

Childs Engineering LLC

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July 14, 2020

Project No. 1448

Mr. Alan Huizenga, P.E.
President
Green Mountain Engineering, Inc.
1438 South Brownell Road
P.O. Box 159
Williston, Vermont 05495

Re: **Concrete Water Storage Reservoir**
Jericho Road
Richmond, VT

Dear Alan:

I looked at the efflorescence on Richmond's Jericho Road Water Storage Reservoir on July 13, 2020 and present my findings in this report. Efflorescence is an indication of water seepage and the town was concerned and asked me to look at it.



Reservoir Construction and History

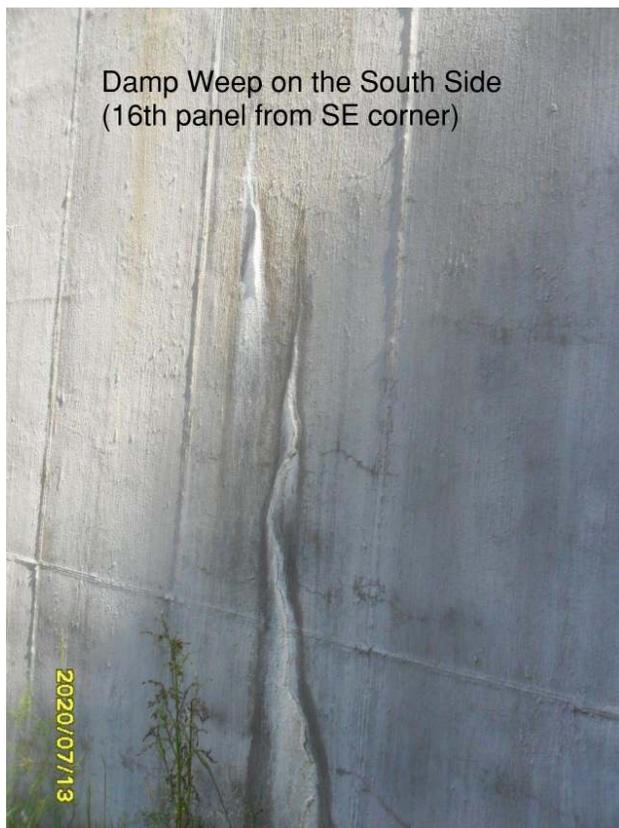
The reservoir is cast-in-place concrete with 18” thick walls and was constructed in 2015. The concrete contains a waterproofing admixture which is suppose to prevent weeps and seeps through the concrete. The original plans called for that admixture to be Xypex C-500 but the contractor substituted Penetron Admix SB which is supposed to do the same thing.

The reservoir was leakage tested and various weeps were noted. It is not uncommon to have some weeps with some sealing themselves and others needing treatment. In the case of this reservoir, the contractor epoxy injected the weeps which did not seal themselves and some stubborn weeps required several injection attempts. Eventually though, I think they were all stopped though Green Mtn. Engineering’s field representative would know the details better.

The reservoir has an exterior cementitious coating. Normally this isn’t necessary but was done on this project to improve the aesthetics.

Current Observations

We noted 4 efflorescence streaks on the south side, 11 on the west side (side most visible from the road), and 7 on the north side. About half of these are minor (only obvious from up close), with the other half being more substantial. We also noted that 2 of the steaks appeared to be damp on the south side, 6 were damp on the west side and 2 on the north side. The dampness probably indicates water seeping through from the inside though, in some cases, it may be moisture trapped behind the coating which is working its way out.



Discussion

Efflorescence is caused as water seeps through tiny masonry cracks, picking up minerals along the way and depositing them on the surface as the water evaporates. For this reservoir, the source of the water, in most cases, is the water inside the reservoir. But, in a few places, the efflorescence is at the very top of the wall indicating that the source of that water is probably rain.

The efflorescence is unsightly though structurally, it is not a problem. However, freeze-thaw at the most active weeps has caused the exterior coating to pop in a few places and this may be an ongoing issue. The coating itself is not structurally necessary and was put on for aesthetic reasons.

Going Forward

Stopping the efflorescence requires stopping the water source and this means sealing all the active weeps. Unfortunately, this is a lot easier said than done. You could try epoxy injection though it may take several attempts (or more), to finally seal the weep. The issue is, as the weep is sealed, the water finds another path and reappears, usually higher up along the same hairline crack. And with the coating, it is not readily apparent where the hairline cracks are.

Where rain is the water source, cracks and spalls in the roof slab coating will need to be patched to keep that water from getting under the coating.

Making Repairs

I expect the project is beyond the warranty period so any repairs at this point will probably be at the Town's expense though this should be verified. In any case, stopping the weeps and efflorescence is not structurally critical so and the Town will need to decide if the better appearance is worth the extra cost associated with stopping the weeps and subsequent efflorescence.

Summary

Efflorescence appears on the south, west and north walls of the reservoir. The efflorescence is caused by water laden with minerals evaporating and depositing the minerals on the surface. Where the efflorescence is damp (about half), there is an active weep and the source of the water is most likely the water from inside the reservoir. Where the efflorescence is dry, the weep may be seasonal or may have sealed itself or, may be related to rain water.

The weeping water will need to be stopped in order to stop future efflorescence. Usually, epoxy injection is used to seal cracks that are weeping water but this can be a multi-step process as the water sometimes finds a new path as weeps are sealed. Eventually though, the weep can usually be stopped.

Stopping the weeps and efflorescence is not imperative. They are unsightly but have minimal structural affect except for the coating which, again, is for aesthetics.

Thank-you for this opportunity to provide Structural Engineering services. Please call if you have questions or comments.

Sincerely yours,
Childs Engineering LLC



Carl A. Childs, PE
President

