My initial thoughts are that since the proposed work is being built on filled wetland area infiltration of stormwater is unnecessary and problematic due to the presence of marine clays as shown in the boring logs.

If it can be shown that increases in impervious areas can be constructed without causing offsite flooding, I would find that acceptable without controls.

The total area being disturbed is 0.32 acres and areas A, B, C and D are only 0.16, 0.06, 0.03, and 0.07 acres in size respectively. While numbers can be generated for each area I doubt if the accuracy of the numbers generated are within the precision of the model when calculating the site as a whole. Assuming the entire area is 6 acres the total disturbed are by this project is only 5% of the total. Individual areas as broken down are only 0.05% of the project site. Is the model accurate to that level?

Putting aside the above I have reviewed the plans and analysis as submitted and offer the following comments

**Fuller Field Review of submitted materials 1/23/20**

Soils in area of work show as Scantic silt loam

Hydric soils

Water table 0-12 Inches

Ksat 0-0.02 inches/ hour

Typical profile

H1 - 0 to 11 inches: silt loam

H2 - 11 to 26 inches: silty clay loam

H3 - 26 to 60 inches: clay

Seems Water Table above silt clay loam layer

Soil Borings GP-1 Through GP-3 on northerly side of field. Marine clay layer at 1.7 to 3 feet from surface. Marine layer coincides with H2 horizon

Boring GP-4 on westerly side of field. Marine clay layer (H2) horizon at 2.8 feet from surface.

While borings did not detect GW assuming the site is sand fill above marine clay water table should be assumed to be above the marine clay layer. As stated in the GSI report "It should be anticipated that perched groundwater above the Marine Deposits should be anticipated during construction due to seasonal groundwater conditions and weather."

**BMP "A"**

Area Drains #A and B are between GP-1 and GP-2 Clay layer varies from 1.7 to 3 feet from existing surface. Assume existing surface at el 19 (drawing Ex-1) clay layer is at el 16 to 17.3.

Outlets from area drains A and B range from 16.75 to 17.5

Detail 5 on sheet L-5 shows 6 inches of stone under perforated pipe so bottom of stone at el 16.25 to 17 which is in part within the clay layer.

Detail 5 shows 2.5 feet from surface to bottom of stone. Rim el of 18.75 at surface puts bottom of stone at el 16.25 which is within the clay horizon

Area Drains #C, D and E are between GP-2 and GP-3 Clay layer varies from 2 to 3 feet from existing surface. Assume existing surface at el 19 (drawing Ex-1) clay layer is at el 16 to 17.

Outlets from AD #C, D and E range from el 17.5 to el 16.5

Detail 5 on sheet L-5 shows 6 inches of stone under perforated pipe so bottom of stone at el 16 to 17 which is on top of clay layer.

Detail 5 shows 2.5 feet from surface to bottom of stone. Rim el of 18.75 at surface puts bottom of stone at el 16.25 which is within the clay horizon

**BMP B and BMP C**

Boring GP-4 appears to be at surface el of 19 which puts the Marine layer at el 16.2

BMP B is a leaching catch basin with rim at 17.5

Detail 3 on sheet L-5 Shows the total depth from rim to bottom of stone of 7 feet. Which would place the bottom of stone at el 10.5 for BMP B which is well below the marine layer at 16.2.

BMP C is a leaching catch basin with rim at el 18

Detail 3 on sheet L-5 Shows the total depth from rim to bottom of stone of 7 feet. Which would place the bottom of stone at el 11 for BMP C which is well below the marine layer at 16.2.

**BMP "D"**

BMP "D" is an infiltration trench is a linear trench along the parking area and a curvilinear trench around the turnaround area and also includes a rain garden. The surface elevation of the trenches range from 18.15 to 17.0. According to detail 6 on sheet L-5 the bottom of stone in the trench is 2.5 feet from the surface and would therefore range from el 14.5 to 15.65 which is well below the marine layer elevation of 16.2 as shown in GP-4.

The bottom elevation of the Rian Garden on Sheet L-2 is shown to be El 16.0 Detail 2 on sheet L-5 shows amended soil below the bottom of the Bio-Retention Area. But a depth of the amended soil layer is not provided. The stormwater handbook specifies the amended soil layer must be 30 inches deep at a minimum. If that criteria were applied to the proposed plan the

bottom of the amended soil layer would be at elevation 13.5 which is well into the marine clay horizon which starts at elevation 16.2.

Additionally, the detail shows the Rain Garden built upon “Free Draining Soil” which is certainly not the case in this application.

**BMP Characteristics**

Pond No. 1

In the details on sheet L-5 BMP A is a perforated drainpipe not a trench but the pond report lists it as a trench

The Pond Data

Chambers are listed which is confusing.

A 300 ft barrel length is listed but the new drain lines are not that long

The height if stone is listed as 2.5 feet but the details show 2 feet.

Storage shows depth of 2.75 feet yet from the bottom of stone to the grate at “C” is only 1.75 feet.

The weir structure is shown as 100 ft long at elevation 100.22 yet the only outlet are the catch basin inlets which are not 100 feet long.

The elevations listed do not relate to the elevations on the plans

Considering the stone around the pipe will in part be in clay the use of an infiltration rate of 8.27 in/hr. over the full area of stone is not appropriate.

Pond No. 2 BMP -B

Please explain the UG chamber

The details show 7 feet from rim to bottom of stone. Stone depth is 6 feet. Pond data shows a width of 6 feet and height of 4 feet but that doesn’t properly define the stone used nor does it account for the barrel of the leach pit. The weir is specified as 10 ft in length when it is actually a catch basin top and the crest elevation is 100.22 which doesn’t relate to the plan elevations.

Pond No. 2 BMP -C

Same problems as with BMP B

Pond No. 4 BMP D is listed as a rain garden, but the plans show it as combined infiltration trench and rain garden. The text in the Narrative specifies BMP “D” as stone trenches and a rain garden. It should be modeled as described in the plans and text.

The area at 17 and 17.2 appear from plan view to be far larger than shown in the table

**General comments on BMP Characteristics**

Seems as if the two distinct infiltration trenches were run as one. Yet they both have distinctive cross-sections. The stone for the perforated drain line as shown in detail 5 is 18" wide and 2 feet deep covered in topsoil. The infiltration trench is shown to be 2 feet wide and filled with stone for 2.5 feet deep as depicted in detail 6. They should be run separately.

**Standard 3 Recharge**

Considering the subsoil, I don't think recharge is required. Rawls table lists clay having an infiltration rate of 0.02 in/hr.

**Plans**

Sheet L-3

Detail 6 type of gravel should be specified. Thickness of binder course and top course as well as asphalt type should be specified.

Detail 7 type of gravel should be specified

Detail 8 The type of gravel should be specified and it should be crushed

Sheet L-5

The overflow weir specified in the calculations should be shown as to length width and elevation and stone provided for overflow if necessary

Depth of amended soil should be specified and note of "free draining subbase" changed to "existing soil subbase".

**General note**

The rainfall precipitation rates used should be as shown in the Newburyport Stormwater Management Standards B. Design Calculations 1.a.Table 1 Rainfall Data