



May 17, 2023

Mr. Gregory Rondeau, Chairman
355 East Central Street
Franklin, MA 02038

**Re: 25 Forge Parkway
Site Plan -3rd Peer Review**

Dear Mr. Rondeau:

BETA Group, Inc. is pleased to continue our engineering peer review services for the proposed project entitled "**Site Development Plans for 25 Forge Parkway**" located at 25 Forge Parkway in Franklin, Massachusetts. This letter is provided to outline findings, comments, and recommendations.

BASIS OF REVIEW

The following documents were received by BETA and formed the basis of the review:

- Revised Site plans entitled **Site Development Plans for 25 Forge Parkway**; sheets C-103, C-502 & C-503, prepared by Brian E. Jones, P.E. with Allen & Major Associates, Inc.; dated February 15, 2023, revised May 11, 2023.
- Drainage report entitled **25 Forge Parkway Drainage Report**; prepared by Allen & Major Associates, Inc.; dated February 21, 2023, revised May 11, 2023.
- HYDRO-CAD program input file from drainage analysis.

Review by BETA will include the above items along with the following, as applicable:

- **Zoning Chapter 185 From the Code of the Town of Franklin**, current through July 2021
- **Zoning Map of the Town of Franklin, Massachusetts**, attested to October 7, 2020
- **Stormwater Management Chapter 153 From the Code of the Town of Franklin**, Adopted May 2, 2007
- **Subdivision Regulations Chapter 300 From the Code of the Town of Franklin**, current through March 8, 2021
- **Wetlands Protection Chapter 181 From the Code of the Town of Franklin**, dated August 20, 1997
- **Town of Franklin Best Development Practices Guidebook**, dated September 2016

INTRODUCTION

The project site includes one parcel, Lot 275-014, with a total area of 5.91 acres located at 25 Forge Parkway in the Town of Franklin (the "Site"). The Site and all the surrounding lots are located within the Industrial zoning district. The Site is not located within the Water Resource District.

The existing Site is the location of a 1-story brick building with a footprint area of 18,619± sq. ft. An existing paved 50 space parking lot and access driveway from Forge Parkway are each located on the westerly edge of the building with access to a loading dock at the rear of the building. The northerly area behind the building is currently wooded. A wooded strip is located east of the building and along the frontage in front of the building. Bordering vegetated wetlands have been flagged along the eastern and westerly

edges of the parcel. The wetlands at the rear of the site are along the banks of a pond. All proposed work is located within the portion of the Site to the north of the existing building.

Topography within the limit of work generally slopes west across the lot. There is a ridge that separates this area from the pond which is approximately 12' high and slopes at a 3h:1v slope down to the edge of the pond. The Site is not located within a wellhead protection area, a FEMA mapped 100-year floodplain, an NHESP-mapped estimated habitat of rare or endangered species, or any other critical area. NRCS soil maps indicate the presence of Ridgebury fine sandy loam with a Hydrologic Soil Group (HSG) rating of D (low infiltration potential when unsaturated) and Charlton-Hollis-Rock Complex with an HSG rating of A (high infiltration potential when unsaturated). The development area is primarily located within the HSG A soils area.

The project proposes to clear the woodlands at the rear of the Site and construct a new 16,000 sq. ft. warehouse building with an additional 38,000 ± sq. ft. of paved area to add 17 parking spaces and truck access to the warehouse. This area will connect to the existing driveway and parking west of the existing brick building. Stormwater management is proposed via a new subsurface chamber system with overflow directed to the wetlands on the adjacent parcel to the west. Three dumpsters will be located at the northerly edge of the pavement on a fenced concrete pad. Lighting for the new pavement area will be provided by 2 proposed pole mounted fixtures along the outside edge of the pavement, modification of an existing pole, and 7 wall mounted fixtures on the front of the building.

To assist with the review, those issues that were addressed in the 2nd review will be discontinued and the BETA's additional comments to the revised plans and drainage report are prefaced **BETA3:** with comments in **bold**.

FINDINGS, COMMENTS, AND RECOMMENDATIONS

ZONING

The Site is located within the industrial (I) Zoning District. The proposed use is Warehouse, which is permitted within this district.

SCHEDULE OF LOT, AREA, FRONTAGE, YARD, AND HEIGHT REQUIREMENTS (§185 ATTACHMENT 9)

As shown on the schedule on the Zoning table on Sheet C-102 of the set, the Site meets the requirements for lot area, depth, frontage, width. The proposed building will meet the front, side, and rear yards and building height is also identified as a 1 story warehouse.

PARKING, LOADING AND DRIVEWAY REQUIREMENTS (§185-21)

Access to the proposed warehouse and expanded parking area will come through the existing entrance from Forge Parkway. The width of the entrance drive is 26'± wide as it passes in front of the existing building. There is vertical granite curbing along the entrance driveway and in front of the existing building. The curbing changes to a bituminous berm around the parking spaces and landscape islands. There are currently 50 parking spaces on the site including 3 accessible spaces. There is a paved approach driveway to a loading area on the north side of the existing building off the entrance driveway. The proposed pavement expansion will extend north beyond the existing pavement edge. The bituminous berm will be removed, and the proposed pavement will match the existing edge. The existing landscaped islands in the parking lot will be maintained.

- P1. In accordance with §185-21, C. (5). Parking lots for 20 or more cars shall contain or be bordered within 5' by at least one tree per 10 parking spaces, , with not less than 40 square feet of unpaved soil area per tree.

A&M: *The project proposes a total of 67 parking spaces which means that 7 trees are required. The perimeter of the site is wooded, with far more than 7 trees existing. We respectfully suggest that the existing trees meet the requirement. The landscape plan proposes adding three additional trees within the landscape islands.*

BETA2: **The landscaping plan shows 2 additional trees.. BETA will defer this issue to the Board.**

CURBING (§185-29)

A bituminous curb is being proposed around the expanded pavement area. This matches the current edge of pavement treatment on the site beyond the entrance drive. There is a wooden guard rail proposed along the westerly edge of the new pavement area above the 2h:1v rip rap slope in this area.

- C1. BETA recommends that a vertical curb be place along this edge with a return along the north edge wherever the slope is greater than 3h:1v. Since the remaining curb treatment matches the existing BETA will defer this to the Board whether vertical curbing should be used for the remaining pavement area.

A&M: *The new curbing is proposed to match the existing curbing which helps to maintain a consistent appearance across the site. The proposed steel guard rail will provide sufficient protection where slopes exceed 3:1.*

BETA2: **BETA will defer this issue to the Board.**

SITE PLAN AND DESIGN REVIEW (§185-31)

The project has been submitted for Site Plan Review and is required to conform to the requirements of this section.

- SP3. In accordance with §185-31.1.C(4)(a), the issue of traffic safety at the entrance into the site should be addressed by the Applicant to determine that it is protected. As noted in §185-31.1.C(3)(s), the description of traffic circulation, safety and capacity should be in sufficient detail for the board to make a determination of whether a traffic impact analysis is necessary.

A&M: *The entrance to the site is existing with no changes proposed. The turning radii entering and exiting the site are large enough to facilitate large trucks if necessary. The entrance is well lit, with one onsite light fixture on the north side of the driveway as well as a double luminaire fixture in the median within Forge Parkway. Traffic circulation within the site uses typical parking stalls and drive aisles and the proposed portion of the site provides ample space for maneuvering trucks. The current owner and tenant will remain the user of the property and so traffic is not expected to increase significantly.*

BETA2: **The use of the site is being converted from office to warehouse. BETA recommends that truck turning movements at the entrance for the tractor trailers anticipated be shown and site distances identified to determine whether some trimming of vegetation is needed along Forge Parkway to maintain sight distances, especially to the east.**

BETA3: The sight distance is shown for 20 MPH. although it is posted for that speed, the DPW indicates that it is not enforceable, and that 35-40 MPH is a more reasonable speed. At 35MPH the sight triangle requirement according to AASHTO would be 390'. BETA recommends that the proponent indicate the sight triangle required and show the vegetation trimming necessary to maintain that sight distance.

STORMWATER MANAGEMENT

The stormwater management design proposes a subsurface infiltration system located along the western edge of the proposed parking lot. Runoff from the pavement area will be collected by 2 double grated catch basins located on either side of the subsurface chamber system. Roof runoff will be piped directly into a collection system around the rear of the building. The discharge from the existing catch basin at the rear of the existing building will be redirected to the roof collection system for the proposed structure. All this runoff will be piped directly into the subsurface infiltration system. Overflow from this system will be conveyed to a new outfall at the far northwest corner of the site. This outfall will discharge onto the proposed rip rap surface treatment along this slope prior to discharge into a stormwater detention basin located at 27 Forge Parkway.

STORMWATER MANAGEMENT REGULATIONS (CHAPTER 153)

The project proposes to disturb land in excess of one acre within the Town of Franklin. It is therefore subject to the Stormwater Management Regulations. The project is also required to comply with the Town of Franklin Best Development Practices Guidebook (BDPG). Compliance with these regulations is outlined below and throughout the following sections.

SUBDIVISION REGULATIONS - STORMWATER MANAGEMENT REGULATIONS (§300-11)

Additional requirements for stormwater management are outlined in §300-11 of the Town of Franklin Subdivision Regulations.

SW1. Revise proposed drainage pipe to be reinforced concrete or request waiver (§300-11.B(2.a)).

A&M: *The applicant respectfully requests a waiver to the requirement to use reinforced concrete pipe (RCP). The proposed drainage pipes need to connect to the subsurface plastic chambers. HDPE piping is typically used to make this connection. The openings and fittings are set up to receive double wall HDPE pipe.*

BETA2: **BETA will defer this question to the Board but notes that historically direct connections to plastic chambers with HDPE have been permitted .**

MASSDEP STORMWATER STANDARDS

The project is subject to the Massachusetts Stormwater Standards as outlined by MassDEP. Compliance with these standards is outlined below:

NO UNTREATED STORMWATER (STANDARD NUMBER 1): *No new stormwater conveyances (e.g., outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.* The project proposes one new outfall which will discharge on the rip rap slope and in accordance with the calculations only at the peak of the 100-year frequency event.

SW3. Based on the calculations and the watershed maps, it appears that a small portion of the proposed pavement area will flow south towards the existing stormwater system. The existing stormwater collection system on site does not conform to the requirements of the standards and/or bylaw.

BETA recommends that the designer review the outfall from the site to Forge Parkway stormwater collection system and provide a BMP that will provide the treatment required by the standards.

A&M: *The grading of the site has been revised in such a way that there is now a 1,104 square foot reduction in the amount of pavement draining into the municipal stormwater system. This reduction results in the improvement of the quality of runoff to the municipal system, over existing conditions. We therefore respectfully suggest that additional treatment of runoff from existing pavement is unwarranted.*

BETA2: Comment addressed. (See Comment SW10 below)

POST-DEVELOPMENT PEAK DISCHARGE RATES (STANDARD NUMBER 2): *Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. The project proposes a net increase in impervious area and changes to site hydrology. Stormwater runoff will be mitigated via a new subsurface infiltration BMP. Calculations indicate a decrease in peak discharge rate to all watersheds.*

SW4. Because of the basin on the adjacent parcel at 27 Forge Parkway, provide table comparing pre- and post-development runoff volumes.

A&M: *The project does not impact the flow to the basin described above and therefore will result in no change to the runoff rate to said basin.*

BETA2: In accordance with the Town of Franklin requirements, the post development peak flow rate and total volume must not exceed pre-development levels. Comment remains. (See comment below)

BETA3: **The calculations have been revised and the results indicate that the rate and volume of runoff entering the wetlands on the adjacent site from the site are reduced for every event.**

SW5. In the Hydro-CAD analysis of the infiltration system, the exfiltration rate has been applied to the surface area of the system. In accordance with the handbook, this should be applied to the bottom area only.

A&M: *The area to which exfiltration rate is applied has been revised as requested.*

BETA2: There remains an issue with the exfiltration rate in HYDRO-CAD, the actual exfiltration rate should be

$$\begin{aligned} \text{Rawls Rate} &= 2.41 \text{ Inches/hour} \\ \text{Surface area} &= 101.58' \times 63.06' = 6,405.3 \text{ sq. ft.} \\ \text{Rate} &= 6,405.3 [(2.41"/\text{hr})/(12"/\text{ft})] = 1,281.13 \text{ cu. ft./hr} \\ &= 1,281.13 (1 \text{ hr}/3600 \text{ secs}) = 0.36 \text{ cfs.} \end{aligned}$$

In the HYDRO-CAD analysis page 26, the exfiltration rate for the system is 1.10 cfs. Which is 3x the actual rate. Comment remains.

BETA3: **The exfiltration rate in the analysis has been corrected and is now based solely upon the Rawl's Rate. No further comments.**

RECHARGE TO GROUNDWATER (STANDARD NUMBER 3): *Loss of annual recharge to groundwater should be minimized through the use of infiltration measures to maximum extent practicable. NRCS soil maps indicate that soil in the area of proposed infiltration system is Charlton-Hollis-Rock complex with a Hydrologic Soil Group (HSG) rating of A (high infiltration potential). The proposed building area is identified as Ridgebury, fine sandy loam with a HSG Rating of C (moderate infiltration potential).*

The Applicant has conducted test pits at the Site indicating that subsurface soil is loamy sand. The depth of the test pits was limited to a depth of 9'. Groundwater and/or redoximorphic features were not indicated on the test pit logs, therefore, ESHGW was not established and the elevation at the bottom of the deepest test pit was Elev. 282.0±.

Recharge is proposed via a new subsurface infiltration system. Runoff from the proposed pavement area will be collected in 2-double grated catch basins. Flow from the 2 basins will be directed into an isolator row to provide the pretreatment required. The BMPs are anticipated to provide groundwater recharge nearly 10x the volume required by the standards.

SW6. Based upon the proximity of the rip rap slope to the edge of the infiltration system, BETA recommends that an impermeable breakout barrier be provided along the north and west edge of the system.

A&M: *An impenetrable barrier has been added to the plan and detail as requested.*

BETA2: **Comment addressed.**

SW7. The elevation noted in the stage-storage table in Appendix 6 is incorrect. The static storage elevation is the weir crest in the manhole at Elev. 289.60. The storage volume is far greater than stated. Based upon this, adjust the calculation for dewatering time accordingly.

A&M: *The revisions requested above have been completed.*

BETA2: **Comment addressed.**

TOTAL SUSPENDED SOLIDS (STANDARD NUMBER 4): *For new development, stormwater management systems must be designed to remove 80% (90% per Town Bylaw) of the annual load of Total Suspended Solids (TSS). The runoff from the proposed additional impervious surfaces will flow through a single treatment train.*

The project is required to treat the 1.0-inch water quality volume per Town Bylaws. The static storage volume provided in the proposed infiltration BMP is more than what is required. The Isolator Row will provide the pretreatment required. The roof runoff and the runoff from the landscaped area at the rear of the buildings will flow directly into the chamber system.

SW8. Impervious watershed area into the 2 catch basins far exceeds 0.25 acres, thus in accordance with Volume 2 Chapter 2 they will not provide the 25% TSS Removal anticipated by the design engineer. Adjust the TSS Removal calculations accordingly.

A&M: *The calculation has been revised as requested.*

BETA2: **Comment addressed.**

SW9. In accordance with the stormwater standards, one additional test pit should be conducted in the infiltration system location. BETA recommends that the test pit be excavated to a depth sufficient to document that the Estimated Seasonal High Groundwater is below Elev. 280.75. If the actual elevation of ESHGW is determined to be higher than in accordance with the standards, a mounding analysis will be required for the system.

A&M: *It has been noted on the Grading & Design Plan that an additional test pit shall be performed prior to construction to confirm that there is sufficient separation between the infiltration system and ESHGW, see note #14. Additionally, a mounding analysis has been performed which shows*

that a 2.48' mound will occur below the infiltration system. This value is acceptable given the current design because the bottom of the system is situated 2.75' above the bottom of test pit #2.

BETA2: BETA recommends that this be added as a condition of approval.

HIGHER POTENTIAL POLLUTANT LOADS (STANDARD NUMBER 5): *Stormwater discharges from Land Uses with Higher Potential Pollutant Loads (LUHPPLs) require the use of specific stormwater management BMPs. The project is not considered a LUHPPL – not applicable.*

CRITICAL AREAS (STANDARD NUMBER 6): *Stormwater discharges to critical areas must utilize certain stormwater management BMPs approved for critical areas. The project is not located within a critical area – not applicable.*

REDEVELOPMENT (STANDARD NUMBER 7): *Redevelopment of previously developed sites must meet the Stormwater Management Standards to the maximum extent practicable. Although most of the proposed development is new impervious surfaces beyond the limit of the existing impervious surfaces, the project is a redevelopment based upon the fact that a portion of the runoff from the proposed impervious surfaces will flow into the existing stormwater collection system on site and not the proposed improvements.*

SW10. BETA recommends that the design engineer review the proposed pavement areas and document that portion that flows south into the existing system and whether enough of the existing impervious surfaces can be diverted to offset that increase or provide treatment at outlet to meet the standards. (See SW3 above)

A&M: *As mentioned above, the grading design has been revised to result in a net reduction in pavement area flowing to the municipal drainage system.*

BETA2: BETA agrees that the modification of the proposed grading will result in a net reduction in the impervious surfaces on site tributary to the system in Forge Parkway, thus the treatment and infiltration requirements for this discharge are not required to meet the standards completely. However, there is the possibility to provide some proprietary treatment either at the final manhole or in the catch basins which will provide some treatment and meet the definition of Maximum Extent Possible.

BETA3: **The plans indicate that hoods will now be provided on the 3 existing catch basins on site; however, the driveway basin is piped into the middle catch basin. BETA recommends that at a minimum an inlet treatment insert be placed on this catch basin which will provide the treatment benefits to meet the MEP threshold.**

EROSION AND SEDIMENT CONTROLS (STANDARD NUMBER 8): *Erosion and sediment controls must be implemented to prevent impacts during construction or land disturbance activities. As the project proposes to disturb greater than one acre of land, it will be required to file a Notice of Intent with EPA and develop a Stormwater Pollution Prevention Plan (SWPPP). Erosion control measures are depicted on the plans include silt fence, inlet protection, stabilized construction entrance, dust control, and designated stockpile area.*

SW11. The applicant is reminded that a Stormwater permit from the Franklin DPW is required based upon the size of the disturbance.

A&M: *Understood. The applicant will file the Stormwater permit application prior to construction.*

Mr. Gregory Rondeau, Chairman
May 17, 2023
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BETA2: No further comments.

OPERATIONS/MAINTENANCE PLAN (STANDARD NUMBER 9): *A Long-Term Operation and Maintenance Plan shall be developed and implemented to ensure that stormwater management systems function as designed.* A Stormwater Operation and Maintenance Manual was provided with the Stormwater Management Report.

SW20. Identify proposed inspection port locations on the plan view of the subsurface infiltration system.

A&M: *No response given.*

BETA2: Comment remains.

BETA3: Comment remains. Inspection port locations are not identified on the plan. BETA recommends that inspection ports should be added at either end of the isolator row and at each end of the inlet row from the roof leader.

ILLICIT DISCHARGES (STANDARD NUMBER 10): *All illicit discharges to the stormwater management system are prohibited.* An Illicit Discharge Compliance Statement was provided with the submission.

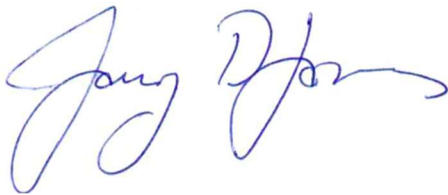
WETLANDS PROTECTION

The Project proposes work within Areas Subject to Protection and Jurisdiction of the Franklin Conservation Commission, including the 100-foot Buffer Zone to a vegetated wetland. Work within his area includes a small portion of the proposed parking lot, and the back half of the proposed warehouse addition. Therefore, the Applicant is required to submit an NOI to the Town of Franklin Conservation Commission and must obtain an Order of Conditions to complete the proposed work.

If we can be of any further assistance regarding this matter, please contact us at our office.

Very truly yours,

BETA Group, Inc.



Gary D. James, P.E.
Senior Project Engineer

cc: Amy Love, Town Planner



TOWN OF FRANKLIN

DEPARTMENT OF PUBLIC WORKS

Franklin Municipal Building
257 Fisher Street
Franklin, MA 02038-3026

May 18, 2023

Mr. Greg Rondeau, Chairman
Members of the Franklin Planning Board
355 East Central Street
Franklin, MA 02038

RE: Site Plan Modification – Warehouse Addition, #25 Forge Parkway

Dear Mr. Chairman and Members:

We have reviewed the revised site plans for the subject project and offer the following comment:

1. We note that the curb along the rear of the new parking area expansion has been called out as vertical granite or concrete, but the section along the western edge which has the steep side slope still has proposed bituminous berm called out.

Should you have any questions or require additional information, please do not hesitate to contact me.

Sincerely,

Michael Maglio, P.E.
Town Engineer

Town of Franklin

355 East Central Street
Franklin, Massachusetts 02038-1352



Phone: (508) 520-4907
www.franklinma.gov

DEPARTMENT OF PLANNING AND COMMUNITY DEVELOPMENT

DATE: May 16, 2023
TO: Franklin Planning Board
FROM: Department of Planning and Community Development
RE: 25 Forge Parkway
Site Plan Modification

The DPCD has reviewed the above referenced Site Plan Modification application for the Monday, May 22, 2023 Planning Board meeting and offers the following commentary:

General:

1. The site is located at 25 Forge Parkway located in the Industrial Zoning District (Assessors Map 275 Lot 014).
2. The proposed project includes the construction of a 16,000 bay building addition, 17 additional parking spaces and contractor yard.
3. The Applicant met with the Conservation Commission on May 18 – will provide an update at the Planning Board meeting.

Comments from the April 24, 2023 meeting:

1. Planning Board wanting to hear from BETA for final review. *BETA has submitted a letter.*
2. Applicant is still proposing a bituminous curb along the western side of the site. The Planning Board at the April 24 meeting requested that the curbing be reinforced concrete or vertical granite– Planning Board can make this a condition.

Waiver Requested:

- §300-11.B.2.a – Use HDPE piping in instead of Reinforced Concrete pipe

RECEIVED

MAY 2 2022

PLANNING DEPT.



ALLEN & MAJOR ASSOCIATES, INC.

May 1, 2023

To: Mr. Gregory Rondeau, Chairman
Town of Franklin Planning Board
355 East Central Street
Franklin, MA 02038

A&M Project #: 2712-02
Re: 25 Forge Parkway
Industrial/Warehouse
Response to
Review Comments

Copy: TMC Holdings & Development 2, LLC

Dear Mr. Rondeau,

Allen & Major (A&M) is in receipt of review comments from the following groups for the above referenced project:

BETA Group, Inc.: Dated April 19, 2023

Town of Franklin Department of Public Works: Dates April 20, 2023

Town of Franklin Department of Planning and Community Development: Dated April 19, 2023

Please find A&M's responses to these comments below. The initial comments are provided along with A&M's responses in **bold**. Comments that have been addressed have been omitted for ease of review.

BETA Group, Inc:

P1. The landscaping plan shows 2 additional trees. As a minimum, BETA recommends that the existing trees that fulfill this requirement be identified on the landscaping plan. BETA will defer this issue to the Board.

A&M Response: The Landscape Plan has been revised to graphically show the existing trees to remain which satisfy this requirement.

SP3. The use of the site is being converted from office to warehouse. BETA recommends that truck turning movements at the entrance for the tractor trailers anticipated be shown and site distances identified to determine whether some trimming of vegetation is needed along Forge Parkway to maintain sight distances, especially to the east.

A&M Response: Forge Parkway is a private road with a posted speed limit of 20 miles per hour (MPH). The stopping sight distance determined by AASHTO for a 20 MPH zone is 115 feet. We've added dimensions to the Layout & Materials Plan which illustrate that a sight distance of 115 feet is available from the site driveway exit. A truck turning figure is provided with this letter which illustrates that a WB-67 is able to maneuver through the site.

SW4. In accordance with the Town of Franklin requirements, the post development peak flow rate and total volume must not exceed pre-development levels. Comment remains. (See comment below)

A&M Response: See response to SW5 below.

SW5. There remains an issue with the exfiltration rate in HYDRO-CAD, the actual exfiltration rate should be

$$\text{Rawls Rate} = 2.41 \text{ Inches/hour}$$

$$\text{Surface area} = 101.58' \times 63.06' = 6,405.3 \text{ sq. ft.}$$

$$\begin{aligned} \text{Rate} &= 6,405.3 [(2.41"/\text{hr})/(12"/\text{ft})] = 1,281.13 \text{ cu. ft./hr} \\ &= 1,281.13 (1 \text{ hr}/3600 \text{ secs}) = 0.36 \text{ cfs.} \end{aligned}$$

In the HYDRO-CAD analysis page 26, the exfiltration rate for the system is 1.10 cfs. Which is 3x the actual rate. Comment remains.

A&M Response: HydroCAD provides three options for calculating pond exfiltration. The method used for the project uses the saturated hydraulic conductivity (Rawls Rate) and calculates the exfiltration rate using Darcy's Law. Darcy's law takes the hydraulic head into consideration when calculating the exfiltration rate. A higher hydraulic head, meaning a higher level of water in the infiltration system, results in a higher exfiltration rate. Since the hydraulic head varies between storm events, the peak exfiltration rate reported by HydroCAD will be different for each storm event. The attached Stage – Discharge worksheets show how the exfiltration rate changes as the water level increases. The "Discarded" column on this worksheet begins with a flow rate of 0.36 cfs, which matches the rate described in the comment above. But as the water level rises, the exfiltration rate rises, until it reaches the maximum value of 1.10 cfs.

SW10. BETA agrees that the modification of the proposed grading will result in a net reduction in the impervious surfaces on site tributary to the system in Forge Parkway, thus the treatment and infiltration requirements for this discharge are not required to meet the standards completely. However, there is the possibility to provide some proprietary treatment either at the final manhole or in the catch basins which will provide some treatment and meet the definition of Maximum Extent Possible.

A&M Response: The Grading & Drainage Plan has been revised to specify that a hood be installed on the outlet pipe of the existing catch basins within the pavement. These hoods will provide treatment of the stormwater prior to discharge to the municipal system.

SW21. Identify proposed inspection port locations on the plan view of the subsurface infiltration system. Comment remains.

A&M Response: An inspection port has been added to the plan view. Inspection and maintenance of the isolator row can be performed via DMH-01.

Department of Public Works:

2. The discharge point from proposed infiltration system outlet has been moved back 4 feet from the property line, however we are still concerned about potential erosion from the discharge during extreme events. Consideration should be given to providing appropriately sized riprap at the outfall for energy dissipation and/or rotating the outfall 90 degrees to the north where there is more room on the subject property if the existing grades are conducive to that alignment.

A&M Response: The headwall was moved an additional 4 feet away from the property line. A spreadsheet is provided with this letter which specifies the sizing requirements for the rip rap apron. The headwall detail on sheet C-503 has been updated to illustrate the rip rap apron dimensions, as specified in the sizing spreadsheet. The rip rap slope detail provided in the plan set specifies a d₅₀ stone size of 6" which exceeds that which is specified by the rip rap sizing spreadsheet.

Department of Planning and Community Development:

1. Applicant is providing cape cod berm. *Planning Board requested reinforced concrete or granite along the north end of the site.*

A&M Response: The plan has been revised to indicate that the curb along the north end of the site shall be either vertical granite or precast concrete.

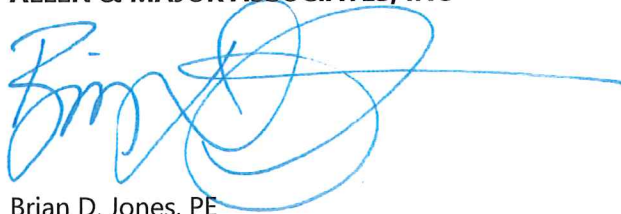
3. Fire has requested an access road north of the building addition. *Plans should show the fire lane along the North side of the site.*

A&M Response: The pavement area along the north side of the building has been revised to include striping to prevent parking within the fire truck access road.

4. Mark the drive isle through the contractors yard.

A&M Response: The drive aisles have been marked through the contractor yard as requested. See Sheet C-102, Layout & Materials Plan.

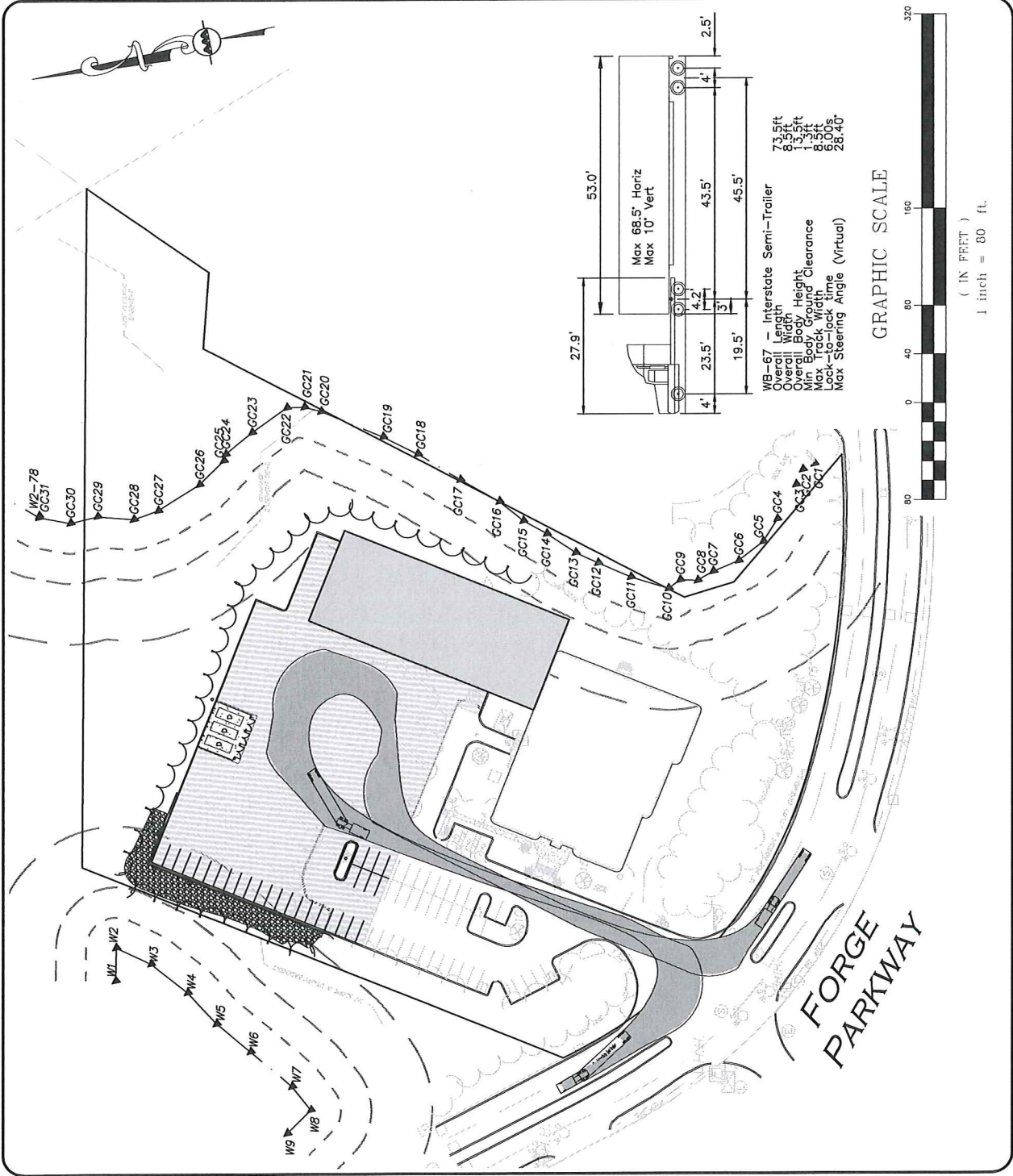
Very Truly Yours,
ALLEN & MAJOR ASSOCIATES, INC

A handwritten signature in blue ink, appearing to read "Brian D. Jones", with a long horizontal line extending to the right.

Brian D. Jones, PE
Senior Project Manager

Attachments:

1. Site Development Plans, revised as of May 1, 2023
2. Truck Turning Figure
3. Stage-Discharge HydroCAD worksheets
4. Rip rap apron sizing spreadsheet




REV	DATE	DESCRIPTION

APPLICANT/OWNER:
 TMC HOLDINGS & DEVELOPMENT 2, LLC
 24 WILLIAM WAY
 BELLINGHAM, MA 02019

PROJECT:
 25 FORGE PARKWAY
 FRANKLIN, MA

PROJECT NO. 2712-02A | DATE: 04-27-23
 SCALE: 1" = 80' | DWG. NAME: C2712-02A
 DESIGNED BY: SM | CHECKED BY: BDJ
 PREPARED BY:


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 environmental consulting • landscape architecture
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DRAWING TITLE: TRUCK TURNING FIGURE
 SHEET No. 1
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2712-02A - Proposed HydroCAD

Type III 24-hr 100-year Rainfall=8.78"

Prepared by Allen & Major Associates, Inc

Printed 4/27/2023

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Stage-Discharge for Pond IS-1: IS-1

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
284.75	0.00	0.00	0.00	285.28	0.43	0.43	0.00
284.76	0.36	0.36	0.00	285.29	0.43	0.43	0.00
284.77	0.36	0.36	0.00	285.30	0.43	0.43	0.00
284.78	0.36	0.36	0.00	285.31	0.43	0.43	0.00
284.79	0.36	0.36	0.00	285.32	0.43	0.43	0.00
284.80	0.36	0.36	0.00	285.33	0.43	0.43	0.00
284.81	0.37	0.37	0.00	285.34	0.43	0.43	0.00
284.82	0.37	0.37	0.00	285.35	0.44	0.44	0.00
284.83	0.37	0.37	0.00	285.36	0.44	0.44	0.00
284.84	0.37	0.37	0.00	285.37	0.44	0.44	0.00
284.85	0.37	0.37	0.00	285.38	0.44	0.44	0.00
284.86	0.37	0.37	0.00	285.39	0.44	0.44	0.00
284.87	0.37	0.37	0.00	285.40	0.44	0.44	0.00
284.88	0.37	0.37	0.00	285.41	0.44	0.44	0.00
284.89	0.38	0.38	0.00	285.42	0.44	0.44	0.00
284.90	0.38	0.38	0.00	285.43	0.45	0.45	0.00
284.91	0.38	0.38	0.00	285.44	0.45	0.45	0.00
284.92	0.38	0.38	0.00	285.45	0.45	0.45	0.00
284.93	0.38	0.38	0.00	285.46	0.45	0.45	0.00
284.94	0.38	0.38	0.00	285.47	0.45	0.45	0.00
284.95	0.38	0.38	0.00	285.48	0.45	0.45	0.00
284.96	0.38	0.38	0.00	285.49	0.45	0.45	0.00
284.97	0.39	0.39	0.00	285.50	0.45	0.45	0.00
284.98	0.39	0.39	0.00	285.51	0.46	0.46	0.00
284.99	0.39	0.39	0.00	285.52	0.46	0.46	0.00
285.00	0.39	0.39	0.00	285.53	0.46	0.46	0.00
285.01	0.39	0.39	0.00	285.54	0.46	0.46	0.00
285.02	0.39	0.39	0.00	285.55	0.46	0.46	0.00
285.03	0.39	0.39	0.00	285.56	0.46	0.46	0.00
285.04	0.40	0.40	0.00	285.57	0.46	0.46	0.00
285.05	0.40	0.40	0.00	285.58	0.47	0.47	0.00
285.06	0.40	0.40	0.00	285.59	0.47	0.47	0.00
285.07	0.40	0.40	0.00	285.60	0.47	0.47	0.00
285.08	0.40	0.40	0.00	285.61	0.47	0.47	0.00
285.09	0.40	0.40	0.00	285.62	0.47	0.47	0.00
285.10	0.40	0.40	0.00	285.63	0.47	0.47	0.00
285.11	0.40	0.40	0.00	285.64	0.47	0.47	0.00
285.12	0.41	0.41	0.00	285.65	0.47	0.47	0.00
285.13	0.41	0.41	0.00	285.66	0.48	0.48	0.00
285.14	0.41	0.41	0.00	285.67	0.48	0.48	0.00
285.15	0.41	0.41	0.00	285.68	0.48	0.48	0.00
285.16	0.41	0.41	0.00	285.69	0.48	0.48	0.00
285.17	0.41	0.41	0.00	285.70	0.48	0.48	0.00
285.18	0.41	0.41	0.00	285.71	0.48	0.48	0.00
285.19	0.41	0.41	0.00	285.72	0.48	0.48	0.00
285.20	0.42	0.42	0.00	285.73	0.48	0.48	0.00
285.21	0.42	0.42	0.00	285.74	0.49	0.49	0.00
285.22	0.42	0.42	0.00	285.75	0.49	0.49	0.00
285.23	0.42	0.42	0.00	285.76	0.49	0.49	0.00
285.24	0.42	0.42	0.00	285.77	0.49	0.49	0.00
285.25	0.42	0.42	0.00	285.78	0.49	0.49	0.00
285.26	0.42	0.42	0.00	285.79	0.49	0.49	0.00
285.27	0.42	0.42	0.00	285.80	0.49	0.49	0.00

2712-02A - Proposed HydroCAD

Type III 24-hr 100-year Rainfall=8.78"

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Stage-Discharge for Pond IS-1: IS-1 (continued)

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
285.81	0.50	0.50	0.00	286.34	0.56	0.56	0.00
285.82	0.50	0.50	0.00	286.35	0.57	0.57	0.00
285.83	0.50	0.50	0.00	286.36	0.57	0.57	0.00
285.84	0.50	0.50	0.00	286.37	0.57	0.57	0.00
285.85	0.50	0.50	0.00	286.38	0.57	0.57	0.00
285.86	0.50	0.50	0.00	286.39	0.57	0.57	0.00
285.87	0.50	0.50	0.00	286.40	0.57	0.57	0.00
285.88	0.50	0.50	0.00	286.41	0.57	0.57	0.00
285.89	0.51	0.51	0.00	286.42	0.57	0.57	0.00
285.90	0.51	0.51	0.00	286.43	0.58	0.58	0.00
285.91	0.51	0.51	0.00	286.44	0.58	0.58	0.00
285.92	0.51	0.51	0.00	286.45	0.58	0.58	0.00
285.93	0.51	0.51	0.00	286.46	0.58	0.58	0.00
285.94	0.51	0.51	0.00	286.47	0.58	0.58	0.00
285.95	0.51	0.51	0.00	286.48	0.58	0.58	0.00
285.96	0.51	0.51	0.00	286.49	0.58	0.58	0.00
285.97	0.52	0.52	0.00	286.50	0.58	0.58	0.00
285.98	0.52	0.52	0.00	286.51	0.59	0.59	0.00
285.99	0.52	0.52	0.00	286.52	0.59	0.59	0.00
286.00	0.52	0.52	0.00	286.53	0.59	0.59	0.00
286.01	0.52	0.52	0.00	286.54	0.59	0.59	0.00
286.02	0.52	0.52	0.00	286.55	0.59	0.59	0.00
286.03	0.52	0.52	0.00	286.56	0.59	0.59	0.00
286.04	0.52	0.52	0.00	286.57	0.59	0.59	0.00
286.05	0.53	0.53	0.00	286.58	0.60	0.60	0.00
286.06	0.53	0.53	0.00	286.59	0.60	0.60	0.00
286.07	0.53	0.53	0.00	286.60	0.60	0.60	0.00
286.08	0.53	0.53	0.00	286.61	0.60	0.60	0.00
286.09	0.53	0.53	0.00	286.62	0.60	0.60	0.00
286.10	0.53	0.53	0.00	286.63	0.60	0.60	0.00
286.11	0.53	0.53	0.00	286.64	0.60	0.60	0.00
286.12	0.54	0.54	0.00	286.65	0.60	0.60	0.00
286.13	0.54	0.54	0.00	286.66	0.61	0.61	0.00
286.14	0.54	0.54	0.00	286.67	0.61	0.61	0.00
286.15	0.54	0.54	0.00	286.68	0.61	0.61	0.00
286.16	0.54	0.54	0.00	286.69	0.61	0.61	0.00
286.17	0.54	0.54	0.00	286.70	0.61	0.61	0.00
286.18	0.54	0.54	0.00	286.71	0.61	0.61	0.00
286.19	0.54	0.54	0.00	286.72	0.61	0.61	0.00
286.20	0.55	0.55	0.00	286.73	0.61	0.61	0.00
286.21	0.55	0.55	0.00	286.74	0.62	0.62	0.00
286.22	0.55	0.55	0.00	286.75	0.62	0.62	0.00
286.23	0.55	0.55	0.00	286.76	0.62	0.62	0.00
286.24	0.55	0.55	0.00	286.77	0.62	0.62	0.00
286.25	0.55	0.55	0.00	286.78	0.62	0.62	0.00
286.26	0.55	0.55	0.00	286.79	0.62	0.62	0.00
286.27	0.55	0.55	0.00	286.80	0.62	0.62	0.00
286.28	0.56	0.56	0.00	286.81	0.63	0.63	0.00
286.29	0.56	0.56	0.00	286.82	0.63	0.63	0.00
286.30	0.56	0.56	0.00	286.83	0.63	0.63	0.00
286.31	0.56	0.56	0.00	286.84	0.63	0.63	0.00
286.32	0.56	0.56	0.00	286.85	0.63	0.63	0.00
286.33	0.56	0.56	0.00	286.86	0.63	0.63	0.00

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Stage-Discharge for Pond IS-1: IS-1 (continued)

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
286.87	0.63	0.63	0.00	287.40	0.70	0.70	0.00
286.88	0.63	0.63	0.00	287.41	0.70	0.70	0.00
286.89	0.64	0.64	0.00	287.42	0.70	0.70	0.00
286.90	0.64	0.64	0.00	287.43	0.71	0.71	0.00
286.91	0.64	0.64	0.00	287.44	0.71	0.71	0.00
286.92	0.64	0.64	0.00	287.45	0.71	0.71	0.00
286.93	0.64	0.64	0.00	287.46	0.71	0.71	0.00
286.94	0.64	0.64	0.00	287.47	0.71	0.71	0.00
286.95	0.64	0.64	0.00	287.48	0.71	0.71	0.00
286.96	0.64	0.64	0.00	287.49	0.71	0.71	0.00
286.97	0.65	0.65	0.00	287.50	0.71	0.71	0.00
286.98	0.65	0.65	0.00	287.51	0.72	0.72	0.00
286.99	0.65	0.65	0.00	287.52	0.72	0.72	0.00
287.00	0.65	0.65	0.00	287.53	0.72	0.72	0.00
287.01	0.65	0.65	0.00	287.54	0.72	0.72	0.00
287.02	0.65	0.65	0.00	287.55	0.72	0.72	0.00
287.03	0.65	0.65	0.00	287.56	0.72	0.72	0.00
287.04	0.65	0.65	0.00	287.57	0.72	0.72	0.00
287.05	0.66	0.66	0.00	287.58	0.73	0.73	0.00
287.06	0.66	0.66	0.00	287.59	0.73	0.73	0.00
287.07	0.66	0.66	0.00	287.60	0.73	0.73	0.00
287.08	0.66	0.66	0.00	287.61	0.73	0.73	0.00
287.09	0.66	0.66	0.00	287.62	0.73	0.73	0.00
287.10	0.66	0.66	0.00	287.63	0.73	0.73	0.00
287.11	0.66	0.66	0.00	287.64	0.73	0.73	0.00
287.12	0.67	0.67	0.00	287.65	0.73	0.73	0.00
287.13	0.67	0.67	0.00	287.66	0.74	0.74	0.00
287.14	0.67	0.67	0.00	287.67	0.74	0.74	0.00
287.15	0.67	0.67	0.00	287.68	0.74	0.74	0.00
287.16	0.67	0.67	0.00	287.69	0.74	0.74	0.00
287.17	0.67	0.67	0.00	287.70	0.74	0.74	0.00
287.18	0.67	0.67	0.00	287.71	0.74	0.74	0.00
287.19	0.67	0.67	0.00	287.72	0.74	0.74	0.00
287.20	0.68	0.68	0.00	287.73	0.74	0.74	0.00
287.21	0.68	0.68	0.00	287.74	0.75	0.75	0.00
287.22	0.68	0.68	0.00	287.75	0.75	0.75	0.00
287.23	0.68	0.68	0.00	287.76	0.75	0.75	0.00
287.24	0.68	0.68	0.00	287.77	0.75	0.75	0.00
287.25	0.68	0.68	0.00	287.78	0.75	0.75	0.00
287.26	0.68	0.68	0.00	287.79	0.75	0.75	0.00
287.27	0.68	0.68	0.00	287.80	0.75	0.75	0.00
287.28	0.69	0.69	0.00	287.81	0.76	0.76	0.00
287.29	0.69	0.69	0.00	287.82	0.76	0.76	0.00
287.30	0.69	0.69	0.00	287.83	0.76	0.76	0.00
287.31	0.69	0.69	0.00	287.84	0.76	0.76	0.00
287.32	0.69	0.69	0.00	287.85	0.76	0.76	0.00
287.33	0.69	0.69	0.00	287.86	0.76	0.76	0.00
287.34	0.69	0.69	0.00	287.87	0.76	0.76	0.00
287.35	0.70	0.70	0.00	287.88	0.76	0.76	0.00
287.36	0.70	0.70	0.00	287.89	0.77	0.77	0.00
287.37	0.70	0.70	0.00	287.90	0.77	0.77	0.00
287.38	0.70	0.70	0.00	287.91	0.77	0.77	0.00
287.39	0.70	0.70	0.00	287.92	0.77	0.77	0.00

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Stage-Discharge for Pond IS-1: IS-1 (continued)

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
287.93	0.77	0.77	0.00	288.46	0.84	0.84	0.00
287.94	0.77	0.77	0.00	288.47	0.84	0.84	0.00
287.95	0.77	0.77	0.00	288.48	0.84	0.84	0.00
287.96	0.77	0.77	0.00	288.49	0.84	0.84	0.00
287.97	0.78	0.78	0.00	288.50	0.84	0.84	0.00
287.98	0.78	0.78	0.00	288.51	0.85	0.85	0.00
287.99	0.78	0.78	0.00	288.52	0.85	0.85	0.00
288.00	0.78	0.78	0.00	288.53	0.85	0.85	0.00
288.01	0.78	0.78	0.00	288.54	0.85	0.85	0.00
288.02	0.78	0.78	0.00	288.55	0.85	0.85	0.00
288.03	0.78	0.78	0.00	288.56	0.85	0.85	0.00
288.04	0.78	0.78	0.00	288.57	0.85	0.85	0.00
288.05	0.79	0.79	0.00	288.58	0.86	0.86	0.00
288.06	0.79	0.79	0.00	288.59	0.86	0.86	0.00
288.07	0.79	0.79	0.00	288.60	0.86	0.86	0.00
288.08	0.79	0.79	0.00	288.61	0.86	0.86	0.00
288.09	0.79	0.79	0.00	288.62	0.86	0.86	0.00
288.10	0.79	0.79	0.00	288.63	0.86	0.86	0.00
288.11	0.79	0.79	0.00	288.64	0.86	0.86	0.00
288.12	0.80	0.80	0.00	288.65	0.86	0.86	0.00
288.13	0.80	0.80	0.00	288.66	0.87	0.87	0.00
288.14	0.80	0.80	0.00	288.67	0.87	0.87	0.00
288.15	0.80	0.80	0.00	288.68	0.87	0.87	0.00
288.16	0.80	0.80	0.00	288.69	0.87	0.87	0.00
288.17	0.80	0.80	0.00	288.70	0.87	0.87	0.00
288.18	0.80	0.80	0.00	288.71	0.87	0.87	0.00
288.19	0.80	0.80	0.00	288.72	0.87	0.87	0.00
288.20	0.81	0.81	0.00	288.73	0.87	0.87	0.00
288.21	0.81	0.81	0.00	288.74	0.88	0.88	0.00
288.22	0.81	0.81	0.00	288.75	0.88	0.88	0.00
288.23	0.81	0.81	0.00	288.76	0.88	0.88	0.00
288.24	0.81	0.81	0.00	288.77	0.88	0.88	0.00
288.25	0.81	0.81	0.00	288.78	0.88	0.88	0.00
288.26	0.81	0.81	0.00	288.79	0.88	0.88	0.00
288.27	0.81	0.81	0.00	288.80	0.88	0.88	0.00
288.28	0.82	0.82	0.00	288.81	0.88	0.88	0.00
288.29	0.82	0.82	0.00	288.82	0.89	0.89	0.00
288.30	0.82	0.82	0.00	288.83	0.89	0.89	0.00
288.31	0.82	0.82	0.00	288.84	0.89	0.89	0.00
288.32	0.82	0.82	0.00	288.85	0.89	0.89	0.00
288.33	0.82	0.82	0.00	288.86	0.89	0.89	0.00
288.34	0.82	0.82	0.00	288.87	0.89	0.89	0.00
288.35	0.83	0.83	0.00	288.88	0.89	0.89	0.00
288.36	0.83	0.83	0.00	288.89	0.90	0.90	0.00
288.37	0.83	0.83	0.00	288.90	0.90	0.90	0.00
288.38	0.83	0.83	0.00	288.91	0.90	0.90	0.00
288.39	0.83	0.83	0.00	288.92	0.90	0.90	0.00
288.40	0.83	0.83	0.00	288.93	0.90	0.90	0.00
288.41	0.83	0.83	0.00	288.94	0.90	0.90	0.00
288.42	0.83	0.83	0.00	288.95	0.90	0.90	0.00
288.43	0.84	0.84	0.00	288.96	0.90	0.90	0.00
288.44	0.84	0.84	0.00	288.97	0.91	0.91	0.00
288.45	0.84	0.84	0.00	288.98	0.91	0.91	0.00

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Stage-Discharge for Pond IS-1: IS-1 (continued)

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
288.99	0.91	0.91	0.00	289.52	0.98	0.98	0.00
289.00	0.91	0.91	0.00	289.53	0.98	0.98	0.00
289.01	0.91	0.91	0.00	289.54	0.98	0.98	0.00
289.02	0.91	0.91	0.00	289.55	0.98	0.98	0.00
289.03	0.91	0.91	0.00	289.56	0.98	0.98	0.00
289.04	0.91	0.91	0.00	289.57	0.98	0.98	0.00
289.05	0.92	0.92	0.00	289.58	0.99	0.99	0.00
289.06	0.92	0.92	0.00	289.59	0.99	0.99	0.00
289.07	0.92	0.92	0.00	289.60	0.99	0.99	0.00
289.08	0.92	0.92	0.00	289.61	1.00	0.99	0.01
289.09	0.92	0.92	0.00	289.62	1.03	0.99	0.04
289.10	0.92	0.92	0.00	289.63	1.06	0.99	0.07
289.11	0.92	0.92	0.00	289.64	1.10	0.99	0.10
289.12	0.93	0.93	0.00	289.65	1.14	0.99	0.15
289.13	0.93	0.93	0.00	289.66	1.19	1.00	0.19
289.14	0.93	0.93	0.00	289.67	1.24	1.00	0.24
289.15	0.93	0.93	0.00	289.68	1.29	1.00	0.29
289.16	0.93	0.93	0.00	289.69	1.35	1.00	0.35
289.17	0.93	0.93	0.00	289.70	1.41	1.00	0.41
289.18	0.93	0.93	0.00	289.71	1.48	1.00	0.47
289.19	0.93	0.93	0.00	289.72	1.54	1.00	0.54
289.20	0.94	0.94	0.00	289.73	1.61	1.00	0.61
289.21	0.94	0.94	0.00	289.74	1.69	1.01	0.68
289.22	0.94	0.94	0.00	289.75	1.76	1.01	0.75
289.23	0.94	0.94	0.00	289.76	1.84	1.01	0.83
289.24	0.94	0.94	0.00	289.77	1.92	1.01	0.91
289.25	0.94	0.94	0.00	289.78	2.00	1.01	0.99
289.26	0.94	0.94	0.00	289.79	2.09	1.01	1.07
289.27	0.94	0.94	0.00	289.80	2.17	1.01	1.16
289.28	0.95	0.95	0.00	289.81	2.26	1.01	1.25
289.29	0.95	0.95	0.00	289.82	2.35	1.02	1.33
289.30	0.95	0.95	0.00	289.83	2.44	1.02	1.43
289.31	0.95	0.95	0.00	289.84	2.54	1.02	1.52
289.32	0.95	0.95	0.00	289.85	2.63	1.02	1.61
289.33	0.95	0.95	0.00	289.86	2.73	1.02	1.71
289.34	0.95	0.95	0.00	289.87	2.83	1.02	1.81
289.35	0.96	0.96	0.00	289.88	2.93	1.02	1.91
289.36	0.96	0.96	0.00	289.89	3.04	1.03	2.01
289.37	0.96	0.96	0.00	289.90	3.14	1.03	2.12
289.38	0.96	0.96	0.00	289.91	3.25	1.03	2.22
289.39	0.96	0.96	0.00	289.92	3.36	1.03	2.33
289.40	0.96	0.96	0.00	289.93	3.37	1.03	2.33
289.41	0.96	0.96	0.00	289.94	3.37	1.03	2.34
289.42	0.96	0.96	0.00	289.95	3.38	1.03	2.34
289.43	0.97	0.97	0.00	289.96	3.38	1.03	2.35
289.44	0.97	0.97	0.00	289.97	3.39	1.04	2.35
289.45	0.97	0.97	0.00	289.98	3.39	1.04	2.35
289.46	0.97	0.97	0.00	289.99	3.40	1.04	2.36
289.47	0.97	0.97	0.00	290.00	3.40	1.04	2.36
289.48	0.97	0.97	0.00	290.01	3.41	1.04	2.36
289.49	0.97	0.97	0.00	290.02	3.41	1.04	2.37
289.50	0.97	0.97	0.00	290.03	3.42	1.04	2.37
289.51	0.98	0.98	0.00	290.04	3.42	1.04	2.38

2712-02A - Proposed HydroCAD

Type III 24-hr 100-year Rainfall=8.78"

Prepared by Allen & Major Associates, Inc

Printed 4/27/2023

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Stage-Discharge for Pond IS-1: IS-1 (continued)

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
290.05	3.43	1.05	2.38
290.06	3.43	1.05	2.38
290.07	3.44	1.05	2.39
290.08	3.44	1.05	2.39
290.09	3.45	1.05	2.39
290.10	3.45	1.05	2.40
290.11	3.46	1.05	2.40
290.12	3.46	1.06	2.41
290.13	3.47	1.06	2.41
290.14	3.47	1.06	2.41
290.15	3.48	1.06	2.42
290.16	3.48	1.06	2.42
290.17	3.49	1.06	2.42
290.18	3.49	1.06	2.43
290.19	3.50	1.06	2.43
290.20	3.50	1.07	2.43
290.21	3.51	1.07	2.44
290.22	3.51	1.07	2.44
290.23	3.51	1.07	2.45
290.24	3.52	1.07	2.45
290.25	3.52	1.07	2.45
290.26	3.53	1.07	2.46
290.27	3.53	1.07	2.46
290.28	3.54	1.08	2.46
290.29	3.54	1.08	2.47
290.30	3.55	1.08	2.47
290.31	3.55	1.08	2.47
290.32	3.56	1.08	2.48
290.33	3.56	1.08	2.48
290.34	3.57	1.08	2.48
290.35	3.57	1.09	2.49
290.36	3.58	1.09	2.49
290.37	3.58	1.09	2.50
290.38	3.59	1.09	2.50
290.39	3.59	1.09	2.50
290.40	3.60	1.09	2.51
290.41	3.60	1.09	2.51
290.42	3.61	1.09	2.51
290.43	3.61	1.10	2.52
290.44	3.62	1.10	2.52
290.45	3.62	1.10	2.52
290.46	3.63	1.10	2.53
290.47	3.63	1.10	2.53
290.48	3.64	1.10	2.53
290.49	3.64	1.10	2.54
290.50	3.65	1.10	2.54



Project No.	2712-02A	Sheet	1 of 2
Project Description	25 Forge Parkway		
	Franklin, MA		
Calculated By	SM	Date	04/27/23
Checked By	BDJ	Date	04/27/23

Outlet # Headwall-01
 Q100 = **2.53** cfs $T_w = 0.25$ feet
 $D_o = 8$ inches

Design Criteria

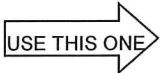
Apron Dimensions

The dimensions of the apron at the outlet of the pipe shall be determined as follows:

- 1.) The width of the apron at the outlet of the pipe or channel shall be 3 times the diameter of the pipe or width of the channel.

$W = 2$ feet

- 2.) The length of the apron shall be determined from the following formula when the tailwater depth at the outlet of the pipe or channel is less than one-half the diameter of the pipe or one-half the width of the channel:



$La = 1.8 * Q / Do^{3/2} + 7Do$
 $La = 13.03$ feet

Where:

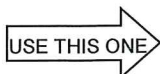
La is the length of the apron
 Q is the discharge from the pipe or channel
 D_o is the diameter of pipe or width of channel

- 3.) When the depth of the tailwater at the outlet of the pipe or channel is equal to or greater than one-half the diameter of the pipe or the width of the channel. Then the following formula applies:

$La = 3.0 * Qo / Do^{1.5} + 7D_o$
 $La = 18.61$ feet

- 4.) Where there is no well defined channel downstream of the outlet, the width of the downstream end of the apron shall be determined as follows:

- a. For minimum tailwater conditions where the tailwater depth is less than the elevation of the center of the pipe:



$W = 3 * Do + La$
 $W = 15.03$ feet

- b. For maximum tailwater conditions where the tailwater depth is greater than the elevation of the center of the pipe:

$W = 3 * Do + 0.4 * La$
 $W = 9.44$ feet



Project No.	2712-02A	Sheet	2 of 2
Project Description	25 Forge Parkway		
	Franklin, MA		
Calculated By	SM	Date	04/27/23
Checked By	BDJ	Date	04/27/23

- 5.) Where there is a stable well-defined channel downstream of the apron, the bottom of the apron shall be equal to the width of the channel.
- 6.) The side of the apron in a well-defined channel shall be 2:1 (horizontal to vertical) or flatter. The height of the structural lining along the channel sides shall begin at the elevation equal to the top of conduit and taper down to the channel bottom through the length of the apron.
- 7.) The bottom grade of the apron shall be level (0% grade). No overfall is allowable at the end of the apron.
- 8.) The apron shall be located so that there are no bends in the horizontal alignment of the apron.

Rock Riprap

The following criteria shall be used to determine the dimensions of the rock riprap used for the apron:

- 1.) The median stone diameter shall be determined using the formula:

$$d_{50} = 0.02 * Q^{4/3} / (Tw * D_0)$$

$d_{50} =$ **4.95** inches **USE 5** inches
 d_{50} minimum 3 inches

Where:
 d_{50} is the median stone diameter in feet
 Tw is the tailwater depth above the invert of the pipe channel in feet
 Q is the discharge from the pipe or channel in cubic feet per second
 D_0 is the diameter of the pipe or width of the channel in feet

- 2.) Fifty percent by weight of the riprap mixture shall be smaller than the median size stone designated as d_{50} . The largest stone size in the mixture shall be 1.5 times the d_{50} size.
- 3.) The quality and gradation of the rock, the thickness of the riprap lining, filter material and the quality of the stone shall meet the requirements in the Rock Riprap BMP. The minimum depth shall be 6 inches or 1.5 times the largest stone size in the mixture whichever is larger (d).

Thickness of the riprap
 $d = 1.5 * (1.5 * d_{50} (\text{largest stone size}))$
 $d =$ **11** inches*
* must use a minimum of 6"

Rock Rip Rap Gradation

% of weight smaller than the given size	size of stone in inches		
		to	
100	7.5	to	10.0
85	6.5	to	9.0
50	5.0	to	7.5
15	1.5	to	2.5

Formulas Used (Reference NHDES Handbook, Pages 7-114, 7-115)