Thank you to our Patrons

We will begin our presentation in a few minutes…
Thank you to our sponsor for financially supporting this webinar

Improving Lives Since 1913. Stanley Consultants has been helping clients solve essential and complex energy and infrastructure challenges for over 100 years, successfully completing more than 50,000 engagements in 110 countries and all 50 states and U.S. territories. Values-based and purpose-driven, Stanley is an employee-owned company of engineers, scientists, technologists, innovators and client-service experts who are recognized for their commitment and passion to make a difference.

For more information on Stanley Consultants, please visit http://www.stanleyconsultants.com.
City Underwater: The Ongoing Challenge of New Orleans Drinking Water Management

Chris Bergeron, P.E., P.M.P. SWBNO
Kate Despinoy, P.E., P.M.P., Stanley Consultants
Scott Warren, P.E., Stanley Consultants
July 19, 2023
Presentation Contents

1. SWBNO background and Carrollton Water Treatment Plant
2. Factors affecting operation
3. Iterative upgrade plan
4. Three-phased improvements plan
5. Instrumentation and controls design
6. Current state and future improvements
Sewerage & Water Board of New Orleans History

• Founded in 1899
• Three systems
  • Water
  • Sewage
  • Drainage
Drainage System

New Orleans Area Map

- Floodwall Along Mississippi River
- Hurricane Protection Levee & Floodwall
- Normal Lake 1.0 FT Level
- SPH Design Elevation 11.5 FT
- 17.5 FT
- 20 FT
- 30 FT

City of New Orleans Ground Elevations
From Canal St. at the Mississippi River to the Lakefront at U.N.O.

© Stanley Consultants, Inc. Not for further distribution, display, or reproduction
The Water System

- Carrollton Water Treatment Plant
  - Constructed in 1908
  - Water and power plant
- Two intake river pumping stations
- 7-step purification process
- 130 MGD average production
The Water System

• Two Separate Systems
  • East Bank
  • West Bank
Carrollton Water Treatment Plant

1. Claiborne Pump Station
2. Panola Pump Station
3. High Lift Pump Station
Carrollton Water Treatment Plant

1. Two 25 Hz, Two 60 Hz pumps
2. Two 25/60 Hz pumps
3. Two steam-driven pumps

Eight total distribution pumps
Hurricane Katrina

August 29, 2005
Water Treatment Plant Pre- and Post Katrina
Factors Affecting Operation

• Hurricane Katrina
• Power outages
• Water main leaks
• Water hammer
FEMA’s Upgrade Plan

- Reiterative process
- Initial plan comprised of:
  - Eight new pumps and motors
  - New slowly opening and closing valves
  - Variable frequency drives (VFD)
  - Vacuum priming system
Surge Analysis Scenario

- 5 pumps running, 4 lose power
- Peak demand 170 MGD
- High vs low pressure transients
Surge Analysis Scenario
Surge Analysis Scenario

Surge node 420-065  No Improvements to the System

Boil Order Trigger = 15 psi

Proposed 2011 FEMA Upgrade Plan
Potential Solutions

- Stand pipes
- Bladder tanks
- *Elevated storage*
Surge Analysis Scenario

Proposed 2011 FEMA Upgrade Plan

BEFORE

Proposed Tanks

AFTER

Pressure (psig)

Time (sec.)

40 MINUTES
FEMA’s Revised Upgrade Plan

- Five refurbished pumps
- Four new motors
- Four VFDs
- Two water towers
- New valves and meters
Overall Water Hammer Program

- Phase 1 – Two elevated 2 MG storage tanks
- Phase 2 – Claiborne improvements
- Phase 3 – Panola and High Lift improvements
Water Towers

- 2 million gallons each
- 200 feet tall
- Composite style – concrete and steel
Hydraulics

- Connected to distribution system
- 40 minutes of water pressure
- Pressurized at 75 psi
Challenges

• Plant utilities
Water Tower Installation
Overall Water Hammer Program

• Phase 1 – Two elevated 2 MG storage tanks
• Phase 2 – Claiborne improvements
• Phase 3 – Panola and High Lift improvements
Water Pump Stations

- Three existing pump stations that distribute potable water into one pressure zone
- The water level in the clear wells is at the same elevation throughout the plant, balanced through a series of pipes
- The clear wells are supplied from the Sycamore and Claiborne filters
Pump Station Flow

- The peak hour pumping capacity is 170 MGD combined
- System pressure is maintained between 68 and 72 PSI

### Pumping Capacity

The capacity for each of the pump stations is indicated in the following table:

<table>
<thead>
<tr>
<th>Pump Station</th>
<th>Pump No.</th>
<th>Maximum Speed (RPM)</th>
<th>Capacity (MGD)</th>
<th>Drive Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump Room</td>
<td>A</td>
<td>742</td>
<td>45.0</td>
<td>Steam</td>
</tr>
<tr>
<td>Pump Room</td>
<td>B</td>
<td>742</td>
<td>45.0</td>
<td>Steam</td>
</tr>
<tr>
<td>Panola</td>
<td>1 (C)</td>
<td>750*</td>
<td>45.0*</td>
<td>Electric</td>
</tr>
<tr>
<td>Panola</td>
<td>2 (D)</td>
<td>750*</td>
<td>45.0*</td>
<td>Electric</td>
</tr>
<tr>
<td>Claiborne</td>
<td>1</td>
<td>740</td>
<td>44.0</td>
<td>Electric</td>
</tr>
<tr>
<td>Claiborne</td>
<td>2</td>
<td>720</td>
<td>41.0</td>
<td>Electric</td>
</tr>
<tr>
<td>Claiborne</td>
<td>3</td>
<td>720</td>
<td>41.0</td>
<td>Electric</td>
</tr>
<tr>
<td>Claiborne</td>
<td>4</td>
<td>740</td>
<td>44.0</td>
<td>Electric</td>
</tr>
</tbody>
</table>

* The Panola pumps will run faster and produce the flow rate indicated in the table at 25 Hz; at 60 Hz the motors will run slightly slower and produce less capacity.
Existing Conditions
Claiborne Pump Station Improvements

• Significant rehabilitation of the existing pumps including:
  • Pump impellers and shaft removed scanned and rebuilt
  • Anti-reverse ratchets for all pumps
• New electric motors and VFDs to regulate discharge pressure
Construction
Construction
Improvements

• Air release valves
• Hydraulic actuated ball valves
• Yard piping, metering vaults, discharge valves and replacement piping
Construction Phasing

- Claiborne is a critical station
- A bypass sequence plan was developed
- While Claiborne was under construction, other two stations and the Claiborne elevated tank needed to be in operation
  - Two pumps were done at a time, never fully shut down
Construction Phasing
Construction Phasing
Construction Phasing
Construction Phasing
Construction
Vacuum Priming System

• Sized to maintain a constant prime
• Instantaneous pump starts
• Automatic and manual operation configured for remote monitoring
• Two vacuum pumps
Improvements

• Surge control facility (remote facility)
• VFD building and switch gear electrical improvements.
The President Visits

- Highlighted the dire need to modernize infrastructure
Roadway Rehabilitation
Project Completion
Project Completion
Overall Water Hammer Program

• Phase 1 – Two elevated 2 MG storage tanks
• Phase 2 – Claiborne improvements
• Phase 3 – Panola and High Lift improvements
Panola Improvements

• Complete rehabilitation of pump no. 1
• Replacement of rotating assemblies
  • Impellers
  • Increase shaft size to add anti-rotation back-spin prevention devices
• New vacuum priming system
• New discharge valves and piping, yard piping
• Structural, electrical and I&C
• Change order – structural lining of clear well
Panola Pump Station Construction
High-Lift Improvements

- Replacement of rotating assemblies
  - Impellers
  - Increase shaft size to add anti-rotation backspin prevention devices
- Vacuum priming system modifications
- New discharge valves and piping, yard piping
- Structural, electrical and I&C
- Change order – convert second pump over to electric motor
Claiborne Pump Station Controls
What is Instrumentation & Controls Engineering?

• Unique discipline

• Interface with process, mechanical, electrical and client operations

• Always the last out the door

• Controls design is personal
History of the Controls at Claiborne Station

• Pump station built in 1958, 11 years before the first programmable logic controller (PLC) was developed

• Pumps were manually started and stopped

• No technology forward leaps
History of the Controls at Claiborne Station

Manual control stations.
History of the Controls at Claiborne Station

• Wound rotor motor control panel, pre-cursor to variable frequency drives (VFDs)

• Had speed control

• Several panels abandoned in the station as motors were upgraded
Discovery Process by Controls Engineers

- Uphill battle on implementing controls
- Started discovery process early 2012
- Not yet digitally cataloged
- Most were the originals from the plant or plant upgrades
Discovery Process

- Temperatures, pump speeds, system pressure manually recorded
- Chart recorders using paper disk
Discovery Process

System pressure gauge
Discovery Process

• Met with SWB engineering staff and operators, observed operations
• Questions we needed to understand:
  • How were pumps brought online?
  • How did controls function?
  • Function of auxiliary systems?
  • Which were essential?
Physical Inspections

• Spent time on-site, tracing large diameter pipes

• Used info to understand vast and complex piping system on the Carrollton site
Physical Inspections – Venturi Flow Metering
Design Challenges, Solutions

Controls-Electrical:

• System redundancy – Must continually run under all scenarios, especially hurricanes

• Consider loss of
  • Incoming power
  • Specific power on sub-systems
  • Control system power

• Uninterruptable power supply (UPS)
Design Challenges, Solutions

Controls-Mechanical:
• Water hammer effect
• New design added ball valves with electro-hydraulic actuators
  • Must close valves if power loss
• Automation decision
Programmable Logic Controllers (PLCs) Installed

- All new instrumentation signals pulled into new “brain”
- Controls VFD speed simultaneously, can change pressure output by adjusting speed
- Controls discharge valves
- Monitors sub-systems
Control Panel – New Screens
SCADA Computer
Instrumentation Installation and Construction

- Flow meters added at discharge of each pump
- Monitoring of the automated vacuum priming system
Variable Frequency Drives (VFD)
Controls Lessons Learned

• Determine how much to automate

• Flexibility needed during equipment startup

• New Equipment Training for staff

• Too much technology, too fast to meet client needs
MAKING OUR WATER SYSTEM MORE RESILIENT

Phase 1
Completed 2019

Water Towers
Build water towers that hold two million gallons of water to provide up to 40 minutes of uninterrupted water pressure in the event of a power outage.

Phase 2
Completed 2022

Claiborne Pumping Station
Upgrade all four pumps and motors at the Claiborne Pumping Station with new controls that can adjust to fluctuations in water pressure.

Phase 3
Underway

Panola and High Lift Pumping Stations
Install new meters and valves at the Panola and High Lift Pumping Stations so we can monitor water flow rates in addition to improvements to the pumps.

Construction projects were phased to prevent water service interruptions.
Future Plans

- Electrical system upgrade
- Evaluate equipment that could be fully automated
- Determine how much automation to implement in the complex pumping system
Contact

Chis Bergeron, P.E., P.M.P.,

cbergeron@swbno.org

Kate Despinoy, P.E., P.M.P.,
despinoykate@stanleygroup.com

Scott Warren, P.E.

warrenscott@stanleygroup.com
Thank you for attending our webinar today.

Would you like to attend our next webinar?
We have several webinars happening soon. Go to https://www.aaees.org/events to reserve your spot.

Would you like to watch this webinar again?
A recording of today’s event will be emailed to all attendees.

Not an AAEES member yet?
To determine which type of AAEES membership is the best fit for you, please go to AAEES.org or email Marisa Waterman at mwaterman@aaees.org.

Need a PDH Certificate?
You will be emailed a PDH Certificate for attending this webinar.

Questions?
Email Marisa Waterman at mwaterman@aaees.org with any questions you may have.