ENVIRONMENTAL PARTNERS
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October 24, 2022

Ms. Sheila Sgarzi, P.E.
Town Engineer
Engineering Division, Town Hall
26 Court Street
Plymouth, MA 02360

RE: Lot 5A at Colony Place Development, Plymouth, Massachusetts
Water & Wastewater System Impact Analysis

Dear Ms. Sgarzi:

In response to your request, we have completed a review of the proposed development, Lot 5A at Colony Place in regards to its proposed water use and sewer capacity study and potential impact on the Town's water and wastewater systems. In December 2020, EP completed a peer review of The Walk at Colony Place development in regards to its proposed water use and potential impact to the Town's water system and sewer system. The proposed Lot 5A at Colony Place would add an additional 116 one-bedroom units, 77 two-bedroom units, 1,500 square feet of office space, and 10 two-bedroom cottage townhomes. A summary of our impact findings is outlined below.

Executive Summary

Water Impact Analysis

EP updated the supply capacity of Plymouth's water sources per input from the Water Division and estimated a supply surplus in the Northern Pressure Zones of approximately 0.503 million gallons per day (MGD) when the largest water source (South Pond Well No. 2) is offline. However, the proposed development is located in the West Plymouth Pressure Zone, where access to water from the other pressure zones is limited to what can be pumped via the Deep Water Booster Pumping Station (BPS). Per discussions with the Town and a review of surrounding service pressures during Deep Water BPS operations, the capacity of the Deep Water BPS is currently limited to well below its full pumping capacity.

This results in a firm capacity deficit of approximately 0.932 MGD in the West Plymouth Pressure Zone, triggered by the loss of the North Plymouth Well. Further, the magnitude of the deficit is large such that the loss of any West Plymouth source would trigger a water shortage in the West Plymouth Pressure Zone during high demand periods. As such, EP recommends the Town restrict development in the West Plymouth Pressure Zone until supply capacity can be improved.

EP is working with the Town to develop an appropriate mitigation strategy, which may include water main improvements near the Deep Water BPS, a pressure zone reconfiguration to safely allow increased pumping rates at Deep Water, a new West Plymouth Source, and/or a new BPS into West Plymouth. Further, EP recommends the Town continue to emphasize low-flow fixtures and water conservation measures for new developments.

Wastewater Impact Analysis

EP reviewed the sewer information provided by the Town for the proposed Claremont age restricted community at Colony Place. EP recommends that Onsite Engineering confirm the projected average daily flows and peak hourly flows referenced in Table 2 of Onsite's letter to ensure all flows entering the PWPS are accounted for, as this significantly impacts the carrying capacity of the 8-inch PVC gravity sewer main along Plaza Way. Further, EP recommends that Onsite Engineering consider applying a peaking factor 5.6 per TR-16 standards for all developments contributing flow to the PWPS. This would eliminate any confusion in terms of applying different peaking factors for the multiple developments along Plaza Way

EP agrees with Onsite's analysis that the privately-operated PWPS on Plaza Way appears to be properly sized to accommodate the addition of the proposed post-development flows. EP has assumed that the developer will extend the existing sewer force main on Plaza Way from the PWPS to connect into SMH-1439. EP recommends that the proposed sewer force main extension be completed prior to bringing the proposed Claremont age restricted community at Colony Place online.

The existing gravity sewer main along Plaza Way and Industrial Park Road and the Industrial Park Pump Station are both appropriately sized to accommodate the projected average daily and peak hourly build-out flows. No anticipated changes are anticipated as part of incorporating these additional build-out flows

Data Update

To perform the Water Impact Analysis, EP reviewed customer billing data from 2021, which was spatially allocated using ArcGIS software. The 2021 demands were then scaled evenly such that the total demand equals the average finished water consumption for the years 2017-2021 based on a review of recent ASR data provided by the Town. EP updated the Town's calibrated finished water distribution system hydraulic model with this information to perform this assessment.

This Water Impact Analysis builds on the draft Water System Master Plan (WSMP) submitted to the Division in November 2019, and includes the effects of previously proposed developments. Upon discussions with the Town, EP learned that several previously proposed developments are reportedly completed and occupied. As such, their demands were removed from the projected total for proposed developments. For developments currently under construction or only partially occupied, EP carried the original proposed demand for that development, minus the amount already present in the customer billing data.

The resultant demands are outlined further in the System Capacity section below. All results included in this analysis are anticipated effects in addition to those referenced above.

Water Impact Analysis

The Town of Plymouth provided estimated demands for the proposed Lot 5A development as calculated by Onsite Engineering Inc. in a memo dated April 19, 2022. The estimated average demands are 21,244 gallons per day, based on an average of 1.61 occupants per unit and 65 gallons per occupant per day. EP assumed a maximum-to-average-demand ratio of 1.828 based on a review of 2017-2021 ASR data, which results in a maximum day demand of 38,834 gallons per day for this proposed development.

The capacities of the Darby Pond Well and the Federal Furnace Well have been amended per Plymouth's MassDEP WMA Permit Amendment dated August 5, 2021. Per this amendment, the maximum daily rate for the Federal Furnace Well is 0.792 million gallons per day (MGD), and the maximum daily rate for the Darby Pond Well is 0.800 MGD. Further, the Conservation Water Level special condition for the Darby Pond Well has been revised following the Town's acquisition of previously protected lands. The 4-hour pumping restriction on the Darby Pond Well now only applies between November 15th and March 31st. As maximum-day demands are likely to occur outside of that date range, EP has increased the firm capacity of the Darby Pond Well to 0.800 MGD for use in surplus/deficit calculations.

Using the above information, EP conducted an extended period simulation utilizing the calibrated hydraulic model to review any effects on tank levels and pump run times. The hydraulic computer model demand assumptions included average-day demands from 2018 and a maximum-day demand multiplier based on the ratio of maximum-day withdrawals to average-day withdrawals averaged across 2017 to 2021.

The follow section compares available supply with anticipated demands based on available data between 2017 and 2021.

System Capacity

The Town of Plymouth water system consists of six pressure zones in total, divided into two regions: the Northern Pressure Zones and the Southern Pressure Zones. Water is currently unable to flow between these regions, so each must be analyzed independently. The proposed project is in the West Plymouth Pressure Zone, which is part of the Northern Pressure Zones, along with the Plymouth Center, Bradford, and Pine Hills Pressure Zones.

Including all known developments planned in the Northern Pressure Zones, water system demands in the Northern Pressure Zones are projected to be as follows:

Table 1 - Northern Pressure Zone Demands *before* Proposed Lot 5A at Colony Place Development

Average Day Demand (MGD)	Maximum Day Demand (MGD)
3.143	5.747

The Lot 5A at Colony Place Development is projected to add 21,244 gallons per day to average-day demands. The projected system demands in the North Plymouth pressure zones are therefore as follows:

Table 2 - Northern Pressure Zone Demands *after* Proposed Lot 5A at Colony Place Development

Average Day Demand (MGD)	Maximum Day Demand (MGD)
3.164	5.786

As outlined in the latest Water Management Act Permit, the Plymouth Water Division must adhere to a withdrawal schedule dated through the year 2030. The current withdrawal limit is 4.71 MGD through the year 2025. Below is the remaining ADD capacity throughout both the Northern and Eastern zones when compared against all known current and projected demands, including the Lot 5A at Colony Place Development:

Table 3 – Plymouth Water Division Water Management Act Remaining Capacity

Total Average Day Demand (MGD)	Permitted Withdrawal, 2021 through 2025 (MGD)	Remaining ADD Capacity (MGD)
4.467	4.710	0.243

Following the amendment to maximum withdrawals from the Darby Pond Well during summer months, the anticipated maximum day yield in the Northern Zones is 7.729 MGD after factoring in updated operational capacities at the Lout Pond and Federal Furnace Wells. This results in the following maximum remaining capacity:

Table 4 – Maximum Supply vs. Demand in the North Plymouth Pressure Zones

Maximum Day Demand (MGD)	Maximum Available Supply (MGD)	Maximum Remaining Capacity (MGD)
5.786	7.729	1.943

However, water systems must provide adequate supply at all times. As such, it is customary to assess supply in the context of "firm capacity", or the total water supply capacity when the largest source is offline. This facilitates continued supply in the event of a mechanical failure. Any maximum demands in excess of firm capacity are considered water deficit. In the case of the Northern Plymouth pressure zones, the largest source is the South Pond Well No. 2. Including all demands stated above, the current water surplus without South Pond Well No. 2 is as follows:

Table 5 - Water Surplus in the North Plymouth Pressure Zones

Maximum Day Demand (MGD)	Firm Capacity (MGD)	Water Surplus (MGD)
5.786	6.289	0.503

While the above data suggests the Town has a slight surplus in the North Plymouth Pressure Zones, it is important to note this proposed development is located in the West Plymouth Pressure Zone, which only has access to water from its three native wells (Darby Pond Well, North Plymouth Well, and Federal Furnace Well), plus water pumped from the Plymouth Center Zone via the Deep Water BPS. EP recently received updated pumping capacity estimates from the Town, which showed an approximate maximum pumping rate of 425 gpm for the Deep Water BPS when both pumps are operating. EP has carried that capacity forward, assuming that appropriate controls adjustments would allow for that rate to be sustained in a maximum demand scenario.

The tables below show the supply and demand analysis for just the West Plymouth Pressure Zone.

Table 6 – Maximum Supply vs. Demand in the West Plymouth Pressure Zone

Maximum Day Demand (MGD)	Maximum Available Supply (MGD)	Maximum Remaining Capacity (MGD)
2.765	3.145	0.380

While the above table shows an available surplus with all sources available, the resulting margin is small enough that the loss of **any** of the West Plymouth sources during high demand periods would results in a water shortage in the West Plymouth Pressure Zone. The table below shows the resulting deficit with the loss of the largest source, the North Plymouth Well.

Table 7 - Water Deficit in the West Plymouth Pressure Zone

Maximum Day Demand (MGD)	Firm Capacity (MGD)	Water Deficit (MGD)
2.765	1.842	**(0.923)**

Pump tests performed on September 21, 2022 by Weston & Sampson suggest the Deep Water BPS is capable of producing higher flow rates if the pumps are run at higher speeds. Flows upwards of 1,000 gpm are theoretically possible, which would result in a firm capacity deficit of 232,000 gpd with the loss of the Deep Water BPS.

However, EP reviewed the adjusted pump curves in the hydraulic model and found that while higher flow rates are possible, it would increase the pressure on the downstream side to over 100 psi, threatening the old cast-iron discharge piping on Westerly Road. Additionally, pressures would drop on the upstream side, where there are already known to be pressures below 20 psi during peak demands on Braley Road, Billington Street, and near the Lout Pond Tank.

Therefore, EP fully supports the Town in their choice to operate the Deep Water pumps at the reported 70% speed until the projects recommended later in this letter are completed, which will address the pressure changes on both sides of the station and allow for more flow to be achieved at Deep Water safely. Should the Town experience the loss of a West Plymouth source before any recommended projects are completed, it is important to know that more flow can be made available through Deep Water on a temporary basis with close monitoring of system performance.

Considering this result, EP would not recommend the Town pursue further development in the West Plymouth Pressure Zone without first increasing the available water supply to the zone. Recommendations for improving supply capacity are presented in the Findings and Recommendations section later in this memo.

Impacts on Hydraulic Performance

EP conducted a hydraulic performance evaluation utilizing the hydraulic model and assuming that all sources are available to assess the development's anticipated impact on system operations during typical operating conditions.

Average-Day Demand

According to the model, the anticipated ADD for Lot 5A at Colony Place development will increase current pump run times at the Deep Water BPS by approximately 12 minutes per day. All other sources in the West Plymouth Pressure Zone are minimally affected (less than 6 minutes difference) as are tank levels (less than 2 inches). The additional flows through the West Plymouth BPS will be met by marginal increases in pump run times in Plymouth Center (less than 6 minutes).

Maximum-Day Demand

With the addition of the Lot 5A at Colony Place development, the Deep Water Booster Pump Station and Federal Furnace Well will be running an additional 15-20 minutes per day, and the North Plymouth Well will run an additional 8 minutes per day. To supply that water from the Plymouth Center Zone, the Plymouth Center sources will run between 2-6 additional minutes per day each, as will the Forges Field Well and the two flow control valves (Jordan Road and Nook Road).

The model shows the Samoset and Harrington tanks dropping an additional 4-5 inches at their lowest levels during MDD scenarios. The North Plymouth Tank will drop an additional 3 inches.

Fire Flow Availability

A fire flow test was completed near the proposed development on April 25, 2022. As a map/diagram of the flow test was not included, this test could not be replicated in the hydraulic model. However, a fire flow analysis of the development area utilizing the modeling software shows available fire flows between 2,900 and 3,100 gpm at 20 psi across the three proposed hydrants on site.

These estimates are conservative; they are modeled with all sources offline and with low tank levels. It is recommended the Division and the Developer review these results against fire flow protection requirements based on the construction type, occupancy, and spacing of the proposed facility.

Water Analysis - Findings and Recommendations

Available fire flow at 20 psi in the vicinity of the development is anticipated to be between 2,900 and 3,100 gpm. EP recommends the Town review these projections against fire flow protection requirements as determined by the Fire Chief to determine whether this is adequate for the proposed development.

A review of the hydraulic model results suggests that the addition of the proposed Lot 5A at Colony Place development will have a minor impact on the Division's water system hydraulics, assuming all

sources are available. However, a review of the available water supply and demand in just the West Plymouth Pressure Zone shows an elevated risk of a water shortage during high demand periods; the Town is anticipated to experience a water shortage should the West Plymouth Pressure Zone lose **any** of its water supplies. As such, EP recommends against further development in the West Plymouth Pressure Zone until supply redundancy and/or capacity can be increased.

To address capacity in the region, EP recommends the following actions, discussed further below:

- Replace or structurally line the discharge pipeline from Deep Water Booster Pumping Station to protect against the risk of pipe failure
- Increase capacity at the Deep Water Booster Pumping Station via the Northern Zones Reconfiguration Project
- Pursue an additional water source in the West Plymouth Pressure Zone
- Require the use of low-flow fixtures and drought tolerant landscaping for all proposed developments to reduce water consumption.

1. Deep Water Discharge Pipeline Replacement/Rehabilitation

The Deep Water Booster Pumping Station produces elevated pressures on the downstream side. A recommendation to line 2,150 feet of 12-inch cast-iron pipe in Westerly Road between the Deep Water station and Summer Street was included in the 2019 WSMP to mitigate the risk of a potential pipe failure. A failure in this pipeline would result in the loss of the Deep Water station and thus a firm capacity shortage in the West Plymouth Pressure Zone. A structural cast-in-place liner or replacement with 12-inch ductile-iron pipe would improve the pipeline's ability to withstand the elevated service pressures.

2. Northern Pressure Zones Reconfiguration Project

The pump curves for the two Deep Water booster pumps indicate they are capable of producing flows upwards of 800 gpm each in low-head environments. However, current operations result in a combined flow rate of approximately 425 gpm on average. The Town indicated their intent to investigate the pump conditions and potential for increasing the pump run speed to achieve higher flow rates. While this may yield some immediate improvements, the increased flow rate is likely to be marginal due to the large pumping head requirements.

EP recommended a reconfiguration of the Northern Pressure Zones in the 2019 WSMP. While this project was intended to address limited fire flow availability in high-elevation areas of Plymouth Center, it would also result in the Deep Water Booster Pumping Station drawing water from the Bradford Pressure Zone rather than Plymouth Center. This would significantly reduce the required pumping head and should allow for greatly increased flow rates through the Deep Water Booster Pumping Station without needing to upgrade the pumps. Conversely, upgrading the pumps for the current head environment would likely result in inefficient pump operations in the future, following the zone reconfiguration.

EP recommends the Town consider accelerating the Northern Pressure Zones Reconfiguration project, given the additional return on the investment and the urgent need to increase the resilience of the West Plymouth Pressure Zone. The pumping requirements at Deep Water can be more

accurately determined based on the yield of the Parting Ways Well. It is possible that Deep Water pump upgrades would be required as part of this reconfiguration project.

In conjunction with the anticipated yield of the Parting Ways Well, the target flow rate for Deep Water is a minimum of 875 gpm. The actual design flow rate may be larger depending on the yield of the Parting Ways site and the desire to offset the risks associated with the loss of other sources in the zone given their history or water quality challenges.

It is possible that the new tanks can be delayed until a later phase, and that only the pipeline, control valve, and pumping work be conducted in the initial phase. Further analysis would need to be performed as part of the design of this project.

3. Additional Source at Parting Ways

The 2019 WSMP identified the potential for a new well in the West Plymouth Pressure Zone, known as the Parting Ways Well. The site is located south of Plympton Road at Bishops Hwy. Preliminary analysis suggested a potential yield of 285,000 gallons per day. While this yield is relatively small and would not mitigate the projected firm capacity deficit of 0.923 MGD itself, a new source is required as part of the mitigation strategy. Should the Deep Water station capacity surpass the North Plymouth Well through upgrades, the resultant firm capacity in the zone would be the addition of the capacities of North Plymouth, Federal Furnace, and Darby Pond Wells, which is 2.533 MGD. This would result in a firm capacity deficit of 0.232 MGD. Therefore, even if Deep Water capacity can be increased considerably, a new source capable of producing at least 232,000 gallons per day would still be required.

EP recommends the Town proceed with this effort as soon as possible, as new source permitting and implementation is a time-consuming and lengthy process, and a better understanding of the anticipated yield of this well will inform the scope of the Deep Water improvements.

4. Conservation Measures

EP recommends the Town emphasize the use of low-flow fixtures and drought-tolerant landscaping for all future developments across the system, but especially in West Plymouth. This will help reduce the impact of new developments, particularly during hot or dry periods. Approximations using a town-wide, five-year average of 3.16 persons per residential connection appear to show elevated RGPDC in the West Plymouth Pressure Zone, near 80 gallons per day.

Wastewater Impact Analysis

EP's sewer analysis was based on project information provided by the Town of Plymouth and the sewer generation evaluation completed by Onsite Engineering in the technical memorandum dated April 19, 2022. This peer review focuses on sewer impacts to the Town's sewer system because of the development project located at Lot 5A Colony Place.

This development project is an age restricted residential community located in the Mixed Commerce Zone under the Town of Plymouth's zoning map. EP used the following documents as a basis for our analysis:

1) Report titled *Proposed Age Restricted Residential Community; Lot 5A – Colony Place, Plymouth, Massachusetts – Sewage Generation and Water Demand Evaluation* prepared by Onsite Engineering, Inc., April 19, 2022
2) Utility Plan titled *Proposed Independent Living Facility* prepared by Highpoint Engineering, Inc., May 13, 2022.
3) Peer Review Letter titled *The Walk at Colony Place Development, Plymouth, Massachusetts, Review of Supplemental Sewer Information Associated with Wastewater Analysis* prepared by Environmental Partners Group, LLC, December 2, 2020.
4) Drawing titled *Sewer Force Main Extension* for Plaza Way Sewer Extension, Plaza Way, Plymouth, MA 02360 prepared by Highpoint Engineering, Inc., October 27, 2020.
5) Report titled *The Walk at Colony Place Development, Plymouth, Massachusetts, Peak Hour Flow and Sewage Collection System Capacity Evaluation* prepared by Onsite Engineering, Inc., October 5, 2020.
6) Peer Review Letter titled *The Walk at Colony Place Development, Plymouth, Massachusetts, Water & Wastewater System Impact Analyses* prepared by Environmental Partners Group, LLC, July 28, 2020 (later revised on November 20, 2020).
7) Technical Memorandum titled *Industrial Park Pump Station Generator Evaluation* prepared by Environmental Partners Group, August 2, 2018
8) Technical Memorandum titled *The Walk at Colony Place, Sewer Capacity Study Memo* prepared by Highpoint Engineering Inc., March 10, 2020
9) Sewer Collection System Information from Plymouth CMOM Database

As part of this analysis, EP reviewed these project documents provided by the Town in accordance with 310 CMR 15.000 Title 5 requirements and TR-16 standards. Based on the submitted information, the proposed development is proposing to connect into the privately operated Plaza Way Pump Station (PWPS), which pumps wastewater into the Town's sewer collection system on Plaza Way. Collected wastewater would flow by gravity via an existing 8-inch PVC gravity sewer main easterly into the Industrial Park Pump Station operated and maintained by the Town's sewer

collection system operator, Woodard & Curran. Additional record information on the existing sewer collection system was collected from previous peer review studies, as-built sewer plans and available CMOM database information.

EP utilized the estimated flow information provided in the October 5, 2020, technical memorandum by Onsite Engineering titled *The Walk at Colony Place Development, Plymouth, Massachusetts, Peak Hour Flow and Sewage Collection System Capacity Evaluation* to determine impacts to the PWPS. EP also completed an assessment of the sewer system hydraulics associated with the proposed development projects on Plaza Way to advise the Town on a recommended plan to maintain and preserve the Town's sewer infrastructure affected by the post-development flows.

Peer Review Comments on Evaluation Memo

As previously discussed, Onsite Engineering completed a sewage generation and water demand evaluation memo for the proposed residential development project located at Lot 5A Colony Place. This memo calculated the Title V design flow for the new development, estimated the average daily flow and peak hourly flow for each new development connected to the privately operated PWPS, and estimated the water demand for the proposed development. EP reviewed this memo in conjunction with EP's findings from previous peer reviews in this focus area. EP's peer review comments are presented below for the Town's consideration:

1. The memorandum references that the sewage generation flow calculation is based on using a combination of agreed upon average daily sewage flows from the Sawyers Reach development and Home2 Suites Hotel, and sewage flow estimates for the Saxon Developments, as outlined in the October 5, 2020. technical memorandum prepared by Onsite Engineering. It should be noted that the estimated flows presented in the April 19, 2022, technical memorandum do not include the future Saxon Development project, which was projected to contribute an ADF of 14,388 gpd as listed in the October 5, 2020 technical memorandum. EP recommends that the Town confirm with the developer that this ADF is no longer anticipated as part of the post-development flows on Plaza Way.

2. The memorandum indicates that the estimated Title V flow from the Hanover Colony Place (i.e., The Walk) development is estimated to be 30,613 gpd based on Title V flows. This differs from EP's review of The Walk development on July 28, 2020, which indicated that the development has an estimated flow rate of 32,890 gpd based on Title V flows. EP recommends that the Town confirm with the developer the actual ADF proposed for The Walk development to be included as part of the post-development flows on Plaza Way.

3. The memorandum indicates that the estimated Title V flows from the proposed Claremont age restricted community at Colony Place are considered to be maximum day flows (rather than average day flows) for sewage generation in accordance with 310 CMR 15.203. This is consistent with the same methodology used in determining the estimated sewage flow rate for the Hanover Colony Place (i.e., The Walk) development, as reviewed under our December 2, 2020, peer review letter. EP takes no exception to this calculation for estimating the ADF

entering the PWPS (73,120 gpd or 50.8 gpm). However, EP recommends that the developer consider applying a single peaking factor of 5.6 per TR-16 standards for all developments contributing flow to the PWPS. This would eliminate any confusion in terms of applying different peaking factors for the multiple developments along Plaza Way. Therefore, the PHF entering the PWPS would be 409,472 gpd or 283 gpm.

4. EP recommends that the Town confirm all projected average daily flows and peak hourly flows referenced in Table 2 of Onsite's April 2022 memo to ensure all flows entering the PWPS are accounted for. As noted in EP's July 28, 2020 peer review letter, there are several buildings in the vicinity of this project (i.e., Eye Center at 146 Commerce Way, West Plymouth Square at 71 Carver Road) that also convey wastewater flow into the Industrial Park Road gravity sewer and Industrial Park Pump Station that do not appear to be accounted for.

5. The memorandum indicates that the proposed peak hour flow entering the Plaza Way Pump Station (PWPS) is 233.6 gpm, which is less than the measured pumping capacity of the pump station (279 gpm for Pump #1, 335 gpm for Pump #2) based on drawdown testing performed on August 24, 2021 by Onsite Engineering. It should be noted that EP has not reviewed this drawdown testing data as part of this peer review evaluation; however, it is EP's understanding that the developer has provided this documentation to the Town confirming the station's current operating conditions.

6. The memorandum does not make reference to the recommended sewer force main extension outlined in Onsite's October 5, 2020, technical memorandum to address the sewer capacity issues along Plaza Way as identified in previous peer reviews. The proposed sewer extension work involves the installation of approximately 868-ft of new 6-inch SDR-21 PVC force main piping along Plaza Way, along with additional fittings, valves, and bends, that were not part of the original pump station design. EP recommends that the developer provide documentation confirming the station's new operating point (originally 225 gpm @ 66.7-ft based on Highpoint Engineering's October 27, 2020, Sewer Force Main Extension design plan). The PWPS shall be capable of achieving a minimum pump flow rate of 233.6 gpm based on the projected post-development flows for this area.

7. For the purposes of this analysis, EP estimated the average pumping rate for the PWPS is based on the average of the drawdown test results performed on August 24, 2021, by Onsite Engineering (279 gpm for Pump #1, 335 gpm for Pump #2). Therefore, EP utilized an average flow rate of 307 gpm to determine the impact on the Town's sewer collection system.

Proposed Development Flow Assessment

Onsite Engineering's April 2022 memo estimates an average daily flow (ADF) of 72,990 gpd and a peak hourly flow (PHF) of 233.6 gpm at the PWPS. These flows were estimated based on information collected from the four development projects (Sawyers Reach, Claremont Development, Hanover

Colony Place (The Walk), and Home2 Suites Hotel) along Plaza Way. For the purposes of this evaluation, these flows were used to determine the impact on the Town's sewer collection system.

8-Inch PVC Gravity Sewer Main

Wastewater is currently conveyed from the proposed developments into the PWPS on Plaza Way and pumped into the Town's sewer collection system at SMH-1445. From here, wastewater flows inside an 8-inch PVC gravity sewer main for approximately 1,800 feet to a sewer manhole located just upstream of the Industrial Park Pump Station off Industrial Park Road (SMH-1006).

In their October 5, 2020, technical memorandum, Onsite recommended extending the PWPS sewer force main to discharge wastewater flow into the sewer manhole near the intersection of Plaza Way and Commerce Way (SMH-1439), which would address some of the potentially undersized pipe segments along Plaza Way identified in previous peer reviews. Highpoint Engineering's October 27, 2020, drawing titled *Sewer Force Main Extension* identified an extension of the sewer force main on Plaza Way. For the purposes of this memo, EP has assumed that the force main extension will be completed prior to bringing the proposed Claremont age restricted community at Colony Place online.

Based on the revised ADF and PHF information provided in Onsite Engineering's April 2022 memo, EP rechecked the pre-development and post-development flows in the existing 8-inch PVC gravity sewer main from SMH-1445 on Plaza Way to SMH-1006 on Industrial Park Road. EP used the as-built sewer information for the 8-inch PVC gravity sewer main from Highpoint Engineering's March 2020 sewer capacity memo to determine the capacity of this main. For pre-development flows, EP used the maximum peak flows collected from flow metering data for the gravity sewer main from both the March 2018 Highpoint Engineering report and from the August 2018 Flow Assessment Services report. For post-development flows, EP used the flows referenced in Onsite's letter to determine the true capacity of the 8-inch PVC gravity sewer main. Assuming the PWPS will discharge an average discharge rate of 307 gpm into the sewer manhole near the intersection of Plaza Way and Commerce Way (SMH-1439), EP reran the capacity calculations for the 8-inch PVC gravity sewer main under pre-development and post-development conditions shown in Table 6 below.

Table 8: 8-Inch PVC Gravity Sewer Main Capacity Analysis

From	To	Pre Development Flow (gpm)	Post Development Flow (gpm)	% Flowing Full (Pre-Develop)	% Flowing Full (Post-Develop
SMH-1445	SMH-1446	56	56	16	16
SMH-1446	SMH-1447	79	79	23	23
SMH-1447	SMH-1448	79	79	20	20
SMH-1448	SMH-1450	79	79	23	23
SMH-1450	SMH-1451	79	79	18	18
SMH-1451	SMH-1439	106	106	26	26
SMH-1439[1]	SMH-1452	106	413	11	44
SMH-1452	SMH-1499	106	413	12	46
SMH-1499	SMH-1505	330	637	28	54
SMH-1505	SMH-1506	330	637	30	57
SMH-1506	SMH-1507	330	637	30	57
SMH-1507	SMH-1508	330	637	23	45
SMH-1508	SMH-1509	330	637	23	45
SMH-1509	SMH-1008	330	637	21	40
SMH-1008	SMH-1007	330	637	15	28
SMH-1007	SMH-1006	330	637	45	86

1. Proposed PWPS force main discharge location

Table 6 shows that by extending the PWPS sewer force main to discharge into SMH-1439, the existing main's capacity is sufficient to handle post-development flows. Downstream of this force main discharge, EP does not anticipate any changes to the existing sewer infrastructure along Industrial Park Road and the Industrial Park Pump Station as a result of incorporating these additional post-development flows.

Wastewater Analysis - Findings and Recommendations

EP reviewed the sewer information provided by the Town for the proposed Claremont age restricted community at Colony Place. EP takes no exception to Onsite's proposed approach for estimating the ADF and PHF at the PWPS. EP recommends that Onsite Engineering confirm the projected average

daily flows and peak hourly flows referenced in Table 2 of Onsite's letter to ensure all flows entering the PWPS are accounted for, as this significantly impacts the carrying capacity of the 8-inch PVC gravity sewer main along Plaza Way. Further, EP recommends that Onsite Engineering consider applying a peaking factor 5.6 per TR-16 standards for all developments contributing flow to the PWPS. This would eliminate any confusion in terms of applying different peaking factors for the multiple developments along Plaza Way

EP agrees with Onsite's analysis that the privately-operated PWPS on Plaza Way appears to be properly sized to accommodate the addition of the proposed post-development flows. EP has assumed that the developer will extend the existing sewer force main on Plaza Way from the PWPS to connect into SMH-1439. EP recommends that the proposed sewer force main extension be completed prior to bringing the proposed Claremont age restricted community at Colony Place online.

The existing gravity sewer main along Plaza Way and Industrial Park Road and the Industrial Park Pump Station are both appropriately sized to accommodate the projected average daily and peak hourly build-out flows. No anticipated changes are anticipated as part of incorporating these additional build-out flows.

We thank you for the opportunity to assist you with this important project. Please feel free to contact us with any questions or concerns.

Very truly yours,

Environmental Partners Group, LLC

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