

**Bolinas Community Public Utility District**  
**A Meeting Of The Operations Committee of the Board Of Directors**  
**September 10, 2020 270 Elm Road, Bolinas**

**In compliance with local and state shelter-in-place orders, and as allowed by the Brown Act as currently in effect under the State Emergency Services Act, the Governor’s Emergency Declaration related to COVID-19, and the Governor’s Executive Order N-29-20 (March 17, 2020), the BCPUD did not offer an in-person meeting location for the public to attend this meeting. The meeting was limited to essential district business items and was conducted by the BCPUD Board, staff and public via teleconference.**

**1. Call to Order.**

2:04 p.m.

**2. Roll.**

Directors Comstock and Smith (by phone); General Manager Jennifer Blackman, Chief Operator Bill Pierce, and limnology consultant Eli Kersh also present (by phone).

**3. Woodrat Reservoir Rehabilitation Project – *Updated Proposal from Moleaer re Nanobubble Generator Technology.***

Eli Kersh began by stating that the district pilot-tested a nanobubble generator at Woodrat 1, but did not see the results it hoped for, probably due to the regrowth of azolla on top of the reservoir – however, he noted, the district did see some improvements to water quality. The district had expected to see an increase in dissolved oxygen (“DO”) throughout the reservoir, which did occur during the first few weeks the nanobubble unit was in place, but the re-growth of the azolla over the surface of the reservoir has now blocked all sunlight and the photosynthesis process. Algae and other plants produce oxygen as a result of photosynthesis so, by removing the sunlight, these natural oxygen-generating processes cannot occur; moreover, there is no exchange of oxygen at the surface of the reservoir because of the azolla. As a result, the only oxygen in the reservoir is the artificial source via the nanobubble generator, which is not enough to register on any meter – that is not to say no oxygen is being added, Eli said, but not enough oxygen is being added (the oxygen that is there likely is being used up very rapidly by the fish and other organisms in the reservoir).

The district’s original goal in pilot-testing the nanobubble unit at Woodrat 1 was to oxygenate the entire water body to prevent the release of nutrients from the soil (such as phosphorus, iron, manganese and so forth) into the water, rendering the water in the reservoir less susceptible to algae and plant growth and easier to treat. While that has not occurred, the BCPUD has seen water quality benefits such as decreased turbidity, the disappearance of midge fly larvae, and an increase in oxygen reduction potential (“ORP”), so staff does not wish to remove the unit at this time. Eli noted that while oxygenation is important, ORP is the key factor to evaluate for possible reductions in the release of phosphorus, iron and other target indicators. Eli said that he is working on another project in the East Bay, at a larger lake that does not have an azolla problem, and the nanobubble unit piloted there is producing exactly the kind of oxygenation he had hoped to see in Woodrat 1. Director Comstock said this could be a very useful comparative project for the BCPUD to follow insofar as the district needs to make a decision whether to install at unit at Woodrat 2 (which does not currently have the same extensive azolla problem). Eli agreed and said that the technology has shown great promise at reservoirs and lakes and he does not think the district would be “throwing good money after bad” if it were to purchase a new nanobubble generator for Woodrat 1 and then move the current unit over to the Woodrat 2 reservoir – he believes Moleaer would allow the district to keep the current unit for additional testing.

Eli said the Woodrat 2 Reservoir has been mapped and samples have been taken; the samples confirm significant stratification in the lake, with heavy minerals and metals settled on the bottom. Specifically, samples reveal a high level of dissolved iron at the bottom of the reservoir as compared to the top, which is known as a “chemocline,” or chemical stratification. Eli said that if oxygen is added to Woodrat 2, that should increase the ORP; thereafter, the district can monitor iron levels to confirm whether they are reduced. Chief Operator Bill Pierce said this would be a huge benefit as iron and manganese levels currently pose major treatment challenges. Discussion then turned to whether the district should purchase or lease a new nanobubble unit for Woodrat 1, and whether Moleaer would be willing to allow the district to move the existing unit to Woodrat 2 in exchange for monitoring data once the new nanobubble unit is installed at Woodrat 1.

Director Comstock inquired whether Woodrat 2 is likely to develop the same sort of azolla problem as Woodrat 1 is experiencing. Eli said that while there is some azolla in the Woodrat 2 reservoir, it is limited to the edges of the lake among the cattails; he would not recommend pilot testing there if that lake had extensive azolla. In contrast, Woodrat 1 had 70+% coverage last Spring which all re-grew after the experimental physical removal project (and before the nanobubble unit was installed) – which did not remove all of the azolla by any means -- due to the increased nutrient levels and other circumstances there conducive to rapid growth. Eli said there is no evidence to suggest that the nanobubble unit *caused* the azolla re-growth problem on Woodrat 1 as

the plant was extensively present there already. Discussion ensued about the differences between the “standard” and “enriched” air nanobubble units produced by Moleaer; Eli explained that the enriched air units are designed to more quickly oxygenate a water body. He noted that Moleaer experienced moisture problems with the enriched air units – the generator membranes were accumulating moisture and failing – so the company has hired a technical expert from Ingersoll Rand to devise a solution/redesign the units. The standard units do the same thing – oxygenate water bodies – but do so less quickly and without the moisture problems on the membranes. Discussion continued about any advantages of leasing vs. purchasing and whether to negotiate possible warranty terms.

In response to questions from Director Comstock, Eli and Bill explained that the operating costs of the Moleaer units are not high – primarily electricity costs – and that it currently is not possible to directly divert “the better” water from Woodrat 2 directly to the treatment plant without an engineering solution. Bill said that if the removal of the azolla and installation of a new nanobubble unit at Woodrat 1 brings the water quality there more in balance with Woodrat 2 (and the iron levels are reduced in Woodrat 2 by putting the existing nanobubble unit there), that would be ideal and far less expensive than replumbing the Woodrat 2 Reservoir. Eli recommended that physical removal of the azolla be conducted prior to a frost that could damage and kill the azolla, causing it to die off and sink to the bottom of the lake. Bill noted that the azolla did not die off last year, likely due to the very mild winter. Staff noted that September and October typically are very warm months in Bolinas, so the azolla removal should occur after October; Eli concurred.

Discussion then turned to the potential costs of physically removing the azolla (at least \$1,000 - \$1,500 per day) and likely schedule (several times a year). Director Smith inquired about possible chemical and biological treatment options. Eli explained that large water districts tend to use flurodone to control azolla but that may not be a solution for the BCPUD as flurodone cannot be applied within ¼ mile of any intake – given the small size of the Woodrat 1 Reservoir, this is likely impossible – and it requires 30-60 days to breakdown. Given the district’s need to use the Woodrat 1 Reservoir for various reasons throughout the year, it is not practical to apply a treatment like this. As for biological treatment options, there are some to be considered but the district would need to obtain guidance and approval from state regulators. Director Comstock said any sort of chemical or biological treatment of one of the district’s water sources would be a major Board decision; he suggested the district request engineering proposals to divert directly from Woodrat 2 to the treatment plant given that Woodrat 1 might have to be taken out of service to fully rehabilitate it in the event any sort of chemical or biological treatment is needed. Bill Pierce said that there could be many benefits realized to the district’s operations if it was possible to divert directly to the treatment plant from Woodrat 2. Eli said he would investigate OMRI-approved non-chemical options for the district to consider.

Following an extended discussion, director Comstock proposed that the Operations Committee recommend to the full Board that the district proceed with the purchase of a new nanobubble unit for Woodrat 1 and the retention of the existing unit to be moved to Woodrat 2 in exchange for providing monitoring data to Moleaer. He further proposed that staff continue to work on short-term (such as physical removal) and longer term (such as possible treatments) plans for dealing with the azolla. Finally, he proposed that the district solicit engineering proposals to enable the district to divert water directly from Woodrat 1 to the water treatment plant. Director Smith concurred.

#### **4. Community Expression**

None.

#### **5. Adjournment**

4:00 p.m.