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RESILIENCY IMPROVEMENTS AT WATERSHOPS POND DAM DRAWDOWN PERIOD MONITORING REPORT #5

MAY 27, 2021 (with followup monitoring on JUNE 2, 2021)

For Compliance with:

Order of Conditions, DEP File No. 294-0607, issued 09/17/2020

Section 401 Water Quality Certification, BRP WW 08, DEP Transmittal No. X286704, issued 07/23/2021

Section 404 Permit, File No. NAE-2020-02301, issued 10/21/2020

Certificate on the SEIR, Secretary of Energy and Environmental Affairs, EOEEA No. 16234, issued 07/31/2020

Prepared by: Paul G. Davis, PhD, Adrienne Dunk

Reviewed by: Tom Jenkins, P.E.

INTRODUCTION AND METHODOLOGY

In compliance with authorized procedures approved under the above-referenced permits and authorizations, GZA is monitoring dissolved oxygen levels, temperature, and transparency during the period of drawdown associated with the Resiliency Improvements at Watershops Pond Dam Project. This report presents the results of the fifth monitoring event conducted during the period of drawdown, which commenced with the opening of the low-level outlets at the dam on October 26, 2020. During the winter drawdown period, dissolved oxygen monitoring will occur at a frequency of once every 2 months. From March through October, during the growing season, monitoring will occur monthly.

Ecological resource monitoring was initially identified as a means to gauge the environmental impacts associated with a partial or full drawdown of Watershops Pond that may occur during the Project. The monitoring was discussed conceptually in the Alternatives Analysis included in the Expanded Environmental Notification Form (EENF) for the Project (EOEEA No. 16234, EENF dated June 15, 2020). On July 31, 2020, the Secretary of Energy and Environmental Affairs issued her Certificate on the EENF requiring the preparation of a Single Environmental Impact Report (SEIR). In response to comments received on the EENF and in response to the Secretary's Certificate on the EENF, a detailed draft "Aquatic and Wetland Resource Monitoring and Mitigation Plan"; the "Plan") was developed in coordination with regulatory agencies and was submitted as an integral mitigation commitment detailed within the SEIR dated August 28, 2020. The Plan was referenced in the Secretary's Certificate on the SEIR (October 16, 2020) and became a mitigation requirement associated with the City of Springfield's Preferred Alternative of full pond drawdown during the Project. The basic elements of the Plan were developed based upon prior studies of the pond and consultations with the Springfield Conservation Commission and State and Federal regulatory officials.



A copy of the Plan was provided in **Appendix 1.** to the “Pre-Drawdown Ecological Monitoring Report,” GZA, September 2020.

During the winter drawdown period, dissolved oxygen monitoring occurred at a frequency of once every 2 months. From March through October, during the growing season, dissolved oxygen and groundwater monitoring occurs monthly. Within the Pond, vertical profiles are being conducted at the three locations and Dissolved Oxygen (DO) and Temperature (°C) were measured at one-foot depth intervals. Secchi disk depth is recorded at each site. Vegetation community monitoring occurs twice per growing season, in late May and between August 15 and September 15. Groundwater and vegetation community monitoring is being conducted at the six stations located at the three BVWs identified during the pre-drawdown report and depicted on **Figures 2 through 4.** This report presents the results of the fifth monitoring event conducted during the period of drawdown, which commenced with the opening of the low-level outlets at the dam on October 26, 2020.

The current monitoring event was conducted on May 27, 2021. Monitoring was repeated at the two locations selected during the first sampling event, conducted December 15, 2020, and at a third sampling location near the dam which was added on March 23, 2021, to take advantage of deeper residual pool depth for monitoring (see **Figure 1A** for data collection locations).

RESULTS

The Watershops Pond residual pool encompasses about 29.8 acres upgradient of the dam where the water exits the pond basin through the sluice gates. The maximum pool depth observed was slightly over 6 feet, with most of the pool area less than 3 feet deep. The height of the pool was determined by measuring the surface water elevation below the deck of the privately-owned steel bridge located approximately 200 feet upstream of the dam. The measured surface water elevation was at Elevation 142.7± which is approximately 1.9± feet higher than the water surface elevation that was measured in April 2021 and approximately 2.0± feet higher than measured in December 2020.

Based upon the Secchi Disk depth, the water within the pool basin was observed to be much more turbid than earlier sampling events; Secchi Disk depths recorded at 0.8 feet deep in May as opposed to 1.5-3.0 feet in April and 4.0 feet in March. Watershops Pond had an average temperature of 21.0° C for locations measured. The measured temperatures ranged from 20.5° C to 22.4° C. The maximum DO observed was 5.0 at one location (**Table 1**). It should be noted that there was a significant rainfall event in the watershed on the 24-hour period to the May sampling that likely affected turbidity and the Biochemical Oxygen Demand during this sampling.



Table 1. Watershops Pond Drawdown Pool Dissolved Oxygen, Temperature, and Secchi Depth Measurements
Date of Data Collection: 05/27/2021 10:00AM – 11:00 AM

Thursday 05-27-2021; 10:30 AM											
Surface Water Elevation: 142.70 Note: chisel mark on pond side of pier made at 12.00' below bridge deck											
Location: Main Body, Near Dam, East of Steel (private) Bridge; 42°05.861 N; 072°33.624 W				Location: Main Body, Central Pond, East of RR Bridge; 42°05.940 N; 072°33.345 W				Location: Main Body, Near Dam, 100'± West of Steel (private) Bridge; 42°05.848 N; 072°33.735 W			
Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C	Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C	Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C
0.6	0	3.6	21.5	0.68	0	5	22.4	0.8	0	3.5	21.1
	1	3.6	21.4		1	5	22.2		1	3.4	21
	2	3.6	20.8		2	4.9	21.3		2	3.3	21
	3	3.6	20.6		2.2 bottom	4.9	21.5		3	3.3	20.8
	4	3.7	20.6						4	3.2	20.6
	4.75 bottom	3.4	20.5						5	3.2	20.5
									6	3.3	20.5
									6.25 bottom	3.1	20.5

A second sampling event was performed on June 2, 2021, to verify if the May 27, 2021, data was representative of a trend to high turbidity and low dissolved oxygen, or an episodic result of an intense watershed rainfall event and pollen washoff. This second round of sampling (**Table 2**) indicates that the water quality rebounded following the rain event. The average temperature lowered from 21.0° C to 19.3° C and the minimum recorded DO was 7.6.

Table 2. Watershops Pond Drawdown Pool Dissolved Oxygen, Temperature, and Secchi Depth Measurements
Date of Data Collection: 06/02/2021 10:00AM – 11:00 AM

Wednesday 06-02-2021; 2:30 PM											
Surface Water Elevation: 142.20 Note: chisel mark on pond side of pier made at 12.00' below bridge deck											
Location: Main Body, Near Dam, East of Steel (private) Bridge; 42°05.861 N; 072°33.624 W				Location: Main Body, Central Pond, East of RR Bridge; 42°05.940 N; 072°33.345 W				Location: Main Body, Near Dam, 100'± West of Steel (private) Bridge; 42°05.848 N; 072°33.735 W			
Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C	Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C	Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C
1.5	0	7.8	20.8	1	0	7.6	21.5	1.5	0	7.9	20.6
	1	7.8	20.8		1	7.8	21.5		1	8.1	20.4
	2	7.8	20.4		2	7.9	21		2	8.2	18.6
	3	7.9	18.7		2.25 bottom	7.6	21		3	8.2	18.1
	4	8	17.3						4	8.2	17.3
	4.5 bottom	8.1	17.1						5	8.1	16.4
									6.0 bottom	8	16



The average DO concentration at each depth range of the water column is shown in **Table 3**. Though the May data meets the threshold for mitigative action, the June data, obtained one-week later, indicates an improved water quality with results above action thresholds. Given that there appears to be an association between the DO concentration and watershed rainfall events, followed by rapid recovery, it would seem to suggest that aeration would not provide significant mitigation of the transient low DO conditions, which appear to rebound as the watershed response to the rainfall lessens. Additional sampling of the inflow water from at least the North Branch of the Mill River might be helpful to distinguish between watershed and in-pond low DO events and determine when more aggressive mitigation measures are appropriate if threshold conditions are encountered (see discussion).

Table 3. Hypsometric Distribution of Lake Volume and Dissolved Oxygen by Depth

Depth (ft)	Acres Encompassed by Contour Depth	Water column volume by depth interval (CF)	% vol. of water column within depth interval	Cum. % vol. above interval depth	Average DO (mg/l) May 27, 2021	Average DO (mg/l) June 2, 2021
0-1	29.8	1,135,237.4	37.1	37.1	4.0	7.8
1-2	22.5	860,941.9	28.1	65.2	4.0	7.9
2-3	17.2	623,461.9	20.4	85.6	3.9	8.0
3-4	11.6	335,447.7	11	96.6	3.9	7.9
4-5	4.3	96,265.6	3.1	99.7	3.5	8.1
5-6	0.63	11,608.4	0.4	100.1	3.3	8.1
6+	0.03	435.0	0	100.1	3.1	8.0
Total		3,063,397.9				

Groundwater levels were measured at the six stations by auguring a 3-inch diameter hole to a depth of at least 24 inches and allowing time for equilibration. The observed depths to groundwater are shown in **Table 4**.

**Table 4. Watershops Pond Drawdown Groundwater Monitoring Measurements (inches below ground surface)
Date of Data Collection: 05/27/2021 11:00AM – 1:00 PM**

Date	Springfield College	Springfield College East Campus		GYSGT J. Sullivan Park		
	Station 1	Station 1	Station 2	Station 1	Station 2	Station 3
05/27/2021	-24+	-24+	-24+	-16	-8	-2

Note: Depths denoted with a “+” indicate that groundwater was not observed at this depth

Vegetation was also inventoried with percent cover estimated for each observed species at the six stations. No change in species or percent composition was observed in the tree canopy, shrub/sapling, or vine layers. Changes in the herbaceous layer are shown in **Table 5**.

**Table 5. Watershops Pond Drawdown Wetland Vegetation Monitoring Herbaceous Vegetation Change
Date of Data Collection: 05/27/2021 11:00AM – 1:00PM**

Species		Springfield College	Springfield College East Campus		GYSGT J. Sullivan Park		
Common Name	Scientific Name	Station 1	Station 1	Station 2	Station 1	Station 2	Station 3
Fleabane Daisy	<i>Erigeron annuus</i>	-trace					
Purple Loosestrife*	<i>Lythrum salicaria</i>	-5%				-7%	
Thistle	<i>Cirsium sp.</i>	+2%					



Glossy Buckthorn*	<i>Frangula alnus</i>		+3%				
Clearweed	<i>Pilea pumila</i>		-5%		-5%	-15%	
Barberpole Sedge	<i>Scirpus rubrotinctus</i>		-15%**				
Skunk cabbage	<i>Symplocarpus foetidus</i>		+5%	+5%			
Fringed Sedge	<i>Carex crinita</i>		+trace				
Swamp Beggar's Tick	<i>Bidens discoidea</i>		+2%				-2%
Awl-fruit sedge	<i>Carex stipata</i>		+3%				
Arrowwood	<i>Viburnum dentatum</i>			+3%			
Red Oak	<i>Quercus rubra</i>			+trace			
Spinulose Wood Fern	<i>Dryopteris carthusiana</i>			-5%			
Pennsylvania Sedge	<i>Carex Pennsylvanica</i>			-5%**			
Swamp Azalea	<i>Rhododendron viscosum</i>			-5%**			
Princess Pine	<i>Lycopodium obscurum</i>			+2%			
Jewelweed	<i>Impatiens capensis</i>				+5%	+10%	
Sensitive Fern	<i>Onoclea sensibilis</i>				+15%		
Arrow Arum	<i>Peltandra virginica</i>					-3%	
Black Nightshade	<i>Solanum nigrum</i>					-3%	
Greater Water Dock	<i>Rumex Britannica</i>					+2%	
Forget-me-not	<i>Myosotis verna</i>					+2%	
Duckweed	<i>Lemna minor</i>						-85%

Note:

“+” indicates an increase in percent cover from pre-drawdown conditions

“-” indicates a decrease in percent cover from pre-drawdown conditions

* indicates the species is considered invasive in Massachusetts

** indicates that the species may have previously been misidentified

DISCUSSION




The Plan suggested the action level for DO should be 5 mg/l for at least 75% of the surface waters in the residual pool. The measured May DO level was 4 mg/l or less for at least 75% of the surface waters. Per the Plan, this DO level should have triggered mitigation (i.e., aeration); however, the sampling event immediately followed a rain event with local rainfall recordings ranging from 0.53 inches (reported via wunderground.com at Bradley International Airport Station) and 0.774 inches (reported via localconditions.com for Springfield MA). GZA observed significantly increased turbidity from the April 2021, sampling event and hypothesized that the DO was depressed due to a watershed event and not in association with a drawdown-induced seasonal event. Increased turbidity from sediment and/or pollen within the watershed and basin could have resulted in a higher than usual Biochemical Oxygen Demand (BOD), but under such circumstances, DO would be expected to return to normal conditions as the storm-induced turbidity lessened and the sediment settled. In consultation with the Springfield Conservation Commission, GZA performed a second sampling event one week later, on June 2, 2021, to verify if DO had returned to non-threshold levels. On June 2, 2021, the turbidity in Watershops Pond had decreased, and the DO levels had risen to 7.8 mg/l or greater for all contour elevations. This result is more in line with the anticipated gradual fall in DO as the weather and water warms. The return of more normal expected DO levels observed on this date, even though there were some smaller rainfall amounts between May 29 and May 31 preceding the second sampling which ranged from a rainfall total of 0.993 inches (reported via localconditions.com for Springfield MA) and 2.70 inches (reported via wunderground.com at Bradley International Airport Station).



The groundwater levels in the wetlands were expected to drop with the Watershops Pond drawdown. Groundwater depths will continue to be monitored throughout the growing season. Due to this drop, there may be a short-term shift in some herbaceous vegetation. More permanent vegetation in the tree canopy, shrub/sapling, and vine layers are not anticipated to change from the drawdown. The observed changes herbaceous vegetation composition was not significant when accounting for time of year with the exception of duckweed. The percentage of duckweed coverage at Sullivan Park Station 3 decreased by 85%. Duckweed is an aquatic plant which floats at the top of the water column; however, there is no standing or ponded water at this sample station currently. The duckweed is anticipated to return when the pond is refilled. These data will be discussed and analyzed further in the annual wetland monitoring report. Following the refilling of the pool, wetland impacts, and potential mitigation measures will be discussed.

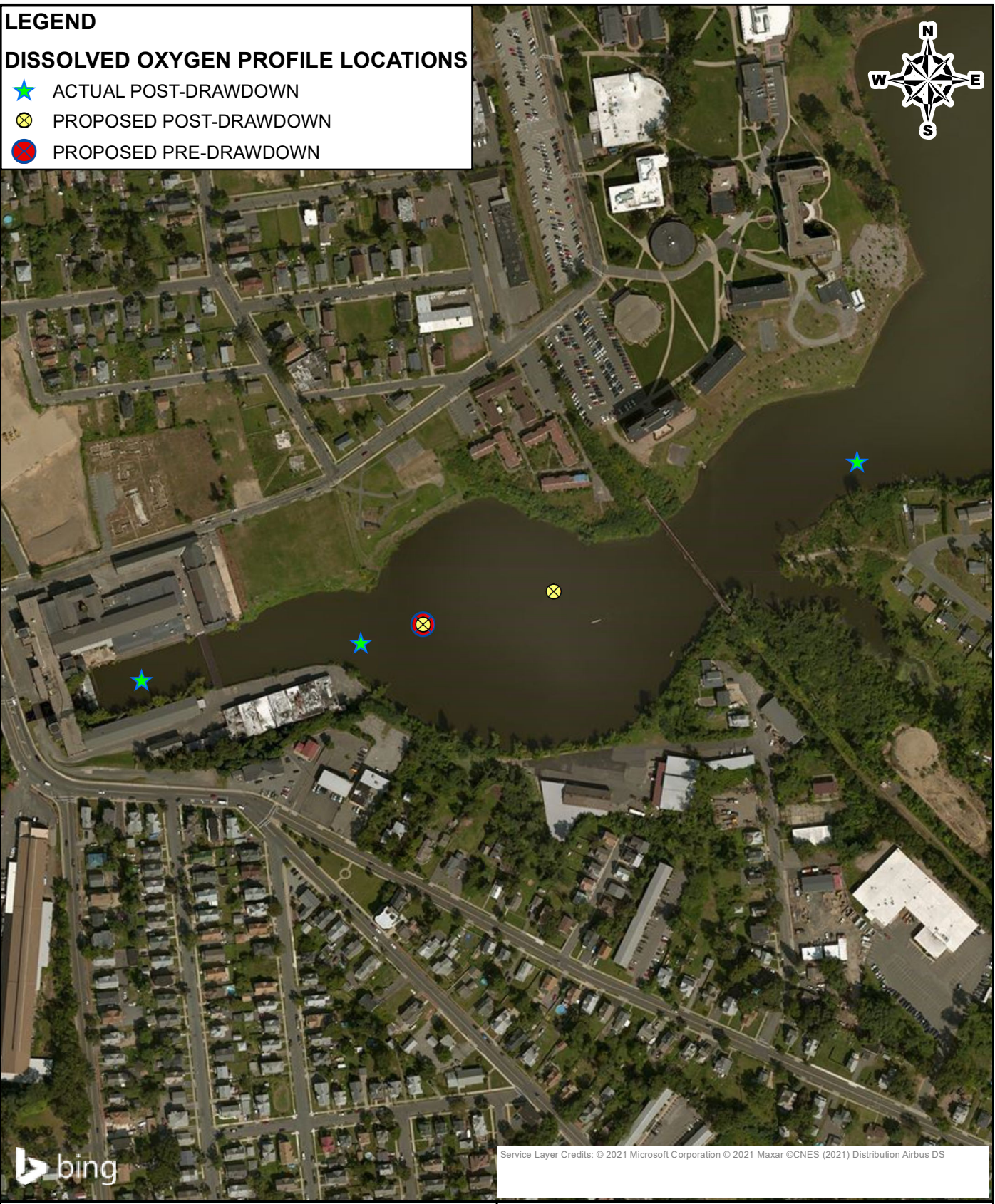
LEGEND

DISSOLVED OXYGEN PROFILE LOCATIONS

-  ACTUAL POST-DRAWDOWN
-  PROPOSED POST-DRAWDOWN
-  PROPOSED PRE-DRAWDOWN

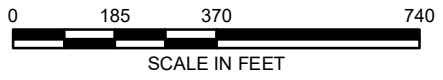


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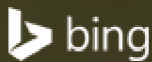
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**DISSOLVED OXYGEN PROFILE
 MONITORING LOCATIONS**

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DESIGNED BY: ARD	DRAWN BY: ARD	SCALE: 1 in = 350 ft
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FIG.
1A

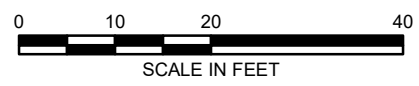


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LEGEND

- + MONITORING STATION
- WETLAND BOUNDARY POINT
- OBSERVED MEAN HIGH WATER
- WETLAND BOUNDARY
- BVW SURVEY AREAS
- PROJECT AREA



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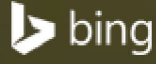
RESILIENCY IMPROVEMENTS AT WATERSHOPS POND DAM
1 ALLEN STREET
SPRINGFIELD, MASSACHUSETTS

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SPRINGFIELD COLLEGE BVW

PROJ MGR: TEJ	REVIEWED BY: TEJ	CHECKED BY: SLL	FIG. 2
DESIGNED BY: JRB	DRAWN BY: ARD	SCALE: 1 in = 20 ft	
DATE: 11/24/2020	PROJECT NO: 15.0166625.20	REVISION NO:	



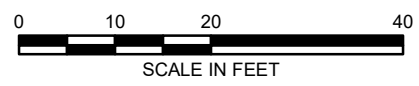
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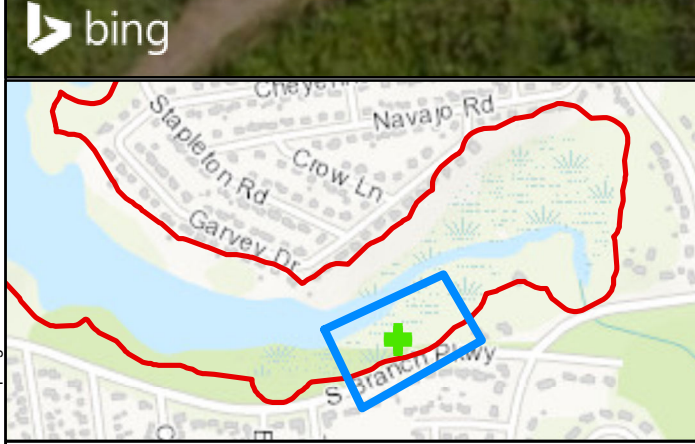
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SPRINGFIELD COLLEGE
EAST CAMPUS BVW

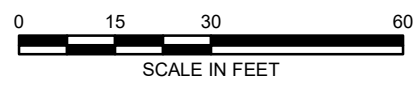
PROJ MGR: TEJ	REVIEWED BY: TEJ	CHECKED BY: SLL	FIG. 3
DESIGNED BY: JRB	DRAWN BY: ARD	SCALE: 1 in = 20 ft	
DATE: 11/25/2020	PROJECT NO: 15.0166625.20	REVISION NO:	



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GYSGT. J. SULLIVAN PARK BVW

PROJ MGR: TEJ	REVIEWED BY: TEJ	CHECKED BY: SLL	FIG. 4
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