American Bar Association, Forum on Construction Law
2018 Regional Program

Infrastructure From the Ground Up: Civil Works Projects for Lawyers.

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Importance of Water Industry

• 75% of Earth’s surface is water: **Only 0.5%** of that is fresh water

• Over 5 million deaths occur annually due to lack of clean water

• Industrialized societies impact cost and difficulty treating water

• Extensive growth has resulted in water supply challenges in key areas
Part 1: Water Treatment
Drivers & Challenges

• Regulatory Requirements
• Water Demand / Growth Projections
• Limited Resource / Water Supply
• Funding
EPA Standards

• Clean Water Act (CWA)
  Safe Drinking Water Act (SDWA)

• Over 170,000 public water systems in US

• Enforcement can include administrative orders, legal action or fines
# Federal Water Pollution Control Act

## Clean Water Act (CWA)

<table>
<thead>
<tr>
<th>Year</th>
<th>Update</th>
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<tbody>
<tr>
<td>1948</td>
<td>Federal CWA</td>
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<tr>
<td>1950</td>
<td>CWA Update</td>
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<tr>
<td>1960</td>
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- **Enforcement**: U.S. EPA with states, largely administering laws.

All discharges into the nation’s waters are unlawful unless authorized by a permit.

Control Water Pollution with State & Local Efforts

Addressed Sewage, Industrial & Toxic Discharges. Wetlands and Contaminated runoff

Goal to make waters fishable & swimmable
Clean Water Act (CWA) Core Programs

Identifying Polluted Waters and Developing Plans to Restore Them
• States required to assess whether surface waters meet water quality standards (called impaired waters)

Permitting Discharges of Pollutants from Point Sources
• National Pollutant Discharge Elimination System (NPDES)
  – Key regulatory tool
• Permits issued only after operator shows that they are using the best available technology to reduce pollutants
Clean Water Act (CWA) Core Programs

Addressing diffuse, nonpoint sources of pollution

- Prior to 1987, CWA programs primarily directed at point source pollution

- CWA Section 319 - reduce pollution from unregulated, diffuse sources, such as agriculture
  - Biological Nitrogen Removal
  - Phosphorus Removal
Safe Drinking Water Act (SDWA)

  • 1996 amendments expanded beyond safe drinking water at the tap to source water protection, operator training, funding and public information requirements
  • EPA sets standards (maximum contaminant levels for particular contaminants or required ways to treat water) with states or tribes implementing various programs
Threats to Drinking Water

EPA sets national health-based standards for drinking water protection from:

- Improperly disposed chemicals
- Animal wastes
- Pesticides
- Wastes injected underground
- Human threats
- Naturally occurring substances
- Not properly treated or disinfected
- Poorly maintained distribution system
Defining the Standards (SDWA)

• ID contaminants that may adversely affect public health and occur in drinking water
• Maximum Contaminant Level (MCL)
• Standards are set to be as close to the feasible level of no known or expected risk to health
  - Feasible is defined as achieved with the use of best technology, treatment techniques and other means available taking cost into consideration
• If no maximum level, EPA may establish a required treatment technique
Key Regulatory Issue

- States have the right to make standards more stringent
- Implemented through permit process
- Enforced through reporting, inspection, fines for violation, and consent decrees
Treatment Plant Size (MGD)

- **Service Area**
  - Population projections / industrial users
  - Residential use approx. 75 to 150 gallons per day per person

- **Key Treatment Issue / Contact Time**
  - How long does disinfectant or flocculent need to be in the water to be effective?
Evaluating Raw Water Supply

- Variation in Availability
  - Raw water quality and quantity variation by season
  - Variability results in challenges in design

- Source Water and Quality
  - Reservoir, river, stream (affected by environment)
  - Groundwater (higher in dissolved solids and hardness, pumping requirements)
  - Ocean (expensive to remove salt)
Water Treatment Plants

• Design Considerations
  • Quality and quantity of influent water
  • Raw water supply availability
  • Plant process – legacy versus new technology

• Engineering determined by
  • Water available
  • EPA standards for the water
  • Quantity of water needed
  • Treatment technologies
Intake Structures

• Choice of Structure Depending on Source
  • Water Availability
  • Bathymetry (depth and shape of body of water)
  • Sediment Transport
  • Environmental Regulations
  • Climatic Conditions
  • Constructability
  • Operations and Maintenance
Treatment Methods

• Chemical Process
• Mechanical Process
• Filtration Systems
  • Skimmers
  • Ultraviolet Light
  • Ozone
  • Permeable Membranes
Surface Water Plant Flow Diagram

Remove Big Things
- Coagulation removes dirt and other particles suspended in water. Alum and other chemicals are added to water to form tiny sticky particles called “floc” which attract the dirt particles. The combined weight of the dirt and the alum (floc) become heavy enough to sink to the bottom during sedimentation.

Filter Small Things
- The heavy particles (floc) settle to the bottom and the clear water moves to filtration.
- The water passes through filters, some made of layers of sand, gravel, and charcoal that help remove even smaller particles.

Filter
- A small amount of chlorine is added or some other disinfection method is used to kill any bacteria or microorganisms that may be in the water.

Disinfection

Drinking Water Treatment

Mix it
Ground Water Plant Flow Diagram

(4) GreensandPlus Pressure Filters

Filter Particles & Iron

Ranney Wells

KOH

Chlorine

No. 1
No. 2
No. 3
No. 4

(6) GAC Contactors

Filter Fines

No. 1A
No. 1B
No. 2A
No. 2B
No. 3A
No. 3B

Corrosion Inhibitor

KOH

Chlorine

Chlorine Contact Main

To Distribution

Finished Water Storage Tank

Layton Wells

Supernatant Pumps

Ferric Chloride

Backwash Waste Storage Tank No. 1
Backwash Waste Storage Tank No. 2

Residuals Transfer Pumps

Residuals

Holding Tank

Remove Particulates

Sludge trucked to off-site disposal
pH

Acid Range

Base Range

Chemistry Matters

pOH 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

pH 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Acid Range

Base Range

Caustic Soda

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Chemicals Used in Treatment

• **Chlorine**
  • Effective disinfectant best used on warmer water

• **Ammonia**
  • Used to limit disinfection by-product caused by chlorine

• **Potassium Permanganate**
  • Controls color, taste and odors

• **Acids and Caustics**
  • Used to control pH level of water
Other Disinfection Options

• **Ozone Disinfection**
  • Control of carbon based materials in water

• **Ultraviolet Germicidal Irradiation**
  • Use of light to destroy microbes in water
Filtration

- **Rapid Sand Filters**
  - Passing water through sand beds to remove solids

- **Slow Sand Filters**
  - Graded layers of sand filters water as it passes

- **Activated Carbon Adsorption**
  - Uses adsorption to capture organics

- **Membrane Filtration**
  - Operate at the molecular level
Membrane Type of Filters

Ultrafiltration - .001-.01µ

Nanofiltration - .0001-.001µ

Reverse Osmosis - <.0001µ

* A human hair is approx. 80µ
Plant Instrumentation & Controls

• Instrumentation monitors:
  • Raw water coming in
  • Effluent going out
  • Distribution system
Plant Instrumentation & Controls (SCADA)
Sustainable Design

Triple Bottom Line (TBL) approach: Quantifying financial, social and environmental benefit

Consideration Metrics

- Minimizing Plant Waste
- Minimize Power Use
- Triple Bottom Line
- People
- Planet
- Profit
Pumping Considerations

- Volume or quantity needed in processing water
- Moving water to higher elevations
- Impact of pipe size and allowable pressure
- Energy Use – efficiencies derived from variable speed drives
Pumping Considerations
Wastewater
Wastewater Treatment

Wastewater treatment is the engineered process of accelerating natural processes to protect public health and the environment.
Did you know that?

There is no pristine water, all water has been recycled several times.

De Facto Reuse has been implemented in USA and other countries for many years.
Regulatory Scheme

• Prior to 1947 – No federal regulation of waste water

• 1948 to 1970 – Federal Water Pollution Control Act (FWPCA)

• 1970 to Present – EPA Clean Water Act
  • Controls discharge of pollutants into above ground waters
  • Ensures surface waters meet standards necessary for human sports and recreation
Degree of Treatment

• Driven by location, location, location
• Permits based on the local receiving body of water and its capacity to clean
• Plants with ocean outfalls require less (intense) treatment because of diffusion, currents
• Sensitive ecosystems with limited flushing capacity
• Long Island Sound (NY), Puget Sound (WA), Chesapeake Bay (DC, MD, VA)
WASTEWATER TREATMENT

LIQUID PROCESSING
Preliminary Treatment

**Screenings** - Unsightly in discharge and biosolids; Can damage equipment in plant and include floating debris - plastics, sticks, paper.

**Grit** - inert, not treatable component; Damaging to equipment in plant and typically includes sand, egg shells, plastic particles, coffee grounds.

**FOG** – Can affect settling; Creates foam, scum; Unsightly in discharge; Organic and inorganic sources.
Primary Treatment

Involves the physical separation of solids so the liquid component gets additional treatment

- Solids settled out
- Sludge pumped off

- Follows Preliminary Treatment
Secondary Treatment

- Follows **Primary Treatment**
- Biological treatment to remove soluble pollutants
- Degree of **Secondary Treatment** ranges from organic pollutants to nutrients like Nitrogen
- Treatment configurations vary significantly
Secondary Treatment: Trickling Filters

1. Influent Pumping
2. Screening
3. Grit/Grease Removal
4. Primary Settling
5. Trickling Filter
6. Recirculation Pumping
7. Secondary Clarifier
8. Chlorine Contact
9. Secondary Sludge
10. Secondary Sludge
Secondary Treatment: Activated Sludge

- Influent Pumping
- Screening
  - Screenings
- Grit/Grease Removal
- Primary Settling
  - Grit
  - Grease
  - Primary Sludge
- Biological Treatment
  - Return Activated Sludge
- Secondary Settling
  - Secondary Sludge
- Filtration
- Disinfection
Blue Plains, Washington DC
Secondary Treatment: Membrane Bioreactor (MBR)

- Screening
- Grit/Grease Removal
- Aeration Tank
- Membrane Bioreactor
- Ultraviolet Disinfection
- Influent Pumping
- Return Sludge
Disinfection

• Follows **Secondary Treatment**
• Required prior to discharging to receiving body of water
• Strong oxidizer required like Chlorine Gas or Sodium Hypochlorite
• Advanced oxidation process like ultraviolet (UV) disinfection
• Plants may be required to remove Chlorine residual
Industry Trends

Innovation

• Less money
• Less power
• Less GHG emissions

Reuse/Recharge

• Orange County
• Hampton Roads
• Texas
WASTEWATER TREATMENT

SOLIDS PROCESSING
WASTEWATER TREATMENT

Primary Treatment

Headworks

Grit & Screenings (Landfill)

Primary Clarifier

Primary Sludge

Secondary Treatment

Biological Treatment

Secondary Sludge
Or Waste Activated Sludge

Secondary Clarifier

Tertiary Treatment

Effluent
Biosolids Processing Goals:

- Stabilize (Biologically, Chemically or Thermally)
- Remove Water
- Reduce Volume
Energy Recovery Opportunities

- Sludge
  - Burn Dry Incineration
  - Combustible Gas via Pyrolysis/Gasification
  - Biogas Via Anaerobic Digestion

- Conversion to Products Oil/Gas
- Heat Thermal Energy
- Co-gen Electricity and Heat
- Direct Use Sale of Methane Gas
Trend

1950s

1970s

1990s

Today
Public utilities are moving to follow the hierarchy of solids management methods.
Emerging Technology

• More “black-box” technology providers selected by clients as the basis for CAPEX upgrades

• CAMBI: Norwegian Thermal Hydrolysis process selected as the head of a DC project - first of its kind in the US and largest in the world

• RISKS:
  • Default – European company with no US track record
  • Currency fluctuations – timing of selection vs. award vs. procurement
  • Process guarantees: who is on the hook and for what? Owner? Contractor? Owner’s advisor?
Legal Issues in Water / Wastewater Projects

Presented By:
Jessica Sabbath
King & Spaulding
Legal Issues in Water/Wastewater Projects

Risk Drivers for Water/Wastewater Projects:
- Substantial Excavations
- Design Complexity
- Standard of Care
- Performance Guarantees
Legal Issues in Water/Wastewater Projects

Common Sources of Delays and Budget Overruns Include:

- Incomplete or Defective Design
- Differing Site Conditions
- Scheduling Logic
- Contract Administration
Differing Site Conditions – Common Law Approach:

- Contractors are responsible for unknown and unanticipated site conditions
- Often leads to large contingencies
- First DSC clause appeared in Federal contracts in 1926
Legal Issues in Water/Wastewater Projects

DSC clauses appear in:

- Federal Acquisition Regulations, Section 52.236
- AIA A201, Section 3.7.4
- ConsensusDocs 200, Section 3.16
- Engineers Joint Contract Documents, Section 5.03
Legal Issues in Water/Wastewater Projects

- DSC – A condition “differing materially from those indicated in the contract.”

- Type II DSC – Physical conditions at the site of an unusual nature that generally are not recognized as inherent in the work.
Legal Issues in Water/Wastewater Projects

If DSC discovered, the Contractor should:

• Read the contract!
• Provide written Notice to Owner
• Stop work
• Keep accounting costs
• Follow contract claims procedures
Legal Issues in Water/Wastewater Projects

Factors impacting recovery for DSC:

- Pre-bid site investigation
- Contractor’s compliance with standard of care for investigation
- Representation of risk acceptance
- Exculpatory clauses
Legal Issues in Water/Wastewater Projects

Exculpatory Clauses:

- Metcalf Construction v. United States
  102 Fed. Cl. 334 (2011)
  “Metcalf I”

- Metcalf Construction v. United States
  742 F.3d 984 (2014)
  “Metcalf II”
Thank You

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