



Engineers, Surveyors, Planners, Scientists

September 28, 2018

City of Columbus, Division of Sewerage & Drainage  
Attn: Mr. Greg Fedner, P.E.  
Private Development Section Manager  
910 Dublin Road  
Columbus, Ohio 43215

**Subject: Romanelli & Hughes Building Company – Greensward Road Development  
Type III Variance from Stormwater Drainage Manual**

Dear Mr. Fedner,

On behalf of Romanelli & Hughes Building Company, EMH&T is submitting an application for a Type III variance from the City of Columbus Stormwater Drainage Manual for the proposed Greensward Road Development project.

The proposed development site includes Stream Corridor Protection Zones (SCPZ) along Sugar Run, and two unnamed ephemeral tributaries. The proposed development will result in non-permitted, direct impacts to 318 linear feet of one of the ephemeral tributaries and 0.43 acre of associated SCPZ. The mitigation plan developed for and included as part of this variance application includes onsite restoration activities and SCPZ enhancement along Sugar Run.

The following information is provided in support of the application:

- Project Name: Greensward Road Development
- Address, PID, Site Disturbance and Total Site Area:  
Address: Greensward Road, New Albany, OH 43054  
PID: 010-217754 and 545-289381  
Site Disturbance: 6.5 acres  
Total Site Area: 20.9 acres
- Primary (Owner) Contact:  
Romanelli & Hughes Building Company  
Attn: Mr. Jim Ohlin  
148 W. Schrock Rd., Westerville, OH 43081  
(614) 891-2042; johlin@rh-homes.com

Additional information pertaining to the requested variance is included in the enclosed application document. Two hardcopies with CD have been provided. Please contact me with any questions you may have at (614) 775-4523, or by email at [hdardinger@emht.com](mailto:hdardinger@emht.com).

Sincerely,

A handwritten signature in blue ink that reads "Heather Dardinger".

Heather L. Dardinger  
Senior Environmental Scientist

C: Mr. Jim Ohlin, Romanelli & Hughes Building Company



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Delivering**Solutions.**

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20181068

## **GREENSWARD ROAD**

City of Columbus SWDM Type III Variance Application

City of Columbus Department of Public Service

September 28, 2018

emht.com

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## 1.0 INTRODUCTION

The following report provides information pertaining to a requested variance from the City of Columbus Stormwater Drainage Manual (the Manual) for the proposed Greensward Road Development project. Romanelli & Hughes Building Company (R&H) plans to construct this 22-home residential development southeast of Greensward Road and East Dublin Granville Road in northeast Columbus.

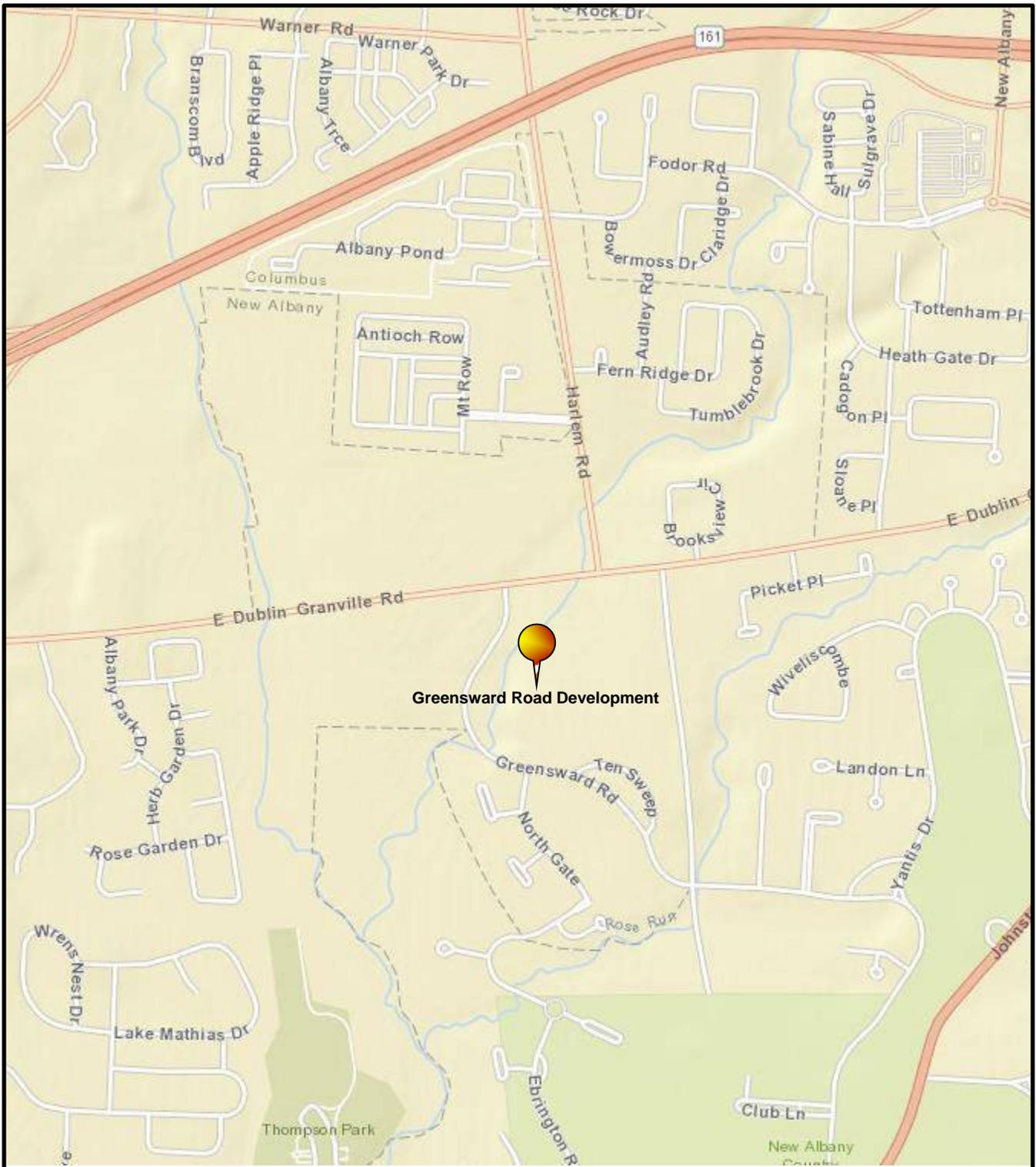
The proposed development is located on portions of two parcels (Franklin County Parcel ID 010-217754 and 545-289381). The  $\pm 20.9$ -acre project site is located south of East Dublin Granville Road, northeast of Greensward Road and west of Harlem Road (refer to Figure 1). The site is currently forested, with some open, maintained lawn areas adjacent to Greensward Road. Sugar Run, a tributary of Rocky Fork Creek, flows through the site from north to south.

The site is located within the Preserve District of the Northland Plan Volume II (City of Columbus, 2002), along Columbus' eastern border with the City of New Albany. Development of this area has been very active, and the demand for additional housing options continues to grow. The site will provide for 22 homes and associated roadway and stormwater management facilities. The development will be located on approximately 6.5 acres located east of Sugar Run. The remainder of the site ( $\pm 14.4$  acres) will be left as open space.

A Stream Corridor Protection Zone (SCPZ) is present along Sugar Run, which flows for approximately 1,685 linear feet through the project site. As defined by the Manual, this SCPZ is equal to 250 feet or the FEMA floodway, whichever is greater. In addition, there are two small, ephemeral tributaries to Sugar Run located within the project area. Streams 2 and 3 flow through the project site in a westerly direction toward Sugar Run for approximately 406 linear feet and 125 linear feet, respectively. These streams each have a 50-foot wide SCPZ.

A street crossing will result in impacts to a portion of the Stream 2 channel and SCPZ. This is a permitted use in the SCPZ, and does not require a variance from the Manual. Similarly, a proposed open drainage channel between a stormwater basin and Sugar Run will result in minor encroachment within the Sugar Run SCPZ. The proposed stormwater pipe outfall will be located outside the SCPZ and will be discharged into the constructed open channel, as recommended by the Manual. Compensatory floodplain storage will also be provided onsite, at a location to be determined within the Sugar Run SCPZ. As required by the Manual, the SCPZ disturbed by these permitted uses will be revegetated. Details regarding these permitted uses, including additional details regarding the compensatory floodplain storage, will be submitted as part of the Stormwater Management Report and Construction Plan submission for the project.

Additional, non-permitted activities associated with the proposed development will require direct channel and SCPZ impacts to Stream 2, as well as SCPZ impacts to Stream 3. The Stream 2 channel and SCPZ will be impacted to allow for development of three housing lots. A portion of the Stream 3 SCPZ will be impacted by grading associated with a stormwater basin. These impacts are not considered permitted uses per the Manual. As such, the City is seeking a Type III variance for channel impacts to Stream 2 and SCPZ impacts to Streams 2 and 3 for the purpose of completing the proposed development. A Section 404 Nationwide Permit from the U.S. Army Corps of Engineers will also be requested for the channel impacts to Stream 2.



**Greensward Road Development**



## **2.0 TYPE III VARIANCE (STREAM PROTECTION)**

The Stream Corridor Protection Zone (SCPZ) consists of the stream channel and the adjacent riparian area. Its purpose is to allow the natural, lateral movement of the stream, provide sufficient area for flood conveyance, protect water quality and prevent structures from being impacted by natural streambank erosion. A SCPZ is present along Sugar Run and two unnamed ephemeral tributaries at the Greenward Road development site. The Preferred Plan will encroach upon the SCPZ.

R&H is requesting a variance from Section 1.3.2 and 1.3.3 of the Manual for the proposed residential development, specifically a variance allowing for SCPZ and channel impacts in order to construct three residential buildings, grade a stormwater basin and complete associated earthwork. The proposed project will also result in channel and SCPZ impacts for a roadway crossing and SCPZ impacts for an open drainage channel and compensatory floodplain storage; however, these activities are permitted within the SCPZ per the Manual and a variance is not required for these impacts.

### **2.1 Proposed SCPZ Impacts**

As described on Exhibit Sheet 1, Sugar Run has a drainage area of 4.79 square miles. Therefore, based upon the criteria provided in the Manual, Sugar Run has a SCPZ width of 250 feet or the FEMA floodway, whichever is wider. Streams 2 and 3 are small, ephemeral tributaries with drainage areas of less than 0.05 square mile. As such, they each have a SCPZ width of 50 feet, which is the minimum provided per the Manual.

Under the Preferred Alternative, discussed below, the proposed area of impact within the SCPZ is 0.43 acre, which includes 318 linear feet of direct channel impacts to Stream 2 (refer to Sheet 1). As further discussed below, the proposed impacts to the channel and the SCPZ allows for construction of the preferred development layout and necessary stormwater management facilities.

### **2.2 Existing Conditions**

The property is bordered by East Dublin Granville Road to the north, Greensward Road to the west and south, and residential lots to the east. The majority of the project area is forested and undeveloped, with some open, maintained lawn areas adjacent to Greensward Road. Sugar Run flows southward through the western portion of the property from a culvert beneath East Dublin Granville Road to a culvert beneath Greensward Road. An existing sanitary sewer runs through the property, which is located east of and roughly parallel with Sugar Run.

Within the project site, there are 1,685 linear feet of Sugar Run, which is a perennial stream with an aquatic life designation of Warmwater Habitat (WWH). A Qualitative Habitat Evaluation Index (QHEI) assessment was completed for Sugar Run within the project area. The stream received a QHEI score of 52, which is indicative of 'fair' habitat quality. As shown on the QHEI dataform (Appendix A), the stream exhibits some high quality attributes, including gravel, cobble and boulder substrates, deep pools and good instream cover. However, this segment of Sugar Run also exhibits significant bank erosion, high levels of silt, embedded substrates, and poor

riffle/run habitat. Several large log/debris jams were noted along the stream reach, which are significantly degrading stream habitat, contributing to bank erosion and causing local flooding.

Streams 2 and 3 are unnamed, ephemeral tributaries to Sugar Run that flow through the project site in a westerly direction for approximately 406 linear feet and 125 linear feet, respectively. A Headwater Habitat Evaluation Index (HHEI) assessment was performed on Stream 2. The HHEI metric is applicable to streams with a watershed area of less than one square mile and maximum pool depths less than 40 centimeters, both of which apply to Stream 2. The stream received an HHEI score of 10, indicative of Class I Primary Headwater Habitat. An HHEI was not completed for Stream 3, as it will not be impacted by the project, but it exhibited similar habitat characteristics. The HHEI dataform is provided in Appendix A.

As described by Ohio EPA, Class I ephemeral streams have little or no aquatic life potential and have little or no potential to achieve higher stream functions. Based upon the field observations and the HHEI assessment, Streams 2 and 3 exhibit minimal stream functions. These channels primarily serve to convey overland stormwater flow from the surrounding forest to Sugar Run. They have no aquatic life potential, and have flowing water only for very short time periods following significant rainfall events.

## **2.3 Site Development Alternatives**

### 2.3.1 Proposed Conditions / Preferred Alternative

Under the Preferred Alternative (Exhibit Sheet 1), a 22-home development will be built on approximately 6.5 acres of land located east of the onsite sanitary sewer easement. A cul-de-sac will be constructed off Greensward Road to access the proposed development. Three detention basins will be constructed to provide stormwater control. The Preferred Alternative will result in **318 linear feet of channel impacts and 0.43 acre of SCPZ impacts**. Specifically, the following non-permitted impacts to streams and associated SCPZ are proposed:

- 318 linear feet of direct channel impacts to Stream 2;
- 0.39 acre of SCPZ impacts to Stream 2; and
- 0.04 acre of SCPZ impacts to Stream 3.

The impacts to the Stream 2 channel and SCPZ are necessary for construction of three of the proposed housing lots. The impacts to the Stream 3 SCPZ will allow for grading associated with one of the stormwater detention basins (Basin A). The proposed layout maximizes the developable space east of the sanitary sewer easement, and maintains the majority of the site as undeveloped open space. The proposed impacts will result in the loss of low quality, ephemeral stream channel and will preserve the higher quality Sugar Run SCPZ.

### 2.3.2 Minimal Impact Alternative

In the Minimal Impact Alternative (Exhibit Sheet 2), the direct channel and SCPZ impacts to Stream 2 have been reduced by eliminating one of the housing lots. Under this alternative, non-permitted impacts will include 166 linear feet of stream channel and 0.25 acre of SCPZ, as follows:

- 166 linear feet of direct channel impacts to Stream 2;
- 0.21 acre of SCPZ impacts to Stream 2; and
- 0.04 acre of SCPZ impacts to Stream 3.

The loss of the housing lot under the Minimal Impact Alternative will result in a financial impact of approximately \$242,800. This includes the direct loss of revenue associated with the lot, based on the current market, as well as unrecoverable development costs. This will reduce the development's financial viability.

Moreover, avoiding impacts on that lot will complicate the grading for the adjacent lots and increase the overall project cost. If the SCPZ is to be avoided, the pads graded for the adjacent lots will require retaining walls in order to achieve the required grade differential between the pads and the undisturbed SCPZ. For the minimal impact alternative, two such retaining walls would be required (one on the northern side of Lot 1 and one on the southern side of Lot 2). This would result in an additional cost of approximately \$15,000.

The empty lot that will be left under the Minimal Impact Alternative will also have an impact on the visual aesthetics of the overall development. The wooded area may likely be perceived as a detriment by potential buyers of the neighboring lots. The presence of trees and brush immediately adjacent to the neighboring houses may result in increased maintenance burdens (raking leaves, cleaning gutters, picking up fallen branches, etc.), potential for tree damage, and increased mosquito habitat.

### 2.3.3 Full Compliance / No-Impact Alternative

In order to avoid all non-permitted stream channel and SCPZ impacts on the site, three housing lots must be eliminated and the grading for Basin A must be modified to avoid the SCPZ. Under this alternative (Exhibit Sheet 3), channel and SCPZ impacts to Stream 2 would be limited to the minimum necessary to construct the road crossing (a permitted use). There would also be minor impacts to the SCPZ of Sugar Run and Stream 3 in order to construct open channels to convey flow from the outfalls of Basin A and C, which will be located outside the SCPZ.

The loss of the three housing lots and modification to Basin A under the No-Impact Alternative will result in a financial impact of approximately \$700,000. This will significantly reduce the development's financial viability. As described under the Minimal Impact Alternative, the empty lots will also have an impact on the visual aesthetics of the overall development, and may be perceived as a detriment by potential homebuyers of the neighboring lots.

As in the Minimal Impact Alternative, retaining walls will be required along the pads adjacent to the SCPZ in order to achieve the required grade differential. For the No Impact Alternative, three such retaining walls would be required (one on the northern side of Lot 1, one on the southern side of Lot 2, and one on the southern side of Lot 19). This would result in an additional cost of approximately \$25,000.

### 2.3.4 Comparison of Project Alternatives

As summarized in Table 1, the Preferred Alternative will result in the following non-permitted impacts: 318 linear feet of Stream 2 channel, 0.39 acre of Stream 2 SCPZ and 0.04 acre of Stream 3 SCPZ. The Minimal Impact Plan will reduce these impacts by approximately half.

**Table 1  
Comparison of Project Alternatives**

Alternative	Non-Permitted Impact		Remaining	
	Channel (lf)	SCPZ (ac)	Channel (lf)	SCPZ (ac)
<i>Existing Condition</i>			2,216	9.72
Preferred Plan	318	0.43	1,810	9.18
Minimal Impact Plan	166	0.25	1,962	9.36
No Impact Plan*	0	0	2,128	9.60

\* The No Impact plan will include 88 linear feet of channel impacts and 0.12 ac of SCPZ impacts associated with the proposed road crossings and open drainage channels (permitted uses).

The layout of the development in the Preferred Alternative maximizes the number of developable lots on the project site, while still preserving the majority of the site as open space. Reducing the proposed impacts under the Minimal Impact and No Impact Alternatives would significantly impact the visual aesthetics of the development, negatively affect the marketability of the neighboring lots, result in increased development costs and lead to a significant loss of revenue. Under all the proposed scenarios, there will be no impacts to Sugar Run or its SCPZ, other than a minor impact necessary to construct an open drainage channel from the outfall of Basin C.

### 2.4 Impacts to Stormwater Detention and Water Quality

Of the three alternatives, the Preferred Plan has the greatest impervious area, thereby slightly increasing the volume of stormwater runoff as compared to the Minimal or No Impact Alternatives. However, the stormwater management facilities for all three alternatives would be designed to comply with the stormwater management and water quality requirements of both the City of Columbus and Ohio EPA. Thus, each alternative would have similar impacts on stormwater detention and water quality.

### 2.5 Statement of Hardship

The proposed channel and SCPZ impacts under the Preferred Plan Alternative are driven by the need to maximize the developable space on the property east of the sanitary sewer easement. As detailed above, implementation of the Minimal Impact Alternative would significantly impact the financial viability of the project. The proposed minimization would result in a combined loss of revenue and increase in costs in excess of \$250,000, and result in significant impacts to the aesthetics and marketability of the development. Avoidance of all stream and SCPZ impacts would further impact the project, resulting in a combined loss of revenue and increase in costs of \$725,000. Thus, full compliance with the Manual will result in a significant hardship to R&H. Thus, R&H respectfully requests approval of the variance for the Preferred Plan Alternative.

### **3.0 MITIGATION**

As described in the Manual, adequate mitigation must be provided for impacts to the SCPZ by creating equivalent mitigation also within a SCPZ. Additionally, for direct stream impacts, the Manual states that “the applicant must demonstrate that the predicted post-construction QHEI/HHEI will meet or exceed the existing QHEI/HHEI.”

The Manual states, “Generally, mitigation SCPZ will be considered equivalent if it performs the same function as the disturbed SPCZ.” It is the City’s preference that mitigation occur on the same site as the SCPZ encroachment, or as close as possible if onsite mitigation is infeasible. The Manual specifies that mitigation should consist of equivalent SCPZ created at the following ratios: 1:1 onsite, 1:1.5 on an adjacent site, 1:2 in the same watershed assessment unit, 1:3 in the same county, and 1:5 in a contiguous county.

Under the Preferred Alternative Plan, the proposed impacts requiring mitigation include 318 linear feet of Stream 2, 0.39 acre of the Stream 2 SCPZ and 0.04 acre of the Stream 3 SCPZ. R&H is proposing to complete onsite mitigation within the Sugar Run channel and SCPZ. This onsite mitigation will include the following (refer to Exhibit Sheet 4):

1. Removal of logjams within the Sugar Run channel;
2. Removal of dead trees along the Sugar Run stream banks to help prevent formation of future logjams;
3. Restoration of forested habitat within an area currently maintained as mowed lawn; and
4. Preservation of approximately 9.5 acres of SCPZ and adjacent riparian forest.

### **3.1 Stream Channel Improvements**

#### **3.1.1 Proposed Mitigation Plan**

Stream channel improvements will be achieved by removing several significant logjams along 1,472 linear feet of the Sugar Run channel. Based on site reconnaissance completed August 29, 2018, four (4) such logjams were observed (refer to Photographs). While minor logjams may have beneficial effects on stream habitat, these logjams are very large, and tightly packed. As such, they are negatively impacting Sugar Run.

Specifically, the logjams pose a barrier to fish migration and are significantly impounding water behind the logjams. During high flow events, the logjams redirect the stream’s energy toward the stream banks, leading to the significant erosion that is observed within this stream segment. This erosion is contributing to the sediment load in Sugar Run, and degrading water quality. Moreover, the logjams are reducing the natural storage capacity of the stream channel and floodplain, exacerbating local flooding. The logjams also pose a hazard to downstream bridges and culverts, should they be swept downstream during a large scale flood event.

R&H proposes to remove the logjams from the stream channel during low flow conditions. The debris will be removed from the floodplain so that it is not redeposited during a flood event. Work will occur from the streambank, with no impacts to the stream channel. Any trees still rooted

in the streambank will be cut and their stumps and roots will be left in place to protect against erosion.

### 3.1.2 Expected Habitat Improvement

Sampling conducted by Ohio EPA in 2000 showed that Sugar Run was marginally meeting WWH expectations. Fish and macroinvertebrate populations were found to be ‘marginally good,’ and habitat conditions were ‘good’ at the sampling location. However, Ohio EPA noted that Sugar Run was showing a degree of impact and exhibited a higher proportion of modified habitat attributes than natural ones.

The QHEI assessment completed on Sugar Run within the project site confirms these findings, and indicates that habitat conditions have continued to decline over the past 18 years. Sugar Run received a QHEI score of 52, which is in the ‘fair’ narrative range (Appendix A). This score reflects the significant bank erosion, high levels of silt, embedded substrates, and poor riffle/run habitat observed within the project reach. Several large logjams were noted along the stream, behind which the stream is significantly impounded, with barely perceptible flow. These logjams are contributing to the degraded habitat conditions observed in the stream, in particular causing local flooding and exacerbating stream bank erosion.

The results of the QHEI assessment and onsite observations indicate that Sugar Run is significantly impacted by the logjams and online impoundments. The proposed restoration of natural flow through this portion of the stream channel will have a beneficial effect on aquatic habitat and water quality, as well as ameliorate local flooding and bank erosion.

Sugar Run is expected to obtain a post-restoration QHEI score of 62, which is in the ‘good’ narrative range for headwater streams (≤20 square mile watershed) and exceeds the goal score of 55 for WWH criteria. As noted in the post-restoration QHEI (Appendix A) and shown below in Table 2, improvements are expected in the substrate, bank erosion, and pool/glide and riffle/run quality metrics.

**Table 2  
Sugar Run Existing and Post-Restoration QHEI Comparison**

<b>Metric</b>	<b>Existing Condition</b>	<b>Post-Restoration</b>	<b>Net Improvement</b>
Substrate	6	11	+5
Instream Cover	14	14	No change
Channel Morphology	13	13	No change
Bank Erosion/Riparian	8	9	+1
Pool/Glide	3	6	+3
Riffle/Run	2	3	+1
Gradient	6	6	No change
<b>Total QHEI Score</b>	<b>52</b>	<b>62</b>	<b>+10</b>

### 3.1.3 Comparison of Proposed Impacts and Mitigation

As described in Section 2.2, the segment of Stream 2 that will be impacted by the proposed project received an HHEI score of 10. The HHEI score of 10 indicates that Stream 2 is a Class I

Primary Headwater Habitat (PHWH) stream. Class I PHWH streams are ephemeral streams that have extremely limited potential to support aquatic life or higher stream functions. The channel primarily serves to convey overland stormwater flow from the surrounding forest to Sugar Run.

In order to facilitate comparison of the Stream 2 habitat conditions to that of the proposed mitigation on Sugar Run, a QHEI assessment of Stream 2 was also completed. The QHEI score of 28 obtained for Stream 2 falls within the 'very poor' narrative range. The score reflects poor channel morphology and a lack of coarse substrates, instream cover, and instream habitat (riffles and pools).

In contrast, Sugar Run received a post-restoration QHEI score of 62, indicative of 'good' habitat exceeding WWH standards. This post-restoration QHEI score represents a lift of +10 points over the pre-restoration conditions and +34 points over the existing conditions of Stream 2. This represents significant benefits to local water quality and aquatic habitat in Sugar Run and in the wider Blacklick Creek-Big Walnut Creek watershed.

Overall, the proposed stream channel improvements will improve the habitat conditions over approximately 1,472 linear feet of Sugar Run, providing a QHEI score of 62, which will exceed WWH standards. This mitigation will offset non-permitted impacts to 318 linear feet of low quality, ephemeral stream (QHEI of 28). The mitigation will occur on the same site as the project impacts. The mitigation is more than equivalent as it performs a significantly higher function than the area impacted.

## **3.2 SCPZ Enhancement and Preservation**

### 3.2.1 Proposed Mitigation Plan

The proposed SCPZ enhancement along Sugar Run will include two components: (1) removal of standing dead trees, or "snags," along approximately 1,472 linear feet of Sugar Run; and (2) reforestation of a portion of the SCPZ. These activities will serve to enhance the riparian corridor, and prevent the formation of future logjams along Sugar Run.

Numerous large, standing dead trees were observed immediately adjacent to the stream channel during the site reconnaissance. Such trees are generally desirable for the riparian ecosystem, insofar as they provide important wildlife habitat, contribute coarse woody debris to the stream, and help to return nutrients to the forest floor through decomposition. However, when these trees eventually fall into the stream channel they cause logjams, which lead to the attendant negative impacts described in the previous section.

In order to preserve the natural benefits provided by dead and dying trees across the majority of the site, while also reducing future logjams, the removal of snags will be limited to within 15 feet of the stream channel, along both streambanks (approximately one acre). This will limit the snags to the large dead trees immediately on the streambank that are most likely to create future logjams. Snags will be identified within this area and then selectively cut, so as to not disturb adjacent vegetation. The tree stumps and roots will be left in place to protect against streambank erosion, and the dead tree material will be removed and disposed of offsite.

R&H also proposes to restore forested cover over approximately 1.06 acres of land, including 0.5 acre of SCPZ, located at the corner of Greensward Road and East Dublin Granville Road within the project site. This area is currently maintained as mowed lawn. R&H proposes to plant approximately 210 15-gallon trees and shrubs across this area, as listed on Exhibit Sheet 4. The trees to be planted will be native species, intended to mimic the tree community observed within the existing riparian corridor.

Finally, R&H will place approximately 9.54 acres of the site into in a conservation easement to ensure its perpetual protection and management. The easement will be recorded with the property deed.

### 3.2.2 Proposed SCPZ Mitigation Ratio

The proposed mitigation project will provide for the enhancement of approximately 1.5 acres of the Sugar Run SCPZ, including one acre of streambank snag removal and 0.5 acre of SCPZ tree restoration. Based upon the proposed SCPZ impacts of 0.43 acres (for non-permitted uses), this provides mitigation at a **ratio of 1 to 3.5**, exceeding the 1:1 onsite ratio provided by the Manual. This mitigation is more than equivalent, as the SCPZ of Sugar Run provides much higher functions and value to water quality than the SCPZ to be impacted along Streams 2 and 3.

#### **4.0 CONCLUSIONS**

R&H respectfully requests approval of the Type III variance for the Preferred Project Alternative for the Greensward Road Development project. The proposed non-permitted impacts to 318 linear feet of Stream 2 and 0.43 acre of SCPZ have been carefully considered, and ultimately determined to be necessary to meet the project's space requirements and financial considerations. Reducing or eliminating these impacts would have a significant impact on the project's financial viability.

The mitigation proposed for the Preferred Alternative will be achieved on the project site and includes stream channel improvements along 1,472 linear feet of Sugar Run and approximately 1.5 acre of forested riparian corridor enhancement within the Sugar Run SCPZ. The restoration activities on Sugar Run will result in a significant ecological lift as compared to the current condition of the Stream 2 channel to be impacted. The SCPZ mitigation will result in mitigation ratio of 1 to 3.5. The proposed mitigation is more than equivalent as the areas to be restored/enhanced perform significantly higher functions than the area to be impacted.

PHOTOGRAPHS



Photograph 1. Stream 1 (Sugar Run), looking downstream (south) (EMH&T 8/29/18)



Photograph 2. Stream 1 (Sugar Run), looking upstream (north) (EMH&T 8/29/18)



Photograph 3. Stream 2, looking upstream (east) (EMH&T 8/29/18)



Photograph 4. Stream 2, looking downstream (west) (EMH&T 8/29/18)



Photograph 5. Stream 3, looking upstream (east) (EMH&T 8/29/18)



Photograph 6. Stream 3, looking downstream (west) (EMH&T 8/29/18)



Photograph 7. Stream 1 (Sugar Run) substrate (EMH&T 8/29/18)



Photograph 8. Stream 2 substrate (EMH&T 8/29/18)



Photograph 9. Stream 3 substrate (EMH&T 8/29/18)



Photograph 10. Large log/debris jam on Sugar Run, looking south (EMH&T 8/29/18)



Photograph 11. Impoundment upstream of logjam, looking north (EMH&T 8/29/18)



Photograph 12. Eroding stream banks along Sugar Run (EMH&T 8/29/18)



Photograph 13. Logjam along Sugar Creek (EMH&T 8/29/18)



Photograph 14. Standing dead trees along Sugar Creek (EMH&T 8/29/18)



Photograph 15. Grass area to be reforested, looking south (EMH&T 8/29/18)



Photograph 16. Grass area to be reforested, looking west (EMH&T 8/29/18)

EXHIBITS





**LEGEND**

-  Ex Stream Channel
-  FEMA Base Flood Elevation Line (BFLE)
-  Floodway
-  Floodplain
-  Flood Plain Fill  
0.11 Ac/185 CY
-  Stream Corridor Protection Zone  
9.72 Ac
-  Permitted Use Stream Corridor Protection Zone  
0.12 Ac

**NOTES:**  
 The total length of the cul-de-sac is 1,145 feet from the centerline of Greensward Road to the center of the cul-de-sac bulb.  
 All data shown is based on GIS information, To Be Confirmed during Final Engineering.

**SITE STATISTICS:**

Total Acreage	20.9± Ac
Number of Lots	19
Gross Density	0.91± Lot/Ac
Total Open Space	15.28± Ac (73.1%)

**City of Columbus Stream Corridor Protection Zone Calculation (Section 1.3.1 of Stormwater Drainage Manual):**  
 The total width of the Stream Corridor Protection Zone for streams shall be established using the following criteria, whichever is greater:

1. The FEMA-designated floodway, or
2. Using the equation below with a minimum of 50 feet to a maximum of 250 feet. The zone shall be centered on the stream valley generally located at the point where both zone boundaries intersect equal elevations on either side of the stream:  

$$\text{Stream Corridor Protection Zone, in feet of width} = 147(\text{DA})^{0.38}$$
 where DA=drainage area of the stream in square miles, or
3. 50 feet from the top of each bank for fourth order streams or larger

Note: Where wetlands are located partially within the Stream Corridor Protection Zone, the Stream Corridor Protection Zone shall be extended to include the full extent of the wetland area.

**Sugar Run:**  
 Drainage area at DA2 = 3,065.60 acres = 4.790 sq miles  
 Stream Corridor Protection Zone Width = 250 feet or FEMA Floodway, whichever is greater

REVISIONS

MARK	DATE	DESCRIPTION

CITY OF COLUMBUS, FRANKLIN COUNTY, OHIO  
 SCVPZ VARIANCE  
**GREENSWARD ROAD**  
 NO IMPACT OPTION

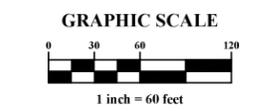
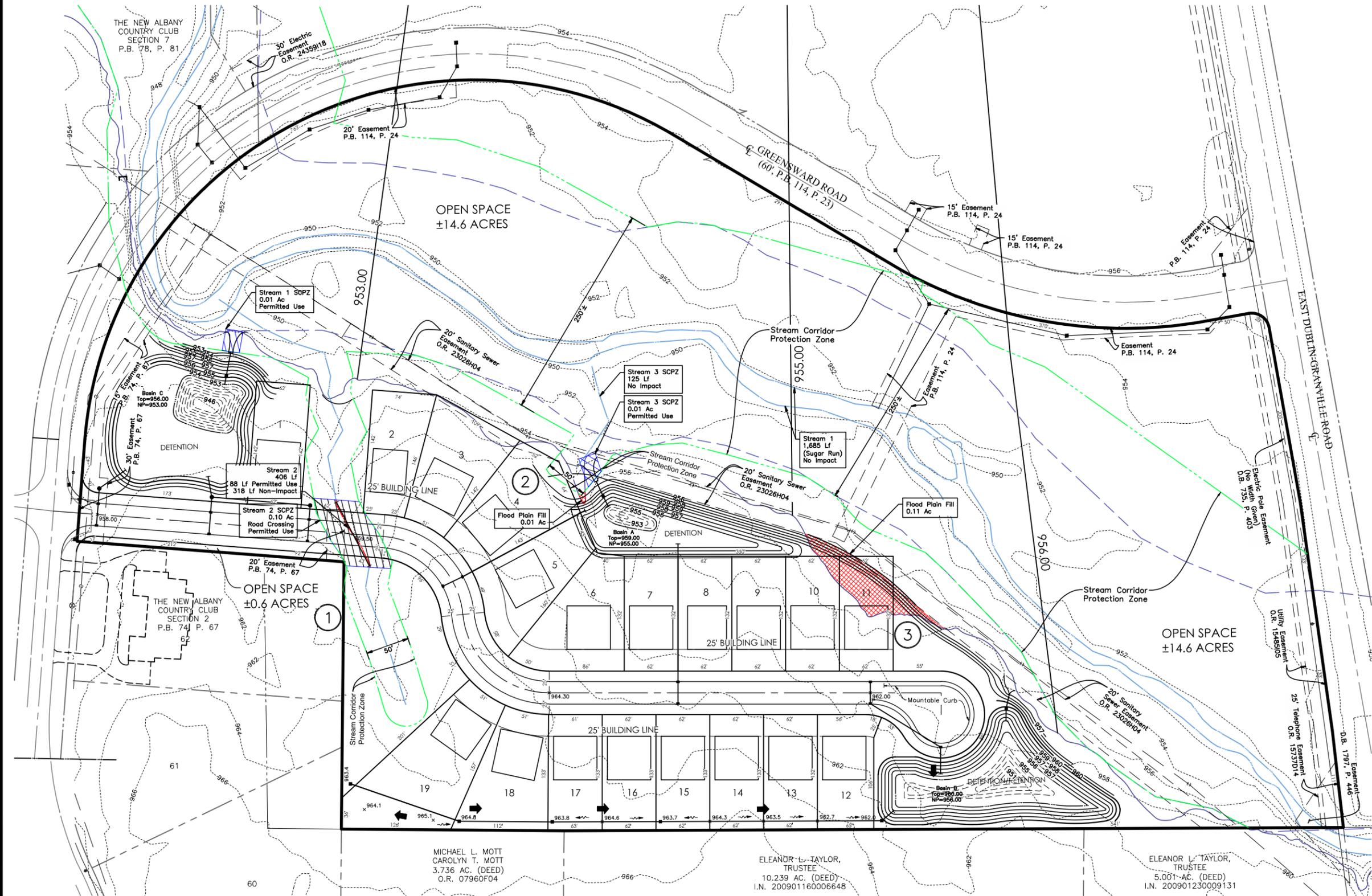


DATE  
 SEPTEMBER 21, 2018

SCALE  
 1" = 60'

JOB NO.  
 2018-0878

SHEET  
 3/4



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MICHAEL L. MOTT  
 CAROLYN T. MOTT  
 3.736 AC. (DEED)  
 O.R. 07960F04

ELEANOR L. TAYLOR,  
 TRUSTEE  
 10.239 AC. (DEED)  
 I.N. 200901160006648

ELEANOR L. TAYLOR,  
 TRUSTEE  
 5.001-AC. (DEED)  
 I.N. 200901230009131

TREE RESTORATION PLANTING TABLE				
COMMON NAME	SCIENTIFIC NAME	QUANTITY	MATERIAL	MINIMUM SPACING
Red Oak	Quercus rubra	30	15-Gal	15 OC
Swamp White Oak	Quercus bicolor	30	15-Gal	15 OC
Sugar Maple	Acer saccharum	30	15-Gal	15 OC
Sycamore	Platanum accidentalis	30	15-Gal	15 OC
Gray Dogwood	Cornus racemosa	30	5-Gal	15 OC
Arrowwood Viburnum	Viburnum dentatum	30	5-Gal	15 OC
Serviceberry	Amelanchier sp	30	5-Gal	15 OC

**LEGEND**

- Dead Tree Removal Zone
- Proposed Environmental Conservation Easement 9.54 Ac
- 000.00 FEMA Base Flood Elevation Line (BFLE)
- XXX Stream Blockage Removal
- Tree Restoration 1.06 Ac

**NOTES:**

The total length of the cul-de-sac is 1,145 feet from the centerline of Greensward Road to the center of the cul-de-sac bulb.

All data shown is based on GIS information, To Be Confirmed during Final Engineering.

**SITE STATISTICS:**

Total Acreage	20.9± Ac
Number of Lots (68'x130' Min.)	22
Gross Density	1.05± Lot/Ac
Total Open Space	14.46± Ac (69.1%)

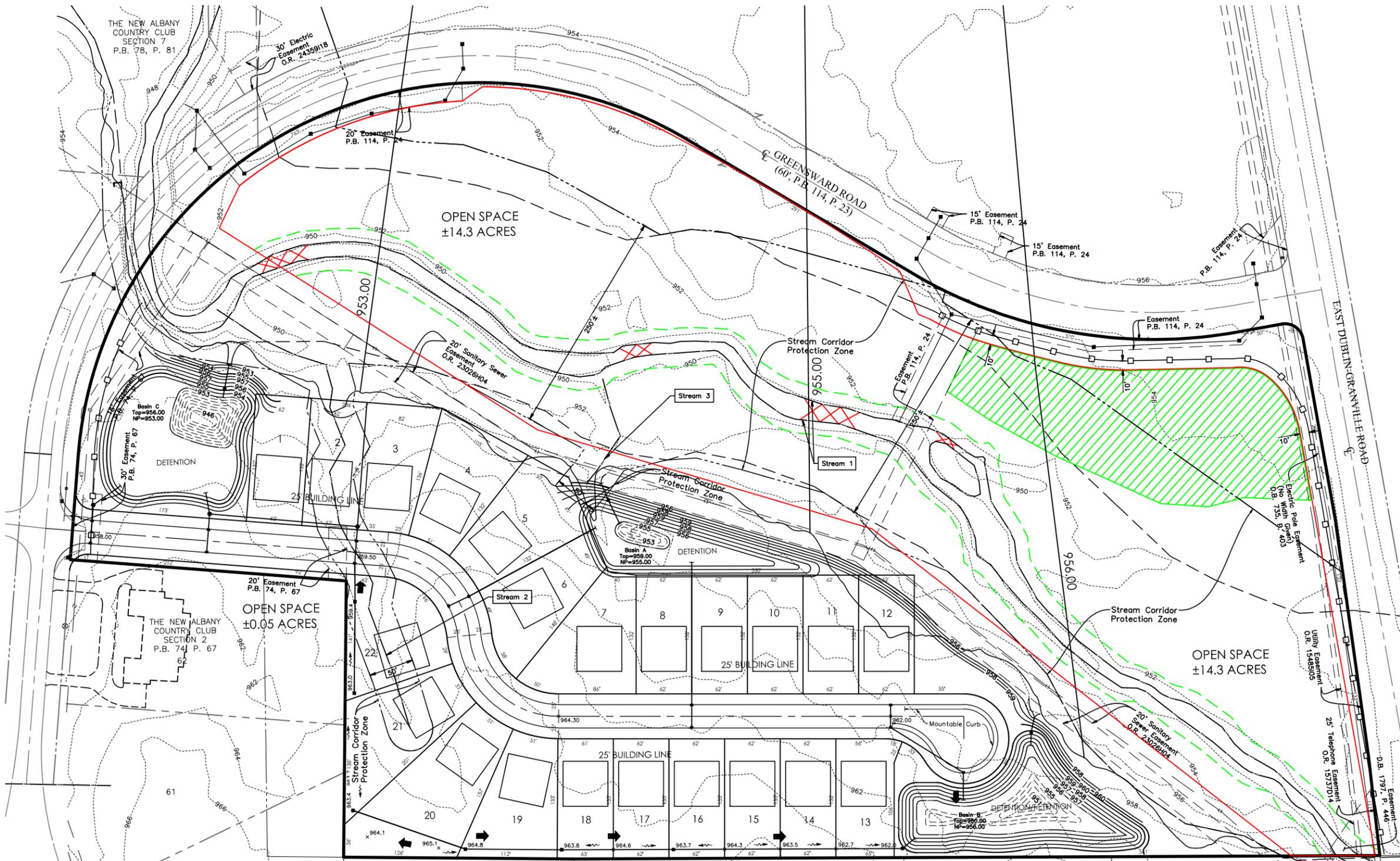
**City of Columbus Stream Corridor Protection Zone Calculation (Section 1.3.1 of Stormwater Drainage Manual):**

The total width of the Stream Corridor Protection Zone for streams shall be established using the following criteria, whichever is greater:

- The FEMA-designated floodway, or
- Using the equation below with a minimum of 50 feet to a maximum of 250 feet. The zone shall be centered on the stream valley generally located at the point where both zone boundaries intersect equal elevations on either side of the stream:  
  
Stream Corridor Protection Zone, in feet of width =  $147(DA)^{0.38}$   
where DA=drainage area of the stream in square miles, or
- 50 feet from the top of each bank for fourth order streams or larger

Note: Where wetlands are located partially within the Stream Corridor Protection Zone, the Stream Corridor Protection Zone shall be extended to include the full extent of the wetland area.

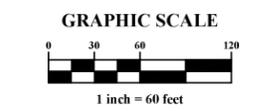
**Sugar Run:**  
Drainage area at DA2 = 3,065.60 acres = 4,790 sq miles  
Stream Corridor Protection Zone Width = 250 feet or FEMA Floodway, whichever is greater



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5.001-AC. (DEED)  
I.N. 200901230009131



REVISIONS

MARK	DATE	DESCRIPTION

CITY OF COLUMBUS, FRANKLIN COUNTY, OHIO  
SCPZ VARIANCE  
FOR  
**GREENSWARD ROAD**  
MITIGATION PLAN



DATE  
SEPTEMBER 21, 2018

SCALE  
1" = 60'

JOB NO.  
2018-0878

SHEET  
4/4

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APPENDIX A

Stream & Location: Sugar Run - Greensward Road Residential RM: Date: 8 / 29 / 18

Scorers Full Name & Affiliation: R. Milligan EMH&T

River Code: STORET #: Lat./ Long.: 40 183 Office verified location

1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average). BEST TYPES, OTHER TYPES, POOL RIFFLE, ORIGIN, QUALITY. Includes checkboxes for BLDR/SLABS, BOULDER, COBBLE, GRAVEL, SAND, BEDROCK, HARDPAN, DETRITUS, MUCK, SILT, ARTIFICIAL, LIMESTONE, TILLS, WETLANDS, SANDSTONE, RIP/RAP, LACUSTURINE, SHALE, COAL FINES, HEAVY, MODERATE, NORMAL, FREE, EXTENSIVE, NONE.

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts. AMOUNT. Includes checkboxes for UNDERCUT BANKS, OVERHANGING VEGETATION, SHALLOWS, ROOTMATS, POOLS > 70cm, ROOTWADS, BOULDERS, OXBOWS, BACKWATERS, AQUATIC MACROPHYTES, LOGS OR WOODY DEBRIS, EXTENSIVE >75%, MODERATE 25-75%, SPARSE 5-<25%, NEARLY ABSENT <5%.

3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average). SINUOSITY, DEVELOPMENT, CHANNELIZATION, STABILITY. Includes checkboxes for HIGH, MODERATE, LOW, NONE, EXCELLENT, GOOD, FAIR, POOR, NONE, RECOVERED, RECOVERING, RECENT OR NO RECOVERY, HIGH, MODERATE, LOW.

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average). RIVER RIGHT LOOKING DOWNSTREAM. EROSION, RIPARIAN WIDTH, FLOOD PLAIN QUALITY. Includes checkboxes for NONE/LITTLE, MODERATE, HEAVY/SEVERE, WIDE > 50m, MODERATE 10-50m, NARROW 5-10m, VERY NARROW < 5m, NONE, FOREST, SWAMP, SHRUB OR OLD FIELD, RESIDENTIAL, PARK, NEW FIELD, FENCED PASTURE, OPEN PASTURE, ROWCROP, CONSERVATION TILLAGE, URBAN OR INDUSTRIAL, MINING / CONSTRUCTION.

5] POOL / GLIDE AND RIFFLE / RUN QUALITY MAXIMUM DEPTH, CHANNEL WIDTH, CURRENT VELOCITY. Recreation Potential Primary Contact, Secondary Contact. Includes checkboxes for > 1m, 0.7-<1m, 0.4-<0.7m, 0.2-<0.4m, < 0.2m, POOL WIDTH > RIFFLE WIDTH, POOL WIDTH = RIFFLE WIDTH, POOL WIDTH < RIFFLE WIDTH, TORRENTIAL, VERY FAST, FAST, MODERATE, SLOW, INTERSTITIAL, INTERMITTENT, EDDIES.

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). NO RIFFLE [metric=0]. RIFFLE DEPTH, RUN DEPTH, RIFFLE / RUN SUBSTRATE, RIFFLE / RUN EMBEDDEDNESS. Includes checkboxes for BEST AREAS > 10cm, BEST AREAS 5-10cm, BEST AREAS < 5cm, MAXIMUM > 50cm, MAXIMUM < 50cm, STABLE, MOD. STABLE, UNSTABLE, NONE, LOW, MODERATE, EXTENSIVE.

6] GRADIENT (10 ft/mi) DRAINAGE AREA (4.8 mi^2) VERY LOW - LOW, MODERATE, HIGH - VERY HIGH. %POOL: 5, %GLIDE: 80, %RUN: 10, %RIFFLE: 5. Gradient Maximum 10.

**AJ SAMPLED REACH**

Check ALL that apply

Comment RE: Reach consistency/Is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

- METHOD**
- BOAT
  - WADE
  - L. LINE
  - OTHER
- DISTANCE**
- 0.5 Km
  - 0.2 Km
  - 0.15 Km
  - 0.12 Km
  - OTHER

- STAGE**
- HIGH
  - UP
  - NORMAL
  - LOW
  - DRY

- CLARITY**
- 1st --sample pass-- 2nd
- < 20 cm
  - 20-40 cm
  - 40-70 cm
  - > 70 cm/ CTB
  - SECCHI DEPTH

- CANOPY**
- 1st \_\_\_\_\_ cm
- 2nd \_\_\_\_\_ cm
- > 85% - OPEN
  - 55% - < 85%
  - 30% - < 55%
  - 10% - < 30%
  - < 10% - CLOSED

- BJ AESTHETICS**
- NUISANCE ALGAE
  - INVASIVE MACROPHYTES
  - EXCESS TURBIDITY
  - DISCOLORATION
  - FOAM / SCUM
  - OIL SHEEN
  - TRASH / LITTER
  - NUISANCE ODOR
  - SLUDGE DEPOSITS
  - CSOs/SSOs/OUTFALLS

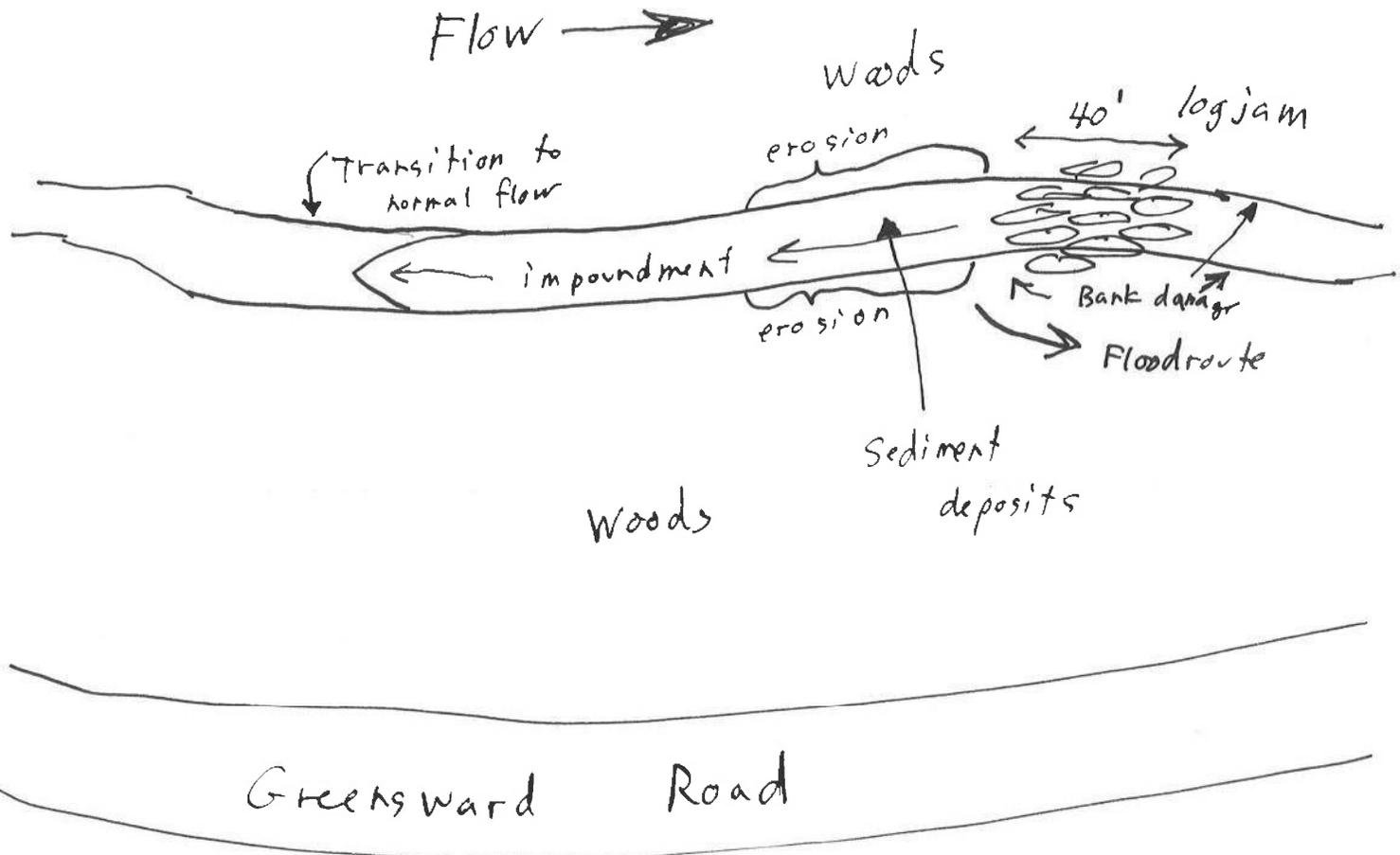
- DJ MAINTENANCE**
- Circle some & COMMENT
- PUBLIC / PRIVATE / BOTH / NA
  - ACTIVE / HISTORIC / BOTH / NA
  - YOUNG-SUCCESSION-OLD
  - SPRAY / SNAG / REMOVED
  - MODIFIED / DIPPED OUT / NA
  - LEVEED / ONE SIDED
  - RELOCATED / CUTOFFS
  - MOVING-BEDLOAD-STABLE
  - ARMoured / SLUMPS
  - ISLANDS / SCoured
  - IMPOUNDED / DESICCATED
  - FLOOD CONTROL / DRAINAGE

- EJ ISSUES**
- WWTP / CSO / NPDES / INDUSTRY
  - HARDENED / URBAN / DIRT&GRIME
  - CONTAMINATED / LANDFILL
  - BMPs-CONSTRUCTION-SEDIMENT
  - LOGGING / IRRIGATION / COOLING
  - BANK / EROSION / SURFACE
  - FALSE BANK / MANURE / LAGOON
  - WASH H<sub>2</sub>O / TILE / H<sub>2</sub>O TABLE
  - ACID / MINE / QUARRY / FLOW
  - NATURAL / WETLAND / STAGNANT
  - PARK / GOLF / LAWN / HOME
  - ATMOSPHERE / DATA PAUCITY

- FJ MEASUREMENTS**
- $\bar{x}$  width
  - $\bar{x}$  depth
  - max. depth
  - $\bar{x}$  bankfull width
  - bankfull  $\bar{x}$  depth
  - W/D ratio
  - bankfull max. depth
  - floodprone  $x^2$  width
  - entrench. ratio

- CJ RECREATION**
- AREA DEPTH
- POOL:  >100ft<sup>2</sup>  >3ft

**Stream Drawing:**



SITE NAME/LOCATION **Greensward Road Residential - Stream 2**

SITE NUMBER  RIVER BASIN **Rocky Fork** DRAINAGE AREA (mi<sup>2</sup>) **0.03**

LENGTH OF STREAM REACH (ft) **200** LAT.  LONG.  RIVER CODE  RIVER MILE

DATE **08/29/18** SCORER **RFM** COMMENTS

**NOTE: Complete All Items On This Form - Refer to "Field Evaluation Manual for Ohio's PWH Streams" for Instructions**

**STREAM CHANNEL MODIFICATIONS:**  NONE / NATURAL CHANNEL  RECOVERED  RECOVERING  RECENT OR NO RECOVERY

**1. SUBSTRATE (Estimate percent of every type of substrate present. Check ONLY two predominant substrate TYPE boxes (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B.**

TYPE	PERCENT	TYPE	PERCENT
<input type="checkbox"/> <input type="checkbox"/> BLDR SLABS [16 pts]	0%	<input checked="" type="checkbox"/> <input type="checkbox"/> SILT [3 pt]	40%
<input type="checkbox"/> <input type="checkbox"/> BOULDER (>256 mm) [16 pts]	0%	<input type="checkbox"/> <input type="checkbox"/> LEAF PACK/WOODY DEBRIS [3 pts]	0%
<input type="checkbox"/> <input type="checkbox"/> BEDROCK [16 pt]	0%	<input type="checkbox"/> <input type="checkbox"/> FINE DETRITUS [3 pts]	0%
<input type="checkbox"/> <input type="checkbox"/> COBBLE (65-256 mm) [12 pts]	0%	<input type="checkbox"/> <input checked="" type="checkbox"/> CLAY or HARDPAN [0 pt]	60%
<input type="checkbox"/> <input type="checkbox"/> GRAVEL (2-64 mm) [9 pts]	0%	<input type="checkbox"/> <input type="checkbox"/> MUCK [0 pts]	0%
<input type="checkbox"/> <input type="checkbox"/> SAND (<2 mm) [6 pts]	0%	<input type="checkbox"/> <input type="checkbox"/> ARTIFICIAL [3 pts]	0%

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock **0.00%** (A) Substrate Percentage Check **100%** (B)

**SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: 3** **TOTAL NUMBER OF SUBSTRATE TYPES: 2**

**2. Maximum Pool Depth (Measure the maximum pool depth within the 61 meter (200 ft) evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes) (Check ONLY one box):**

<input type="checkbox"/> > 30 centimeters [20 pts]	<input type="checkbox"/> > 5 cm - 10 cm [15 pts]
<input type="checkbox"/> > 22.5 - 30 cm [30 pts]	<input type="checkbox"/> < 5 cm [5 pts]
<input type="checkbox"/> > 10 - 22.5 cm [25 pts]	<input checked="" type="checkbox"/> NO WATER OR MOIST CHANNEL [0 pts]

COMMENTS **No pools** MAXIMUM POOL DEPTH (centimeters):

**3. BANK FULL WIDTH (Measured as the average of 3-4 measurements) (Check ONLY one box):**

<input type="checkbox"/> > 4.0 meters (> 13') [30 pts]	<input type="checkbox"/> > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
<input type="checkbox"/> > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]	<input checked="" type="checkbox"/> ≤ 1.0 m (≤ 3' 3") [5 pts]
<input type="checkbox"/> > 1.5 m - 3.0 m (> 9' 7" - 4' 8") [20 pts]	

COMMENTS  AVERAGE BANKFULL WIDTH (meters): **1.00**

**HHEI Metric Points**

Substrate Max = 40

5

A + B

---

Pool Depth Max = 30

0

---

Bankfull Width Max=30

5

**This information must also be completed**

**RIPARIAN ZONE AND FLOODPLAIN QUALITY** ⚡NOTE: River Left (L) and Right (R) as looking downstream⚡

<u>RIPARIAN WIDTH</u>		<u>FLOODPLAIN QUALITY</u>		<u>FLOODPLAIN QUALITY</u>	
L	R	L	R	L	R
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wide >10m		Mature Forest, Wetland		Conservation Tillage	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Moderate 5-10m		Immature Forest, Shrub or Old Field		Urban or Industrial	
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Narrow <5m		Residential, Park, New Field		Open Pasture, Row Crop	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
None		Fenced Pasture		Mining or Construction	

COMMENTS

**FLOW REGIME (At Time of Evaluation) (Check ONLY one box):**

<input type="checkbox"/> Stream Flowing	<input type="checkbox"/> Moist Channel, isolated pools, no flow (Intermittent)
<input type="checkbox"/> Subsurface flow with isolated pools (Interstitial)	<input checked="" type="checkbox"/> Dry channel, no water (Ephemeral)

COMMENTS

**SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check ONLY one box):**

<input type="checkbox"/> None	<input type="checkbox"/> 1.0	<input checked="" type="checkbox"/> 2.0	<input type="checkbox"/> 3.0
<input type="checkbox"/> 0.5	<input type="checkbox"/> 1.5	<input type="checkbox"/> 2.5	<input type="checkbox"/> >3

**STREAM GRADIENT ESTIMATE**

Flat (0.5 ft/100 ft)  Flat to Moderate  Moderate (2 ft/100 ft)  Moderate to Severe  Severe (10 ft/100 ft)

**ADDITIONAL STREAM INFORMATION (This Information Must Also be Completed):**

QHEI PERFORMED? -  Yes  No QHEI Score  (If Yes, Attach Completed QHEI Form)

**DOWNSTREAM DESIGNATED USE(S)**

<input type="checkbox"/> WWH Name:	<input type="text"/>	Distance from Evaluated Stream	<input type="text"/>
<input type="checkbox"/> CWH Name:	<input type="text"/>	Distance from Evaluated Stream	<input type="text"/>
<input type="checkbox"/> EWH Name:	<input type="text"/>	Distance from Evaluated Stream	<input type="text"/>

**MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION**

USGS Quadrangle Name:  NRCS Soil Map Page:  NRCS Soil Map Stream Order   
County: Franklin Township / City:

**MISCELLANEOUS**

Base Flow Conditions? (Y/N): Y Date of last precipitation:  Quantity: 0.00  
Photograph Information:   
Elevated Turbidity? (Y/N): N Canopy (% open): 0%  
Were samples collected for water chemistry? (Y/N): N (Note lab sample no. or id. and attach results) Lab Number:   
Field Measures: Temp (°C)  Dissolved Oxygen (mg/l)  pH (S.U.)  Conductivity (µmhos/cm)   
Is the sampling reach representative of the stream (Y/N) Y If not, please explain:

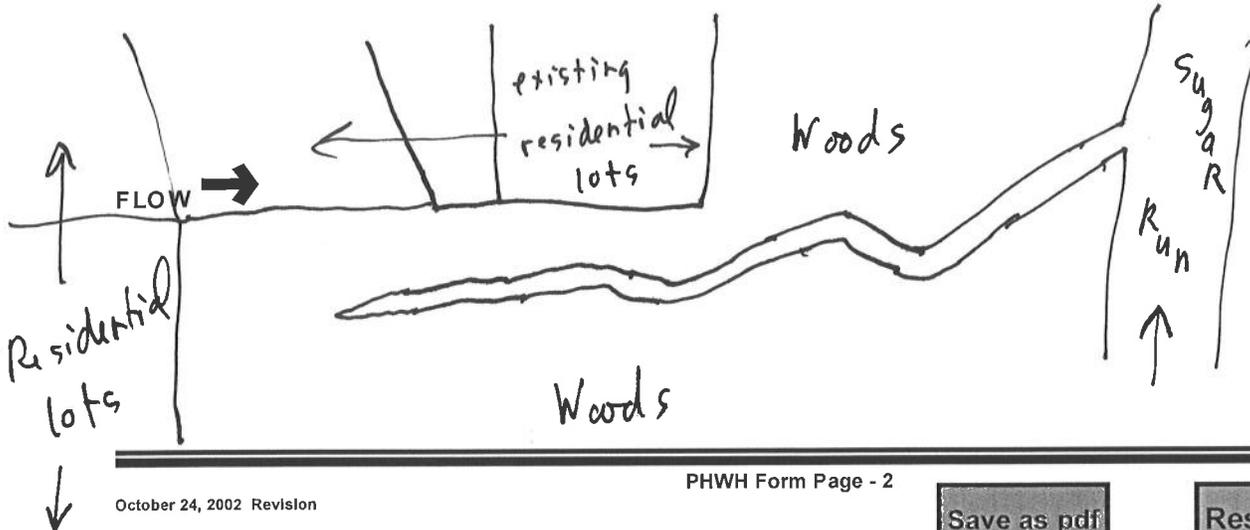
Additional comments/description of pollution impacts:

**BIOTIC EVALUATION**

Performed? (Y/N): N (If Yes, Record all observations. Voucher collections optional. NOTE: all voucher samples must be labeled with the site ID number. Include appropriate field data sheets from the Primary Headwater Habitat Assessment Manual)  
Fish Observed? (Y/N) N Voucher? (Y/N) N Salamanders Observed? (Y/N) N Voucher? (Y/N) N  
Frogs or Tadpoles Observed? (Y/N) N Voucher? (Y/N) N Aquatic Macroinvertebrates Observed? (Y/N) N Voucher? (Y/N) N  
Comments Regarding Biology:

**DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed):**

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location



Stream & Location: Stream 2 - Greensward Road Residential RM: Date: 8 / 29 / 18

Scorers Full Name & Affiliation: R. Milligan EMH&T

River Code: STORET #: Lat./ Long.: 40 183 Office verified location

1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average). BEST TYPES, OTHER TYPES, POOL RIFFLE, ORIGIN, QUALITY. Includes checkboxes for BLDR/SLABS, BOULDER, COBBLE, GRAVEL, SAND, BEDROCK, HARDPAN, DETRITUS, MUCK, SILT, ARTIFICIAL, LIMESTONE, TILLS, WETLANDS, SANDSTONE, RIP/RAP, LACUSTURINE, SHALE, COAL FINES, HEAVY, MODERATE, NORMAL, FREE, EXTENSIVE, MODERATE, NORMAL, NONE.

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts. AMOUNT Check ONE (Or 2 & average). Includes checkboxes for UNDERCUT BANKS, OVERHANGING VEGETATION, SHALLOWS, ROOTMATS, POOLS > 70cm, ROOTWADS, BOULDERS, OXBOWS, BACKWATERS, AQUATIC MACROPHYTES, LOGS OR WOODY DEBRIS, EXTENSIVE >75%, MODERATE 25-75%, SPARSE 5-<25%, NEARLY ABSENT <5%.

3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average). SINUOSITY, DEVELOPMENT, CHANNELIZATION, STABILITY. Includes checkboxes for HIGH, MODERATE, LOW, NONE, EXCELLENT, GOOD, FAIR, POOR, NONE, RECOVERED, RECOVERING, RECENT OR NO RECOVERY, HIGH, MODERATE, LOW.

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average). River right looking downstream. EROSION, RIPARIAN WIDTH, FLOOD PLAIN QUALITY. Includes checkboxes for NONE/LITTLE, MODERATE, HEAVY/SEVERE, WIDE > 50m, MODERATE 10-50m, NARROW 5-10m, VERY NARROW < 5m, NONE, FOREST, SWAMP, SHRUB OR OLD FIELD, RESIDENTIAL, PARK, NEW FIELD, FENCED PASTURE, OPEN PASTURE, ROWCROP, CONSERVATION TILLAGE, URBAN OR INDUSTRIAL, MINING / CONSTRUCTION.

5] POOL / GLIDE AND RIFFLE / RUN QUALITY MAXIMUM DEPTH, CHANNEL WIDTH, CURRENT VELOCITY. Includes checkboxes for > 1m, 0.7-<1m, 0.4-<0.7m, 0.2-<0.4m, < 0.2m, POOL WIDTH > RIFFLE WIDTH, POOL WIDTH = RIFFLE WIDTH, POOL WIDTH < RIFFLE WIDTH, TORRENTIAL, VERY FAST, FAST, MODERATE, SLOW, INTERSTITIAL, INTERMITTENT, EDDIES. Recreation Potential Primary Contact, Secondary Contact.

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). RIFFLE DEPTH, RUN DEPTH, RIFFLE / RUN SUBSTRATE, RIFFLE / RUN EMBEDDEDNESS. Includes checkboxes for BEST AREAS > 10cm, 5-10cm, < 5cm, MAXIMUM > 50cm, < 50cm, STABLE, MOD. STABLE, UNSTABLE, NONE, LOW, MODERATE, EXTENSIVE.

6] GRADIENT (3 ft/mi) DRAINAGE AREA (0.03 mi^2). Includes checkboxes for VERY LOW - LOW, MODERATE, HIGH - VERY HIGH. %POOL: 0, %GLIDE: 0, %RUN: 100, %RIFFLE: 0. Gradient Maximum 10.

**AJ SAMPLED REACH**

Check ALL that apply

- METHOD**
- BOAT
  - WADE
  - L. LINE
  - OTHER
- DISTANCE**
- 0.5 Km
  - 0.2 Km
  - 0.15 Km
  - 0.12 Km
  - OTHER
- 200 meters

- STAGE**
- 1st -sample pass- 2nd
- HIGH
  - UP
  - NORMAL
  - LOW
  - DRY

- CLARITY**
- 1st -sample pass- 2nd
- < 20 cm
  - 20-40 cm
  - 40-70 cm
  - > 70 cm/ CTB
  - SECCHI DEPTH

- CANOPY**
- 1st pass
- > 85% - OPEN
  - 55%-85%
  - 30%-55%
  - 10%-30%
  - <10% - CLOSED

- CJ RECREATION** AREA DEPTH
- POOL:  >100ft<sup>2</sup>  >3ft

Comment RE: Reach consistency/ Is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

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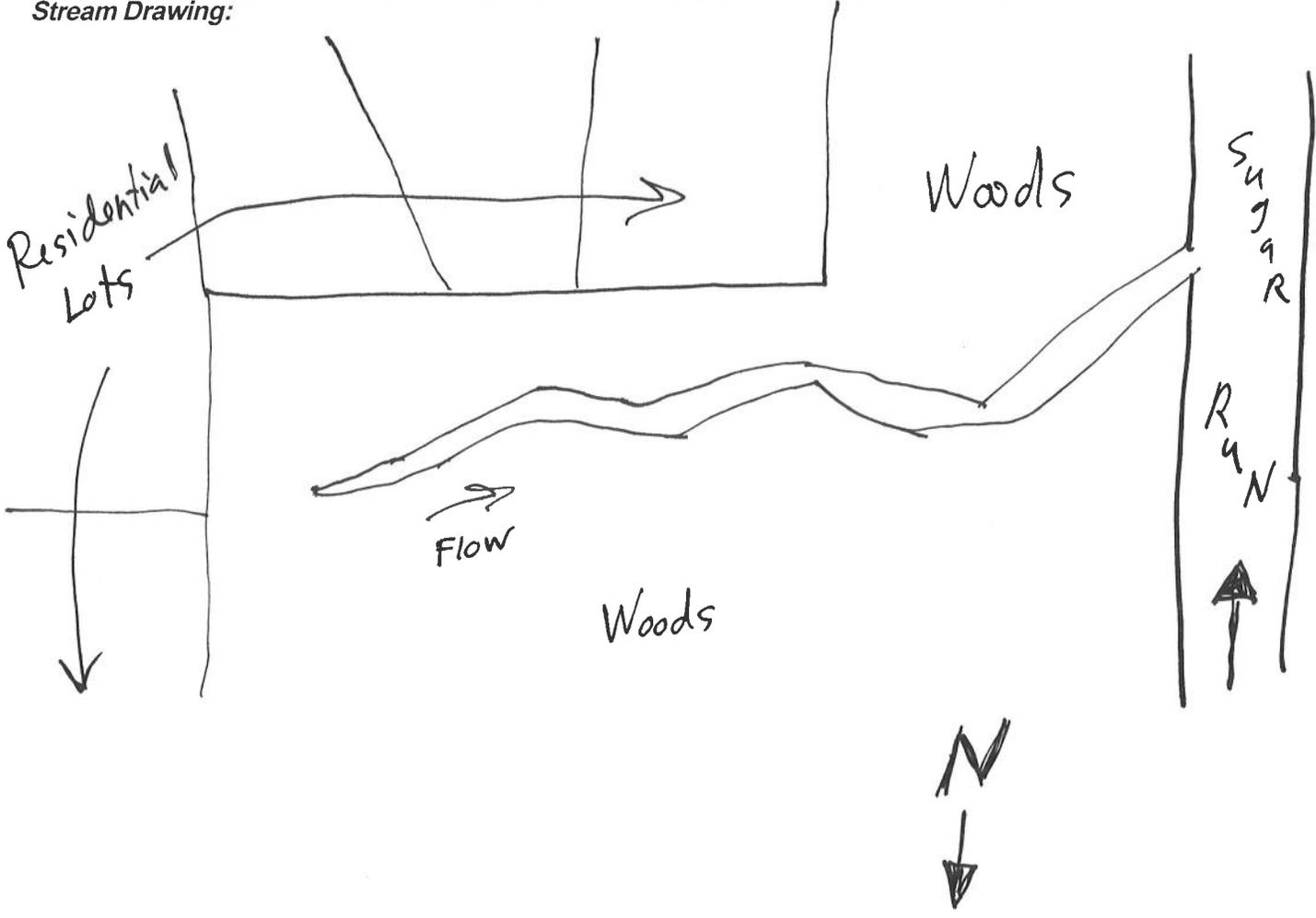
- BJ AESTHETICS**
- NUISANCE ALGAE
  - INVASIVE MACROPHYTES
  - EXCESS TURBIDITY
  - DISCOLORATION
  - FOAM / SCUM
  - OIL SHEEN
  - TRASH / LITTER
  - NUISANCE ODOR
  - SLUDGE DEPOSITS
  - CSOs/SSOs/OUTFALLS

- DJ MAINTENANCE**
- CIRCLE SOME & COMMENT
- PUBLIC / PRIVATE / BOTH / NA
  - ACTIVE / HISTORIC / BOTH / NA
  - YOUNG-SUCCESSION-OLD
  - SPRAY / SNAG / REMOVED
  - MODIFIED / DIPPED OUT / NA
  - LEVEED / ONE SIDED
  - RELOCATED / CUTOFFS
  - MOVING-BEDLOAD-STABLE
  - ARMORED / SLUMPS
  - ISLANDS / SCOURED
  - IMPOUNDED / DESICCATED
  - FLOOD CONTROL / DRAINAGE

- EJ ISSUES**
- WWTP / CSO / NPDES / INDUSTRY
  - HARDENED / URBAN / DIRT&GRIME
  - CONTAMINATED / LANDFILL
  - BMPs-CONSTRUCTION-SEDIMENT
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  - WASH H<sub>2</sub>O / TILE / H<sub>2</sub>O TABLE
  - ACID / MINE / QUARRY / FLOW
  - NATURAL / WETLAND / STAGNANT
  - PARK / GOLF / LAWN / HOME
  - ATMOSPHERE / DATA PAUCITY

- FJ MEASUREMENTS**
- $\bar{x}$  width
  - $\bar{x}$  depth
  - max. depth
  - $\bar{x}$  bankfull width
  - bankfull  $\bar{x}$  depth
  - W/D ratio
  - bankfull max. depth
  - floodprone x<sup>2</sup> width
  - entrench. ratio
- Legacy Tree:

**Stream Drawing:**



Stream & Location: Sugar Run - Greensward Road Residential RM: Date: 8 / 29 / 18

Post Restoration Projection Scorers Full Name & Affiliation: R. Milligan EMH&T

River Code: STORET #: Lat./ Long.: 40 183 Office verified location

1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average). BEST TYPES: BLDR /SLABS [10], BOULDER [9], COBBLE [8], GRAVEL [7], SAND [6], BEDROCK [5]. OTHER TYPES: HARDPAN [4], DETRITUS [3], MUCK [2], SILT [2], ARTIFICIAL [0]. ORIGIN: LIMESTONE [1], TILLS [1], WETLANDS [0], SANDSTONE [0], RIP/RAP [0], LACUSTURINE [0], SHALE [-1], COAL FINES [-2]. QUALITY: HEAVY [-2], MODERATE [-1], NORMAL [0], FREE [1], EXTENSIVE [-2], MODERATE [-1], NORMAL [0], NONE [1]. NUMBER OF BEST TYPES: 4 or more [2], 3 or less [0]. Comments

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts. AMOUNT: EXTENSIVE >75% [11], MODERATE 25-75% [7], SPARSE 5-<25% [3], NEARLY ABSENT <5% [1]. Comments

3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average). SINUOSITY: HIGH [4], MODERATE [3], LOW [2], NONE [1]. DEVELOPMENT: EXCELLENT [7], GOOD [5], FAIR [3], POOR [1]. CHANNELIZATION: NONE [6], RECOVERED [4], RECOVERING [3], RECENT OR NO RECOVERY [1]. STABILITY: HIGH [3], MODERATE [2], LOW [1]. Comments

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average). EROSION: NONE / LITTLE [3], MODERATE [2], HEAVY / SEVERE [1]. RIPARIAN WIDTH: WIDE > 50m [4], MODERATE 10-50m [3], NARROW 5-10m [2], VERY NARROW < 5m [1], NONE [0]. FLOOD PLAIN QUALITY: FOREST, SWAMP [3], SHRUB OR OLD FIELD [2], RESIDENTIAL, PARK, NEW FIELD [1], FENCED PASTURE [1], OPEN PASTURE, ROWCROP [0]. CONSERVATION TILLAGE [1], URBAN OR INDUSTRIAL [0], MINING / CONSTRUCTION [0]. Comments

5] POOL / GLIDE AND RIFFLE / RUN QUALITY MAXIMUM DEPTH: > 1m [6], 0.7-<1m [4], 0.4-<0.7m [2], 0.2-<0.4m [1], < 0.2m [0]. CHANNEL WIDTH: POOL WIDTH > RIFFLE WIDTH [2], POOL WIDTH = RIFFLE WIDTH [1], POOL WIDTH < RIFFLE WIDTH [0]. CURRENT VELOCITY: TORRENTIAL [-1], SLOW [1], VERY FAST [1], INTERSTITIAL [-1], FAST [1], INTERMITTENT [-2], MODERATE [1], EDDIES [1]. Recreation Potential: Primary Contact, Secondary Contact. Comments

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). NO RIFFLE [metric=0]. RIFFLE DEPTH: BEST AREAS > 10cm [2], BEST AREAS 5-10cm [1], BEST AREAS < 5cm [metric=0]. RUN DEPTH: MAXIMUM > 50cm [2], MAXIMUM < 50cm [1]. RIFFLE / RUN SUBSTRATE: STABLE (e.g., Cobble, Boulder) [2], MOD. STABLE (e.g., Large Gravel) [1], UNSTABLE (e.g., Fine Gravel, Sand) [0]. RIFFLE / RUN EMBEDDEDNESS: NONE [2], LOW [1], MODERATE [0], EXTENSIVE [-1]. Comments

6] GRADIENT (10 ft/mi) VERY LOW - LOW [2-4], MODERATE [6-10], HIGH - VERY HIGH [10-6]. DRAINAGE AREA (4.8 mi^2). %POOL: 5, %GLIDE: 80, %RUN: 10, %RIFFLE: 5. Gradient Maximum 10. Comments

**AJ SAMPLED REACH**

Check ALL that apply

- METHOD**
- BOAT
  - WADE
  - L. LINE
  - OTHER
- DISTANCE**
- 0.5 Km
  - 0.2 Km
  - 0.15 Km
  - 0.12 Km
  - OTHER

- STAGE**
- 1st -sample pass- 2nd
- HIGH
  - UP
  - NORMAL
  - LOW
  - DRY

- CLARITY**
- 1st --sample pass-- 2nd
- < 20 cm
  - 20-40 cm
  - 40-70 cm
  - > 70 cm/ CTB
  - SECCHI DEPTH

- CANOPY**
- 1st \_\_\_\_\_ cm
- 2nd \_\_\_\_\_ cm
- > 85% - OPEN
  - 55% -<85%
  - 30% -<55%
  - 10% -<30%
  - <10% - CLOSED

- CJ RECREATION** AREA DEPTH
- POOL:  >100ft<sup>2</sup>  >3ft

Comment RE: Reach consistency/ Is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

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- BJ AESTHETICS**
- NUISANCE ALGAE
  - INVASIVE MACROPHYTES
  - EXCESS TURBIDITY
  - DISCOLORATION
  - FOAM / SCUM
  - OIL SHEEN
  - TRASH / LITTER
  - NUISANCE ODOR
  - SLUDGE DEPOSITS
  - CSOs/SSOs/OUTFALLS

- DJ MAINTENANCE**
- Circle some & COMMENT
- PUBLIC / PRIVATE / BOTH / NA
  - ACTIVE / HISTORIC / BOTH / NA
  - YOUNG-SUCCESSION-OLD
  - SPRAY / SNAG / REMOVED
  - MODIFIED / DIPPED OUT / NA
  - LEVEED / ONE SIDED
  - RELOCATED / CUTOFFS
  - MOVING-BEDLOAD-STABLE
  - ARMoured / SLUMPS
  - ISLANDS / SCoured
  - IMPOUNDED / DESICCATED
  - FLOOD CONTROL / DRAINAGE

- EJ ISSUES**
- WWTP / CSO / NPDES / INDUSTRY
  - HARDENED / URBAN / DIRT&GRIME
  - CONTAMINATED / LANDFILL
  - BMPs-CONSTRUCTION-SEDIMENT
  - LOGGING / IRRIGATION / COOLING
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- Legacy Tree:

**Stream Drawing:**

