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RESILIENCY IMPROVEMENTS AT WATERSHOPS POND DAM DRAWDOWN PERIOD MONITORING REPORT #13

June 14, 2022

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, and Adrienne Dunk

Reviewed by: Guy Dalton, LSP, Associate Principal

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 thirteenth 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.

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 the 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 spring drawdown and proposed refilling period, dissolved oxygen monitoring occurred monthly from April to June and August to November. During the winter drawdown period, dissolved oxygen monitoring occurred at a frequency of once every 2 months. During the 2021 drawdown, from March through October, during the growing season, dissolved oxygen monitoring occurred monthly. As the pond refilling began in May 2022, vertical profiles are conducted at four locations (**Figure 1B**) and Dissolved Oxygen (DO) and Temperature (°C) are measured at one-foot depth intervals. Secchi disk depth is recorded at each monitoring location. During the 2021 and 2022 growing season, April through October, groundwater monitoring occurred monthly at the six stations located within the three bordering vegetated wetlands (BVWs) identified during the pre-drawdown report and depicted on **Figures 2 through 4**. Vegetation community monitoring occurs twice per growing season, in late May and between August 15 and September 15 at the same six stations as the groundwater monitoring.

The most recent water quality monitoring event was conducted on May 23, 2022. Monitoring was repeated at the two locations selected during the first sampling event, conducted December 15, 2020, at a third sampling location near the dam which was added on March 23, 2021, and at a fourth sampling location which became accessible due to pond refilling (see **Figure 1B** for data collection locations).

RESULTS

The Watershops Pond residual pool currently encompasses 59± acres upgradient of the dam where the water exits the pond basin through the sluice gates. During the May sampling event, the maximum pool depth observed was 11.0 feet, with most of the pool area less than 8 feet deep. However, observed pool depths varied from previous observations due to slight variations in monitoring locations as well as the closure of the low-level outlet on May 16, 2022, and refilling of the pond. 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 146.2± which is approximately 1.25± feet higher than the water surface elevation that was measured in April 2022.

Based upon the Secchi Disk depths which ranged from 1.50 to 3.0 feet, the water within the pool basin was observed to be more turbid than the April 2022 sampling event which recorded Secchi Disk depths of 3.00 to 5.50 feet.

Watershops Pond had an average temperature of 22.0° C for locations measured. The measured temperatures ranged from 16.4° C to 23.9° C. The DO levels measured ranged from 0.8 at the pond bottom to a maximum of 9.3 mg/l within the water column (**Table 1**).



Table 1. Watershops Pond Drawdown Pool Dissolved Oxygen, Temperature, and Secchi Depth Measurements
Date of Data Collection: 05/23/2022 11:00 AM – 12:30 PM

Date: 5/23/2022				Time: 11:00 AM			
Surface Water Elevation: 146.2 (Note: chisel mark on pond side of pier made at 12.00' below bridge deck)							
Location: Main Body, Near Dam, East of Steel 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			
Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C	Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C
3	0	8.8	23.7	2	0	8.3	23.3
	1	9.0	23.8		1	8.2	23.5
	2	9.0	23.7		2	8.3	23.5
	3	9.0	23.7		3	8.3	23.5
	4	8.9	23.4		4	8.2	23.4
	5	8.6	23.2		5	7.5	23.3
	6	8.1	22.9		5.5	5.2	22.4
	7	7.0	20.9				
	8	5.2	18.1				
	9	2.2	16.4				
Location: Main Body, Near Dam, 100'± West of Steel Bridge; 42°05.848 N; 072°33.735 W				Location: Main Body, Central Pond West of Roosevelt St. Bridge 42°06.212 N; 072°33.061 W			
Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C	Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C
2.5	0	9.3	23.9	1.5	0	6.5	21.5
	1	9.3	23.8		1	6.5	21.5
	2	9.3	23.6		2	6.5	21.5
	3	9.3	23.5		3	6.3	21.2
	4	9.2	23.5		3.5	6.0	21.7
	5	9.0	23.3				
	6	8.8	23.3				
	7	7.1	22.5				
	8	5.9	19.9				
	9	5.6	18.8				
	10	2.2	16.6				
	11	0.8	16.7				

The average DO concentration at each depth range of the water column is shown in **Table 2**. Because the DO concentrations remained relatively stable throughout most of the water column, the average DO as measured by the average concentration at each depth interval is above the action level of 5.0 mg/l.



Table 2. 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)
0-1	58.78	2,321,613.8	22.4	22.4	8.2
1-2	48.00	1,930,250.4	18.6	41	8.3
2-3	37.88	1,650,247.5	15.9	56.9	8.3
3-4	32.42	1,412,099.0	13.6	70.5	8.2
4-5	26.06	1,135,237.4	10.9	81.4	8.1
5-6	22.5	860,941.9	8.3	89.7	8.4
6-7	17.2	623,461.9	6.0	95.7	7.4
7-8	11.6	335,447.7	3.2	98.9	7.1
8-9	4.3	96,265.6	0.9	99.8	5.6
9-10	0.63	11,608.4	0.1	99.9	3.9
10-11	0.03	435.0	0.0	99.9	2.2
Total		10,377,608.6		100	

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

**Table 3. Watershops Pond Drawdown Groundwater Monitoring Measurements (inches below ground surface)
Date of Data Collection: 05/23/2022 1:00 PM – 3:00 PM**

Date	Springfield College	Springfield College East Campus		GYSGT J. Sullivan Park		
	Station 1	Station 1	Station 2	Station 1	Station 2	Station 3
05/23/2022	-24+	-24+	-24+	-24+	-23	-8

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 since the initial inventory in September 2020. Changes in the herbaceous layer since September 2020 are shown in **Table 4**.



Table 4. Watershops Pond Drawdown Wetland Vegetation Monitoring Herbaceous Vegetation Change
Date of Data Collection: 05/23/2022 1:00 – 3:00 PM

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
Wild Mint	<i>Mentha arvensis</i>	-25%					+trace
Fleabane Daisy	<i>Erigeron annuus</i>	-trace					
Purple Loosestrife*	<i>Lythrum salicaria</i>					-7%	
Thistle	<i>Cirsium sp.</i>	+2%					
Multiflora Rose	<i>Rosa multiflora</i>	+50%					
Crinkle-leaved Dock	<i>Rumex obtusifolius</i>	+3%					
Goldenrod	<i>Solidago sp.</i>	+20%					
Glossy Buckthorn*	<i>Frangula alnus</i>		+8%		-10%		
Clearweed	<i>Pilea pumila</i>		-15%		+trace	-30%	
Barberpole Sedge	<i>Scirpus rubrotinctus</i>		-15%**				
Skunk cabbage	<i>Symplocarpus foetidus</i>		+3%	+5%	+5%		
Fringed Sedge	<i>Carex crinita</i>					+5%	
Swamp Beggar's Tick	<i>Bidens discoidea</i>					-trace	
Awl-fruit sedge	<i>Carex stipata</i>		+3%				
Arrowwood	<i>Viburnum dentatum</i>		+1%	+trace			
Red Oak	<i>Quercus rubra</i>			+trace			
Spinulose Wood Fern	<i>Dryopteris carthusiana</i>			-4%	-5%		
Pennsylvania Sedge	<i>Carex Pennsylvanica</i>			-5%**			
Swamp Azalea	<i>Rhododendron viscosum</i>			-5%**			
Princess Pine	<i>Lycopodium obscurum</i>		+2%	+2%			
Jewelweed	<i>Impatiens capensis</i>				+15%	+60%	
Sensitive Fern	<i>Onoclea sensibilis</i>				+20%		
Duckweed	<i>Lemna minor</i>						-85%
Highbush Blueberry	<i>Vaccinium corymbosum</i>			+3%			
Black Nightshade	<i>Solanum nigrum</i>					-3%	
American Bur-reed	<i>Sparganium Americanum</i>					-3%	
Broadleaf Cattail	<i>Typha latifolia</i>					-19%	
Tussock Sedge	<i>Carex stricta</i>			+15%			
False Nettle	<i>Boehmeria cylindrica</i>				-10%**		
Arrow Arum	<i>Peltandra virginica</i>					-3%	
Common Reed	<i>Phragmites australis</i>						+30%

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 an action level for DO of 5 mg/l for at least 75% of the surface waters in the residual pool, with lesser values potentially triggering mitigation action. During the May 2022 monitoring event, this action level was met as the average DO concentration exceeded 5 mg/l at nine of eleven contour elevations. This result demonstrates a decrease in DO levels from April 2022 which is anticipated given the increasing average temperatures and daylight. As temperatures continue to increase, it is likely that the DO will continue to decrease as the spring and summer seasons progress. During the ongoing refill period, some areas of vegetation that developed within exposed sediments will be inundated resulting in the death and decay of these plants. Such decomposition could result in localized DO depletion; therefore, continued water quality observations will be useful for the 2022 growing season to determine if DO mitigation is necessary. The areas of vegetation submergence appear relatively small compared to the entirety of Watershops Pond, so we remain optimistic that DO levels should remain above the action thresholds during this refill and post-refill season.

The groundwater levels in the wetlands were expected to drop with the Watershops Pond drawdown. The groundwater depths remained relatively stable from April 2022 with a decrease in depth to groundwater at Sergeant Gunnery Park. The Groundwater depths will continue to be monitored throughout the growing season. 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.

Most observed loss of wetland species in the herbaceous vegetation were not significant with the exception of clearweed, broadleaf cattail, and duckweed. The change in clearweed density is likely due to the seasonality of the sampling, and the density is anticipated to increase in the September 2022 observation report. Broadleaf cattail requires standing water and duckweed is an aquatic plant which floats on the water surface. These two species are anticipated to increase in density following the refilling of the pond. Other herbaceous wetland vegetation which increased over 20% included jewelweed, sensitive fern, and common reed. These increases indicate that the wetland at Sullivan Park has received sufficient surface inundation and groundwater inputs to sustain a wetland habitat despite the drawdown. These data will be discussed and analyzed further in the 2022 year-end wetland monitoring report. Following the refilling of the pool, wetland impacts, and any potentially needed mitigation measures will be discussed.

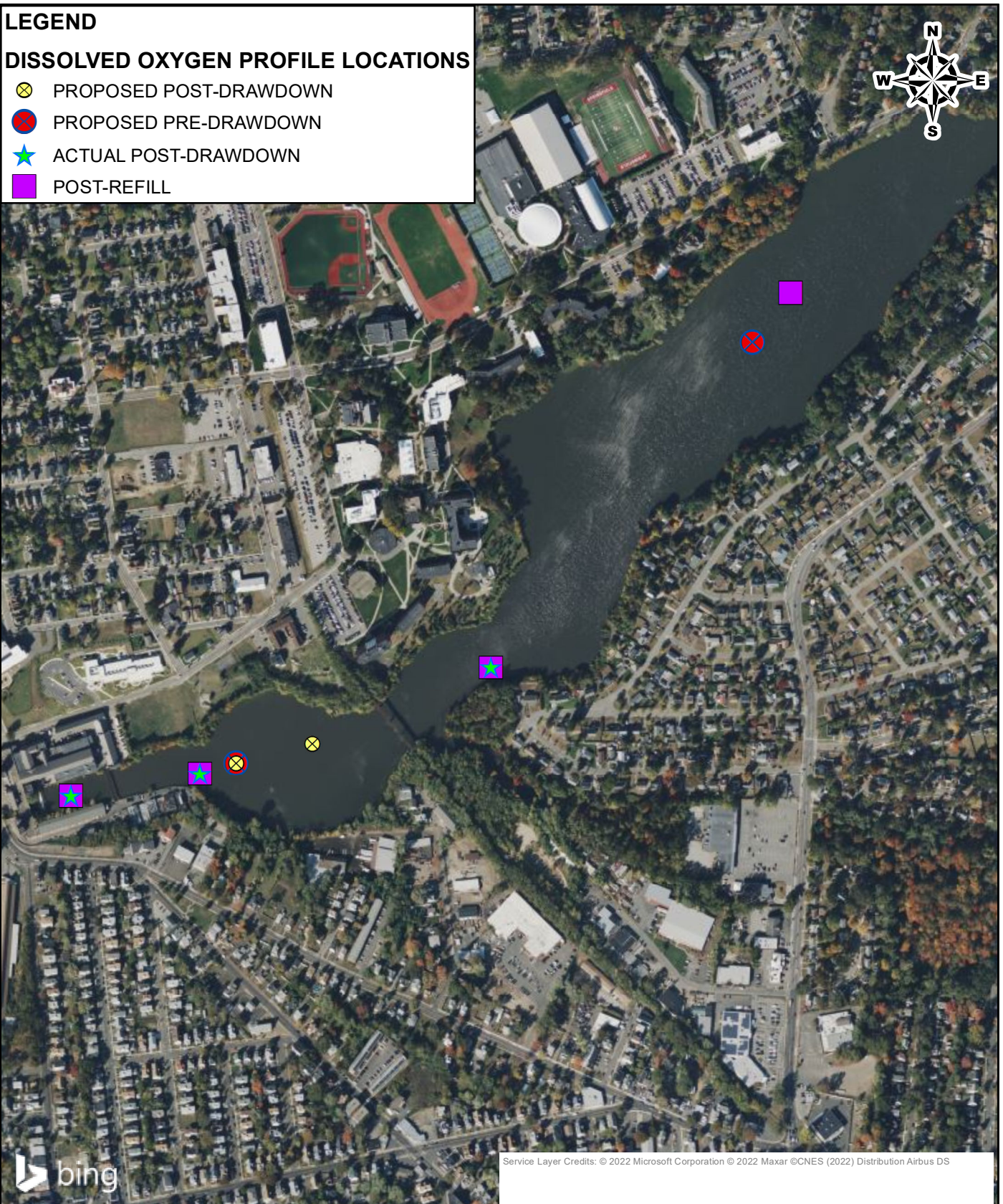
LEGEND

DISSOLVED OXYGEN PROFILE LOCATIONS

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

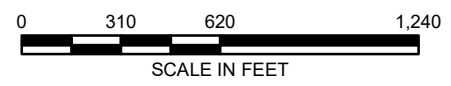


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 1 ALLEN STREET
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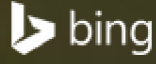
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**DISSOLVED OXYGEN PROFILE
 MONITORING LOCATIONS**

PROJ MGR: JRB	REVIEWED BY: GPD	CHECKED BY: SLL
DESIGNED BY: ARD	DRAWN BY: ARD	SCALE: 1 in = 600 ft
DATE: 06/09/2022	PROJECT NO: 15.0166625.20	REVISION NO:

FIG.
1B

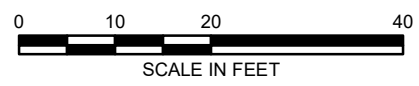


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LEGEND

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



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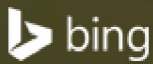
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SPRINGFIELD COLLEGE BVW

PROJ MGR: TEJ	REVIEWED BY: TEJ	CHECKED BY: SLL	FIG. 2
DESIGNED BY: JRB	DRAWN BY: ARD	SCALE: 1 in = 20 ft	
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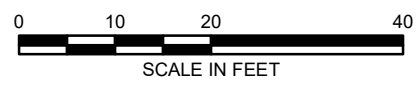


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LEGEND

- MONITORING STATION
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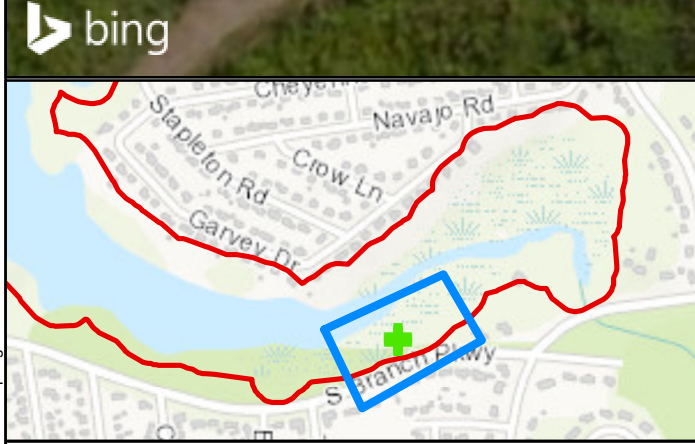
RESILIENCY IMPROVEMENTS AT WATERSHOPS POND DAM
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SPRINGFIELD COLLEGE
EAST CAMPUS BVW

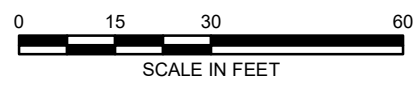
PROJ MGR: TEJ	REVIEWED BY: TEJ	CHECKED BY: SLL	FIG. 3
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LEGEND

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