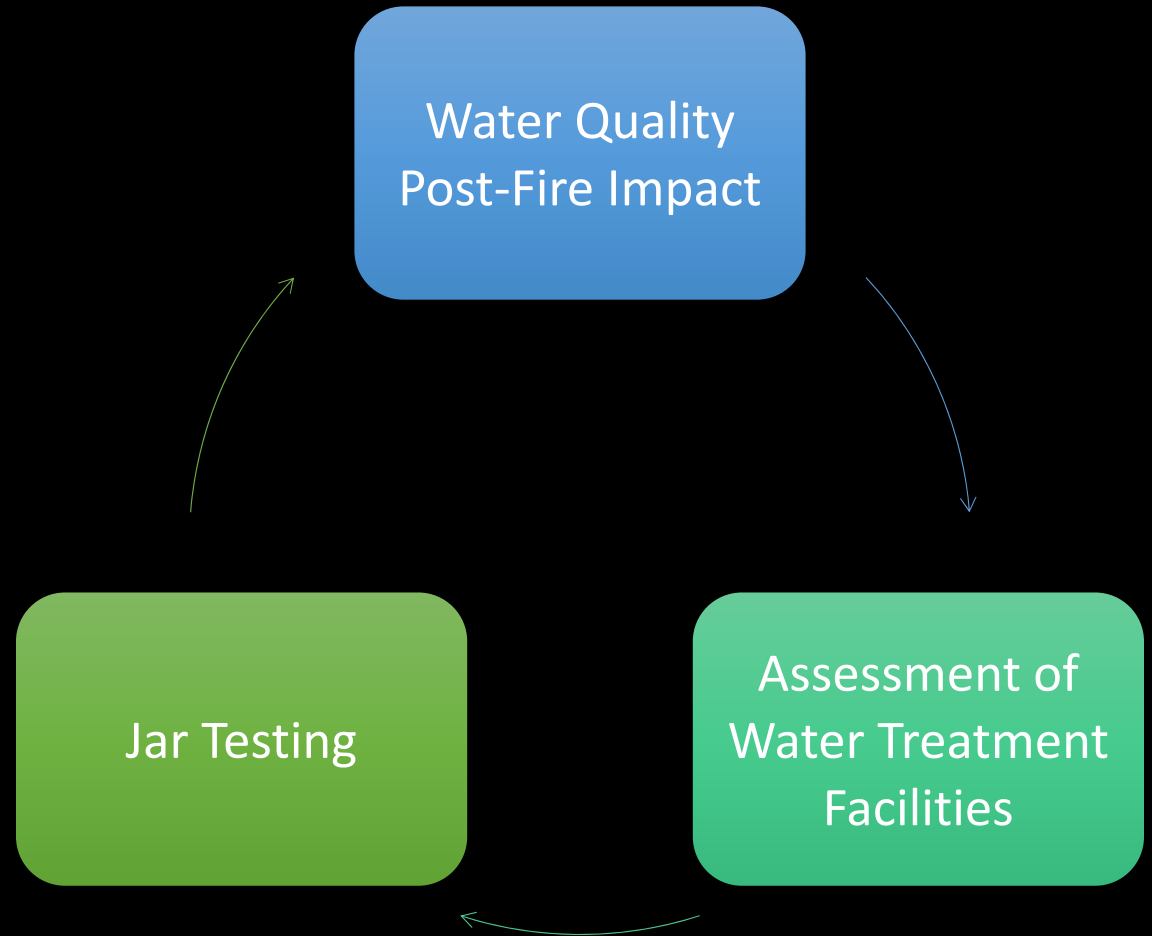


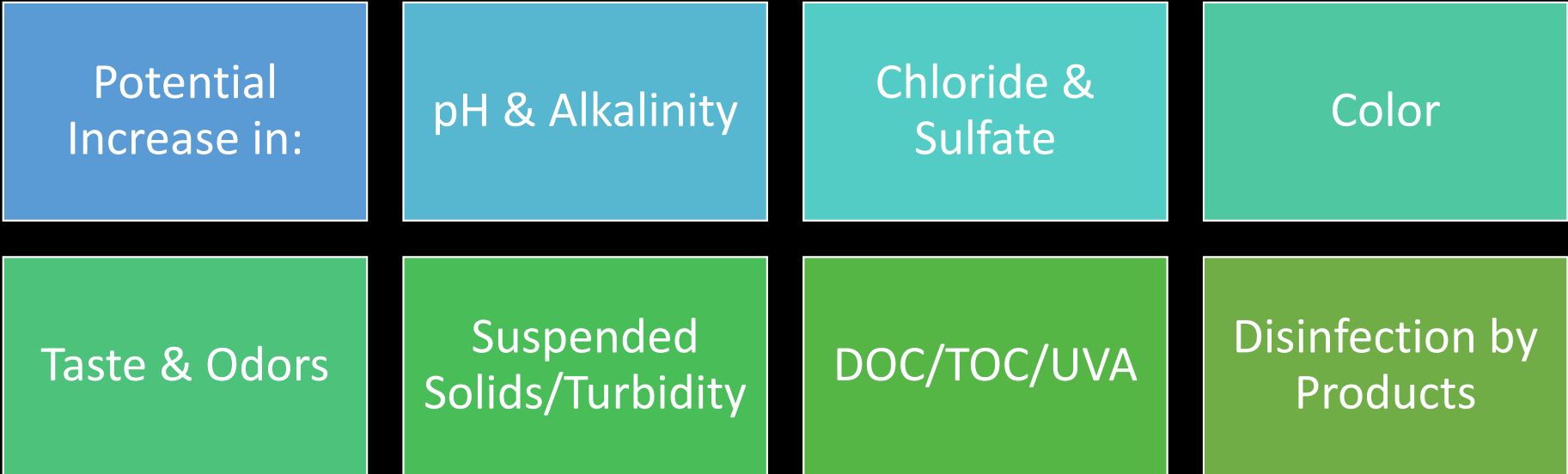
## Water Quality Effect of Wildfires & its Potential Impact on Water Treatment Facilities

- Guy Schott, P.E.
- State Water Resources Control Board
- Division of Drinking Water
- October 12, 2018



# Topics





# Water Quality – Fire Aftermath



# Clear Creek, 10/4/18 First Flush (Carr Fire)

---



## Clear Creek

### Pre-Fire Water Quality

- Turbidity: 0.4 – 3.6 NTU
- pH: 7.3 – 7.5
- Alk: 34 – 38 mg/L as  $\text{CaCO}_3$
- Nitrate: 0 mg/L as N

### 2018 Post Fire Water Quality (first flush, 10/5/18)

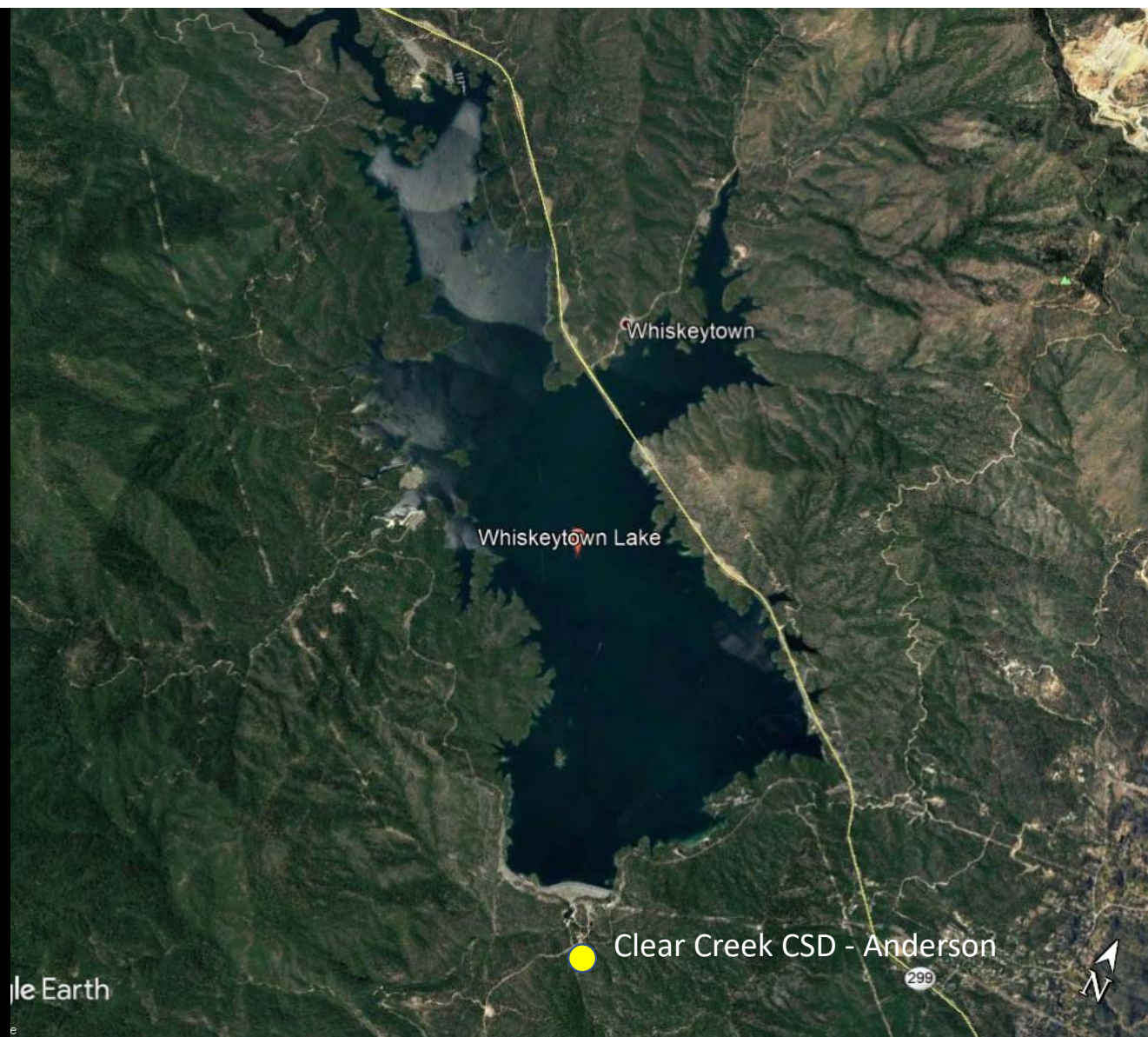
- Turbidity: 180 – 280 NTU
- pH: 8.0 – 8.1
- Alk: 65 mg/L as  $\text{CaCO}_3$
- Nitrate: 0.4 mg/L as N
- UVT: 76.5 % (filtrate, 0.2  $\mu\text{m}$ )
- UVA: 0.116/cm (filtrate, 0.2  $\mu\text{m}$ )
- Black ash
- Settling of solids

UV absorption (UVA): Represents the amount of light absorbed by constituents within a sample stream.  
UV transmittance (UVT): Represents the amount of light transmitted through a sample stream.



# Whiskey Town Lake

- Clear Creek CSD – Anderson
- Inline Filtration
- Population > 8,700
- Turbidity: 0.3 – 0.5 NTU
- pH: 7.1 – 7.3
- TOC: 1.2 – 1.7 mg/L as C
- Alkalinity: 40 mg/L as CaCO<sub>3</sub>



# Facilities susceptible to high solids loading - Ranking

1. Slow-sand filtration
2. Stand-alone membrane/cartridge filtration
3. In-line filtration (coagulation/filtration)
4. Direct filtration (coagulation/flocculation/filtration)
5. Package Plants (Roberts/Tridents/Similar Technologies)
6. Conventional filtration
7. Actifloc
8. Expanded conventional filtration (pre-oxidation/GAC)

0.2 um isopore membrane





# Assume Forecast of High Solids Loading/Turbidity

1. Shut-down (do you have storage to wait out storm?)
2. Intertie connection and/or well source availability
3. Slow-sand/membrane/cartridge filtration treatment plants - Consider installation of pre-treatment (i.e., inline filtration)
4. Expect frequent backwash and/or flush (inline/Direct, Package Plant)
5. Jar testing (determine coagulant dosage, settleability and filterability)
6. Call an expert for assistance on treatment



# Treatment Plant Assessment

Evaluate each of your processes:

- Pre-Oxidation ( $\text{KMnO}_4$ ,  $\text{O}_3$ ,  $\text{Cl}_2$ ,  $\text{ClO}_2$ )
- pH Adjustment (acid/base)
  - $\text{H}_2\text{SO}_4$ ,  $\text{HCl}$ ,  $\text{CO}_2$ ;  $\text{NaOH}$ ,  $\text{Na}_2\text{CO}_3$
  - Acid Alum ( $\text{H}_2\text{SO}_4$  + Alum)
- Coagulation (multiple injection)
- Flocculation
- Sedimentation
- Filtration (media condition)
- GAC (age)
- Disinfection

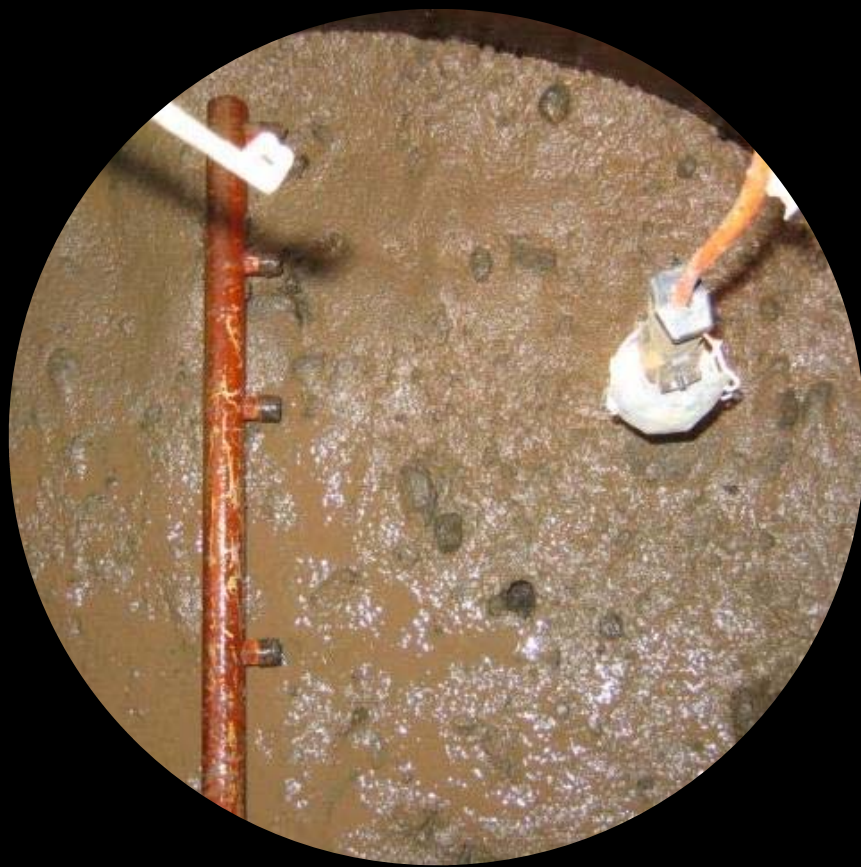
Visual  
Inspection of  
Filter Media



Media Mounding  
BWR < 10 gpm/ft<sup>2</sup>



Bad



Good







Jar Testing  
to determine optimum  
coagulant dosage

- Floc size
- Settleability
- Filterability
- TOC reduction
- UVA/%UVT
- Keep it simple



- UVT/UVA Analyzer
- Turbidity
- Laboratory Charge Analyzer
- pH probe
- Coagulant Stock Solution
- Pipette
- Jar Tester
- Syringe/Filters

## Jar Testing

32 mg/L ACH  
Settled 0.6 NTU  
Filtrate 0.11 NTU  
UVT: 87.1%  
UVA: 0.060/cm

38 mg/L ACH  
Settled 1 NTU  
Filtrate 0.08 NTU  
UVT: 87.7%  
UVA: 0.057/cm

44 mg/L ACH  
Settled 0.6 NTU  
Filtrate 0.08 NTU  
UVT: 87.7%  
UVA: 0.057/cm

50 mg/L ACH  
Settled 0.6 NTU  
Filtrate 0.09 NTU  
UVT: 89.2%  
UVA: 0.050/cm

JAR 1

JAR 2

JAR 3

JAR 4

LCA: ACH = 38.4 mg/L

ACH (Aluminum Chlorohydrate, dosed as product)

Rapid mix (200 RPM) for 1 minute followed by slow mix (28 RPM) for 5 minutes

French Gulch (Clear Creek source)





Settled for 5 minutes and then pull-off 30 mL from each jar for filtration

French Gulch (Clear Creek source)



Settled 0.6 NTU

Settled 1 NTU

Settled 0.6 NTU

Settled 0.6 NTU



25 minutes settled

French Gulch (Clear Creek source)

# Jar Test by Hand



End of 5 minute  
slow stirring

Filterability: 0.10  
NTU

End of 5  
minutes settling

Filterability: 0.08  
NTU

44 mg/L ACH (product)  
French Gulch (Clear Creek)

# Jar Test Filterability Test Equipment

- Turbidity Instrument
- Syringe PP/PE, luer lock tip, capacity 50 mL (part#: Z683698)
- Swinnex Filter Holder, 25 mm (part#: SX0002500)
- Isopore Membrane Filter, 1.2  $\mu\text{m}$ , 25 mm (part #: RTTP02500)
- <http://www.sigmaaldrich.com/>

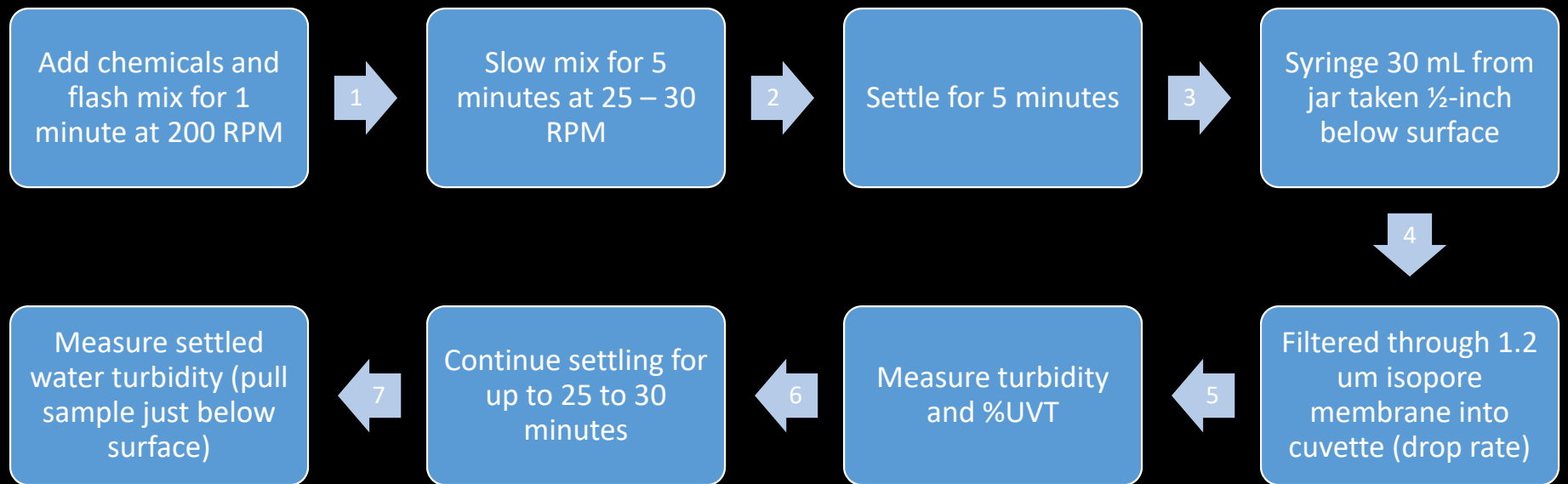


# Jar Test - Filterability Test

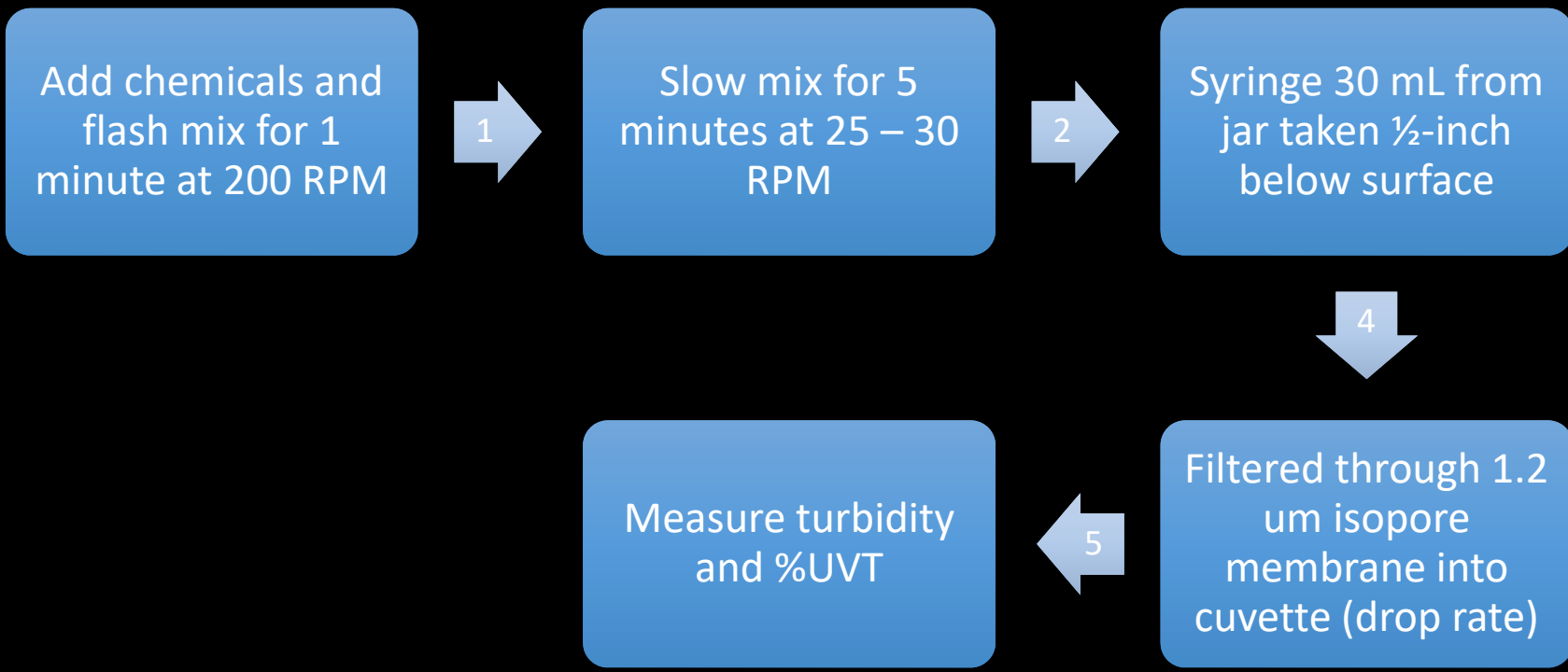
- Syringe ~ 30 mL from jar (after 5 minutes of settling)
- Filter-to-waste 2-3 mL
- Filter directly into clean cuvette
- Measure turbidity
- Note: Take several readings before recording final NTU results







Jar test procedures for systems with settling or solids removal



Jar test procedures for inline and direct filtration plant

Take Away

---

Start Preparing

---

Plant Evaluation

---

Jar Testing

---

Collaboration

---

Make it Happen

# Contact

- Guy Schott, P.E.
- State Water Resources Control Board
- Division of Drinking Water
- Santa Rosa, CA

For Stock Solution/Dosage calculations go to:

- [https://www.waterboards.ca.gov/drinking\\_water/programs/districts/mendocino\\_district.html](https://www.waterboards.ca.gov/drinking_water/programs/districts/mendocino_district.html)
- [Guy.Schott@waterboards.ca.gov](mailto:Guy.Schott@waterboards.ca.gov)
- 707-576-2732

