C-43 West Basin Storage Reservoir Water Quality Feasibility Study
Public Meeting Minutes

March 25, 2020 6:00 PM – 8:00 PM

Webinar

Meeting Welcome

Drew Bartlett, Executive Director of the South Florida Water Management District (SFWMD), welcomed everyone to the C-43 West Basin Storage Reservoir Water Quality Feasibility Study public meeting. This is the third public meeting. Drew stated that he is very proud of SFWMD staff for pulling together and holding this meeting even though we are not in person. This project is critical to the C-43 Reservoir and Caloosahatchee River. SFWMD will continue to do what is needed, which is why we are holding this meeting to provide information to the public in a timely manner so that the next steps can be taken to provide good quality and quantity of water to the river. Drew thanked the Working Group members for their work in narrowing down the options to 10 technologies to present tonight. This meeting has been set up to be as interactive as possible, and SFWMD staff are available by phone for any additional discussions.

Georgia Vince, J-Tech Project Manager, provided a welcome and introduced herself as supporting the SFWMD on this important project. She stated we are excited to bring you this virtual public meeting via Zoom technology and look forward to an interactive meeting with the participants, using this technology.

Georgia stated that there will be opportunities for a few questions at the end of each section of the presentation and asked that you keep your questions pertinent to the topic that was just presented.

If you called in only and are not on the web press *9 to raise and lower hand and *6 to mute or unmute OR - you will be able to provide feedback via our project email address which will be provided later

Georgia stated that at the end of the presentation we will be utilizing another program called “Menti” to obtain input and feedback from Zoom participants and there will be a second question and answer session at the end of the meeting where you can type in your questions regarding the information presented today.

You can access Menti from a separate internet browser window or from your smart phone and the website address and code will be provided during that section of the presentation.

Georgia explained that the C-43 Reservoir water quality study is being supported by several municipal entities within the region. The following are our working group members and introduced them:

SFWMD lead is Kim Fikoski, Project Manager
FDEP representative is Edward Smith, Director – Office of Water Policy and Ecosystem Restoration
Hendry County - Shane Parker, Public Works Director
Lee County - Roland Ottolini, Director of Natural Resources
City of Cape Coral - Maya Robert, Environmental Resources Division Manager
City of Sanibel - James Evans, Director of Natural Resources
Lehigh Acres Municipal Services Improvement District - Michael Cook, Assistant District Manager

The Consultant team leading the study efforts is J-Tech, a joint venture between Jacobs Engineering and Tetra Tech. You will be hearing from the consulting team today during the presentation including Shawn Waldeck and Jim Bays of J-Tech, and Chris Keller with Wetland Solutions Inc.

The purpose of today's meeting includes an overview of our Study goals and objectives, an update on our Information Collection Summary Report and key findings, and to obtain input for the Study.

Study Background

In January of 2019, Governor DeSantis signed an executive order for greater protection of Florida's environment and water quality. It included efforts to reduce harmful algae blooms and specific to today's topic, it included a directive to study additional WQ treatment opportunities for water leaving the C-43 West Basin Storage Reservoir.

DEP is leading many of the efforts outlined in the executive order including Harmful Algae Bloom Task Force, Blue Green Algae Task Force, Caloosahatchee Basin Management Action Plan update adopted January 2020, and Agricultural BMP assessments with the Dept of Agriculture and Consumer Services. DEP is also serving on the Working Group for THIS study and is managing the Technology Library which is accessible on their website.

The primary objective of the Study is to identify opportunities to provide additional treatment and improve water quality leaving the C-43 Reservoir. During the study we will identify and evaluate treatment technologies that may be implemented with the reservoir project, with the ultimate goal being identifying three alternatives.

The study will evaluate:

- ✓ Pre-treatment (Prior To Entering Reservoir)
- ✓ In-reservoir treatment
- ✓ Post Storage treatment
- ✓ Will Ensure the technology is cost-effective and technically feasible
- ✓ Will Use conventional and/or innovative treatment methods
- ✓ Will Consider biological, chemical and physical water quality treatment technologies
- ✓ Must be Scalable and "available" for long term operation
- ✓ MUST BE Compatible with the objectives of the C-43 Reservoir Project

The working group and consultant team have identified some constraints that we will need to keep in mind as this study moves forward.

- The identified alternatives cannot affect the congressionally approved C-43 WBSR project purposes, benefits, infrastructure, construction schedule, or operation;
- Available project lands have not been specifically identified for the Study;
- The C-43 WBSR and the selected treatment component(s) are not intended to achieve compliance with the Caloosahatchee River and Estuary Total Maximum Daily Loads (TMDLs)

The Information Collection Summary Report will be available on the project website on April 3rd, and the final public meeting will be held on July 16th. The final Feasibility Study with recommendations will be submitted in October to the SFWMD.

QUESTIONS

- Q: Could you talk about the status of the reservoir itself in terms of construction and whether there is water in it?
- A: This is a good transition to the next part of the presentation on the reservoir and its operations.

Georgia introduced Shawn Waldeck, J-Tech Construction Manager for C-43 Reservoir, to discuss some of the important details about the Reservoir.

C-43 West Basin Storage Reservoir Operations

Shawn Waldeck stated that the C-43 Reservoir is a component of the Comprehensive Everglades Restoration Plan (CERP). The project is funded by annual Florida legislative appropriations and the U.S. Army Corps of Engineers will credit eligible project costs. The purpose of the reservoir is to capture excess basin runoff and Lake Okeechobee releases to store water to improve the quantity, timing, and distribution of discharges to the Caloosahatchee Estuary. Another purpose of the project is to maintain water supply for existing users.

Shawn provided an overview of the location of the C-43 Reservoir including its location related to the C-43 River/Canal, Lake Okeechobee, Ortona and Franklin Locks, and Townsend Canal. This is a 10,500 acre project that will provide above-ground storage. Flows from the river will be directed down the Townsend Canal and into the reservoir. When the river and estuary call for it, water that is stored will be discharged through the Townsend Canal and back into the river and estuary.

The reservoir has two cells that are about equal size. Water is drawn through a large pump station into the reservoir. When discharges are needed, water is discharged from each cell to the perimeter canals into the Townsend Canal and back into the Caloosahatchee River.

The major constraints to the reservoir operations are the Lake Okeechobee operation schedule and the Caloosahatchee Minimum Flow and Level (MFL) that was established at 457 cubic feet per second (cfs). The reservoir will be filled during the wet season and discharge during the dry season to help maintain the salinity levels in the estuary. The discharges and inflows will be based on flows at the Franklin Lock.

The inflow capacity for the reservoir is 1,500 cfs, which equates to about 3 inches per day. In an emergency, the reservoir can discharge up to 2,500 cfs but normal discharges are to meet MFLs. Shawn noted that the reservoir construction contract was issued in June 2019 and the contract substantial completion date is December 2023.

QUESTIONS

- Q: Will the planned toll road have any impact or influence on this project?
- A: The footprint of the reservoir has been designated as not a viable location for the toll road so there will be no impacts.

- Q: Where is the MFL of 457 cfs measured?
- A: The flows are measured at the Franklin Lock.

- Q: What situation would be considered an emergency?
- A: The reservoir is an above ground impoundment that is surrounded by a dam. When flood conditions are approaching, water can be evacuated quickly from the reservoir to protect not only the reservoir itself but everyone around the reservoir.

- Q: How high are the finished walls and how high will the water level be?
- A: The dams will be about 35 feet above the existing ground surface. The water in the reservoir will appear to be half full even though it is full because there needs to be room in the reservoir for storm events and to contain waves in the event of a high wind event. The height of the water will be about 25 feet deep in the northwest corner and about 15–20 feet deep in the southeast corner due to elevation differences.

- Q: Are the reservoir walls just earthen dam or is there steel inside?
- A: They are earthen walls with a cutoff wall that reaches a clay layer, which makes the reservoir like a big bathtub. The clay layer is why the reservoir was sited here because it helps to reduce water loss.

- Q: Are there are going to be any criteria set before the reservoir is built for incoming water quality and for water quality in the releases into the river? If so, will these criteria be set in conjunction with the construction?
- A: This is the purpose of the Study. The authorized CERP project did not include any additional water quality requirements. The Study will identify options to improve water quality coming into the reservoir, within the reservoir, and leaving the reservoir.

- Q: Are there any federal water quality standards that would apply for the reservoir operation?
- A: There are no standards that are part of the authorized project.

Treatment Technologies: Physical, Chemical, and Biological

Jim Bays, J-Tech, stated that while the treatment focus is on nitrogen, they are also evaluating phosphorus and suspended solids (algae or suspended particles) removal. The different parameters for each nutrient require different types of treatment. Nitrogen exists in multiple forms which vary in their availability to algae, including organic Nitrogen, inorganic nitrogen including ammonia, and

nitrate. Phosphorus occurs in dissolved and particulate forms which have different mechanisms of treatment.

For this project, because we face area and operational constraints, we are considering the spectrum of natural and conventional treatment systems. Natural systems utilize the same chemical and biological processes for treatment as conventional systems. Where conventional systems build tank-based treatment reactors of concrete, steel and move water and add compounds using electricity and chemicals: natural treatment systems are typically land-based systems that rely upon gravity flow and natural plant, soil and microbes to provide the media and biological habitat that sustains these processes at natural rates. As a result, fewer staff are required to operate and time in the field, maintenance and monitoring processes are reduced significantly, and fewer residuals are produced. This often means lower long-term unit operational costs per pound removed.

In the Information Collection Summary Report for this project, which will be available on April 3, 2020, we summarized the attributes of 33 technologies listed in the DEP's Library of 33 accepted water treatment technologies, which includes chemical, biological and physical methods of treatment. We also received suggestions from our Working Group members drawing from their knowledge and experience, other treatment professionals, submittals from vendors and suggestions from the public.

As we reviewed the different technologies, we described them by key attributes. These included:

- Whether Florida case studies were available, and whether the data was suitable for analysis
- Nutrient removal data and to what extent it could be used to scale up to treat large flows
- The general land area requirements and whether its features were compatible with the reservoir system and location
- If treatment residuals are produced and how they'd be managed
- What amount of energy is required?
- A schedule for implementation
- O&M requirements
- General costs for construction, O&M and cost benefit
- Regulatory constraints with the provision that the technology can't harm the environment.

Treatment Technology Highlights

Chris Keller, Wetlands Solutions, reviewed the constructed treatment wetlands technology.

Constructed Treatment Wetlands are large created marshes that are designed to naturally improve water quality. They are commonly used in South Florida and you may have heard them referred to as Stormwater Treatment Areas or Filter Marshes. They reduce nutrient concentrations by consuming nitrogen and phosphorus for growth of wetland plants and as an energy source for microbial processes.

There are many successful applications of this technology in Florida and around the world. We are fortunate to have very robust operational data sets from large-scale systems in this region. General

removal efficiencies range from 20-40% for total nitrogen, 75-90% for total phosphorus, and over 90% for suspended algal solids.

Treatment wetlands generally require large land areas and therefore have correspondingly large capital costs for land acquisition and construction. However, they typically have lower O&M costs than the conventional technologies that Jim will discuss. Most of the annual costs are associated with supplying electricity to operate the pump stations needed to route water to and from the wetlands.

Treatment wetlands accrete residuals in the form of new sediments which are made up of decomposing vegetative matter. The accretion rate is low and treatment wetlands typically have design lives of 30-50 years. Treatment wetlands can be used to treat water either before or after storage in the reservoir.

Sand Filtration involves the gravity separation of particles (such as algae and suspended solids) from the water by forcing water to drain through a bed of sand or similarly sized media. Sand Filtration is considered a passive or natural technology because, other than pumping, it does not require energy or chemical inputs. There are several applications of this technology in Florida with the largest currently under construction for a phosphate mining facility. General removal efficiencies range from 20-40% for total nitrogen, 25-50% for total phosphorus, and over 90% for suspended algal solids.

Like treatment wetlands, Sand Filtration generally requires a large land area and therefore is likely to have a correspondingly large capital cost for land acquisition and construction. Again, they typically have lower O&M costs than most conventional technologies. O&M costs for Sand Filtration include pumping and periodic replacement of the upper sand layer every 3-5 years. Sand Filtration can be used to treat water either before or after storage in the reservoir.

Aeration can be used to reduce algal populations through physical mixing and supplying dissolved oxygen to reduce stratification and minimize the release of nutrients from anaerobic sediments. There are several applications of aeration in lakes and reservoirs in Florida. Removal efficiencies range from 50-75% for total nitrogen and total phosphorus.

Because aeration is employed within the water storage reservoir, little additional land is needed for the blowers and controls. Aeration does not create any residuals that will require removal and disposal. Aeration has moderate capital and O&M costs with most of the O&M cost associated with electricity to run the blowers. O&M includes annual compressor and diffuser maintenance. This technology is applicable within the storage reservoir.

Hybrid Wetland Treatment Technology combines physical-chemical processes of coagulation with the natural settling and uptake processes that occur in treatment wetlands. A coagulant, such as alum, is dosed to bond with nutrient ions and form particles that can settle out in the wetland basins. There are several successful applications of this technology in Florida, mostly within the Northern Lake Okeechobee watershed. These are well-studied systems with robust operational data. Removal efficiencies range from 50-60% for total nitrogen, 80-90% for total phosphorus, and over 90% for suspended algal solids.

Because they are enhanced or intensified by adding chemicals, they require a reduced land area and reduced capital costs in comparison to constructed treatment wetlands. The requirement for chemical addition, however, increases their O&M costs in comparison to treatment wetlands. They do generate solids that require periodic removal and disposal. Hybrid wetlands can be used to treat water either before or after storage in the reservoir.

Coagulation treatments would require a more dedicated system to pull water offline for treatment. There are multiple applications in Florida that are well studied and built for fairly large flows. The removal efficiencies range from 50%–70% for TN, 50%–90% for TP, and greater than 90% for algae. These chemical processes react quickly so there is not much land needed for treatment, but land is needed for settling out solids and storing solids before disposal. There are O&M costs for power for the pumps and dosing mechanisms and to remove the residuals. This technology can be used for pre- or post-reservoir treatment, as well as in-reservoir to settle out nutrients.

MPC Buoys are an innovative approach to treating water during storage by the use of ultrasound emitted at wavelengths in the water that will disrupt the natural buoyancy of algal cells and prevent them from staying in the well-lit upper surface layers. This affects their growth and keeps algae from growing to bloom levels. For this product, the vendor has invented a floating buoy which supports the ultrasonic emitter that is solar powered. There are a limited number of case studies from the US, and much more from Europe. Case studies are just beginning in Florida.

Available data do indicate that a significant reduction of algae may be expected. Some data also indicate that other aquatic organisms may be affected by the ultrasound. A beneficial attribute of this technology is there is not additional area needed, since it is on the reservoir surface, there are no residual produced and capital costs limited to the buoy system, anchoring and supporting electronics. Operations are moderate, focusing on annual maintenance of the transducer and buoy. This approach treats the water during storage.

Electro-coagulation is another form of coagulant addition for nutrient control. The working principle is basically the same, where the charge of a particle is modified by addition of a metal ion to the solution, which allows particles to grow and settle. In this case, instead of a metal salt like alum, an electrical charge is added to the water through a metal electrode and the metal ions are released from metal plates. The system typically includes a sedimentation tank for collecting the coagulated solids.

There are few Florida case studies mostly consisting of pilot and bench scale tests, and there are limited performance data, but the technology has been in wide use across the world for decades for treatment of industrial wastewater. Available pertinent data indicate removals of 60-90% nitrogen, more than 90% phosphorus and 90% algae can be expected. Of all the offline treatment technologies we're discussing, this system will likely require the least land area, given the rapid treatment time (on the order of a few minutes) and the relatively smaller amount of solids produced.

Capital cost is relatively high, given the highly engineered flow, treatment, and solids handling facilities needed. O&M costs will be relatively high, given the higher electricity requirement, electrode replacement, pumps, chemical dosing, and air injection. The amount of residuals produced is less than what can be expected from the use of chemical coagulants, given

that the only solid added is just the metal ion from the electrodes. This technology would be considered for pre- and post-storage .

A more passive treatment technology is the use of a phosphorus sorption media, where nutrients are bound chemically to surfaces of substrates such as sand, clay, or organic materials selected for their property. In Florida, an increasingly common application is the use of **Bold & Gold**, an engineered sorption media developed at UCF for stormwater and surface water applications. This material comes in a range of formulations, which can include sand, clays, iron and tire crumbs, all of which exhibit phosphorus sorption potential. There are a number of applications in Florida, and a number of publications and performance studies have been completed.

Nitrogen removal is typically high (on the order of 75-95%) and phosphorus is too (50-90%). Because of the high flow rates that the media can take, land area requirements are moderate and capital costs are too. Typically, these systems are built in vaults or shallow detention basins, but they may also be built into the berm of a basin and provide final polishing to water infiltrating from the basin. O&M costs are relatively high, given the cost of replacing and disposing of spent media, although on a relatively long interval. This technology could be applicable to pre and a post storage application

Nutrigone Biologically Activated Media (or BAM) product is a phosphorus sorption media combined with an organic carbon media designed to remove phosphorus and nitrogen when water is passed through it. Typically, it is designed as a flow-through filtration vault but can be designed as large basins. There are limited applications in Florida at this time. Available bench-scale studies indicate 90% removal of nitrogen and phosphorus but performance data are limited and varied. Because it is a filtration system with sorption media, this technology would require a moderate land area. The capital cost would be high because of the engineered media and O&M cost would be high because of the need to replace media frequently. The volume of spent media needing to be disposed of would be significant. But power costs would be limited to pumping requirements. This approach would be applicable to pre-storage and post-storage operational phases.

Aqua-Lutions is a combination of chemical addition to coagulate algal solids followed by dissolved air flotation to separate solids. The product is clear water with low nutrients. Several pilot studies have been conducted in Florida, the most notable being a 5-year study treating water from Lake Jesup in north-central Florida. Available data from that project and tests by the District have provided reliable performance data. Nutrient reductions of 65% total nitrogen, 90% phosphorus and 80% algae were achieved in that study. The treatment system operates within a relatively compact footprint. The capital and O&M costs are high, given the chemical and mechanical components.

As with other solid separation techniques, a large volume of solids is produced that must be dried and disposed of. In lieu of landfilling, because the residuals do contain nutrients, the vendor promotes their use for fertilizer pellets but they can be burned too. Another factor to consider is the power cost to operate the mechanical components, including pumps, air compressors, and solids management systems. This technology would be potentially suitable for pre and post-storage.

QUESTIONS

- Q: My question is about disposal of the material.

- A: This is a factor we are considering. Sometimes residuals can be reused as a land amendment or they may need to be disposed of in a landfill or burned. Residual disposal will be assessed further in the next phase of the project.

- Q: How long do you think it will take to get from the qualitative criteria to more detailed costs?
- A: We are going to get to that phase very soon. A preliminary assessment will be ready in June and the final report will be available in October 2020.

- Q: How many acres would be required for an STA?
- A: We will be going into the next phase of the project in the next few weeks where we develop standard inflows and datasets to further develop each alternatives to provide a fair basis of comparison. It will be this next phase where we will determine the size of an STA needed to provide treatment.

- Q: Why are we doing this now instead of before construction began? Some of the options presented would be have been easier to implement before construction like the media that could have been put into the berm.
- A: In the CERP project, this reservoir did not evaluate water quality. It became apparent in recent years that algal blooms are a problem in the river and estuary. At that time, the CERP project was already underway and did not include a water quality component and it just focused on quantity, timing, and distribution of water. Based on recent water quality information, the decision was made to address water quality outside of the federal program.

- Q: I would like to echo the thanks to SFWMD and DEP for moving forward with a water quality project on the reservoir. In evaluating the cost-benefit of these treatment options can you speak to the scalability of a treatment train approach.
- A: Our approach is to look at each technology individually to make comparison. These technologies can be combined and there may be a combination that is selected as a final configuration.

- Q: The three alternatives that you will identify will be three separate technologies and not three options that include a combination?
- A: We will have three technologies or projects that we recommend based on a series of criteria. The SFWMD will then move forward to the design phase to provide the necessary water quality treatment

- Q: Have you determined the fate of alum in the environmental from the HWTT?
- A: We are relying on literature prepared by existing studies of this technology. Floc is created and must be removed periodically. There have not been any findings of toxicity concerns in Florida or nationally. The U.S. Environmental Protection Agency released a new aluminum toxicity standard that we will consider.

Next Steps

Georgia Vince highlighted the upcoming milestones for the project. We look forward to all of you participating again at our July 16th meeting at 2pm.

Georgia Vince reviewed frequently asked questions that were discussed at previous meetings or sent to the project email address.

Georgia Vince directed participants to SFWMD.gov for the working groups webpage and project specific email address where additional comments and questions can be submitted. The email address will be active throughout the study period and it is C43waterquality@sfwmd.gov

Georgia Vince thanked the **Coastal and Heartland National Estuary Partnership** for allowing use of their Menti program. This is a unique interactive tool was used to collect input and feedback from the participants.

Menti Polling and Questions
Participants were asked to provide feedback on the Menti website. The participants can have the results emailed to them and the results will also be posted to the project website.
Please type in any questions you have related to the C-43 Storage Reservoir Project.

- Q: Will the operational plan allow recycling of water within the reservoir?
- A: Right now the reservoir allows flows in from one cell to another. Within the reservoir, the only option is to add aeration to help move water through the system.

- Q: Are there any ways that storage benefits can be increased by multiple fillings?
- A: The operation plan is to fill the reservoir once in the wet season and discharge once in the dry season. Evaluations will be made whether the reservoir is able to take in more water or let more out.

- Q: Now that you are aware of the water quality issue, could a filter marsh be constructed within part of the reservoir footprint?
- A: No. The reservoir must be constructed as authorized by Congress to receive the cost-share funding. Any filter marshes will have to be outside of the reservoir footprint.

- Q: How does the C-43 reservoir volume of water needed to be treated compare to the treatment options presented?
- A: The normal low water discharges will be in 457 cfs range. Any treatment would have to be sized to accommodate that flow to meet the demands of the river and estuary.

- Georgia noted that all questions submitted through Menti will be captured and will be responded to on website.

Please type in any question you have related to the technologies that are being evaluated for the Study.

- Q: Could you list the 10 one more time?
- A: Constructed treatment wetlands, sand filtration, aeration, HWTT, coagulation, ElectroCoagulation, MPC-Buoy, Bold & Gold, Nutrigone BAM, and Aqua-Lutions.

- Q: Is there more detail on the technologies on the website?
- A: Yes. The Information Collection Summary Report includes more details on the technology and information available in the literature and provided by vendors. This report will be available on April 3rd and the literature library is currently on the website.

- Q: What happens if the chosen technology stops doing what it says it will?
- A: We only want to present and select a short list of technologies that are robust and based on sound principles. When we get to final list, it will have a presumption of long-term application for this large-scale project. In the unlikely scenario that the technology does not operate as planned, contingencies will be built into the project.

- Q: Have you considered the use of floating treatment wetlands in the reservoir?
- A: Floating treatment wetlands were on the original list but did not make the shortlist because of the size of the reservoir and wind conditions. This technology would require a robust anchoring under these conditions, which would make it difficult to implement and would have greater uncertainty in the effectiveness. There are opportunities to look at floating wetlands as part of a constructed wetlands system or HWTT to provide polishing.

- Q: As nutrients are removed, will there be a discussion of how the chosen treatment might perform? For example, at 100 parts per billion (ppb) TP, you might remove 70% but will that removal be expected at 20 ppb?
- A: In the next phase of the Study, we will look at flows and nutrient concentrations coming into the reservoir, within the reservoir, and coming out of the reservoir to evaluate how the technologies perform under a range of concentrations. Some of the technologies could drop out because the nutrient concentrations are lower than what was found in previous studies.

Please types in any additional questions you may have about the Study.

- Q: Will the slides from this presentation be available online?
- A: Yes. The slides and the Menti questions and responses will be posted to the website.

- Q: How will this study tie into the CERP Plan?
- A: This is a separate study being pursued by SFWMD and FDEP.

- Q: Is there a possible use of aquifer storage and recovery (ASR) for nutrient reduction?
- A: We drilled some pilot wells for the CERP ASR Program to be co-located with the reservoir. Based on those data, ASR is not a good application in this location

- Q: When will it be published online?
- A: All items related to the Study are posted on the SFWMD Working Group website under priority projects. The Information Collection Summary Report will be posted on April 3rd.

- Q: When is the next public meeting?
- A: The next meeting is July 16th at 2:00 pm.

Meeting Close

Drew Bartlett thanked the team and the participants for a successful meeting. Georgia Vince thanked the attendees for their participation in our virtual public meeting on the C-43 Reservoir Feasibility Study.