



North Sagamore Water District Policy for Available Capacity for Future Development

November 18, 2019

The North Sagamore Water District Board of Water Commissioners has elected to put in place a policy with regards to the capacity of the current infrastructure to supply water to the future growth and development demands of the Water District. Adequacy of the District's water supply is based upon the following factors:

1. The current firm capacity of the Water District's pumps and gravel packed wells relative to the ability of the water supply to meet its maximum day demands with the largest water source offline per MA DEP Guidelines Chapter 7.

Source	Normal Flow (Gallons per minute)	Flow (Largest Source Offline)
Beach Well	470 gpm	470 gpm
Church Lane Well	375 gpm	500 gpm
Black Pond Well	800 gpm	0 gpm
Total Flows (GPM)	1645 gpm	970 gpm
Available Water in a 24 Hour Period	2,368,800 gallons	1,396,800 gallons

2. The maximum authorized withdrawal limits set forth in the District's Water Management Act (WMA) Permit (July 22, 2016). **The District WMA permit allows for a maximum annual average daily withdrawal of from our sources of 530,000 gallons per day (gpd).**
3. The capacity of the District storage tanks relative to peak hour demand and fire protection. Please see the attached report prepared by Kristen Berger, PE of ResilientCE in regards to the District storage tanks and future growth.
4. Potential water usage from unfinished developments with previously approved water availability based on Title 5 flows. The District estimates an average of 39,000 gallons per day for this calculation. **For projected maximum day demand calculations, the District's average ratio of maximum day to average day will be utilized.** Based on the demands from 2016-2018, this ratio is 2.7.

Location	Remaining Approved Buildout	Projected Gallons per Day
Wildwood Lane	50 Bedrooms	5,500
Ridgehill Lane	12 Lots	5,280
Shells Way / Lisa Lane	9 Lots	3,960
Canal Road Crossing	SCOD	24,000
Total Flows		38,740

5. The average well withdrawals and maximum day demands of the years 2016-2018. These average pumping figures of these most recent years accurately reflect the District’s water demands and capacity limitations.

	Maximum Day Demand	Average Day Demand
2016 – 2018 Average	1,172,000 gpd	434,000 gpd
2016 -2018 Average Plus Projected Growth	1,277,000 gpd	473,000 gpd

6. Safety Factors –

- **Maximum Day Demand** – The District cannot allow growth beyond the ability of our wells production in a 24 hour period with Black Pond Well offline. With the current projected growth, our maximum day demand would be 1,277,000 gallons. The Beach Well and Church Lane Well would need to pump 21.9 hours to meet the demands of this maximum day. The District maintains that the wells must have the ability to rest for a period of time each day.
- **Water Management Act Permit** – The District will not allow growth to exceed an average day demand of 500,000 gallons per day for existing customer and future growth. This allows operations a safety factor of 30,000 gallons per day for unforeseen needs such as dry years during which demands increase. The projected Average day demand for existing customers and approved projected future growth is 473,000 gallons per day.
- **Emergency and Equalization Storage** – Based on the current system needs and prospective growth, there is no need to impose safety factors relative to our emergency storage capabilities.

Available Capacity for Future Development

Pumps and Wells	Maximum System Capabilities	Maximum System Capabilities Accounting for Safety Factors	Projected Demand with Approved Buildout	Available Gallons per Day for Future Development
Maximum Day Demand	1,396,000 gpd 24 hours pump runtime	1,338,000 gpd 23 hours pump runtime	1,277,000 gpd	61,000/2.7 = 22,600 gpd

WMA Permit	Maximum Permit Allowance	Maximum Permit Allowance Accounting for Safety Factors	Projected Demand with Approved Buildout	Available Gallons per Day for Future Development
Average Day Demand	530,000 gpd	500,000 gpd	473,000 gpd	27,000 gpd

Storage Tanks	Maximum System Capabilities	Projected Demand with Approved Buildout	Available Gallons for Future Development
Equalization Storage	331,000 gallons	201,000 gallons	130,000 gallons
Emergency Storage	1,246,000 gallons	754,000 gallons	492,000 gallons

Conclusion

Based on current infrastructure and firm capacity of the North Sagamore Water District’s system, the Board of Water Commissioners will not allow future development, not previously approved, beyond a total of **22,600 gallons per day** based on the projected maximum day demand, the lowest of the above calculations. This allows the District a safety factor of 34,400 gallons per day in regards to our Water

Management Act permit while maxing out our projected maximum day demand at 1,338,000 gallons per day. With Black Pond Well offline, these limits would require our remaining two wells to run 23 hours per day on a projected maximum day.

The analysis of the District's storage capabilities shows there is sufficient storage to meet our current needs and some storage for future development.

The District will keep a running calculation deducting the projected daily flows for each new home and or development beginning on the date of this policy. The District will use Title 5 flows for these calculations.

Water availability will be on a first come first serve basis. Properties will not be approved to connect to the system until the applicant has received approval from the Board of Water Commissioners and all the necessary documentation and fees have been paid per the District's Rates and Regulations for Supplying Water. The District reserves the right to request system upgrades or mitigation if it is deemed they are necessary for the project to be connected to the system. Any new development or extension of the water system being proposed must still follow the District's Subdivision Regulations and perform a capacity analysis and hydraulic study.

This policy does not guarantee the availability of water for any project. The Board of Water Commissioners reserve the right to approve or reject the availability of water on a case by case basis if it deems the project will be detrimental to the sustainability of the North Sagamore Water District's ability to provide adequate potable water to its existing customer base.

This policy shall be periodically reviewed by the Board of Water Commissioners. The amount of available water may be adjusted based on infrastructure improvements or failures, Water Management Act permit requirements or any other action that may affect the District's ability to supply water.

November 11, 2019

Matthew Sawicki, Superintendent
North Sagamore Water District
14 Squanto Road
Sagamore Beach, MA 02562

RE: District Storage Capacity

Dear Mr. Sawicki:

The North Sagamore Water District (District) requested Resilient Civil Engineering, P.C. (ResilientCE) to complete a storage capacity analysis.

The NSWD has three water storage tanks: Norris Road, Clark Road and Bournedale. The following Table 1 provides the diameter, volume and capacity per foot for each tank.

Table 1. Tank Characteristics

	Norris Road Tank	Clark Road Tank	Bournedale Tank
Diameter	42 feet	25 feet	73 feet
Volume	487,000 gallons	367,000 gallons	1,000,000 gallons
Capacity per foot*	10,364 gal/ft	3,672 gal/ft	31,309 gal/ft

*Calculated based on the diameter.

Within the Main Zone, the tanks establish the hydraulic gradeline and allow the supply pumps to rest and wells to recover when the tanks are full. Within the Booster Zone, the booster pumps operate continuously and rely on the Norris Road Tank as a supply source.

The total volume of the storage facilities is not usable, unless booster pumps are provided to withdraw water from the tanks such as at the Norris Road Tank. For tanks using gravity operations, in order for the water in the storage tank to be usable it must be stored above an elevation that corresponds to a minimum pressure requirement at ground elevation at all points in the distribution system. The minimum pressure requirement for water distribution systems has been established in the MassDEP “Guidelines and Policies for Public Water Systems”, as 35 psi (pounds per square inch) for all non-emergency conditions and 20 psi for emergency conditions (ie. fire flows).

Each tank provides storage to meet both domestic demand and emergencies such as fire flow events.

The domestic demand storage is called equalization storage and is provided to meet peak demand of short duration (hourly fluctuations) and minimize pressure fluctuations during periods of demand changes. The emergency demand is provided to meet fire flow events and short term emergencies such as main breaks.

The total provided storage for equalization and fire/emergency uses is a factor of the capacity per foot of the tank and the elevation level of the water in the tanks. Table 2 shows the total provided equalization storage. This storage is the volume of water located between the typical low water level and the overflow level in each tank. Table 3 shows the total provided fire and emergency storage. This storage is the volume of water located between the low water level needed to maintain 20 psi within the Main Zone and the typical low level in each tank. Note that the Bournedale Tank base is located above the minimum needed to maintain 20 psi, so this entire tank provides usable storage.

Table 2. Equalization Storage – Total Provided

	Norris Road Tank	Clark Road Tank	Bournedale Tank
Capacity per foot	10,364 gal/ft	3,672 gal/ft	31,309 gal/ft
Overflow Elevation	Elev. 179 ft	Elev. 187 ft	Elev. 187 ft
Typical Low Level	Elev. 174 ft	Elev. 179 ft	Elev. 179 ft
Equalization Storage Height	5 feet	8 feet	8 feet
Equalization Storage Volume	51,819 gallons	29,376 gallons	250,471 gallons
Total Equalization Storage Volume - Total Provided	331,666 gallons		

Table 3. Fire and Emergency Storage - Total Provided

	Norris Road Tank	Clark Road Tank	Bournedale Tank
Capacity per foot	10,364 gal/ft	3,672 gal/ft	31,309 gal/ft
Typical Low Level	Elev. 174 ft	Elev. 179 ft	Elev. 179 ft
Low Level to provide 20 psi within Main Zone	Elev. 140 ft	Elev. 140 ft	Elev. 155 ft (tank base)
Fire & Emergency Storage Height	34 feet	39 feet	24 feet
Fire & Emergency Storage Volume	352,370 gallons	143,208 gallons	751,413 gallons
Total Fire & Emergency Storage Volume - Total Provided	1,246,991 gallons		

The existing customer base puts demands on the total provided storage. The current needed equalization storage (peak hour) may be calculated using pump meter rates and estimated tank flows (calculated using tank level data). However, for the purposes of this analysis, a rule-of-thumb estimate was used which is 15 percent of the maximum day.

The greatest maximum day for the 2016 to 2018 period occurred in 2016 during which 1.236 million gallons (MG) was used. The estimated peak hour is 15 percent of this or 185,400 gallons, which is the current needed equalization storage.

The current needed fire and emergency storage is based on the maximum fire flow requirement that a public water system is typically responsible for providing, which for the District is 3,500 gallons per minute (gpm) for a duration of 3 hours or 630,000 gallons. The emergency storage requirement rule of thumb is 15 percent of the sum of equalization storage and fire flow storage or 122,310 gallons (0.15 times (185,400 gal + 630,000 gal)). Therefore, the current fire and emergency storage needed is 752,310 gallons.

Table 4 provides a comparison of the total provided storage, current needed storage and remaining available for future needs.

Table 4. Comparison of Storage

Storage Type	Volume
Equalization Storage – Total Provided	331,666 gallons
Equalization Storage – Current Needed	185,400 gallons
Equalization Storage – Available for Future Needs	146,266 gallons
Fire and Emergency Storage – Total Provided	1,246,991 gallons
Fire and Emergency Storage – Current Needed	752,310 gallons
Fire and Emergency Storage – Available for Future Needs*	494,681 gallons

*Note that the total provided fire and emergency storage already includes the maximum fire flow requirement that a public water system is typically responsible for providing, which for the District is 3,500 gallons per minute (gpm) for a duration of 3 hours or 630,000 gallons. This volume is considered available for the entire system, current and future use. However, should future development require greater fire flow, then the delta would be subtracted from the fire and emergency storage available for future needs.

This analysis shows that the District has sufficient storage to meet its current needs and some storage that would compensate for additional needs imposed by future development.

Please contact me with any questions at 508-726-2458 or kberger@resilientce.com.

Sincerely,
Resilient Civil Engineering, P.C.



Kristen M. Berger, P.E.
President