

April 23, 2021

Mr. Richard S. Novak, Chairman
Sherborn Zoning Board of Appeals
Town Hall
19 Washington Street
Sherborn, MA 01770

**Re: Wetlands Protection Recommendations
Coolidge Crossing Comprehensive Permit
84-86 Coolidge Street, Sherborn, Massachusetts
Responses to Comments**

Dear Mr. Novak:

Baystone Sherborn, LLC and Civil Design Group, LLC (CDG) are in receipt of the memorandum prepared by Tetra Tech (TT), dated April 20, 2021, for the above-referenced project. Our responses are provided below in **bold** following each of TT's comments (*in italics*).

The Project has requested a waiver from the Sherborn General Wetlands Bylaw (Wetlands Bylaw) in its entirety which we do not recommend granting. In our opinion, the request is overly broad and unnecessary given the Project, as currently proposed, requires only limited relief. We recommend any request for relief be specific and include a justification for granting such relief and a description of any specific mitigation offered in exchange so the Board can balance the need for affordable housing with local concerns expressed in the Wetlands Bylaw.

The Project has requested specific relief from the 50-foot No Alteration Zone (NAZ) requirement of the Sherborn Wetlands Regulations (Wetlands Regulations). Recognizing that balancing affordable housing needs with the local desire to protect wetland resources is a difficult task, we recommend the Board consider Massachusetts Wetlands Protection Act (WPA) performance standards for protection of Riverfront Area. In our judgement, Riverfront Area, like NAZ, is typically comprised of upland area adjacent to a surface water and as such can serve as a reasonable surrogate in evaluating impacts. Riverfront Area performance standards in the WPA consider Projects limiting alteration to less than 10% of total Riverfront Area as having no significant impact. We recommend the Board request the applicant provide a summary comparing Project impacts within the 50-foot "No Alteration Zone" to the 10% alteration standard for Riverfront Area to assist the Board in its evaluation.

The applicant is requesting relief of the 50-foot NAZ to fulfill an important need for affordable housing by developing a community that maximizes affordable units and balances a diversity of housing that Sherborn currently lacks. A compact project design minimizes environmental impacts for the proposed number of units. Coolidge Crossing will help expand housing opportunities in Sherborn to meet the needs of people of all abilities, income levels and household types in a manner that is compatible with the community's character and vision.

In addition to being a very compact development, the project design incorporates the following features and elements to mitigate for the work proposed in portions of the 50-foot NAZ:

- The project does not propose any wetland alteration. All site disturbance is limited to upland areas only.
- The vast majority (81%±) of the on-site NAZ will remain untouched.
- All impervious areas including pavement and building footprints have been held a minimum of 50 feet from wetlands.
- The front and rear yards of the buildings were kept very small to keep the limit of disturbance very compact.
- The design provides parking at a ratio of 1.67 spaces per unit, sufficient for residents and guests without being over-parked thereby limiting impervious area and overall site disturbance.
- Parking spaces that do not abut sidewalks have been reduced in length from 20' to 18' in length to reduce impervious area and to shrink the overall limit of work.
- The project includes garage structures over some of the surface parking spaces, which reduces rainwater contact with paved surfaces thereby reducing potential pollutant loading.
- A highly detailed stormwater design model has been provided and peer reviewed, which reasonably maintains the existing stormwater runoff characteristics of the site.
- The design provides a very high level of stormwater treatment utilizing deep sump hooded catch basins, water quality units designed for a one-inch water quality storm, as well as extensive infiltration practices.
- Buffer zone mitigation plantings have been proposed to enhance the wildlife habitat value of the NAZ.
- Wildlife corridor crossings have been proposed to provide pathways for small animals to make their way between the two main wetland areas that flank the site.
- The lighting plan has been updated to incorporate fixture specifications that will be least impactful to the NAZ areas.
- The design plans have been adjusted to pull the limit of work farther from wetland areas resulting in a reduction of 5,314± square feet of buffer zone impact (3,102± square feet in the 0'-50' inner buffer and 2,212± square feet in the 50'-100' outer buffer) as compared with the originally-submitted design plans.

In response to TT's suggested approach of applying the WPA's Riverfront Area performance standards to the NAZ, we have prepared Exhibit A (attached) to provide a summary of the work proposed within the NAZ. The referenced performance standards consider up to 10% alteration of the Riverfront Area as having no significant adverse impact and provide an allowance for structural stormwater management practices to be located within the Riverfront Area. As shown on Exhibit A, the proposed non-stormwater related work within the NAZ accounts for 9% of the on-site NAZ, thereby meeting the suggested 10% performance standard.

STORMWATER MANAGEMENT

The Project has worked cooperatively to minimize impacts to resource areas and their buffer zones and has demonstrated compliance with applicable sections of the Massachusetts Stormwater Handbook. The Handbook is the recognized standard for demonstrating proper stormwater design and the Project designer

(CDG) has shown a clear understanding of those requirements and ability to incorporate them into an efficient project layout and design.

- a. *We support any additional measures to reduce impervious surfaces, particularly paved surfaces, including reasonable reductions to required parking space and drive aisle dimensions but generally avoid mandating pervious paving systems for high traffic paved surfaces. Any request to reduce parking space or drive aisle dimensions should come from the Project and its design team as they assume responsibility for the design.*

In accordance with the commitment made on our February 24, 2021 peer review response letter, the project plans have been updated to reduce the size of parking spaces that do not abut a sidewalk from 20' to 18' in length. This modification reduces impervious area and shrinks the overall limit of work.

- b. *As indicated in the CDG Response, the Project meets all applicable requirements of the Stormwater Management Handbook including meeting the highest standard for water quality pre-treatment, using infiltrating stormwater basins with high pollutant removal performance, and maintaining required offsets from estimated seasonal high groundwater. In our opinion the design includes robust measures for improving stormwater quality prior to its eventual discharge to the adjacent wetlands and additional measures for water quality treatment are not warranted.*

No response required.

- c. *Adjacent wetland hydrology is more substantively impacted by runoff from the larger Peters Hill watershed to the east and groundwater associated with Course Brook. We do not anticipate the Project will alter wetland hydrology in any significant way provided stormwater management systems are constructed and maintained as represented in the Comprehensive Permit documentation. We recommend the Board include a condition requiring the Project provide all measures described in the Long-Term Operation and Maintenance Plan included in the submittal materials.*

No response required.

- d. *Rainwater collection is an appropriate measure for reducing potable demands and is worth considering as a potential option for offsetting non-potable water demand. However, those measures typically provide very little, if any, demonstrable benefit for managing stormwater due primarily to the large volume of water being managed during a design storm event.*

No response required.

WILDLIFE HABITAT IMPACTS AND MITIGATION

As noted in our earliest comment letter, the Project Site occupies a large portion of the upland area and effectively cuts off access between the wetlands flanking the site. Additionally, Coolidge Street acts as a similar barrier to the west. As such, we recommend the Project incorporate measures to accommodate smaller wildlife seeking to move between the two wetland systems. Larger wildlife is not expected to be affected as the project is relatively narrow with a traversable grade providing suitable opportunity for wetland to wetland movement for larger animals.

- a. *We agree and support incorporation of additional measures for small wildlife passage. In our opinion signage alerting motorists as described in the CDG Response is unnecessary and of little benefit. We would rather see simple crossings incorporated on either side of Building 2 instead. Crossings need only extend across the paved ways and be sized to accommodate wildlife smaller than six inches.*

The project plans have been updated to include wildlife passageways between Buildings 1 & 2 and Buildings 2 & 3 in lieu of signage as requested.

- b. *We support any effort to reduce light intensity and associated impacts. The Lighting Comments provide excellent guidance on potential ways to reduce light impacts and we suggest the Project closely review those recommendations and incorporate changes where possible. Any reduction in artificial light will benefit the resource areas and associated buffers and minimize impacts on neighbors.*

The lighting plan has been revised to provide the requested efficiency, wattage, and color requested in previously-issued project comments. Refer to the attached email from Mr. Michael Lesser, dated April 13, 2021, confirming that the lighting plan as currently proposed has satisfactorily addressed those previously concerns. Mr. Lesser reaffirmed his satisfaction with the lighting plan at the April 14, 2021 ZBA meeting.

- c. *We support efforts that result in more robust buffer zone vegetation. The Project has identified two areas where such measures are suitable and has offered to include design of those enhancements in the Final Plans. We recommend the Project provide a simple sketch identifying those areas and their approximate areas along with a representative plant list for reference in a permit decision.*

See response in the next section below.

LANDSCAPE PLAN FOR JURISDICTIONAL/BUFFER ZONE AREAS

The Applicant has provided a Landscape Plan showing location, species and size of proposed landscape plantings which show reasonable coverage and density to elevate finish of developed areas. While we agree that additional planting in the buffer zone may be beneficial, it is intended to serve a different function and details of its construction are perhaps best reviewed as part of the Notice of Intent process.

Those improvements will logically be within Wetlands Protection Act jurisdiction and resolution of specific treatment is best suited to that review process provided the scope and scale of mitigation is documented in the Comprehensive Permit as described under 2c above.

- a. *We recommend the Project provide a simple Buffer Zone Impact Mitigation Sketch. The sketch should identify areas where landscaping is intended specifically for the purposes of offsetting buffer zone impacts and should also include a reference plant list identifying the contemplated palette of proposed vegetation. Our expectation is that specific layout and construction details will be reviewed by the Conservation Commission under the Notice of Intent and the scope and scale of those improvements will be consistent with commitments shown on the sketch provided to the Board.*

The enclosed landscape plan has been updated to identify specific buffer zone mitigation planting areas that have been selected by the design team as being most beneficial for habitat enhancement. The applicant is committed to providing up to 50 plantings within these areas, consisting of up to 10 trees and 40 shrubs, to be selected from the schedule of mitigation species contained on the landscape plan. Consistent with TT's recommendation, the applicant would suggest that the distribution and placement of these mitigation plantings be left to the forthcoming Notice of Intent review process with input from the Conservation Commission.

- b. *See response above.*

See response above.

- c. *See response above.*

See response above.

OTHER

In addition to addressing TT's April 20, 2021 comments, the enclosed design plans have been updated in accordance with the following commitments that have been made to-date in conjunction with ZBA's review of this project:

- The berm for Basin CC-1 has been adjusted to provide 12" of freeboard. Attached is the updated HydroCad output for this basin to document this modification and show that peak discharge and water elevation remain consistent with the original design.
- The berm for Basin CC-2 has been adjusted to provide 12" of freeboard. Attached is the updated HydroCad output for this basin to document this modification and show that peak discharge and water elevation remain consistent with the original design.
- The floor of Basin CC-3 has been adjusted to achieve the requisite 48 inches of separation to seasonal high groundwater based on TT's interpretation of the test pit data. Attached is the updated HydroCad output for this basin to document this modification and show that peak discharge and water elevation remain consistent with the original design.

- Forebay CC-2 has been adjusted so as not to conflict with the sight line for vehicles exiting the site. Attached is the updated HydroCad output for this forebay to document this modification and show that peak discharge and water elevation remain consistent with the original design.
- The originally-proposed stormwater connection to the municipal stormwater system in Coolidge Street has been eliminated in accordance with our discussions with the Sherborn Department of Public Works.

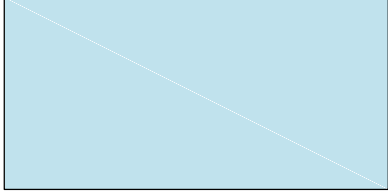
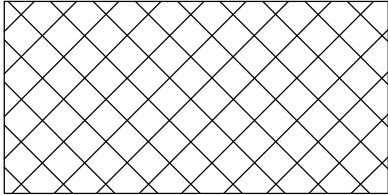
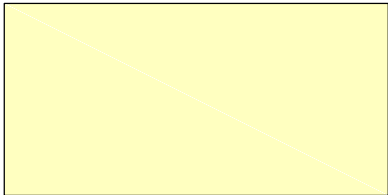
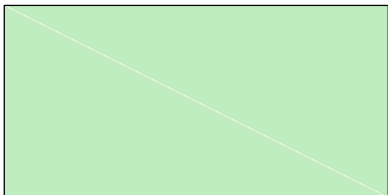
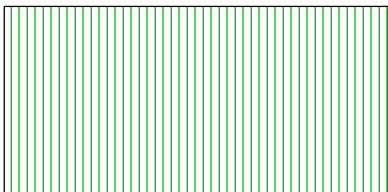
We trust that the responses provided above and the enclosed documents sufficiently address all remaining open items. Please feel free to contact our office should you have any questions or required further clarification.

Respectfully Submitted,
CIVIL DESIGN GROUP, LLC



Matthew A. Leidner, P.E.
Principal



-  **BORDERING
VEGETATED
WETLANDS (BVW)**
-  **TOTAL PROJECT AREA
WITHIN INNER BUFFER
3.12± ACRES**
-  **PROPOSED WORK RELATED TO
NON-STORMWATER FEATURES
0.28± ACRES (9%)**
-  **PROPOSED WORK RELATED TO
STORMWATER FEATURES
0.32± ACRES**
-  **AREA TO REMAIN
UNTOUCHED
2.52± ACRES**

NOT FOR CONSTRUCTION

CDG PROJECT #: 20012

REVISIONS:

REV	DATE	COMMENT
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

ZONING BOARD OF APPEALS:

SEAL:

MATTHEW A. LEIDNER, P.E.

PREPARED BY:

CIVIL DESIGN GROUP, LLC

21 HIGH STREET, SUITE 207
NORTH ANDOVER, MA 01845
www.cdengineering.com
p: 978-794-5400 f: 978-965-3971

PREPARED FOR:

BAYSTONE DEVELOPMENT

21 CENTER STREET
WESTON, MA 02493
www.baystonedevelopment.com

PROJECT:

COOLIDGE CROSSING

84 & 86 COOLIDGE STREET
SHERBORN, MASSACHUSETTS

SCALE:

60 0 30 60 120
GRAPHIC SCALE IN FEET

SHEET:

INNER BUFFER ZONE (0'-50') SUMMARY

EXHIBIT A

DATE: 04/23/2021

From: [Michael Lesser](#)
To: rnovak@pierceatwood.com; "Todd S. MacDowell"
Cc: ["jeanne.guthrie@sherbornma.org"](mailto:jeanne.guthrie@sherbornma.org)
Subject: Coolidge Crossing revised site lighting plan
Date: Wednesday, April 14, 2021 11:34:00 AM

TO: Sherborn Zoning Board of Appeals

FROM: Michael Lesser
resident: 54 Forest Street, Sherborn

DATE: April 13, 2021

RE: **Comments on Revised Coolidge Crossing Site Lighting Plan as per Hawk Design Inc. April 7, 2021 letter and the Site Lighting Plan rev. 3/31/21**

I want to thank Baystone Development and Hawk Design Inc. for their revised lighting work as it addresses my major concerns of efficiency (130 LPW), wattage (40W) and color (3000K). The changes will significantly lessen the energy use for exterior lighting and are better for health.

As to dimmers and motion sensors, the use of smaller 40W fixtures does greatly reduce the possible energy savings; and the concern for resident safety is recognized.

Post Development Condition

NOAA 24-hr A 2-Year Rainfall=3.34"

Prepared by {enter your company name here}

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Summary for Pond BASIN CC-1:

Inflow Area = 1.080 ac, 73.15% Impervious, Inflow Depth > 2.27" for 2-Year event
Inflow = 3.29 cfs @ 12.11 hrs, Volume= 0.205 af
Outflow = 0.58 cfs @ 12.52 hrs, Volume= 0.205 af, Atten= 82%, Lag= 24.8 min
Discarded = 0.58 cfs @ 12.52 hrs, Volume= 0.205 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs / 2
Peak Elev= 175.40' @ 12.52 hrs Surf.Area= 3,054 sf Storage= 3,167 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 42.2 min (794.6 - 752.4)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	10,032 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	1,464	0	0
176.00	3,733	5,197	5,197
177.10	5,058	4,835	10,032

Device	Routing	Invert	Outlet Devices
#1	Primary	176.00'	75.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	174.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.58 cfs @ 12.52 hrs HW=175.40' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.58 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Post Development Condition

NOAA 24-hr A 10-Year Rainfall=5.23"

Prepared by {enter your company name here}

Printed 4/20/2021

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Summary for Pond BASIN CC-1:

Inflow Area = 1.080 ac, 73.15% Impervious, Inflow Depth > 3.72" for 10-Year event
 Inflow = 5.19 cfs @ 12.11 hrs, Volume= 0.335 af
 Outflow = 1.40 cfs @ 12.35 hrs, Volume= 0.335 af, Atten= 73%, Lag= 14.6 min
 Discarded = 0.72 cfs @ 12.35 hrs, Volume= 0.320 af
 Primary = 0.68 cfs @ 12.35 hrs, Volume= 0.015 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs / 2
 Peak Elev= 176.02' @ 12.35 hrs Surf.Area= 3,760 sf Storage= 5,282 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 58.1 min (807.0 - 748.9)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	10,032 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	1,464	0	0
176.00	3,733	5,197	5,197
177.10	5,058	4,835	10,032

Device	Routing	Invert	Outlet Devices
#1	Primary	176.00'	75.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	174.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.72 cfs @ 12.35 hrs HW=176.02' (Free Discharge)
 ↑**2=Exfiltration** (Exfiltration Controls 0.72 cfs)

Primary OutFlow Max=0.57 cfs @ 12.35 hrs HW=176.02' (Free Discharge)
 ↑**1=Broad-Crested Rectangular Weir** (Weir Controls 0.57 cfs @ 0.35 fps)

Post Development Condition

NOAA 24-hr A 100-Year Rainfall=8.23"

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Summary for Pond BASIN CC-1:

Inflow Area = 1.080 ac, 73.15% Impervious, Inflow Depth > 6.18" for 100-Year event
 Inflow = 8.56 cfs @ 12.11 hrs, Volume= 0.556 af
 Outflow = 6.07 cfs @ 12.19 hrs, Volume= 0.548 af, Atten= 29%, Lag= 4.4 min
 Discarded = 0.74 cfs @ 12.18 hrs, Volume= 0.415 af
 Primary = 5.33 cfs @ 12.19 hrs, Volume= 0.133 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs / 2
 Peak Elev= 176.10' @ 12.18 hrs Surf.Area= 3,850 sf Storage= 5,564 cf

Plug-Flow detention time= 56.2 min calculated for 0.546 af (98% of inflow)
 Center-of-Mass det. time= 46.9 min (793.8 - 746.8)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	10,032 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	1,464	0	0
176.00	3,733	5,197	5,197
177.10	5,058	4,835	10,032

Device	Routing	Invert	Outlet Devices
#1	Primary	176.00'	75.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	174.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.74 cfs @ 12.18 hrs HW=176.09' (Free Discharge)
 ↑**2=Exfiltration** (Exfiltration Controls 0.74 cfs)

Primary OutFlow Max=5.03 cfs @ 12.19 hrs HW=176.09' (Free Discharge)
 ↑**1=Broad-Crested Rectangular Weir** (Weir Controls 5.03 cfs @ 0.72 fps)

Post Development Condition

NOAA 24-hr A 2-Year Rainfall=3.34"

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Summary for Pond BASIN CC-2:

Inflow Area = 1.970 ac, 9.14% Impervious, Inflow Depth > 1.03" for 2-Year event
Inflow = 2.38 cfs @ 12.19 hrs, Volume= 0.169 af
Outflow = 1.26 cfs @ 12.38 hrs, Volume= 0.169 af, Atten= 47%, Lag= 11.4 min
Discarded = 1.26 cfs @ 12.38 hrs, Volume= 0.169 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Peak Elev= 176.13' @ 12.38 hrs Surf.Area= 6,562 sf Storage= 864 cf

Plug-Flow detention time= 4.5 min calculated for 0.168 af (100% of inflow)
Center-of-Mass det. time= 4.2 min (825.5 - 821.2)

Volume	Invert	Avail.Storage	Storage Description
#1	176.00'	17,763 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
176.00	6,320	0	0
178.15	10,204	17,763	17,763

Device	Routing	Invert	Outlet Devices
#1	Primary	176.85'	20.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	176.00'	8.270 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=1.26 cfs @ 12.38 hrs HW=176.13' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 1.26 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=176.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Post Development Condition

NOAA 24-hr A 10-Year Rainfall=5.23"

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Summary for Pond BASIN CC-2:

Inflow Area = 1.970 ac, 9.14% Impervious, Inflow Depth > 2.32" for 10-Year event
Inflow = 5.78 cfs @ 12.18 hrs, Volume= 0.381 af
Outflow = 1.45 cfs @ 12.60 hrs, Volume= 0.381 af, Atten= 75%, Lag= 25.3 min
Discarded = 1.45 cfs @ 12.60 hrs, Volume= 0.381 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Peak Elev= 176.69' @ 12.60 hrs Surf.Area= 7,563 sf Storage= 4,777 cf

Plug-Flow detention time= 24.1 min calculated for 0.379 af (100% of inflow)
Center-of-Mass det. time= 23.8 min (833.6 - 809.8)

Volume	Invert	Avail.Storage	Storage Description
#1	176.00'	17,763 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
176.00	6,320	0	0
178.15	10,204	17,763	17,763

Device	Routing	Invert	Outlet Devices
#1	Primary	176.85'	20.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	176.00'	8.270 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=1.45 cfs @ 12.60 hrs HW=176.69' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 1.45 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=176.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Post Development Condition

NOAA 24-hr A 100-Year Rainfall=8.23"

Prepared by {enter your company name here}

Printed 4/20/2021

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Summary for Pond BASIN CC-2:

Inflow Area = 1.970 ac, 9.14% Impervious, Inflow Depth > 4.76" for 100-Year event
 Inflow = 11.99 cfs @ 12.18 hrs, Volume= 0.781 af
 Outflow = 9.02 cfs @ 12.32 hrs, Volume= 0.780 af, Atten= 25%, Lag= 8.4 min
 Discarded = 1.60 cfs @ 12.32 hrs, Volume= 0.594 af
 Primary = 7.42 cfs @ 12.32 hrs, Volume= 0.186 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
 Peak Elev= 177.14' @ 12.32 hrs Surf.Area= 8,376 sf Storage= 8,365 cf

Plug-Flow detention time= 26.0 min calculated for 0.777 af (100% of inflow)
 Center-of-Mass det. time= 25.7 min (824.3 - 798.6)

Volume	Invert	Avail.Storage	Storage Description
#1	176.00'	17,763 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
176.00	6,320	0	0
178.15	10,204	17,763	17,763

Device	Routing	Invert	Outlet Devices
#1	Primary	176.85'	20.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	176.00'	8.270 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=1.60 cfs @ 12.32 hrs HW=177.12' (Free Discharge)
 ↑**2=Exfiltration** (Exfiltration Controls 1.60 cfs)

Primary OutFlow Max=6.91 cfs @ 12.32 hrs HW=177.12' (Free Discharge)
 ↑**1=Broad-Crested Rectangular Weir** (Weir Controls 6.91 cfs @ 1.26 fps)

Post Development Condition

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NOAA 24-hr A 2-Year Rainfall=3.34"

Printed 4/20/2021

Summary for Pond Basin CC-3:

Inflow Area = 0.780 ac, 66.67% Impervious, Inflow Depth > 2.08" for 2-Year event
Inflow = 2.17 cfs @ 12.11 hrs, Volume= 0.135 af
Outflow = 0.21 cfs @ 12.83 hrs, Volume= 0.135 af, Atten= 90%, Lag= 43.0 min
Discarded = 0.21 cfs @ 12.83 hrs, Volume= 0.135 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Peak Elev= 175.78' @ 12.83 hrs Surf.Area= 3,729 sf Storage= 2,596 cf

Plug-Flow detention time= 99.2 min calculated for 0.135 af (100% of inflow)
Center-of-Mass det. time= 98.4 min (851.6 - 753.2)

Volume	Invert	Avail.Storage	Storage Description
#1	175.00'	13,630 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
175.00	2,928	0	0
176.00	3,955	3,442	3,442
178.00	6,233	10,188	13,630
Device	Routing	Invert	Outlet Devices
#1	Primary	177.00'	50.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	175.00'	12.0" Round Culvert L= 247.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 175.00' / 173.50' S= 0.0061 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	176.75'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Discarded	175.00'	2.410 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.21 cfs @ 12.83 hrs HW=175.78' (Free Discharge)
↑**4=Exfiltration** (Exfiltration Controls 0.21 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=175.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
↑**2=Culvert** (Controls 0.00 cfs)
↑**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Post Development Condition

NOAA 24-hr A 10-Year Rainfall=5.23"

Prepared by Microsoft

Printed 4/20/2021

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Summary for Pond Basin CC-3:

Inflow Area = 0.780 ac, 66.67% Impervious, Inflow Depth > 3.44" for 10-Year event
 Inflow = 3.43 cfs @ 12.11 hrs, Volume= 0.223 af
 Outflow = 0.24 cfs @ 13.12 hrs, Volume= 0.223 af, Atten= 93%, Lag= 60.8 min
 Discarded = 0.24 cfs @ 13.12 hrs, Volume= 0.223 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
 Peak Elev= 176.33' @ 13.12 hrs Surf.Area= 4,328 sf Storage= 4,798 cf

Plug-Flow detention time= 172.7 min calculated for 0.223 af (100% of inflow)
 Center-of-Mass det. time= 172.0 min (923.0 - 751.0)

Volume	Invert	Avail.Storage	Storage Description
#1	175.00'	13,630 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
175.00	2,928	0	0
176.00	3,955	3,442	3,442
178.00	6,233	10,188	13,630

Device	Routing	Invert	Outlet Devices
#1	Primary	177.00'	50.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	175.00'	12.0" Round Culvert L= 247.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 175.00' / 173.50' S= 0.0061 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	176.75'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Discarded	175.00'	2.410 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.24 cfs @ 13.12 hrs HW=176.33' (Free Discharge)
 ↳ **4=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=175.00' (Free Discharge)
 ↳ **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
 ↳ **2=Culvert** (Controls 0.00 cfs)
 ↳ **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Post Development Condition

Prepared by Microsoft

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NOAA 24-hr A 100-Year Rainfall=8.23"

Printed 4/20/2021

Summary for Pond Basin CC-3:

Inflow Area = 0.780 ac, 66.67% Impervious, Inflow Depth > 5.81" for 100-Year event
Inflow = 5.82 cfs @ 12.11 hrs, Volume= 0.378 af
Outflow = 1.17 cfs @ 12.51 hrs, Volume= 0.352 af, Atten= 80%, Lag= 24.1 min
Discarded = 0.28 cfs @ 12.51 hrs, Volume= 0.300 af
Primary = 0.89 cfs @ 12.51 hrs, Volume= 0.052 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Peak Elev= 176.92' @ 12.51 hrs Surf.Area= 5,000 sf Storage= 7,549 cf

Plug-Flow detention time= 202.4 min calculated for 0.352 af (93% of inflow)
Center-of-Mass det. time= 167.3 min (917.3 - 749.9)

Volume	Invert	Avail.Storage	Storage Description
#1	175.00'	13,630 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
175.00	2,928	0	0
176.00	3,955	3,442	3,442
178.00	6,233	10,188	13,630

Device	Routing	Invert	Outlet Devices
#1	Primary	177.00'	50.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	175.00'	12.0" Round Culvert L= 247.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 175.00' / 173.50' S= 0.0061 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	176.75'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Discarded	175.00'	2.410 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.28 cfs @ 12.51 hrs HW=176.92' (Free Discharge)
↑**4=Exfiltration** (Exfiltration Controls 0.28 cfs)

Primary OutFlow Max=0.88 cfs @ 12.51 hrs HW=176.92' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
↑**2=Culvert** (Passes 0.88 cfs of 3.15 cfs potential flow)
↑**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.88 cfs @ 1.33 fps)

Post Development Condition

Prepared by Microsoft

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NOAA 24-hr A 2-Year Rainfall=3.34"

Printed 4/21/2021

Summary for Pond FB CC-2:

Inflow Area = 0.230 ac, 21.74% Impervious, Inflow Depth > 1.86" for 2-Year event
Inflow = 0.62 cfs @ 12.12 hrs, Volume= 0.036 af
Outflow = 0.07 cfs @ 12.85 hrs, Volume= 0.036 af, Atten= 89%, Lag= 43.7 min
Discarded = 0.07 cfs @ 12.85 hrs, Volume= 0.036 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Peak Elev= 169.60' @ 12.85 hrs Surf.Area= 1,246 sf Storage= 658 cf

Plug-Flow detention time= 80.5 min calculated for 0.035 af (100% of inflow)
Center-of-Mass det. time= 79.7 min (872.3 - 792.7)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	2,001 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
169.00	952	0	0
170.00	1,443	1,198	1,198
170.50	1,770	803	2,001

Device	Routing	Invert	Outlet Devices
#1	Primary	168.25'	8.0" Round Culvert L= 106.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 168.25' / 167.65' S= 0.0057 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	170.25'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Discarded	169.00'	2.410 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.07 cfs @ 12.85 hrs HW=169.60' (Free Discharge)
↑**3=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=169.00' (Free Discharge)
↑**1=Culvert** (Passes 0.00 cfs of 0.86 cfs potential flow)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Post Development Condition

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NOAA 24-hr A 10-Year Rainfall=5.23"

Printed 4/21/2021

Summary for Pond FB CC-2:

Inflow Area = 0.230 ac, 21.74% Impervious, Inflow Depth > 3.51" for 10-Year event
Inflow = 1.17 cfs @ 12.11 hrs, Volume= 0.067 af
Outflow = 0.09 cfs @ 13.11 hrs, Volume= 0.067 af, Atten= 93%, Lag= 59.8 min
Discarded = 0.09 cfs @ 13.11 hrs, Volume= 0.067 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Peak Elev= 170.20' @ 13.11 hrs Surf.Area= 1,573 sf Storage= 1,497 cf

Plug-Flow detention time= 163.3 min calculated for 0.067 af (100% of inflow)
Center-of-Mass det. time= 162.8 min (946.4 - 783.6)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	2,001 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
169.00	952	0	0
170.00	1,443	1,198	1,198
170.50	1,770	803	2,001

Device	Routing	Invert	Outlet Devices
#1	Primary	168.25'	8.0" Round Culvert L= 106.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 168.25' / 167.65' S= 0.0057 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	170.25'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Discarded	169.00'	2.410 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.09 cfs @ 13.11 hrs HW=170.20' (Free Discharge)
↑**3=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=169.00' (Free Discharge)
↑**1=Culvert** (Passes 0.00 cfs of 0.86 cfs potential flow)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Post Development Condition

NOAA 24-hr A 100-Year Rainfall=8.23"

Prepared by Microsoft

Printed 4/21/2021

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Summary for Pond FB CC-2:

Inflow Area = 0.230 ac, 21.74% Impervious, Inflow Depth > 6.31" for 100-Year event
 Inflow = 2.08 cfs @ 12.11 hrs, Volume= 0.121 af
 Outflow = 1.41 cfs @ 12.24 hrs, Volume= 0.121 af, Atten= 32%, Lag= 7.4 min
 Discarded = 0.10 cfs @ 12.24 hrs, Volume= 0.086 af
 Primary = 1.31 cfs @ 12.24 hrs, Volume= 0.035 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
 Peak Elev= 170.43' @ 12.24 hrs Surf.Area= 1,722 sf Storage= 1,873 cf

Plug-Flow detention time= 126.3 min calculated for 0.121 af (100% of inflow)
 Center-of-Mass det. time= 125.9 min (900.4 - 774.5)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	2,001 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
169.00	952	0	0
170.00	1,443	1,198	1,198
170.50	1,770	803	2,001

Device	Routing	Invert	Outlet Devices
#1	Primary	168.25'	8.0" Round Culvert L= 106.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 168.25' / 167.65' S= 0.0057 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	170.25'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Discarded	169.00'	2.410 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.09 cfs @ 12.24 hrs HW=170.39' (Free Discharge)
 ↑ **3=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=1.15 cfs @ 12.24 hrs HW=170.40' (Free Discharge)
 ↑ **1=Culvert** (Passes 1.15 cfs of 1.46 cfs potential flow)
 ↑ **2=Orifice/Grate** (Weir Controls 1.15 cfs @ 1.25 fps)