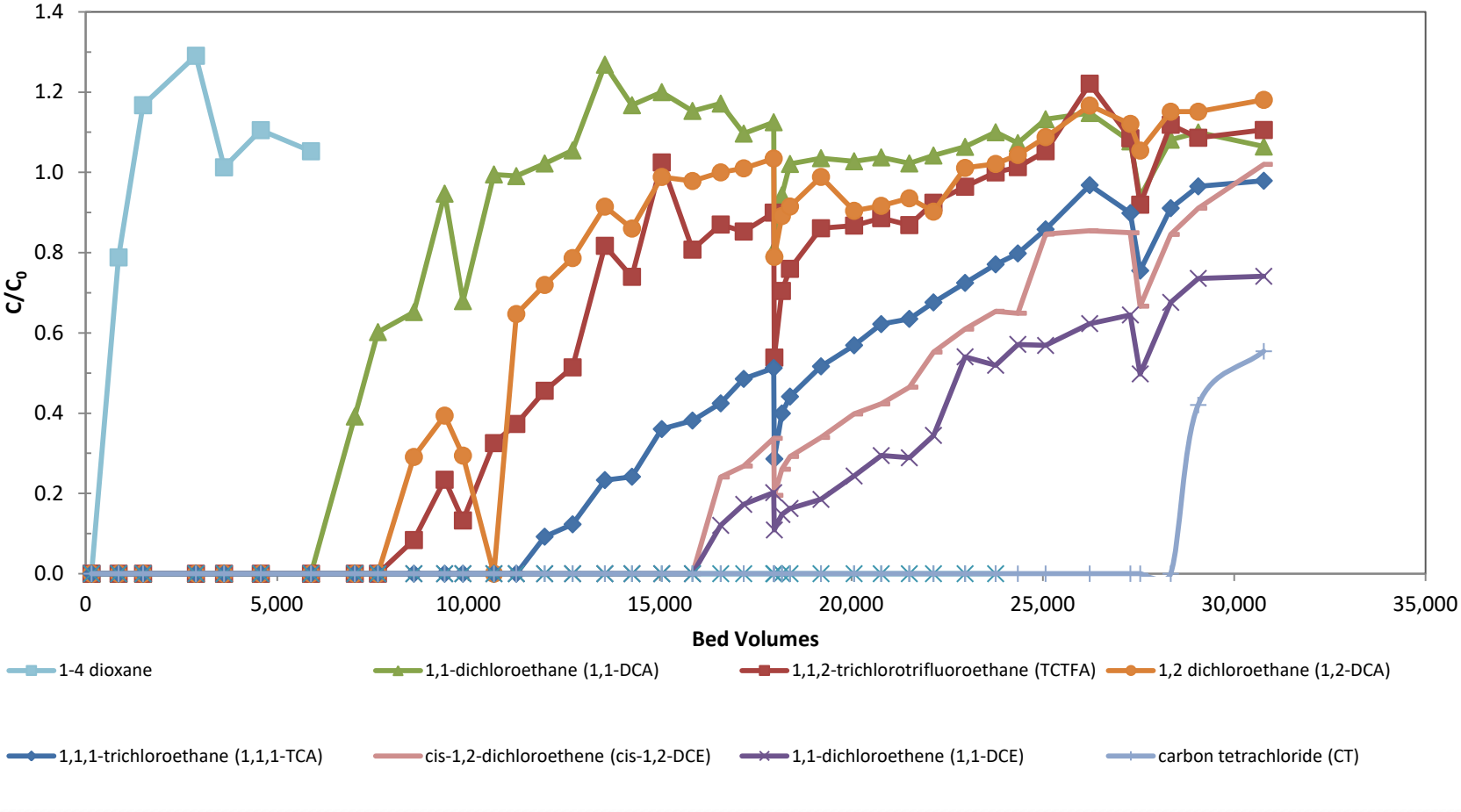
How to Remove 1,4-Dioxane: Advanced Oxidation Process (AOP) Treatment

Timothy Kilcommons

SCWA Chief Engineer

Why AOP?

Contaminant Breakthrough in GAC



What is an Advanced Oxidation Process (AOP)?

Involves the generation of highly reactive species

Primarily hydroxyl radicals (•OH)

- Highly reactive
- Short lived ~ 10 ms
- Non-selective

Tighe&Bond

Hydroxyl Radicals are One of the Most Powerful Oxidants

Relative oxidation power of some oxidizing species	
Oxidizing species	Relative oxidation power
Chlorine	1.00
Hypochlorous acid	1.10
Permanganate	1.24
Hydrogen peroxide	1.31
Ozone	1.52
Hydroxyl radical	2.05
Positively charged hole on titanium dioxide, TiO_2^+	2.35 (Munter, 2001)

Tighe&Bond

Hydroxyl Radical Formation Can be Accomplished Multiple Ways

- Ozone/peroxide
- UV/peroxide
- Ozone/UV
- Ozone/UV/peroxide
- TiO_2-catalyzed UV
- Fenton's reactions
- UV/chlorine

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Important AOP Terms & Concepts

- Transmissivity
  - Ability of light to penetrate through water

$$UV + H_2O_2 \rightarrow 2 \bullet OH$$

Scavenging

- •OH reacts with many background contaminants
  - NOM, DOC, alkalinity, chloride, sulfate and nitrate.
- Inhibits destruction of target contaminants

Important AOP Terms & Concepts (cont'd.)

- Quenching

  Conversion from oxidant → •OH << 100%

  - Can get >75% carry-over of H_2O_2
  - Removed before Distribution System

  Full-scale AOP – Quench with GAC

- By-Products

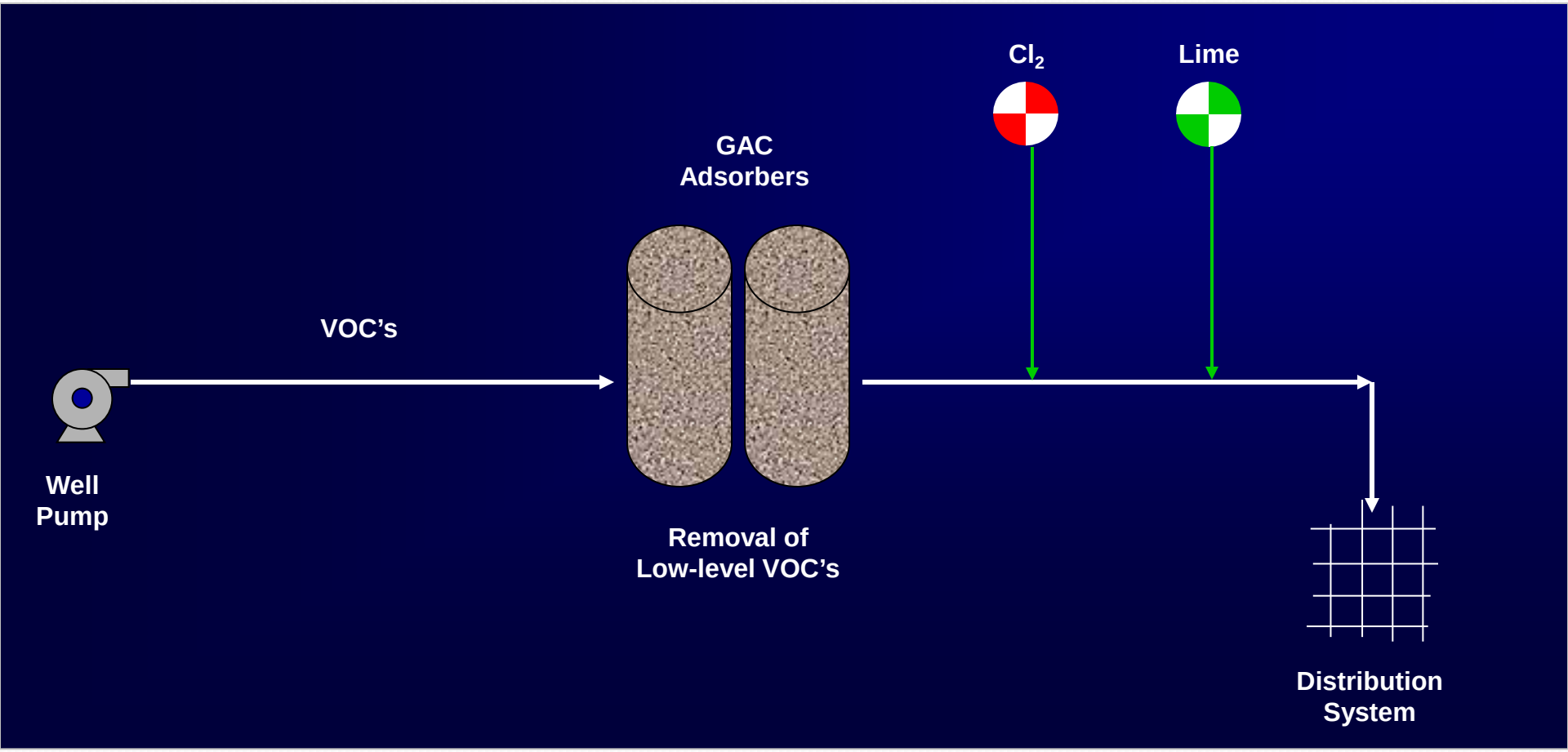
  Goal for oxidation of organic contaminants:

  $$CO_2 + H_2O + \text{mineral salts}$$

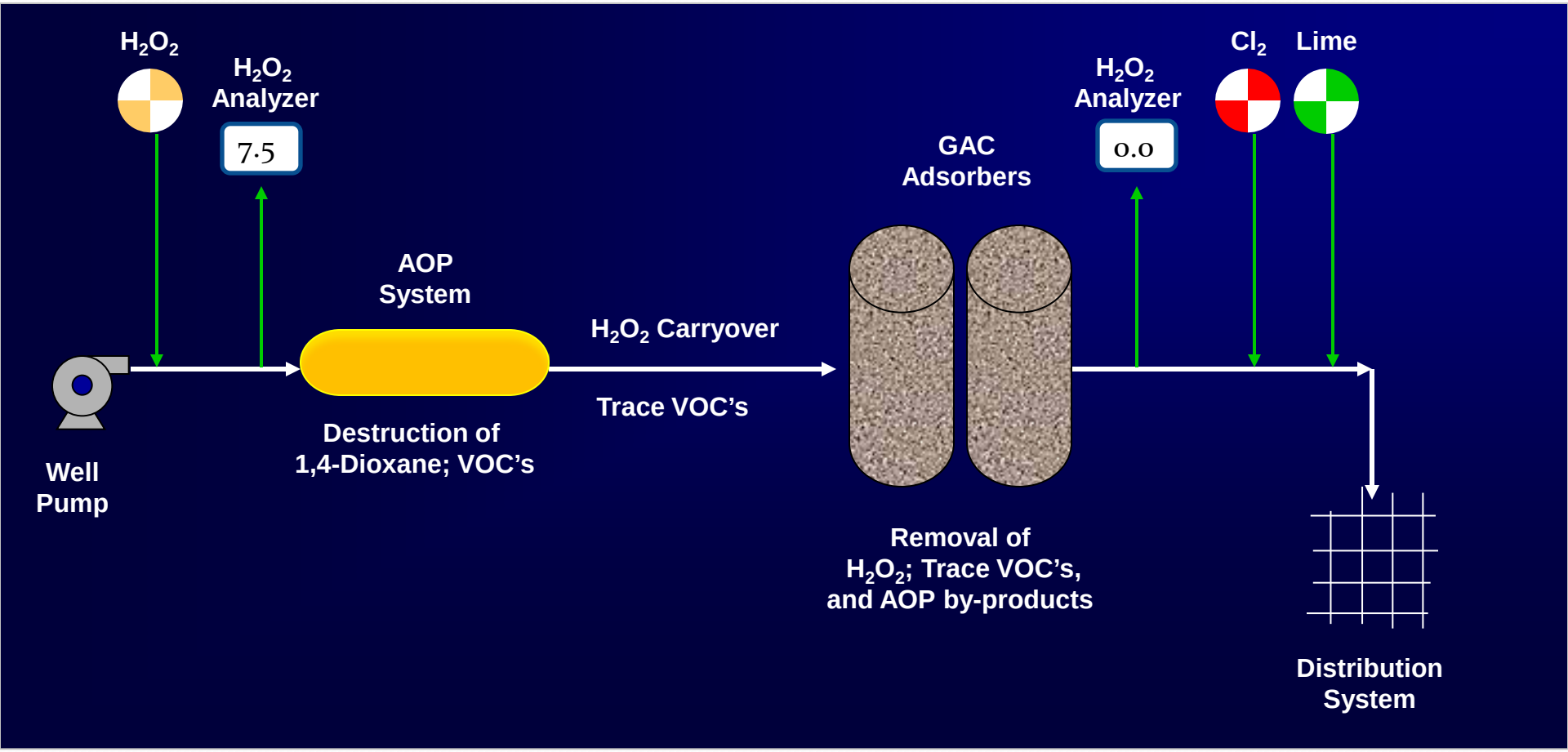
  Incomplete oxidation can yield intermediate breakdown products

  Also concern for BrO_3^-; NO_2^-; $ClO3^-$; DBPs

Typical Process Flow Diagram



AOP Process Flow Diagram



AOP Construction - 2017

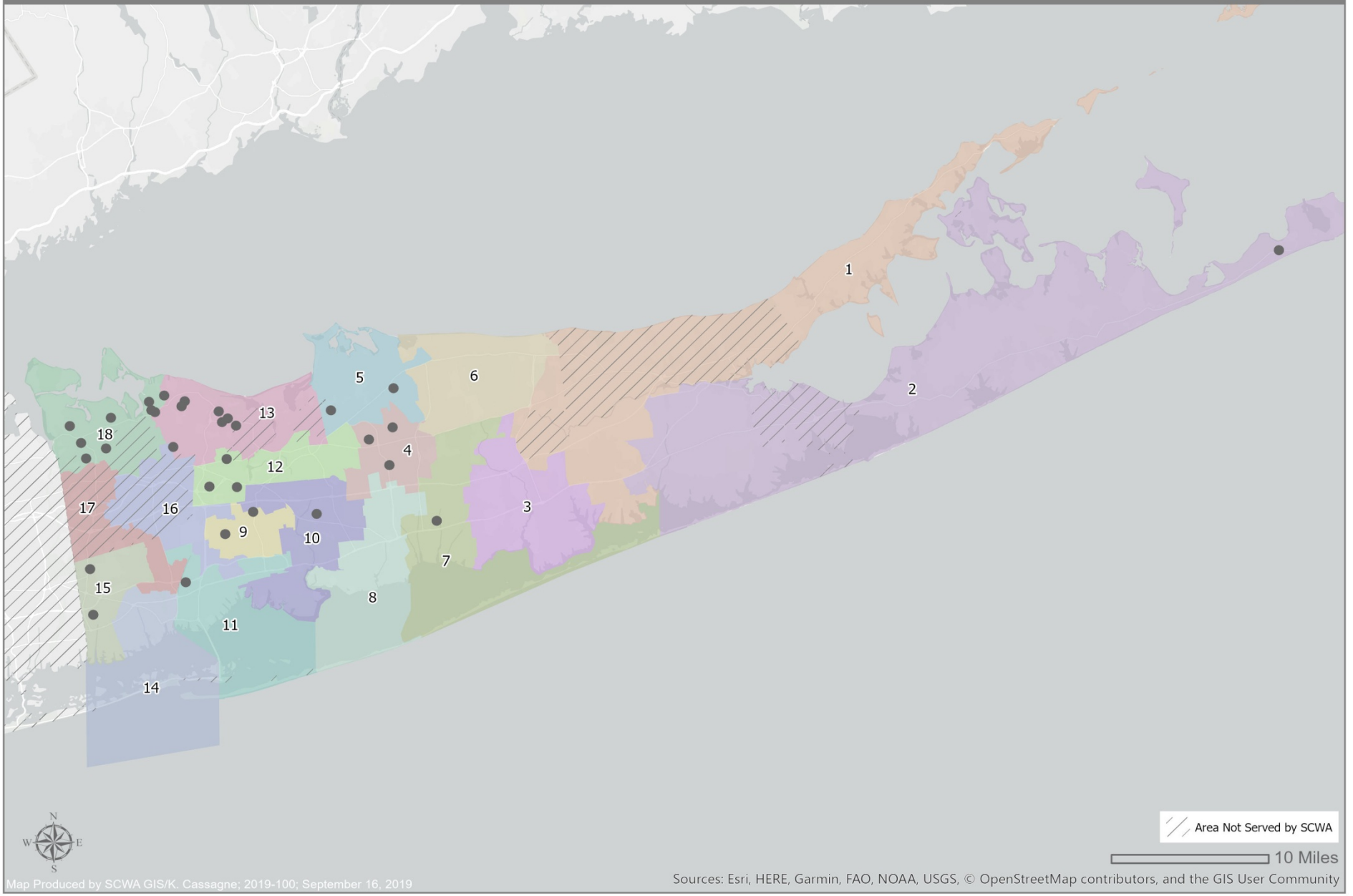
Where We Are: Additional Treatment Systems

- SCWA's full-scale AOP pilot is currently in operation, treating water in Central Islip.
- Two additional AOP systems are currently in development for pump stations in East Farmingdale and Huntington.
- Each AOP system must be pilot tested and receive approval from NYSDOH before it can be put in service.

Potential AOP Sites

Suffolk County Legislative Districts

September 16, 2019



Map Produced by SCWA GIS/K. Cassagne; 2019-100; September 16, 2019

Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Estimated Treatment Cost

- 75 SCWA wells have detections of 1,4-dioxane higher than 0.5 parts-per-billion (SCWA intends to take action at half the MCL).
- New AOP systems cost anywhere between $1.5 million and $6 million in capital costs alone.
- Annual system maintenance costs include electric costs and bulk purchases of chemicals needed for reaction. These costs will vary by site.

AOP Implementation Schedule

- Assumes a one year period for the engineering and regulatory review process to be complete before procurement and construction can begin.
- Assumes NYSDOH will approve a standard SCWA design in order to speed up review process.
- SCWA would incorporate fast track piloting to demonstrate system capability for each well.
- SCWA estimates it can install and start up approximately 6 systems (one system per well) per year.
- Roll out schedule will be based upon MCL adopted, contamination levels, well capacity and criticality of a well in its respective pressure zone.
- Based upon these assumptions, it will take approximately 6 years to complete 31 AOP installations (wells greater than 1 ppb).

Status of PFC's: SCWA Action on PFOS /PFOA

- SCWA began testing for PFOS/PFOA in January of 2013.
- PFOS/PFOA are removed from drinking water using granular activated carbon (GAC) treatment.
- SCWA has GAC treatment already installed at 49.5% of wells with detections of PFOS/PFOA above 5 parts per trillion, or half the MCL.
- SCWA this year received approval from NYSDOH to use an in-house developed test method for PFOS/PFOA that is not only quicker and less expensive than the standard EPA-approved test method, but also detects down to 2 ppt—far lower than the EPA method.
- SCWA has hooked up residents impacted by PFOS/PFOA in private wells to public water in Yaphank and Westhampton and is preparing to do so in East Quogue. SCWA also partnered with the Town of East Hampton on a 45,000-foot water main project when PFOS was detected in private wells in Wainscott.

Granular Activated Carbon (GAC)

GAC Vessels

Carbon media

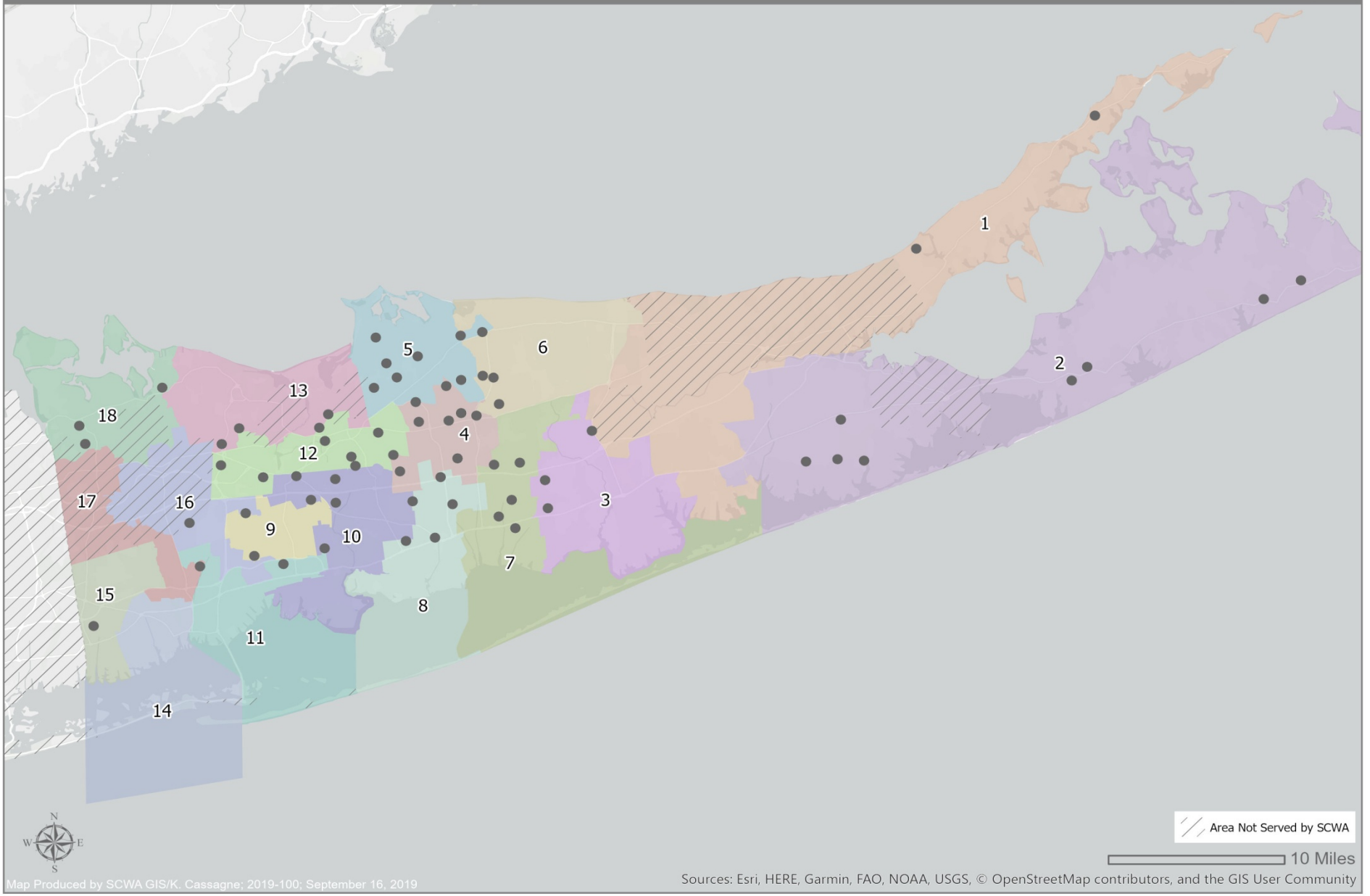
PFOS/PFOA Detections in SCWA Wells

- 110 SCWA wells have detections of PFOS/PFOA higher than 5 parts-per-trillion (SCWA intends to take action at half the new MCL).

Potential GAC Sites

Suffolk County Legislative Districts

September 16, 2019



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Estimated Treatment Cost

- Capital cost to install a GAC system is more than $1.2 million.
- Annual carbon replacement costs are more than $44,000 per unit.
- Additional costs include construction of buildings to house GAC units and increased electrical costs.
- The combined estimated statewide capital cost for removing all three emerging contaminants will be over $1.5 billion. (Long Island Water Conference estimate).
- The total estimated statewide drinking water infrastructure costs exceed $40 billion over the next 20 years. (LIWC estimate).

Regulating PFOS/PFOA

- The EPA in 2016 established a health advisory level of 70 parts per trillion for both PFOS and PFOA.
- The proposed NYSDOH regulation for PFOS & PFOA will be 10 parts per trillion.
- PFOS was discontinued for use by manufacturers in the US around 2002, PFOA several years later.
- Virtually everyone tested by scientists has been found to have PFOS/PFOA in their blood, but levels have been decreasing since its manufacture was discontinued.

PFOS/PFOA Filtration System Installation Schedule

- SCWA needs to install approximately 21 GAC systems.
- 8 Systems are currently on order.
- SCWA is relocating other, spare GAC systems to address contamination.
- Complete roll out of GAC systems expected to take approximately 3 years.

The Need for Increased Funding

- The Clean Water Infrastructure Act of 2017 allocated $2.5 billion state-wide for drinking water infrastructure, including wastewater projects.
- $350 million is now available state-wide through the Water Infrastructure Improvement Act and the Intermunicipal Water Infrastructure Grant Program.
- However, this funding is for all of NYS when costs on Long Island for 1,4-dioxane treatment alone will reach over $840 million, excluding annual operating costs.
- Long Island water suppliers need a significant increase in state funding to fund the required treatment technologies.
- Without additional funds, customers will have to fund the costs of these treatment systems, which means rates could rise significantly.

The Need for a Reasonable Implementation Period

- Water suppliers across Long Island will need ample time to design, procure, install, pilot, evaluate, seek approval, and eventually put treatment systems for 1,4-dioxane in service.

- Each system must go through an NYSDOH approval process before it can be put into service. In the case of SCWA's and Bethpage Water District's first AOP system, DOH approval took just over *two years* for a full-scale pilot.

- It is virtually inconceivable for NYSDOH at current staffing levels to perform 89 AOP reviews simultaneously (Long Island Water Conference estimate).

- Water suppliers including SCWA will be required to comply with the new regulations, but this will be difficult without a reasonable phase-in period that allows for treatment systems to be approved and installed.

Questions?