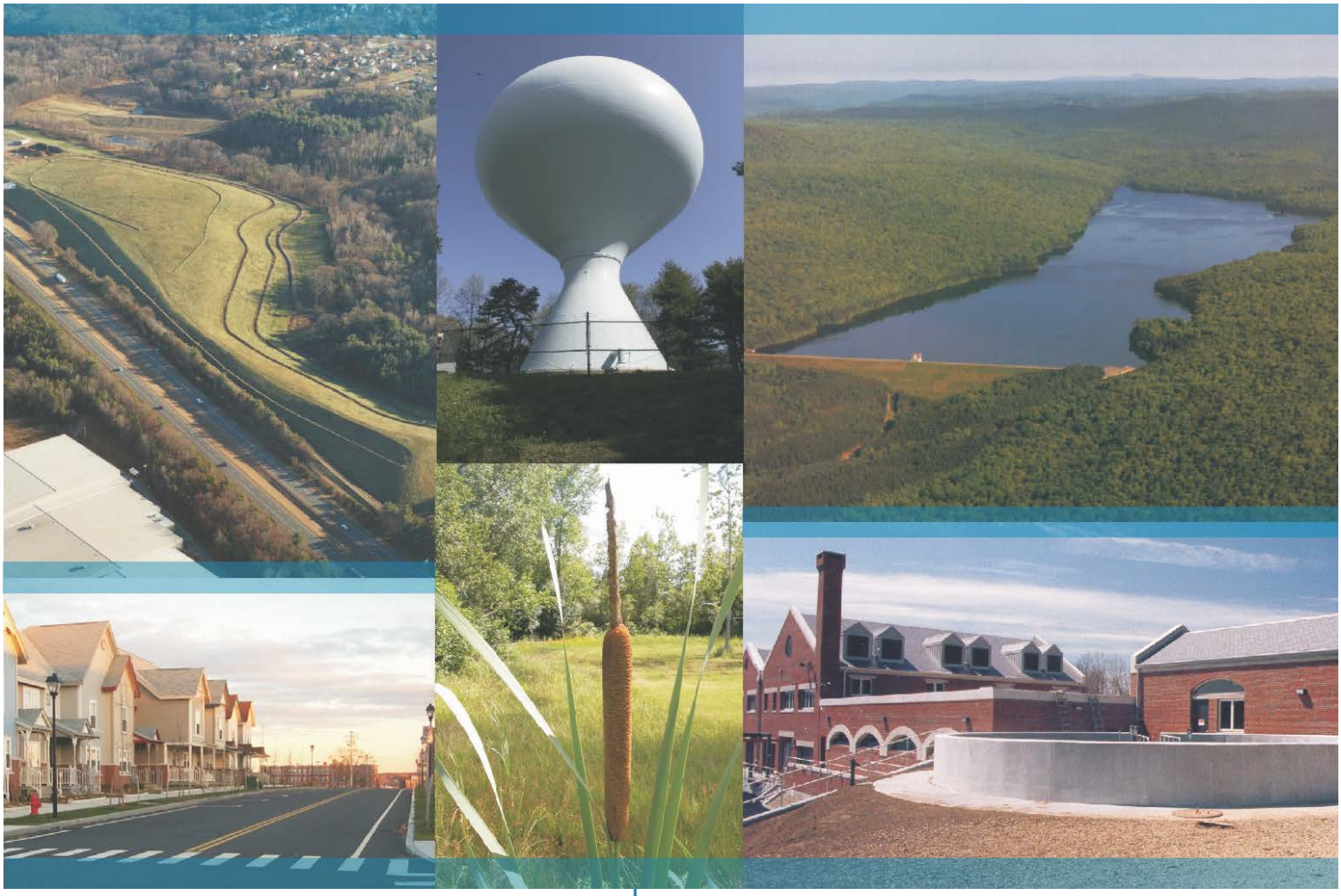

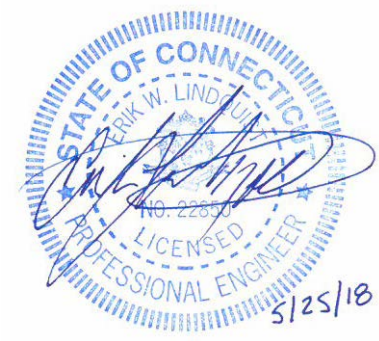

Tighe&Bond

Corbin Block Development
Darien, CT

Engineering Report

Prepared For:

Baywater Corbin Partners, LLC
Darien, CT

May 25, 2018

Section 1
Introduction and Site Conditions

Tighe & Bond, Inc. has prepared this report at the request of Baywater Corbin Partners, LLC (Baywater) to support their applications to the Town Planning and Zoning Commission and Environmental Protection Commission for the proposed Corbin Block Mixed-Use Project.

The development site is located within the new Corbin Subarea of the Central Business District (CBD) as defined by the Town of Darien zoning regulations. The property is situated in the Downtown area of Darien, just north of Interstate 95. The Boston Post Road (U.S. Route 1) bounds the site on the west, properties adjacent to the north side of Corbin Drive bounds the site on the north, Old Kings Highway South on the east, and Interstate 95 on the south. The Darien Metro North Railroad Station is located less than a quarter mile to the north of the project site. See attached Site Location Map (Figure 1).

The plan includes demolishing of all the existing structures, and creating a mixed-use project that will include retail shops, office spaces and upscale apartments on the upper floors, with sufficient off-street parking to satisfy the parking requirements of the development, and new internal drives to address traffic circulation in and around the project.

The enhanced pedestrian environment will be created by reconstructing the unattractive corridors that run along these streets. The Baywater project proposes to be a live, work, play, environment, and a destination all its own and will include the design and subsequent reconstruction of street components to advance the principles of Complete Streets, including traffic calming, sidewalk expansion and improvements to the streetscape such as lighting, paving, landscaping and street furniture. The intersection improvements are intended to calm traffic by creating crosswalk extensions, add accessibility improvements and integrate traffic signals to allow improved traffic management, giving increased priority to pedestrians and better managing peak hour traffic movements.

Tighe & Bond has inspected the property on numerous occasions, conducted meetings with representatives of the Town Department of Public Works, Planning & Zoning, Environmental Protection Commission, Connecticut Department of Transportation and utility companies.

Site analysis and design includes parking and roadway design, on-site stormwater management, sanitary sewer design, utility services design and sedimentation and erosion control.

Tighe & Bond is familiar with the property, and has reviewed and analyzed available soils, drainage, utility, and topographic information. Drainage calculations and stormwater management plans have been prepared in accordance with Town of Darien DPW Stormwater Management and Drainage Manual, Connecticut Department of Transportation (CTDOT) Drainage Manual 2000 and the Connecticut Department of Energy and Environmental Protection (CTDEEP) 2004 Stormwater Quality Manual. The drainage calculations include a hydrologic and hydraulic analysis of the existing conditions and the proposed development. More specifically, the calculations include an

analysis of the on-site stormwater management measures and their performance in handling peak flow attenuation and suspended solids removal rates. Lastly, the report also includes the proposed soil erosion and sedimentation control measures incorporated during construction and operation and maintenance of the drainage and stormwater management systems.

1.1 Project Description

The property is situated in the Downtown area of Darien, just north of Interstate 95. The properties along the north side of Corbin Drive from the northern boundary of the site while the remaining boundaries are formed by Old Kings Highway South to the east, Interstate 95 to the south, and Boston Post Road (U.S. Route 1) to the west. The Darien Metro North Railroad Station is located less than a quarter-mile to the north of the project site.

The site currently houses Bank of America, the Darien Times, a U.S. Post Office branch and several other retail and office buildings containing approximately 52,579 square feet of retail spaces and 45,961 square feet of office spaces.

Baywater's program envisions the construction of approximately 117 luxury apartments, 81,200 square feet of Class A office space, 81,730 square feet of ground floor retail, 16,910 square feet for restaurants of quality restaurant space in eight buildings. The Site will provide 744 on-site parking spaces including 22 handicap accessible spaces. The proposed project is expected to be completed in 2022.

1.2 Existing Conditions

The project site area consists of approximately 7.17 acres that are bisected by Corbin Drive. The project area is an irregular shape and is located in the Central Business District – Corbin Subarea (CBD-CS).

The overall site area is predominantly impervious, consisting of large parking areas and building coverage. The remainder of the site is mostly grasses, sparse trees and underbrush.

The project area south of the intersection of Boston Post Road and Corbin Drive is relatively flat and predominantly drains to a series of catch basins throughout the site. This on-site drainage network flows easterly to the town drainage system in Corbin Drive prior to discharging through an 18" pipe to the Goodwives River. Two smaller areas at the southernmost and northernmost corners of the site drain towards the Post Road into two separate State drainage systems. One flowing south in the Post Road and the other draining north.

The project area north of the intersection of Boston Post Road and Corbin Drive is relatively flat. Runoff from the site is collected by a series of catch basins and flows to an existing watercourse in the center of the site. The existing watercourse is fed from the State drainage system in the Post Road, and flows southeast to twin 24" pipes that convey flow under Old Kings Highway South and discharge to the Goodwives River.

Both drainage systems (north and south of Corbin Drive) will be discussed in greater detail in Section 2 of this report.

1.3 Proposed Conditions

The proposed development will consist of new mixed-use buildings, paved access driveways and surface parking areas, concrete and paver pedestrian sidewalks, a paved loading area, 3 separate parking garages, curbing, landscaping, lighting, site utilities, drainage and stormwater management. In general drainage patterns will match the existing site conditions.

The project area south of Corbin Drive will be accessed by new shared driveways from the Boston Post Road and Corbin Drive. The primary entrance on the Post Road will be one-way in, and will be located between buildings D and C. The secondary access point will be a two-way entrance from Corbin Drive located between buildings L and A. There will also be a second point of egress (one-way out) along Corbin Drive between buildings B and A.

The project area north of Corbin Drive will provide two, two-way access points along Corbin Drive that are aligned with the two egress locations from the project area south of Corbin Drive. One of these drive aisles will be between buildings I and H while the other will be located between buildings H and K. In addition, there will be a one-way exit lane for a bank teller that outlets onto the Post Road. Furthermore, the surface parking area behind Building H will be reconfigured to better facilitate integration with the existing surface parking lots adjacent to the project area.

In order to facilitate the site improvements north of Corbin Drive, the existing watercourse running parallel to Corbin Drive will be rerouted and undergrounded to increase the development footprint along Corbin Drive. The undergrounding will be accomplished by providing a 2'x4' box culvert beneath the surface parking area that will meet the existing drainage piping on either end using new stormwater chambers.

Stormwater management will be accommodated on-site. Surface runoff will be collected and conveyed in a series of area drains, catch basins, and roof leaders. The stormwater collection system will utilize a "treatment train" approach and include low impact development (LID) systems to treat the Water Quality Volume, remove total suspended solids and reduce peak flow. This will include stormwater quality systems to infiltrate runoff, and hydrodynamic separators for the removal of oils, suspended solids and various pollutants. The proposed approach to stormwater management is discussed in greater detail in Section 2 of this report.

1.4 Fresh Meadow Evaluation

Based on our drainage review it is our opinion that the proposed project is eligible for a waiver from the "fresh meadow" existing conditions analysis based on Criteria 1, 2 & 3 in Section 888 of the Town of Darien stormwater regulations as detailed below. It should be noted that the proposed project includes both storm water quality and quantity improvements and substantially improves the existing storm drainage conditions – the project is requesting a waiver from the "fresh meadow" requirement due to the size, location and nature of the project site. As detailed in Section 2 of this report, peak runoff rates are reduced in all storms through the 100-year peak storm event. The project also includes water quality volume and flow measures that meet the requirements of the CTDEEP Connecticut Stormwater Quality Manual.

Criteria 1: The size and/or location of the subject property:

The project site is roughly 7.17 Acres, which is roughly 0.56% of the overall 1,275-acre+/- Goodwives River watershed. In addition, the site is located in the lower 14% of the Goodwives River watershed. Section 5.4 of the Darien Drainage Manual states that retention or detention facilities shall not be provided in the lower reaches of large streams or rivers. The reason for this is that detention in these areas can exacerbate existing flooding issues, timing the site's peak discharge closer to the overall peak from the watershed.

Criteria 2: Based upon any unique site/characteristics of the subject property:

The stormwater management system for the site needs to incorporate the relocation of the existing watercourse north of Corbin Drive, which is part of a larger 112-acre+/- watershed. Providing detention for a storm drainage system that connects to this watershed will also negatively impact the peak flows within the box culvert since we are in the lower 5% of this watershed as well. Additionally, due to our close proximity to this watercourse and the Goodwives River, the groundwater elevation is relatively high, which makes it difficult to provide extensive detention systems.

Criteria 3: Due to the scope, nature and/or amount of work proposed within the application:

Due to the need to convey the off-site drainage from the State of Connecticut I-95 and the area south, we are very limited on the methods by which we can provide additional stormwater management on site. There are two CTDOT drainage easements that currently run through our site, which we are proposing new updated drainage piping to convey the off-site drainage for. In addition, we have met with the CTDOT who has reviewed and preliminarily approved our current drainage approach for the site. Lastly, our analysis showed that providing detention to meet the "fresh meadow" condition would increase flow within the Goodwives River.

It is our opinion and that the project meets Criteria 1, 2 & 3 in Section 888 and that a waiver of the "fresh meadow" analysis requirement by the Planning & Zoning Commission is appropriate in this instance.

1.5 Site Soils

Inland wetland and watercourse boundaries have been identified on-site by Richard Canavan of Tighe & Bond, and surveyed by William W. Seymour & Associates. The preliminary geotechnical report was prepared by Haley & Aldrich and pertinent portions have been included in the appendix for review.

The U.S. Department of Agriculture's National Resource Conservation Service (NRCS) report, deep test hole logs, and the summary of field hydrologic conductivity testing can be found in **Appendix B** of this report.

Section 2
Stormwater Management

2.1 Existing Conditions Analysis and Hydrology

In order to facilitate a review of the impact of the proposed development, we performed an existing conditions analysis of the site. The drainage area impacted by the proposed development was broken up into 5 subwatershed areas identified by Design Points A through E on the Existing Conditions Comparative Hydrology Watershed Map (Figure WM-01) located in **Appendix D** of this report. A description of each area is summarized below:

1. Design Point A – This subwatershed represents a majority of the project development area. The runoff contributing to it is collected through a series of inlets, swales, roof leaders, and drainage piping that are conveyed to the town drainage system in Corbin Drive. The system ultimately discharges to the Goodwives River through an 18-inch pipe beneath Old Kings Highway South. In addition to the area collected on-site, the subwatershed area associated with Design Point A includes runoff from two areas south of I-95. Runoff from both areas are conveyed under I-95 through culverts that discharge to a small degraded swale along the non-access line along the sites southern boundary. The swale discharges to a D-G style endwall that ties into the on-site drainage system. Due to the fact the on-site system maintains runoff from a state system, a drainage easement is currently provided to the state within the site for conveying this runoff. During more intense storm events significant ponding frequently occurs in the location of the swale and D-G endwall due to the limited capacity of the existing system. This ponding extends well into the project site and covers some lawn and surface parking areas.

2. Design Point B – The contributing area for this design point includes the flow being directed to the existing watercourse to the north of Corbin Drive which discharges to the Goodwives River beneath Old Kings Highway South via a pair of 24-inch elliptical culverts. Runoff from the site development area discharges to the watercourse through a series of paved leak-offs, roof leaders and storm drainage inlets that are piped directly to the stone lined bank that runs alongside of it. In addition to the site area, runoff from the Post Road and the balance of a larger 112-acre +/- watershed north of the post road are collected and conveyed to this control point as well. This 112-acrea +/- area includes the contributing Tilley Pond watershed, and the Metro-North Rail station. The associated watershed map for this area can be found on Figure TP WM 01 in **Appendix C** of this report. Similar to the contributing state drainage discussed under Design Point A above, the existing watercourse and piping from the post road are part of a drainage easement with the State to convey the state runoff through the subject properties. The hydraulic model prepared for this watershed was based on the Grove Street Drainage Study, prepared by Dewberry-Goodkind, Inc., dated March 21, 2007. The model was updated to reflect more accurate town drainage information, watershed areas, and outlet controls from Tilley Pond, as well as to include the existing detention that occurs adjacent to the metro-north parking lot on the north side of the rail line.

3. Design Point C – The contributing area for this watershed includes the southernmost portion of the site and includes a portion of the Bank of America office building, parking structure and access drive. Runoff is conveyed to the south to the existing State system located in the Exit 11 off-ramp for I-95.

4. Design Point D – This subwatershed area represents the eastern most portion of the site that currently drains overland off site to a series of catch basin in Corbin Drive and along Old Kings Highway South. The drainage discharges to the Goodwives River through a 15" culvert beneath Old Kings Highway south.

5. Design Point E – The subwatershed associated with Design Point E is a small area that collects runoff from a portion of Corbin Drive and Old Kings Highway South via a catch basin at the intersection of both roads. The runoff is then discharged to the Goodwives River through a 15" culvert beneath Old Kings Highway South.

The project site and the Corbin Drive watershed area discussed under Design Point B and shown on Figure , contribute to the overall Goodwives River watershed. The hydraulic model for the Goodwives River watershed was based on the Milone & McBroom Drainage Evaluation prepared in 2009. The model was updated to reflect the changes noted in the Dewberry-Goodkind study, and the associated Watershed Map can be found on Figure TP WM 01 in **Appendix C**.

The Hydrologic analysis of existing and post-development conditions was carried out by generating a computer model using three separate programs, the U.S. Army Corps of Engineers HEC-HMS Modeling system, Version 3.5, Autodesk® Storm and Sanitary Analysis 2018, and Hydraflow Hydrographs Extension for AutoCAD® Civil 3D 2018. The HEC-HMS Computer model was used to develop an existing flow in the Goodwives River at our design points.

Storm and Sanitary Analysis 2018 was used to analyze the existing flow within the watercourse north of Corbin Drive. It evaluates the watersheds and inlet flow for the pipe network extending from Tilley Pond south through the watercourse and to the design point in the Goodwives River.

Hydraflow was used to analyze the existing flow to the design points from the existing southern property. This model utilizes flows established in the HEC-HMS and the Storm and Sanitary Analysis Model to create the final model.

The methodology and equations intrinsic to the model can be found in the "Hydrologic Modeling System, HEC-HMS User's Manual, Version 3.5", dated August 2010. The data requirements for the HEC-HMS Computer model are summarized in the following categories:

1. Soil Cover.

2. Ground Cover.

3. Ground Slopes.

4. Degree, Density and Type of Development

5. Location and extent of wetlands, including swamps and ponds.

6. Time of concentration, travel time, lag time.

7. Controlled discharge structures, pipes and channel.

Each watershed contributes to the total peak discharge. The soil types were then identified and classified using the Soil Conservation Service's Soil Survey of Fairfield County, Connecticut. Using this data, CN values were determined by evaluating land uses within the watersheds, and then taking a weighted average. The calculated CN values are shown in the appendix.

Impervious and pervious areas, weighted curve numbers, and times of concentration were calculated for each watershed and inputted into a hydraulic model to determine the project's peak flow and volume as part of the comparative hydrology analysis.

The time of concentration was determined for each watershed area using the method outlined in the Connecticut Department of Transportation Drainage Manual 2000, Section 6.C. When determining the time of concentration three hundred feet was the maximum length used for overland flow, beyond that it is assumed that the flow becomes channelized. The calculations for the time of concentrations are included in the appendix, and the paths taken are shown on the watershed map.

A breakdown of exiting watershed areas, existing volumetric hydrographs, and existing watershed map are included in **Appendix D** of this report.

To determine the watershed flow characteristics for a wide range of rainfalls, flows resulting from the 2-year, 10-year, 25-year, 50-year, and 100-year, 24-hour rainfalls were analyzed. The results of this analysis are shown in Table 1 for Existing conditions.

Table 1-Existing Design Flows (CFS)

	2 YR	10 YR	25 YR	50 YR	100 YR
Design Point A	19.820	32.630	40.730	47.020	53.340
Design Point B	34.420	51.450	58.420	65.400	73.950
Design Point C	1.380	2.339	2.933	3.391	3.847
Design Point D	2.095	3.453	4.308	4.971	5.632
Design Point E	0.926	1.437	1.753	1.997	2.240

2.2 Floodplain Management

The Federal Emergency Management Agency's Flood Insurance Rate Map (FIRM) for Fairfield County, effective July 8, 2018 shows the project development area outside of any floodways or floodplains, as shown on Figure 2 of **Appendix A**.

2.3 Proposed Site Hydrologic and Hydraulic Analysis

Flows generated from the site under the proposed condition are intended to mimic the existing condition as closely as possible. In order to review the stormwater management system and the impact of the proposed development on the surrounding drainage system and the Goodwives River, we have broken this analysis up into three studies. The first will be the relocation and undergrounding of the existing watercourse north of

Corbin Drive, the second will be the proposed impact on each of the 5 design points from the project site, and finally the overall impact of the proposed development on the Goodwives River. A summary for each of these analysis is provided below:

1. Existing Watercourse – As described in Section 2.1 of this report, the existing watercourse is part of a much larger watershed (112-acres+/-) that conveys runoff from Tilley Pond, a portion of the Post Road, and the metro-north parking lots. The model was based on the Dewberry-Goodkind model and was updated to reflect more accurate town drainage information, watershed areas, and outlet controls from Tilley Pond, as well as to include the existing detention that occurs adjacent to the metro-north parking lot on the north side of the rail line. As part of the project development plan the existing watercourse will be rerouted and undergrounded to provide additional development area along Corbin Drive. The undergrounding of the system will be designed to eliminate the open watercourse by connecting the existing 42" CMP from the Post Road to the twin 24" elliptical pipes at the eastern end of the property that discharge to the Goodwives River. This will be accomplished by constructing a series of 4 custom chambers that will be connected by a 2'x4' box culvert. The chambers will be designed to provide a seamless connection to the existing infrastructure as well as to route the box culvert away from the proposed building and garage footprints. Proposed drainage north of Building H will be collected by a series of roof leaders and catch basins and conveyed to a hydrodynamic separator prior to discharging into one of the custom storm chambers. The existing infiltration system constructed as part of the 1020 Boston Post Road project will remain in place and function as it does currently due to the negligible impacts to the drainage system in this area. The existing system will make a blind connection to the box culvert with a new piped connection.

   In order to satisfy the requirements of the CT DOT the box culvert has been sized for a 50-year peak storm event, and rights to drain will be coordinated with the State prior to advancing the proposed rerouting. Additionally, the old easement for the State through the property will be released as part of the new drainage rights that will be granted by the property owner.

   Table 2 below summarizes the existing and proposed design flows through the existing water course and proposed box culvert. The design calculations associated with this analysis can be found in **Appendix C** of this report.

Table 2-Existing Connecticut DOT Watercourse (CFS)

Design Point B	2 YR	10 YR	25 YR	50 YR	100 YR
Q_{pk} - Existing	34.420	51.450	58.420	65.400	73.950
Q_{pk} - Proposed	34.340	51.290	58.230	65.170	73.370
Reduction in Peak Flow	**0.23%**	**0.31%**	**0.33%**	**0.35%**	**0.78%**

2. Corbin Block Development – As noted previously, the proposed stormwater management system has been designed to mimic existing drainage patterns as closely as possible. Provided below is a summary of each of the 5 design points (A through E) for the Corbin Block development, and the stormwater management approach for each subwatershed area. Table 3 below summarizes

the existing and proposed design flows for each of the 5 design points. The design calculations associated with this analysis can be found in **Appendix D** of this report.

a. **Design Point A** – Runoff from this subwatershed area will be collected through a series of catch basins, area drains and roof leaders and routed through an underground pipe network. In order to address the impacts from the site and to satisfy the requirements of the Darien Drainage Manual, subsurface water quality systems have been provided to fully infiltrate the water quality volume from this subwatershed area. Due to the limited opportunities on site to accommodate underground infiltration, two systems have been provided. Each system is comprised of perforated 24-inch HDPE pipe in a crushed stone envelope with an outlet control structure designed to retain the WQV while allowing flows in excess of this to bypass the system. The design is based on a 1-in/hr infiltration rate (provided by Haley & Aldrich from on-site testing) which will allow the systems to fully drain within 48 hours.

   The drainage areas to the south of I-95 currently discharge along the non-access line via an existing swale. As part of the project proposal this swale will be eliminated in favor of a piped connection to the proposed drainage system. Providing a piped connection for this system will allow runoff to be conveyed more directly to the outlet and bypass the on-site water quality system. Rights to drain will be coordinated with the State prior to advancing the proposed rerouting of this system through the site. Additionally, the old drainage easement for CTDOT through the property will be released as part of the new drainage rights that will be granted to CTDOT by the property owner.

   As noted under the description for existing site hydrology, the existing system on-site experiences significant flooding during more intense rainfall events. This is due to an inadequately sized system for the existing site area. In order to address this concern, the project proposal calls for providing an additional 18-inch pipe to run in parallel to the existing 18-inch pipe under Old Kings Highway South before discharging to the Goodwives River.

b. **Design Point B** – The subwatershed area for this design point includes runoff being directed to the proposed box culvert, which is being constructed to reroute the existing watercourse north of Corbin Drive. Due to the relative location and elevation of the proposed box culvert on the site, and the required grading and inlet locations to match existing drainage patterns behind Building H, the implementation of a water quality system to infiltrate the water quality volume in this area would not be practical. In an effort to provide compensatory storage for the water quality volume, a water quality basin has been proposed on the 33 Old Kings highway South parcel. The proposed basin has been sized to meet the water quality volume required for the subwatershed area that contributes to Design Point B. The water quality basin will divert runoff from an existing drainage system in Old Kings Highway South that currently discharges to a vegetated swale that bisects the 33 Old Kings Highway Parcel. The diversion wall will provide a low level orifice to

maintain runoff within the swale, but will divert runoff during more intense storms into the basin. Once the basin is full the runoff will then reach the overflow level on the diversion wall and will revert to discharging back into the existing swale. A riprap apron has been provided after the diversion wall to mitigate the impacts for erosive scour velocities after the diversion wall. The runoff from Old Kings Highway South is not part of the subwatershed areas for any of the 5 design points analyzed; however, this area currently goes untreated into the Goodwives River and providing stormwater quality for this compensatory runoff volume will have a comparable impact holistically on the water quality for the downtown area.

c. **Design Point C** – Design point C has been designed to mimic existing runoff patterns to the existing condition. In order to address the water quality volume for this subwatershed, a row of 24-inch perforated HDPE pipes was added with an outlet control structure. This system will function in the same way as the systems described under Design Point A. Overflow from the system will tie into the existing drainage line that discharges south into the existing drainage system located at the end of the I-95 exit 11 off-ramp.

d. **Design Point D** – The existing drainage system associated with this control point went largely unchanged. This system receives overland runoff from the eastern corner of the site and a portion of Corbin Drive. Based on the proposed development plan this subwatershed area will be reduced by roughly 0.09 acres as this reduction in area will be incorporated into the stormwater system for Design Point A.

e. **Design Point E** – The existing catch basin at the intersection of Corbin Drive and Old Kings Highway South will remain unchanged as part of the project development plan. However, the contributing area to this catch basin will be reduced by approximately 0.074-acres based on the project proposal. The reduction in area will be incorporated in the stormwater system for Design Point B.

Table 3-Comparative Hydrology (CFS)

	2 YR	10 YR	25 YR	50 YR	100 YR
Design Point A					
Q_{pk} - Existing	19.820	32.630	40.730	47.020	53.340
Q_{pk} - Proposed	9.486	27.640	37.680	46.720	53.300
Reduction in Peak Flow	**52.14%**	**15.29%**	**7.49%**	**0.64%**	**0.07%**
Design Point B					
Q_{pk} - Existing	34.420	51.450	58.420	65.400	73.950
Q_{pk} - Proposed	34.340	51.290	58.230	65.170	73.370
Reduction in Peak Flow	**0.23%**	**0.31%**	**0.33%**	**0.35%**	**0.78%**
Design Point C					
Q_{pk} - Existing	1.380	2.339	2.933	3.391	3.847
Q_{pk} - Proposed	1.360	2.179	2.808	3.302	3.791
Reduction in Peak Flow	**1.45%**	**6.84%**	**4.26%**	**2.62%**	**1.46%**
Design Point D					
Q_{pk} - Existing	2.095	3.453	4.308	4.971	5.632
Q_{pk} - Proposed	1.618	2.814	3.577	4.171	4.767
Reduction in Peak Flow	**22.77%**	**18.51%**	**16.97%**	**16.09%**	**15.36%**
Design Point E					
Q_{pk} - Existing	0.926	1.437	1.753	1.997	2.240
Q_{pk} - Proposed	0.706	1.080	1.312	1.492	1.671
Reduction in Peak Flow	**23.76%**	**24.84%**	**25.16%**	**25.29%**	**25.40%**

3. Goodwives River – As noted under the existing hydrology section, the Goodwives River analysis is based on the Milone & McBroom model from 2009. This system has bene updated to reflect the changes made to the Dewberry model as well as to reflect the proposed stormwater management system for the proposed condition. Based on this review there will be no impact to the Goodwives River at in the vicinity of the project site. A summary of the findings from this model can be found in Table 4 below:

Table 4-Goodwives River (CFS)

JM-MS-170-180					
	2 YR	**10 YR**	**25 YR**	**50 YR**	**100 YR**
Q_{pk} - Existing	441.3	979.2	1347.5	1641.5	1952.1
Q_{pk} - Proposed	440.0	976.8	1344.2	1637.5	1946.9
Reduction in Peak Flow	**0.29%**	**0.25%**	**0.24%**	**0.24%**	**0.27%**

The drainage structures and pipes have been sized to convey the 25-year storm event.

The hydrodynamic separators have been sized to treat the Water Quality Flow (WQF) as calculated using the Connecticut Department of Energy and Environmental Protection

2004 Stormwater Quality Manual. See **Appendix D** for the associated water quality calculations.

The proposed watershed maps, watershed areas, storm sewer calculations, hydrographs, Water Quality Volume and Flow calculations, are included in **Appendix D & E** of this report.

2.4 Method of Hydrology and Hydraulic Analysis

The following storm drainage design criteria were used for the comparative hydrology analysis:

1. Design storm rainfall data was taken from NOAA Atlas 14 precipitation frequency estimates.

2. Infiltration system is designed for the 25, 50, and 100-year storm events.

3. Piped storm drainage system and the outlets are designed for a 25-year storm event.

4. Minimum time of concentration = 5 minutes.

5. For rational peak flow calculations, runoff coefficients were as follows:

    a. Impervious (Pavement/Roof) areas = 0.90

    b. Wooded areas = 0.50

    c. Landscaped areas = 0.30

6. For hydrograph calculations, SCS Curve Numbers were as follows:

    a. Impervious (Pavement/Roof) areas = 98

    b. Pervious Soils = 74

7. Minimum diameter pipes, excluding roof leaders, underdrains and foundation drains = 12 inches

8. Minimum pipe slope = 0.5 percent

9. The storm water management Plan for the site is designed to treat the Water Quality Volume, remove Total Suspended Solids and promote groundwater recharge while reducing peak flow

10. Watershed areas delineated using polylines in AutoCAD Civil 3D 2015.

11. Comparative hydrology analyzed using AutoCAD Civil 3D 2015 Hydraflow Hydrographs Extension Version 10.40 by Autodesk software.

12. Storm drainage system analyzed using AutoCAD Civil 3D 2015 Hydraflow Storm Sewers Extension Version 10.40 by Autodesk software.

Runoff computations, storm sewer calculations, suspended solids removal rate and existing and proposed conditions are included in the **Appendix D & E** for review.

2.5 Low Impact Development and Best Management Practices

The stormwater management plan for the proposed site has been designed to remove a high percentage of sediments in accordance with the Connecticut Department of Energy and Environmental Protection Stormwater Quality Manual.

The stormwater management plan for this site uses "Best Management Practices ("BMPs")" to meet or exceed the Connecticut DEEP's goal of 80% removal of total suspended solids and other pollutants as described in section 2.5.

The BMPs include:

Area Drains/Catch Basins with Sumps: Area Drains and Catch Basins with sumps serve collect sediment and to prevent discharge of oil and other pollutants into the storm drainage system. All new yard drains and catch basins will have 24-inch sumps.

Hydrodynamic Separators: Hydrodynamic separators serve as pretreatment and to prevent transport of oils and sediment further downstream prior to connection to the campus storm sewer system. The proposed stormwater management system utilizes a Contech stormwater quality structures in an off-line configuration prior to discharge into the underground infiltration systems. The Contech structures have been sized in accordance with the 2004 CTDEEP Stormwater Quality Manual. Water quality flow sizing calculations are provided in **Appendix D**.

Underground Infiltration: Underground Infiltration serves as a primary treatment practice, reduces peak flow rates and promotes groundwater recharge. The proposed stormwater management system consists of three systems that each utilize perforated HDPE pipes surrounded by stone and filter fabric with an outlet control structure designed to attenuate peak flows and provide water quality.

Water Quality Basin: Infiltration basins serve as a primary treatment practice, reduce peak flow rates and promote groundwater recharge. The proposed stormwater management system consists of a water quality basin on the 33 Old Kings Highway site adjacent to the Goodwives River.

2.6 Stormwater Maintenance and Inspection Schedule

The initial inspection will be made during an intense rainfall to check the adequacy of the area drains, catch basins, roof leaders, piping, hydrodynamic separators, infiltration systems, system outlets and the water quality basin.

The following is a checklist of items that will be checked and maintained during scheduled maintenance operations.

Drainage Structures: The Owner will be responsible for cleaning the catch basins, area drains, manholes, piping, and outlet protection on their property. A Connecticut licensed hauler shall clean the sumps, and legally dispose of removed sand at an off-site location.

The road sand may not be reused or stored on-site. As part of the hauling contract, the hauler shall notify the Owner in writing where the material is being disposed.

Each catch basin and yard drain shall be inspected every four months, with one inspection occurring during the month of April. Any debris occurring within one foot from the bottom of each sump shall be removed by Vacuum "Vactor" type of maintenance equipment. Maintain a log of inspections. Remove organic matter, sand and debris from catch basins as necessary and dispose of legally.

Hydrodynamic Separator: The Contech (hydrodynamic separators) will be skimmed and oil and scum removed. In a separate operation, silt, sand and sediment will be removed. Once the structure is cleaned of debris, the chamber will be refilled with clean water to prevent wash through of debris and oil during next storm event.

Underground Infiltration: The underground infiltration systems will be cleaned of all silt, debris and sediment from the inlet structure, outlet structure and the chamber lengths. The outlet control structure will be inspected and cleaned to make sure nothing is clogging the discharge pipe.

Pavement: Paved areas shall be swept periodically by the Owner to clean trash and other debris. The Owner will sweep paved areas on its property in the spring to remove winter accumulations of road sand.

Perform a visual inspection of paved areas four times per year with one inspection after the last snowfall, but no later than April 1. Sweep accumulated sediment and debris from the paved areas. Clean paved areas as necessary during the remainder of the year.

Water Quality Basin: The basin shall be inspected two times annually. Regular maintenance includes removing accumulated debris and sediment, clearing the diversion wall and spillway, checking for erosion, vegetative bare spots, and removing invasive plant species or tree saplings.

A Maintenance and Inspection Plan, including forms and checklists, for the proposed project can be found in **Appendix F**.

Section 3
Site Utility Services

3.1 Water Supply

The Aquarion Water Company (Aquarion) supplies water to the site, and reports a 12-inch water main in Corbin Drive, a 10-inch water main in Boston Post Road and a 6-inch water main in Old Kings Highway South.

Existing hydrants in the vicinity of this project are located on the south side of Corbin Drive near the U.S. Post Office branch, and on the east side of Boston Post Road, approximately 50 feet north of Corbin Drive.

Fire flow tests conducted in May of 2015 by Aquarion on Boston Post Road in the project area indicate a residual pressure of 45 pounds per square inch (psi) and a flow rate of 2,083 gallons per minute at 20 psi.

Separate domestic water services will be brought into each of the proposed buildings. Each service will be designed to handle the peak flow. The average daily water demand will be approximately 59,942 gallons per day for the entire project.

The peak fire protection demand will be approximately 550 gallons per minute and each service will be designed to handle this peak flow. An automatic fire pump will be provided if required and sized as a function of the standpipe configuration which is not yet known.

The Aquarion Water Company anticipates no problems servicing the proposed project as indicated by the enclosed letter of service availability.

3.2 Electric Service

Electric service to the site is provided by Eversource (formerly dba Connecticut Light & Power). Overhead primary service lines are located on the southeast side of Boston Post Road and the south side of Corbin Drive. Overhead service lines feed the project site from both Boston Post Road and Corbin Drive. In addition, Eversource maintains a 115 KV ductbank under Boston Post Road and Corbin Drive that serves as a main transmission link between Glenbrook and Norwalk. This ductbank typically ranges between 4' – 10' below grade.

Eversource indicates that service for the proposed development is available. The final locations of the service connections will be coordinated with Eversource as part of the final design process. An electric load letter has been transmitted to Eversouce Electric. Once the estimated final peak demand for the total project is determined, Eversource will provide a letter of service availability and coordinate the best approach for servicing the site.

In addition, Baywater is investigating removing the overhead utility lines along the site frontage on the Post Road and Corbin Drive. Eversource and Frontier are looking into alternatives for removing these lines.

3.3 Gas Service

Eversource Gas (formerly dba Yankee Gas) provides natural gas service to the project area. Eversource maintains a 6" plastic Intermediate Pressure gas main located along the eastern side of Boston Post Road. Gas service does not currently exist in Corbin Drive. Eversource is in the process of extending and reinforcing gas service to different locations in Darien.

Gas service to the proposed development would be provided from either the intermediate pressure gas main in the Boston Post Road or from a new intermediate pressure main to be installed in Corbin Drive. The exact location of the connection will be coordinated with the Eversource Gas Company during the final design process.

Once a better understanding for the project demands are known, Eversource will coordinate with the design team on the best approach for servicing the site.

3.4 Telephone Service

Frontier Communications provides local and long-distance telephone service to the project area and also offers high speed internet and business data services. The existing network in this area is composed of a combination of overhead lines and underground ductbanks.

Telephone service to the proposed development would be provided underground from a utility pole in one of the adjacent streets. The existing buildings on the site are fed from both Boston Post Road and Corbin Drive. The exact location of the service connections will be coordinated with the utility owner during the final design process.

Frontier and Eversource are investigating removing the overhead utility lines along the site frontage on the Post Road and Corbin Drive into alternatives for removing these lines.

3.5 Cable Television Service

Altice USA provides cable service as well as high speed internet access to the project area. The majority of the existing network runs overhead and follows the same alignment as the telephone service.

The exact locations of building service connections will be coordinated with Altice USA during the final design process.

3.6 Sanitary Sewerage

The project site is in the Stony Brook Sewershed. This sewershed consists of more than 30 miles of sewers and 6 pumping stations. The wastewater from this sewershed flows to the Stony Brook Pump Station located adjacent to Stony Brook west of Boston Post Road.

Based on available Town maps, there are existing sanitary sewerage systems in both Boston Post Road and Corbin Drive. There is an 8-inch gravity sewer on the east side of Boston Post Road that flows northerly to a manhole at the intersection with Corbin Drive. A 12-inch gravity sewer in Corbin Drive flows westerly to this same manhole. The sewers combine at this manhole before crossing to the west side of Boston Post Road and flowing southerly through a main gravity trunk line. This trunk line is

composed of 15-inch gravity sewers along the project frontage, ultimately increasing to a 24-inch gravity sewer before discharging to the Stony Brook Pump Station. A 12-inch force main exits the Stony Brook Pump Station flowing southerly before connecting to a gravity sewer system at Nearwater Lane. This main ultimately outlets to the Nearwater Lane pump station.

Tighe & Bond has prepared a separate report on the Post Road/Corbin Drive Sewer System

Stonybrook Pump Station Capacity Analysis which is included as part of the Town Submission. This report concludes that the addition of the wastewater flow from the proposed Corbin Block project will not adversely impact the Darien sewer system.

Average daily flow from the existing buildings within the project limits were based on the water usage from all properties within the Corbin Drive site, or 5,341 gallons per day (gpd).

The proposed development contains a mix of residential, commercial and retail developments, and restaurants. Residential units include 30 - 1 bedroom units and 87 – 2 bedroom units. Flows from Buildings B, C, D, E, F and G will be conveyed to the sanitary sewer in the Post Road near the intersection with Leroy Avenue via a new 8-inch PVC sanitary sewer under the sidewalk that runs along the south side of the Post Road. Flows from buildings A, I, H, K and L will connect to the existing sanitary sewer in Corbin Drive. Future flows from the proposed development were based upon a sewer flow of 150 gpd/bedroom for all residential units, 0.1 gpd/sf for office and retail space, and 15 square feet/seat with 50% of total space being used for seating at the proposed restaurant. A summary of existing and future sewer flows based on the development proposal are presented below:

Existing Flows: actual water use	= 5,341 gpd
Residential Connections: 204 BR @ 150 gpd/BR	= 30,600 gpd
Office Space: 81,200 sf @0.1 gpd/sf	= 8,120 gpd
Retail Space: 81,730 sf @ 0.1 gpd/sf	= 8,173 gpd
Restaurants: 16,910 sf @ 20 gpd/sf, 15 sf/seat*	= 11,262 gpd
Total:	= 58,155 gpd
Net Increase from Site:	= 52,814 gpd

Section 4
Soil Erosion and Sedimentation Control

4.1 SESC Narrative

The stormwater management measures will address the stormwater quality once the site has been constructed and stabilized. Sedimentation and erosion control measures will be installed during construction which will minimize adverse impacts from construction activities.

All sedimentation and erosion control measures proposed for this development have been designed in accordance with the "2002 Connecticut Guidelines for Soil Erosion and Sedimentation Control" as published by the Connecticut council on soil erosion and water conservation. Additional guidelines have also been followed that are available from the Connecticut Department of Energy and Environmental Protection as recommended for sedimentation control during construction activities.

Listed below are the erosion control narrative and the erosion control notes.

General:

1. The proposed development is entitled "Corbin Block" in Darien, Connecticut.

2. Estimated:

   Project start: Spring 2019

   Project completion: TBD

3. Erosion control narrative refers to drawings C6.0 and C6.1.

4. The proposed site development will consist of clearing and grubbing the existing site, excavation and rough grading of roadways, parking areas, sidewalks and curbing.

5. The development is located in Darien, Connecticut and is located on the corner of the Post Road and Corbin Drive.

4.2 SESC Notes

1. All sedimentation and erosion control measures shall be constructed in accordance with the standards and specifications of the "2002 Connecticut Guidelines for Soil Erosion and Sediment Control", CTDEEP Bulletin No. 34, and all amendments and addenda thereto as published by the Connecticut Department of Energy and Environmental Protection.

2. Land disturbance shall be kept to the minimum necessary for construction operations.

3. All erosion control measures shall be installed as shown on the plan and elsewhere as ordered by the engineer or the town.

4. All catch basins shall be protected with a silt sacks, haybale ring, silt fence or block and stone inlet protection throughout the construction period and until all disturbed areas are thoroughly stabilized.

5. Whenever possible, erosion and sediment control measures shall be installed prior to construction. See "erosion control narrative".

6. Additional control measures shall be installed during the construction period as ordered by the engineer.

7. All sedimentation and erosion control measures shall be maintained in effective condition throughout the construction period.

8. Sediment removed shall be disposed of off-site or in a manner as required by the engineer.

9. The construction contractor shall be responsible for construction and maintenance of all control measures throughout the construction period.

10. All disturbed areas to be left exposed for more than 30 days shall be protected with a temporary vegetative cover. Seed these areas with perennial ryegrass at the rate of 40 lbs. Per acre (1 lb. Per 1,000 sq. Ft). Apply soil amendments and mulch as required to establish a uniform stand of vegetation over all disturbed areas.

11. The construction contractor shall utilize approved methods/materials for preventing the blowing and movement of dust from exposed soil surfaces onto adjacent properties and site areas.

12. The construction contractor shall maintain a supply of silt fence/haybales and anti-tracking crushed stone on site for emergency repairs.

13. All drainage structures shall be periodically inspected weekly by the construction contractor and cleaned to prevent the build-up of silt.

14. The construction contractor shall carefully coordinate the placement of erosion control measures with the phasing of construction.

15. Keep all paved roadways clean. Sweep before forecasted storms.

16. Treat all unpaved surface with 4" minimum of topsoil prior to final stabilization.

17. Haybale barriers and silt fencing shall be installed along the toe of critical cut and fill slopes.

18. The contractor shall notify the Town of Darien's environmental official prior to the installation of erosion controls, cutting of trees, or any excavation.

19. All trucks leaving the site must be covered.

20. Some control measures are permanent. These structures shall be cleaned and replenished at the end of construction. Locations of the permanent control structures are shown on the drainage plans.

23. All sedimentation and erosion controls shall be checked weekly and/or after each rain fall event. Necessary repairs shall be made without delay.

24. Prior to any forecasted rainfall, erosion and sediment controls shall be inspected and repaired as necessary.

25. After all disturbed areas have been stabilized, erosion controls may be removed once authorization to do so has been secured from the town. Disturbed areas shall be seeded and mulched.

4.3 Construction Sequence

1. Flag the limits of construction, right-of-way and tree protection zones.

2. Hold pre-construction meeting. (remember to call before you dig 1-800-922-4455).

3. Hold tree cutting meeting.

4. Install the construction entrance.

5. Install perimeter erosion and sediment controls and tree protection devices in accordance with the SESC plan.

6. Demolish existing buildings and infrastructure not to remain.

7. Make all cuts and fills required. Establish the sub-grade for the topsoil areas, parking and roadway as required and bench the building and garage to a subgrade. Allow a reasonable amount of area around the footprint of the buildings for the construction activities.

8. Provide temporary bypass for existing watercourse and construct proposed box culvert.

9. Begin construction of the buildings.

10. Install all sanitary sewers and drainage facilities starting at the outfall and proceeding upgrade. Install remaining utilities (water, electric, cable, fiber optic, telephone).

11. Prior to installing surface water controls such as temporary diversions and stone dikes, inspect existing conditions to ensure discharge locations are stable. If not stable, review discharge conditions with the design engineer and implement additional stabilization measures prior to installing water surface controls.

12. Prepare sub-base, slopes, parking areas, shoulder areas, and any other area of disturbance for final grading.

13. Install process aggregate in parking areas.

14. Place topsoil where required. Complete the perimeter landscape plantings.

15. Fine grade, rake, seed and mulch to within 2 feet of the curbing.

16. Upon substantial completion of the buildings, complete the balance of site work and stabilization of all other disturbed areas. Install first course of paving.

17. When all other work has been completed, repair and sweep all paved areas for the final course of paving. Inspect the drainage system and clean as needed.

18. Install final course of pavement for parking areas and roadway.

19. After site is stabilized, remove temporary erosion and sediment controls (e.g. geotextile silt fences and haybales).

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