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Technical Memorandum

Date:	June 23, 2021
To:	Matthew Reardon and Malcolm Harper, Massachusetts Department of Environmental Protection
From:	Julia Keay and Adam Questad, Geosyntec Consultants, Inc.
Subject:	Massachusetts Watershed-based Plans Project #18-02/319, Documentation of Tool Updates (Task 4c)

INTRODUCTION

Four updates were made to the Watershed-based Plan tool (WBP tool) during the Fiscal Year 2021 phase of the Massachusetts Watershed-based Plans Project #18-02/319. These WBP tool updates included:

1. Development and incorporation of a "BMP Hotspot Map" in the Element C module
2. Updating the waterbody impairment information in the "Choose Your Watershed" map viewer and the Element A module to reflect the Massachusetts Year 2016 Integrated List of Waters (2016 Integrated List) (MassDEP, 2019)
3. Adding hyperlinks to Massachusetts Department of Environmental Protection (MassDEP) water quality technical memoranda and water quality monitoring program data in the "Review Information Sources" section and the Element A module
4. Updating the formatting of the WBP tool Microsoft Word export document

The remainder of this memorandum summarizes the methodology and assumptions associated with these updates.

BMP HOTSPOT MAP

The BMP Hotspot Map was developed to assist WBP tool users with identifying priority parcels for future nonpoint source best management practice (BMP) implementation within a selected watershed. Creation of the BMP Hotspot Map was a Geographic Information Systems (GIS)-based analysis, which included incorporating the following publicly available GIS layers used to indicate the feasibility of installing a BMP based on parcel ownership, social value, and implementation feasibility characteristics:

- The parcel layer (MassGIS, 2021) was used to identify the parcels within all Massachusetts municipalities.

- School, fire station, police station, town hall and library layers (MassGIS, 2015a; MassGIS, 2015b; MassGIS, 2017a; MassGIS 2017b; MassGIS 2020), were used to identify these public facilities.
- The "Property Type Classification Codes, Non-arm's Length Codes and Sales Report Spreadsheet Specifications" (MA Department of Revenue Division of Local Services, 2016) was used to identify public properties and universities. All parcels with a classification code between 900—997 were assumed to be public property or a university.
- The Environmental Justice Populations layer (MassGIS, 2012) was used to identify parcels within Environmental Justice Areas.
- The hydrologic soil group (HSG) layer (ArcGIS, 2020a) was used to identify the most favorable HSG within each parcel.
- The land use layer (MassGIS, 2009) was used to identify the most favorable land use within each parcel and the percent impervious area within a parcel.
- The water table depth layer (ArcGIS, 2020b) was used to identify the most favorable water table depth within a parcel.
- The topographic layer (MassGIS, 2005) was used to calculate the average slope within each parcel
- The hydrography layer (MassGIS, 2019) was used to identify parcels within 100 feet of a river/stream or lake/pond

A parcel screening protocol, based on applying various geoprocessing tools to the above-listed GIS layers intersecting each parcel, was collaboratively developed by Geosyntec and MassDEP as described below:

1. Each parcel within the watershed was evaluated based on ten different criteria accounting for the parcel ownership, social value, and implementation feasibility (See Attachment 1 for a detailed matrix that includes the ten criteria and corresponding metrics according to each GIS layer included);
2. Each criterion was then given a score from 0 to 5 to represent the priority for BMP implementation based on the metric corresponding to the criterion (e.g., a score of 0 would represent lowest priority for BMP implementation whereas a score of 5 would represent highest priority for BMP implementation);
3. A multiplier was also assigned to each criterion, which reflected the weighted importance of the criterion (e.g., a criterion with a multiplier of 3 had greater weight on the overall prioritization of the parcel than a criterion with a multiplier of 1); and
4. The weighted scores for all the criteria were then summed for each parcel to calculate a total BMP priority score. The maximum potential score for each parcel is 100.

The process above was applied to a test watershed and once minor updates were implemented (e.g., fixing issue with some waterbodies showing up with a score), the same process was applied to the entire commonwealth of Massachusetts. Parcels with total scores above 60 are recommended

for further investigation for BMP implementation suitability. The resulting BMP hotspot map was incorporated into Element C of the WBP tool by adding introductory text, a watershed figure with color-coded parcel scores based on the parcel screening protocol described above, and a hyperlink to an Excel table, which corresponds to the figure and includes a list of the parcels within the watershed with scores of 60 or higher. An example Hotspot Map figure is included in Attachment 2.

This analysis solely evaluated individual parcels for BMP implementation suitability and likelihood for the measures to perform effectively within the parcel's features (e.g., provide infiltration of stormwater based on soil type). This analysis did not quantify the pollutant loading to these parcels from the parcel's upstream catchment and did not account for all constraints (e.g., below ground utilities) due to GIS data limitations. When further evaluating a parcel's BMP implementation suitability and implementation cost-effectiveness based on these parcel scores, the existing pollutant loading from the parcel's upstream catchment and potential pollutant load reduction from BMP implementation should be evaluated. In addition, a site investigation to identify other constraints and potential planned uses for the proposed BMP area should be performed.

2016 INTEGRATED LIST

The "Choose Your Watershed" map viewer and the Element A module of the WBP tool were updated to include the impairment information from the 2016 Integrated List (MassDEP, 2019). The WBP tool previously included impairment information from the "Massachusetts Year 2012 Integrated List of Waters" (2012 Integrated List) (MassDEP, 2013).

The first step in this process was to compare the 2012 Integrated List with the 2016 Integrated List. Key findings of this comparison are listed below:

- Lakes/Ponds
    - There were 27 new lakes/ponds waterbodies on the 2016 Integrated List. Three of these waterbodies had a delineation when selected in the WBP tool. The remaining 24 new lake/pond waterbodies did not have a delineation when selected in the WBP tool and therefore currently cannot be selected in the WBP tool;
    - There were 29 lake/pond assessment unit identification numbers (AUIDs) on the 2012 Integrated List that changed in the 2016 Integrated List;
    - There were 12 lake/pond waterbodies that had a minor change in the waterbody name, but the AUID remained the same between the 2012 Integrated List and the 2016 Integrated List; and
    - There were 12 lake/pond waterbodies that were included on both the 2012 Integrated List and the 2016 Integrated List, but they did not have a delineation when selected in the WBP tool and therefore currently cannot be selected in the WBP tool.

- Rivers/Streams
  - There were 315 new rivers/streams waterbodies on the 2016 Integrated List. All these waterbodies had a delineation when selected in the WBP tool;
  - There were 33 rivers/streams AUIDs on the 2012 Integrated List that changed in the 2016 Integrated List; and
  - There were 6 rivers/streams waterbodies that had a minor change in the waterbody name, but the AUID remained the same between the 2012 Integrated List and the 2016 Integrated List.

The impairment information included in the "Choose Your Watershed" map viewer and the Element A module of the WBP tool was updated accordingly to reflect the 2016 Integrated List including the changes detailed above as well as the designated use, impairment cause, and impairment sources included in the Element A module.

New watershed delineations were not conducted as part of this 2016 Integrated List update. Therefore, as noted above, the 36 lake/pond waterbodies on the 2016 Integrated List without delineations currently cannot be selected in the WBP tool. The table in Attachment 3 identifies these 36 lake/pond waterbodies.

ADDING HYPERLINKS

Introductory text and two hyperlinks for the MassDEP water quality technical memoranda and water quality monitoring program webpages were added in the "Review Information Sources" section as well as in the Element A module of the WBP tool. The introductory text recommends that users review available technical memoranda and water quality monitoring data that is relevant to their watershed and include corresponding information in their WBP.

FORMATTING UPDATES TO MICROSOFT WORD EXPORT DOCUMENT

Formatting updates were made to improve the presentation of the WBP tool Microsoft Word export document. Formatting edits were collaboratively chosen by Geosyntec and MassDEP and included:

- Adding page numbers;
- Adding a table of contents;
- Formatting headings, subheadings, text, user-entered text, and tables consistently;
  - Headings are Calibri (Body) font, font size 16, bolded
  - Subheadings are Calibri (Body) font, font size 12, bolded
  - Text is Calibri (Body) font, font size 11
  - Table text is Calibri (Body) font, font size 9
- Incorporating the changes resulting from the WBP tool updates detailed above (BMP Hotspot Map, 2016 Integrated List, and adding hyperlinks).

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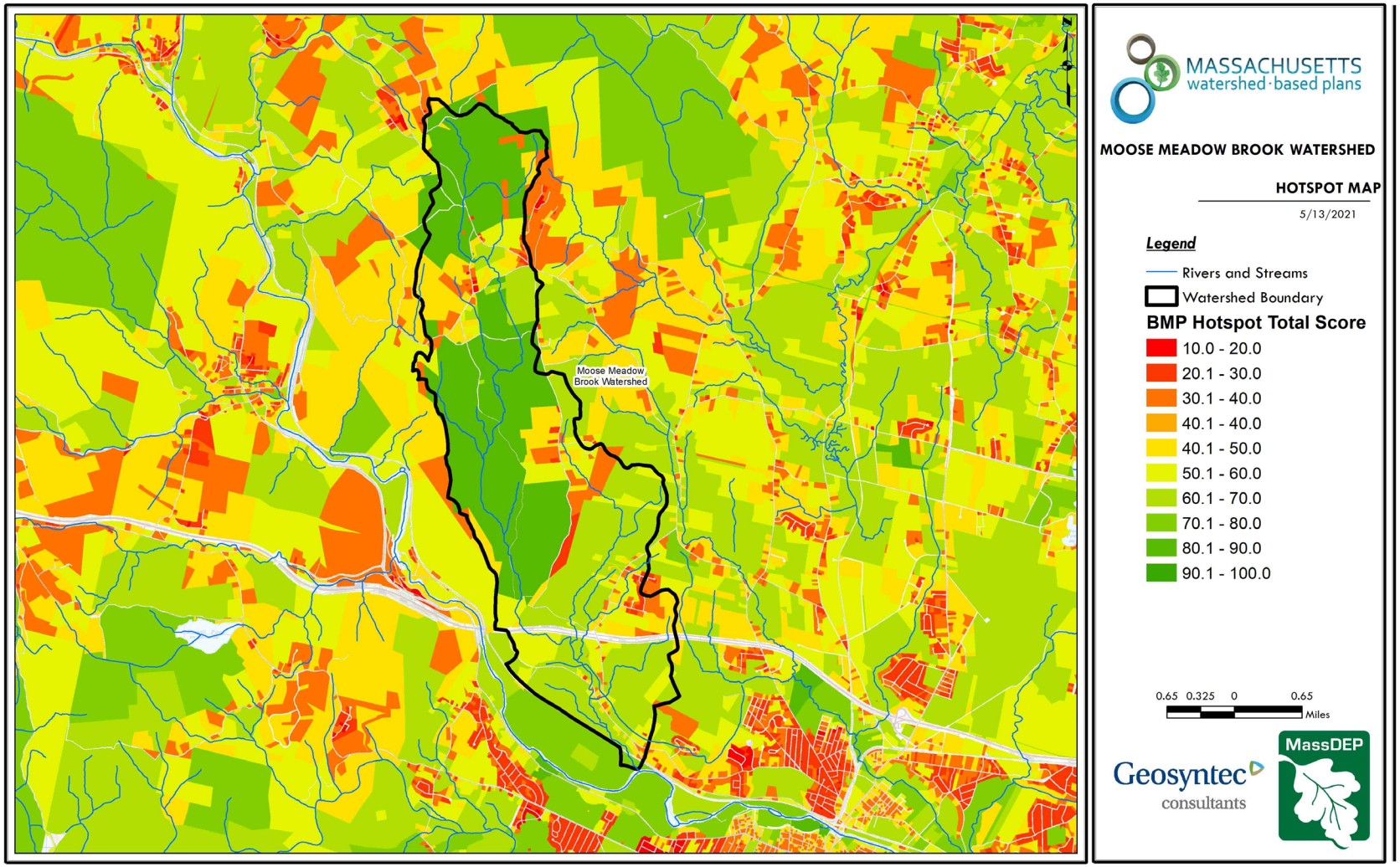
Attachment 1: Matrix for BMP Hotspot Map GIS-based Analysis

Criteria	Indicator Type	METRICS																										Multiplier	Maximum Potential Score
		Yes or No?		Hydrologic Soil Group				Land Use Type								Water Table Depth				Parcel Area			Parcel Average Slope						
		Yes	No	A or A/D	B or B/D	C or C/D	D	Low and Medium Density Residential	High Density Residential	Commercial	Industrial	Highway	Agriculture	Forest	Open Land	Water	101-200 cm	62-100 cm	31-61 cm	0-30 cm	Greater than 2 acres	Between 1-2 acres	Less than 1 acre	Less than 2%	Between 2% and 15%	Greater than 15%	Less than 50%	Between 51% and 100%		
Is the parcel a school, fire station, police station, town hall or library?	**Ownership**	5	0																									2	10
Is the parcel's use code in the 900 series (i.e. public property or university)?	**Ownership**	5	0																									2	10
Is parcel fully or partially in an Environmental Justice Area?	**Social**	5	0																									2	10
Most favorable Hydrologic Soil Group within Parcel	**Implementation Feasibility**			5	3	0	0																					2	10
Most favorable Land Use in Parcel	**Implementation Feasibility**							1	2	4	2	4	5	1	4	**X**[1]												3	15
Most favorable Water Table Depth (deepest in Parcel)	**Implementation Feasibility**																5	4	3	0									2	10
Parcel Area	**Implementation Feasibility**																				5	4	1						3	15
Parcel Average Slope	**Implementation Feasibility**																							3	5	1			1	5
Percent Impervious Area in Parcel	**Implementation Feasibility**																										5	2.5	1	5
Within 100 ft buffer of receiving water (stream or lake/pond)?	**Implementation Feasibility**	5	2																									2	10

Note 1: **X** denotes that parcel is excluded

Attachment 2: BMP Hotspot Map Example (Moose Meadow Brook Watershed, Westfield, MA)



Attachment 3: Lakes/Ponds on 2016 Integrated List without a Delineation in WBP tool

Waterbody Name	Assessment Unit ID
Shad Factory Pond	MA53005
Glue Factory Pond	MA62078
Hartwell School Pond	MA62086
Dean Park Pond	MA82026
Mill Pond	MA93-60
Nasketucket River	MA95-67
Horseneck Channel	MA95-87
The Let	MA95-88
Giles Creek	MA95-89
Allens Harbor	MA96-95
Wychmere Harbor	MA96-96
Unnamed Tributary	MA96-97
Elbow Pond	MA96077
North Pond	MA96225
Smith Pond	MA96301
Uncle Harvey Pond	MA96319
Moll Pond	MA96355
Farm Pond	MA97-30
Sunset Lake	MA97-31
Trapps Pond	MA97-32
Black Point Pond	MA97-33
North Head Long Pond	MA97-34
Tiasquam River	MA97-35
Head of Hummock Pond	MA97035
Central Pond	MA52006
James V. Turner Reservoir	MA52022
Tispaquin Pond	MA62195
Great Meadows Pond #3	MA82053
North Great Meadows	MA82084
Kinnacum Pond	MA96163
Spectacle Pond	MA96306
Village Pond	MA96329
Gibbs Pond	MA97028
Miacomet Pond	MA97055
Seths Pond	MA97085
Tom Nevers Pond	MA97097