POST FIRE IMPACTS ON WATER QUALITY AND TREATMENT

DIVISION OF DRINKING WATER

SANTA BARBARA DISTRICT
SANTA YNEZ RIVER

- Watershed is comprised of approximately 897 square miles. 80% of it is in the Los Padres National Forest.
- Elevation goes from 6,820 feet to 4 feet at the ocean.
- River is usually dry in the summer.
- High priority steelhead river.
  - Was largest steelhead run in Southern California prior to dams being built.
SANTA YNEZ RIVER

• THREE DAMS BUILT ON THE RIVER TO SUPPLY WATER TO THE COMMUNITIES ON THE COAST SIDE OF THE SANTA YNEZ MOUNTAIN RANGE.
  • JUNCAL DAM FORMS JAMESON RESERVOIR
  • GIBRALTAR DAM FORMS GIBRALTAR RESERVOIR
  • BRADBURY DAM FORMS LAKE CACHUMA

• THREE TUNNELS WERE CONSTRUCTED THROUGH THE SANTA YNEZ RANGE TO CONVEY WATER FROM THE RESERVOIRS TO THE COASTAL COMMUNITIES
  • DOULTON TUNNEL
  • MISSION TUNNEL
  • TECOLOTE TUNNEL
RECENT FIRES IN SANTA YNEZ WATERSHED

• THOMAS FIRE
  • DECEMBER 2017; 281,893 ACRES

• ZACA FIRE
  • JULY 2007; 240,207 ACRES
  • SCORCHED 60% OF THE LAKE CACHUMA WATERSHED, LEAVING A 3-INCH THICK BLANKET OF ASH

• REY FIRE
  • AUGUST 2016; 32,606 ACRES

• WHITTIER
  • JULY 2017; 18,430 ACRES
POST FIRE IMPACTS ON SOURCE WATER

• WATER QUALITY DEGRADATION
  • HISTORICAL CACHUMA LAKE TOC CONCENTRATIONS WERE BETWEEN 2 AND 3 MG/L
  • POST ZACA FIRE TOC CONCENTRATIONS INCREASED 165% IN THE FIRST YEAR. SLOWLY DECREASED.
  • NEVER FULLY RECOVERED TO HISTORICAL TOC LEVELS.

• REDUCTION IN RESERVOIR STORAGE CAPACITY DUE TO SILTATION
  • OVER THE YEARS GIBRALTAR RESERVOIRS INITIAL CAPACITY OF 15,374 ACRE-FT HAS BEEN REDUCED TO 5,250 DUE TO SILTATION.
  • INHERENT ISSUE MADE WORSE BY FIRES
LAKE CACHUMA TOC

TOC (mg/L)
SURFACE WATER TREATMENT

• GOLETA WATER DISTRICT OPERATES CORONA DEL MAR WATER TREATMENT PLANT
  • CONVENTIONAL, FREE CHLORINE
  • 24 MGD (DESIGN); 36 MGD (PEAK CAPACITY).

• SANTA BARBARA ALSO OPERATES WILLIAM B. CATER WATER TREATMENT PLANT
  • 37 MGD
  • CONVENTIONAL, FREE CHLORINE
  • ALSO SUPPLIES MONTECITO AND CARPINTERIA

• MONTECITO WATER DISTRICT OPERATES BELLA VISTA AND DOULTON TUNNEL SWTPS
  • TWO TRIDENT PACKAGE PLANTS
  • LARGEST IS 2.2 MGD
  • FREE CHLORINE
SANTA BARBARA’S SURFACE WATER TREATMENT PLANT
ALTHOUGH NOT MONTECITO’S PLANT THEIRS IS SIMILAR TO THE PICTURE BELOW
TREATMENT STRATEGIES TO REDUCE DBPS

- SANTA BARBARA EVALUATED CONVERTING FROM FREE CHLORINE TO CHLORAMINES
  - REGIONAL WATER SUPPLIER
  - RETAILERS UTILIZE FREE CHLORINE FOR GROUNDWATER AND SURFACE WATER TREATMENT AT NUMEROUS LOCATIONS.
  - EVALUATION ELIMINATED THIS AS AN OPTION BECAUSE RETAILERS WOULD ALSO HAVE TO CONVERT TO CHLORAMINES AT ALL OF THEIR INDIVIDUAL CHLORINATION SYSTEMS.
TREATMENT STRATEGIES TO REDUCE DBPS

• ELIMINATION OR REDUCTION OF PRECHLORINATION
  • HISTORICALLY CHLORINATION AT THE HEADWORKS OF THE PLANT PROVIDED A RESIDUAL THROUGHOUT THE TREATMENT TRAIN.
  • HIGHER TOC IN THE SOURCE WATER RESULTED IN ELEVATED DISINFECTION BYPRODUCTS LEAVING THE TREATMENT PLANT.
    • INCREASED THE LIKELIHOOD OF EXCEEDING TTHM STANDARD IN THE DISTRIBUTION. ESPECIALLY SANTA BARBARA’S DOWNSTREAM RETAILERS.
  • GOLETA TRIMMED THE PRECHLORINATION DOSAGE TO PROVIDE A TRACE RESIDUAL GOING ONTO THE FILTERS.
  • SANTA BARBARA ELIMINATED PRECHLORINATION AND REPLACED IT WITH OZONE.
  • APPROACH REDUCTION/ELIMINATION OF PRECHLORINATION CAUTIOUSLY
    • IT MAY AFFECT THE EFFICIENCY OF THE COAGULATION PROCESS.
    • CHLORINE CONTACT TIME NEEDS TO BE REEVALUATED.
TREATMENT STRATEGIES TO REDUCE DBPS

• ADDING CARBON (PAC OR GAC) TO THE TREATMENT PROCESS
  • ADDING GAC TO THE FILTERS WILL REDUCE TOC… BUT NOT FOR VERY LONG
    • MONTECITO REPLACED FILTER MEDIA IN THEIR PACKAGE PLANT WITH GAC
    • GREAT REDUCTION FOR A SHORT PERIOD OF TIME.
      • ONLY FIRST MONTH HAD SIGNIFICANT DECREASE, LIMITED REDUCTION SECOND MONTH. AFTER THAT, NO MEASURABLE REDUCTION.
  • CONTINUOUS PAC ADDITION TO PRETREATMENT
    • EXPENSIVE
    • GENERATES A SIGNIFICANT AMOUNT OF SOLIDS.
      • SANTA BARBARA BUILT A SOLIDS HANDLING FACILITY AS A RESULT
    • SHORTENS RUN TIMES ON FILTERS
      • MAY IMPACT BACKWASH RECOVERY CAPACITY DUE TO MORE FREQUENT BACKWASHES
    • LIMITED TO CERTAIN TREATMENT PLANTS. NOT LIKELY FEASIBLE FOR A PACKAGE PLANT.
DISTRIBUTION STRATEGIES

- Stage 2 DBPR was being rolled out around the same time as the WQ issues associated with the Zaca Fire.
- Santa Barbara and Montecito completed distribution hydraulic models.
- Water age determinations helped identify where improvements could be made.
  - Looped pipe systems where possible.
  - Optimize reservoir operation by altering fill and full setpoints.
    - Allowing as much of the tank volume to cycle as frequently as possible.
- Mixing and/or aeration in long residence time reservoirs.
DISTRIBUTION STRATEGIES

• TTHMS CAN BE SIGNIFICANTLY REDUCED IN THE DISTRIBUTION SYSTEM THROUGH AERATION. NOT AS EFFECTIVE ON HAA5S

• HENRY’S LAW CONSTANTS PROVIDE INFORMATION ON WHICH TTHMS ARE MOST EASILY REMOVED WITH AERATION. IF LARGE PERCENTAGE OF TTHMS ARE CHLOROFORM AND/OR BROMODICHLOROMETHANE, AERATION CAN BE VERY EFFECTIVE. THESE HAVE THE HIGHEST HENRY’S CONSTANT OF ALL FOUR TTHMS.

• CHLORINE RESIDUAL MONITORING DURING AERATION DID NOT SHOW A SIGNIFICANT REDUCTION IN CHLORINE RESIDUAL.

• MAY NEED TO ADD A BLOWER TO VACATE THE HEADSPACE IN THE RESERVOIR SO VOLATILIZED TTHMS ARE NOT REINTRODUCED INTO THE STORED WATER.

• DAILY REPORTING OF AERATION SYSTEM OPERATION TO SHOW ROUTINE TREATMENT IS BEING PROVIDED
THANK YOU

• JEFF.DENSMORE@WATERBOARDS.CA.GOV
• 805.566.1326