LANDSCAPE PERFORMANCE SERIES
presented by the Landscape Architecture Foundation

Muscota Marsh Methods

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ACKNOWLEDGMENTS

We would like to first acknowledge that Muscota Marsh rests on Indigenous land that is part of the traditional territory of the Lenni-Lenape, called Lenapehoking. We acknowledge the Lenni-Lenape as the original people of this land, who were forcibly displaced, and their continuing relationship with their territory.

We would like to acknowledge Peter Macaluso, Facilities Manager for Baker Athletics Complex at Columbia University, for his help coordinating our site visits. Many thanks to Muscota Marsh Groundskeeper Ubaldo Estrada for accompanying us during our visits and observations and providing detailed information about maintenance regimes, site enhancements, and adaptations since the original restoration 10 years earlier.

We would like to thank the Landscape Architecture Foundation, and especially Megan Barnes, for their funding and tremendous support throughout the case study.

Previous LAF Performance Series Investigations were extremely helpful in providing examples of successful methods. We drew inspiration for our business and visitor survey questionnaire from The Rail Park, Phase 1 (Yates, Buckingham, & Delgado Wallace, 2022) Case Study Investigation methods. Citizen science platforms iNaturalist and eBird were vital for data collection and user-friendly publicly available tools iTree and Universal Floristic calculator were valuable in our data analysis.

RESEARCH STRATEGY OVERVIEW

This research evaluated the landscape performance of Muscota Marsh 10 years after its restoration in 2014. It was funded by the Landscape Architecture Foundation as part of its Landscape Performance Series 2024 Case Study Investigations and conducted in collaboration with the design firm Field Operations (formerly James Corner Field Operations) and the site operators at Columbia University.

The research involved collecting and reviewing primary and secondary source data. The primary data collected by the research team consisted of 1) plant and wildlife inventories through observation and

citizen science platforms iNaturalist and eBird; 2) Tree measurements and benefit calculations using iTree; and 2) an online intercept survey distributed via QR codes on signage throughout the site and surrounding area. These data were collected from February through June 2024.

The secondary data shared by Field Operations and Columbia University maintenance staff include 1) stormwater retention capabilities, 2) planting inventory and site plans, 3) site employment, 4) K-12 educational visits, and 5) construction costs and savings.

 The research team focused on investigating the environmental, social, and economic benefits of Muscota Marsh renovation and meeting the project's primary objectives, which were set 10 years prior. These factors guided how the project's performance benefits were defined, measured, and quantified.

ENVIRONMENTAL BENEFITS

Stormwater

➔ **Intercepted an estimated 149,930 gallons of rainfall and avoided 87,187 gallons of stormwater runoff in the ten years after restoration (2014-2024) through trees planted as part of the restoration. Over the next 20 years, these trees are projected to intercept 333,173 gallons of rainfall and avoid 193,746 gallons of stormwater runoff.**

Methods: Tree observations and measurements were conducted in July 2024 and input into iTree Design Version 7.0 calculator (https://mytree.itreetools.org/) to calculate stormwater, energy, carbon sequestration, and air pollution removal. Our tree benefit calculations only include the trees added to the site during the 2014 restoration and not the pre-existing trees that were left (Black Locust, Ailanthus, Mulberry, Norway Maple) or the transplanted baccharis hedge. Moreover, Juniper trees along the perimeter of the property were not mentioned in the planting plans thus they were not included in the measurements. According to the marsh restoration planting plans, provided by Field Operations, 34 trees (3-inch caliper) from six species were planted in 2014. These were Black Gum/Tupelo (*Nyssa sylvatica*), Eastern Redbud (*Cercis canadensis*), Sawtooth Oak (*Quercus acutissima*), English Oak (*Quercus robur*), Pin Oak (*Quercus palustris*), and Northern Red Oak (*Quercus rubra*) planted in 2014. The planting plans included 9 trees planted on the adjoining street. However, since only some of the trees depicted in the planting plans remain and it was not clear which of those remaining trees were preexisting versus added, we did not include the street trees in the calculations.

Except for the Black Tupelo or Black Gum (*Nyssa sylvatica*) trees, which had significantly different heights in the location with direct sun and were easily accessible, we measured one of each tree species planted during the restoration and applied the sample measurements to the remaining trees planted according to species. Table 1 below shows the measurements and information input into iTree. Appendix 1 shows these trees marked on the planting plans. We measured tree height and trunk circumference, noted its species and condition through visual observation of the trunk, branches, leaves, and base, and recorded the sun exposure. We never used "excellent" as the tree condition since we are not maintaining the site and have only visited four times; it would be difficult to substantiate, and we preferred conservative estimates over an overestimation of benefits.

Table 1. The tree inventory and measurements that were input into iTree Design. Color code corresponds to trees marked on diagram in Appendix 1.

#	Code	Botanical Name	Common Name	Condition	Trunk Circumfer. (inches)	Trunk Diameter D=C/3.14 (inches)	Tree Height (feet)	Sun Exposure	Count	Latitude	Longitude	Date Observed	Notes
1	NS	**Nyssa sylvatica**	**Black Gum/Black Tupelo**	**Good**	**21.5**	**6.8**	**22.4**	**Full**	**3**	**40.873711**	**-73.918184**	**7/11/2024**	**Sample Measurement**
2		Nyssa sylvatica	Black Gum/Black Tupelo	Good	21.5	6.8	22.4	Full				7/11/2024	
3		Nyssa sylvatica	Black Gum/Black Tupelo	Good	21.5	6.8	22.4	Full				7/12/2024	
4	NS	**Nyssa sylvatica**	**Black Gum/Black Tupelo**	**Good**	**16**	**5.1**	**13.1**	**Partial**	**2**	**40.87323**	**-73.918106**	**7/11/2024**	**Sample Measurement**
5		Nyssa sylvatica	Black Gum/Black Tupelo	Good	16	5.1	13.1	Partial				7/11/2024	
6	CC	**Cercis canadensis**	**Eastern Redbud**	**Good**	**11.875**	**3.8**	**18.1**	**Partial**	**8**	**40.873074**	**-73.91816**	**7/11/2024**	**Sample Measurement.** Only one tree in the central area of the park (partial sun) was taken, as the other trees in full sun were not easily accessible. Circumference Average = (14.75+14.5+11.5+ 11+ 10.5+9)/6
7		Cercis canadensis	Eastern Redbud	Good	11.875	3.8	18.1	Partial				7/11/2024	
8		Cercis canadensis	Eastern Redbud	Good	11.875	3.8	18.1	Partial				7/11/2024	
9		Cercis canadensis	Eastern Redbud	Good	11.875	3.8	18.1	Partial				7/11/2024	
10		Cercis canadensis	Eastern Redbud	Good	11.875	3.8	18.1	Partial				7/11/2024	
11		Cercis canadensis	Eastern Redbud	Good	11.875	3.8	18.1	Partial				7/11/2024	
12		Cercis canadensis	Eastern Redbud	Good	11.875	3.8	18.1	Partial				7/11/2024	
13		Cercis canadensis	Eastern Redbud	Good	11.875	3.8	18.1	Partial				7/11/2024	
14	QA	**Quercus acutissima**	**Sawtooth Oak**	**Good**	**33.25**	**10.6**	**52.2**	**Partial**	**4**	**40.873291**	**-73.918109**	**7/11/2024**	**Sample Measurement**
15		Quercus acutissima	Sawtooth Oak	Good	33.25	10.6	52.2	Partial				7/11/2024	
16		Quercus acutissima	Sawtooth Oak	Good	33.25	10.6	52.2	Partial				7/11/2024	
17		Quercus acutissima	Sawtooth Oak	Good	33.25	10.6	52.2	Partial				7/11/2024	
18	QRo	**Quercus robur**	**English Oak**	**Good**	**31.5**	**10.0**	**28.1**	**Full**	**2**	**40.873118**	**-73.917936**	**7/11/2024**	**Sample Measurement**
19		Quercus robur	English Oak	Good	31.5	10.0	28.1	Full				7/11/2024	
20	QP	**Quercus palustris**	**Pin Oak**	**Good**	**20**	**6.4**	**27.6**	**Partial**	**3**	**40.873003**	**-73.917917**	**7/11/2024**	**Sample Measurement**
21		Quercus palustris	Pin Oak	Good	20	6.4	27.6	Partial				7/11/2024	
22		Quercus palustris	Pin Oak	Good	20	6.4	27.6	Partial				7/11/2024	
23	QRu	**Quercus rubra**	**Northern Red Oak**	**Good**	**24.5**	**7.8**	**35.6**	**Partial**	**3**	**40.872965**	**-73.917844**	**7/11/2024**	**Sample Measurement**
24		Quercus rubra	Northern Red Oak	Good	24.5	7.8	35.6	Partial				7/11/2024	
25		Quercus rubra	Northern Red Oak	Good	24.5	7.8	35.6	Partial				7/11/2024	
								Total New Trees Measured	**25**				

Calculations: Tree circumference was measured on the trunk of the tree at 4.5 ft from the ground surface (NYS DEC, n.d.) using a cloth measuring tape. Circumference was automatically converted to diameter by iTree Design using (D=C/3.14) and rounding to the nearest decimal place. For the Eastern Redbud, which had multiple trunks (n), the circumference average was calculated $(\sum C)/n$ (NYS DEC, n.d.). Tree height was measured using the Trees app by Forest Monitoring Tools on an Android phone, and the ground distance from the measurement location to the tree base was measured using a Crescent Lufkin Pro 4in Measuring Wheel. While iTree Eco did not require the tree height to calculate benefits, we include these measurements for reference.

A note on how calculations are made by iTree Design (n.d.) – see also the Carbon Sequestration Benefit below:

> "Carbon dioxide sequestration values are derived from species-based biomass equations. Carbon dioxide avoided values are estimated by converting the savings to pounds of avoided carbon emissions. values (kWh and Mbtu) are converted to carbon dioxide using state-based EPA E-grid conversion values. The carbon dioxide dollar value is based on the average central value estimate of the social cost of carbon as calculated by the 2010 Interagency Working Group on Social Cost of Carbon for the United States Government (see: https://www.epa.gov/sites/production/files/2016-12/documents/sc_co2_tsd_august_2016.pdf)." (p. References)

> "The stormwater interception and avoided runoff values were derived from county-based i-Tree Eco runs for the conterminous United States using 2010 data. (see: i-Tree Eco Precipitation Interception Model Descriptions)" (p. References)

> "Future benefits are estimated using a forecasting model that calculates tree height for each consecutive year until the user-specified "future year." For example, if the user wants to estimate benefits 10 years into the future, tree height is estimated for 2014, 2015, 2016,...2024. The forecasting model uses growth rates to estimate the changing size of the tree and calculate the benefits for each year. The model assumes that there is no change to tree condition and sunlight exposure." (p. How to Use)

> "Past benefits are also estimated using the forecasting model. Benefits are calculated each consecutive year in the past until the modeled tree size reaches 1 inch in diameter." (p. How to Use)

Limitations: Given that the past benefits are modeled back until the size reaches 1-inch diameter, but the trees were planted 3-inch diameter (3-inch caliper) per the planting plans, the past benefits may be an overestimate. After completing the inventory, we were informed by iTree support that iTree Planting allows for changing this variable. Given time constraints we did not redo the inventory analysis. This is something future research teams might keep in mind. Also, the reason we selected iTree Design over myTree or iTree Eco is that while it was a simple web-based tool like myTree, it allowed for the entry of multiple trees with the same measurements and showed the inventory list with details, to avoid confusion one what had been entered already. Whereas iTree Eco allowed for an entire inventory to be uploaded via Excel, but the measurements were more complex and it is only available as a desktop tool.

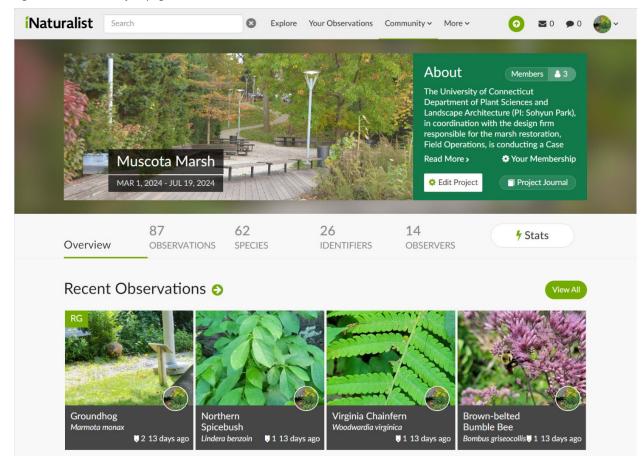**Habitat Quality + Populations & Species Richness**
➔ **Increases ecological quality as demonstrated by a total Floristic Quality Index (FQI) score of 23, a native FQI score of 29, and an adjusted FQI score of 40. An FQI score above 35 is considered to be "natural area" quality.**

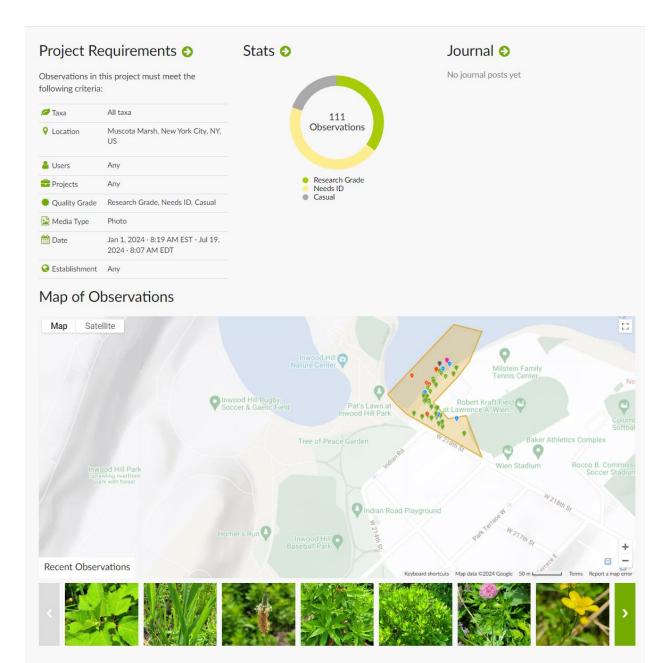➔ **Achieves a native species richness of 61%, with 33 of 54 species observed on-site being native.**

➔ **Has provided habitat for at least 142 observed bird species in the 10 years since restoration was completed (2014-2024), with 53 bird species observed in the first half of 2024.**

Methods: We used the iNaturalist citizen science platform to document and identify plants and animals on site and involve community members in the project. The iNaturalist Project page was set up and limited to observations made at "Muscota Marsh, New York, NY, USA" using a polygon of the restoration site to accumulate all observations between January 1, 2024 and July 19, 2024. We advertised the iNaturalist project along with the survey as described earlier. The research team conducted walking species observations of the site in March, June, and July. Pictures and details of plant and animal observations were then uploaded, and preliminary identifications were made using the iNaturalist suggestions. The research team also relied on the planting plans from the restoration in 2014, the landscape staff maintaining the site, and Google image search to validate certain identifications. The species list was then cleaned to remove duplicate identifications, and identifications with only family taxa. Additionally, we gathered observation data from the existing eBird location, "Inwood Hill Park-Muscota Marsh," as some park patrons informed us it was a preferred platform for local birders. See Appendix 2 and 3 for the plant and animal inventories and marketing materials. The observations for animals were combined in Appendix 3: Animal Observations with a notation on whether they come from iNaturalist or eBird.

PROJECT PAGE

Figure 1. iNaturalist Project page.

Project Requirements →

Observations in this project must meet the following criteria:

🍃 Taxa	All taxa	
📍 Location	Muscota Marsh, New York City, NY, US	
👤 Users	Any	
💼 Projects	Any	
✳ Quality Grade	Research Grade, Needs ID, Casual	
🖼 Media Type	Photo	
📅 Date	Jan 1, 2024 · 8:19 AM EST - Jul 19, 2024 · 8:07 AM EDT	
🌐 Establishment	Any	

Stats →

111 Observations

- ● Research Grade
- ● Needs ID
- ● Casual

Journal →

No journal posts yet

Map of Observations

Recent Observations

ABOUT PAGE (selecting "Read More" in the project description header)

Calculations:

A pivot table and graph were created in Excel with the eBird (2024) data related to the Hotspot "Inwood Hill-Muscota Marsh".

Row Labels	Species Count
<8/29/2011	0
2011	1
2014	2
2015	5
2016	1
2017	3
2018	2
2019	4
2020	13
2021	12
2022	27
2023	20
2024	53
Grand Total	**143**

Figure 2. eBird Species Counts based on Last Observed, 2011-2024.

We input the inventory compiled through iNaturalist submissions and our iTree inventory into the free online Universal Floristic Quality Assessment (FQA) tool. We selected the "Northeastern Coastal Zone (8.1.7) (CT, MA, ME, NH, NY, RI, VT) (Omernik III Ecoregions: 59), 2018" FQA database for our assessment and entered the scientific names for 63 observed plant species (iTree inventory + iNaturalist, see Appendix 2) The following species did not exist in the database: *Helleboreae, Hydrangea petiolaris, Hydrangea quercifolia, Iris sanguinea, Magnoliopsida, Melilotus albus, Nepeta racemosa Quercus acutissima, Quercus robur, Ranunculus bulbosus, Rumex crispus, Rumex cristatus, Ulva*.

Rumex crispus and *Rumex cristatus* were substituted with *Rumex altissimus* a similar pale dock native to the region, as it is possible that the identifications on iNaturalist were not accurate, and since this had not been identified as something planted by the design firm or site operators, it's likely naturally occurring. Similarly, both *Ranunculus acris* and *Ranunculus bulbosus*, were identified on site, and they could be easily confused and are naturally occurring rather than planted, *R.acris* was found in the database and included in the FQI while *R. bulbosus* was not. *Iris versicolor* was substituted for *Iris sanguinea*, as we knew the former had been introduced and these similar non-bearded irises could be mistaken for one another. The remaining species were planted and non-native, therefore we did not attempt to provide a substitute and these were not counted in the FQI. Notes are included in Appendix 2.

Limitations:
The iNaturalist and eBird platforms are citizen science and rely on citizens for identification and validation. Some citizen scientists who partake are novices, while others are hobby naturalists, and still others are scientists with varying specialties but not necessarily expertise in the identification of any species. The platforms provide species suggestions based on the images uploaded. While these are very useful, accuracy depends on the quality and detail in the images, and the effort put into photo comparisons during identification. The community of citizen scientists works diligently to verify or suggest changes to identifications with notes and comments. Overall, they are incredibly useful tools for species observation, but there is potential for identification errors as well as opportunities to amend the errors, which may change the data over time— if old observations and identifications are amended. These platforms have been gaining popularity. Therefore, the unknown pre-restoration species counts and the reduced use of these citizen science platforms in the past are limitations. Moreover, the marsh is an extension of Inwood Hill Park, and while it does add a Freshwater wetland, many of the species observed are not limited to Muscota Marsh and thus cannot be solely ascribed to the restoration. A conclusive statement on biodiversity changes attributed to marsh restoration alone cannot be made.

Carbon Sequestration
→ **Sequestered an estimated 19,315 lbs of atmospheric carbon in the ten years after restoration (2014-2024) in trees planted as part of the restoration. Over the next 20 years, these trees are projected to sequester an additional 45,334 lbs of atmospheric carbon.**

See Stormwater Management Benefit above for Methods, Calculations, and Limitations.

SOCIAL BENEFITS

➔ **Created public waterfront access where there was previously none, with 73% of 63 surveyed visitors reporting that they visit at least once a week.**

➔ **Supports well-being and improved mood, with the number of surveyed visitors reporting feeling "great" increasing by 20% between arriving and departing the marsh. 56% of 64 respondents attributed their improvement in mood to scenery and views, 16% to wild animals, and 13% to plants.**

Methods: A multi-stage intercept survey was conducted between June 4, 2024, and July 19, 2024. The survey was conducted online to maximize the randomization of use times and possible users. The survey (Appendix 4) was distributed via QR code on signage and postcards posted on the site at the entrance, within the park near seating areas, and across the street at a local coffee shop on June 4, 2024. Additionally, posts about the research project with the survey link were made on several Inwood community Facebook groups on June 24, 2024, to garner more results. We ended up extending the original deadline of July 7 to July 19, reposting to the Facebook community groups, and sharing flyers with the extended deadline with some marsh visitors during our final visit on July 11. The survey was restricted to adults (18+) and started by 72 users, of which 68 users agreed to the terms and took the survey with the average number of responses per question 64. Respondents had the option of skipping questions or sections.

Marketing

Participants were asked to answer the questions in several categories (see Appendix 4). Multiple-choice questions were offered in multiple stages to improve completion rates. The first stage was estimated to take approximately 5 minutes to complete, after which participants were allowed to continue to answer additional questions that may be completed within about 10 minutes.

Pocket with extra QR code slips were included so people did not need to take the entire flyer unless they wanted to.

Posted in the Inwood (NYC) Community and the Washington Heights/Inwood Community Inclusion Facebook Groups

Figure 4. Clear polysheet protectors with flyers and QR code slips were left at the cafe across the street from the marsh and taped to trash cans within the marsh.

Calculations: We used Qualtrics as our survey platform which also provides data analysis. The percentages were calculated by dividing the number of a particular response (e.g. numbers of 'no') by the total number of respondents for each question. The breakdown for the noted benefits is as follows:

Q. Do you interact with strangers at Muscota Marsh?
  ▸ Out of 63 respondents to this question, 43 (43/63=.68 or 68%) answered "Yes" and 20 (20/63=.32 or 32%) answered "No".

Q. Is the Marsh a good place to meet new people?
  ▸ Out of 40 respondents to this question, 30 (30/40=.75 or 75%) answered "Yes" and 10 (10/40=.25 or 25%) answered "No".

Q. Do you interact with people of different backgrounds than yourself at the Marsh?
  ▸ Out of 63 respondents to this question, 48 (48/63=.76 or 76%) answered "Yes" and 15 (15/63=.24 or 24%) answered "No".

Q. Do you see people from different backgrounds interacting with one another at the Marsh?
  ▸ Out of 60 respondents to this question, 48 (48/60=.80 or 80%) answered "Yes" and 12 (12/60=.20 or 20%) answered "No".

Q. How often do you visit Muscota Marsh now, after its restoration?
  ▸ Out of 63 respondents to this question, 6 answered "Daily"; 9 answered "4-6 times a week"; 14 answered "2-3 times a week"; and 17 answered "Once a week". (6+9+14+17)/63 = .73 or 73%

Q. Generally, how do you feel when you arrive at the Marsh?
  ▸ Out of 63 respondents to this question, 22 (35%) responded "Great"; 30 (48%) responded "Good"; 10 (16%) responded "Okay / Neutral"; 1(2%) responded "Not Good"; and 0 (0%) responded "Bad".

Q. Generally, how do you feel when you leave the Marsh?

- Out of 64 respondents to this question, 35 (55%) responded "Great"; 25 (39%) responded "Good"; 4 (6%) responded "Okay / Neutral"; 0(0%) responded "Not Good"; and 0 (0%) responded "Bad".
  - This question had one more respondent than the previous but an overall improvement in mood was demonstrated in answers shifted from "Not Good", "Okay/Neutral" and "Good" to "Great".

Q. Have you enjoyed scenic views at the Marsh?
- Out of 63 respondents to this question, 63 (100%) responded "Yes".

Q. What aspect of the Marsh contributes the most to improving your mood?
- Out of 64 respondents to this question, 36 (56%) responded "Scenery and views"; 0 (0%) responded "weather"; 1 responded "sounds"; 8 (13%) responded "Plants at the Marsh"; 10 (16%) responded "Wild animals at the Marsh"; 0 (0%) responded "Other People"; and 9 (14%) responded "Other/Comment". Of the 9 who answered "Other/Comment", 4 noted it was the combination of these aspects; 3 noted the closeness to the water or access for rowing/kayaking was what enhanced their mood. The remaining 2 did not benefit from mood improvement, with one noting they could not visit because of restrictions on bringing dogs although they would love to.

Limitations: Due to the survey's online nature, it excluded users who may not be comfortable with technology and would be more likely to complete a paper survey. We acknowledge that "different background" is subjective and without further clarification, it is difficult to draw conclusions. We recommend future investigators be more specific in terms of socio-economic, racial, ethnic, or educational cross-group interactions. For instance, it was interesting to see that while 80% of respondents noted observing people of different backgrounds interact and 76% indicated they did themselves, however, the majority of respondents identified as white/Caucasian (73%); having an income level over $75,000; and/or an education level of bachelor's degree or higher (many all three).

The following data analysis was conducted via Qualitrics Stats iQ "relate" tool.

	Do you interact with people of different backgrounds than yourself at the Marsh?				
Annual Household Income	**Yes**		**No**		**Count (n=61)**
$0 - $24,999	2	4.3%	0	0.0%	**2**
$25,000 - $49,999	3	6.4%	1	7.1%	**4**
$50,000-$74,999	6	12.8%	2	14.3%	**8**
$75,000 - $99,999	8	17.0%	4	28.6%	**12**
$100,000 - $149,999	16	34.0%	3	21.4%	**19**
$150,000+	12	25.5%	4	28.6%	**16**
Count (n=61)	**47**		**14**		

Highest Education Completed	Do you interact with people of different backgrounds than yourself at the Marsh?		Count (n=63)
	Yes	No	
High School	1	0	1
Some College	5	0	5
Associates	2	0	2
Bachelors	11	4	15
Masters	21	9	30
Doctorate	8	2	10
Count (n=63)	48	15	63

Educational Value
➔ **Promotes public awareness and education about marshes and wetlands with 54% of respondents indicating their visits pushed them to seek out information and learn more.**

Methods: Anecdotal accounts of school visits were obtained from the site operators, and school visits were observed by the researchers while visiting the site. Five teachers ranging from elementary to college responded in the survey that they either brought their students on field trips to the marsh or made recordings at the marsh to use in their classes.

Q. Have you visited the Marsh for a class field trip?

▸ Out of 63 respondents to this question, 5 responded "Yes", with a brief explanation.

Q. Did visiting the Marsh prompt you to further research marsh and wetland habitats or wildlife you encountered there?

▸ Out of 63 respondents to this question, 34 (54%) responded "Yes", and 29 (46%) responded "No"

Limitations: While the observed K-12 school visits demonstrate the introduction of wetland ecosystems and marshes to children and youth and are recorded as an educational event, we were not able to obtain an exact number of annual visits. Moreover, the curriculum that accompanies the visit is assumed to provide educational enhancement beyond the visit itself. The marsh serves as a venue for children to connect with nature and observe wetland and marsh ecosystems. However, the quality of experience and knowledge gained is contingent upon the lesson, the time allocated to the visit and lesson, the student-to-teacher ratio, and several other factors beyond the scope of our study.

Scenic Quality & Views
➔ **Provides aesthetic value, with 100% of 63 surveyed visitors reporting that they enjoyed the scenic views.**

Access & Equity
➔ **Supports social interaction, with 68% of 63 surveyed visitors confirming that they interact with strangers at the marsh and 75% of 40 surveyed visitors agreeing that it is a good place to meet new people.**

→ **Supports cross-group interaction, with 80% of 60 surveyed visitors reporting that they have observed people of different backgrounds interacting at the park and 76% of 63 surveyed visitors reporting having interacted with people of different backgrounds themselves.**

See Social Benefits above for Methods, Calculations, and Limitations.

ECONOMIC BENEFITS

→ **Created 1 full-time year-round position for site maintenance.**

Methods: Site operators explained that one maintenance position was created to care for the site, which also has responsibilities on other university properties.

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scale 1:16
0'   8'   16'   32'   64'

REVISION :

NO.	DATE	DESCRIPTION	BY
		100% CD	
		100% CD	

LEGEND :

— · — · — PROPERTY LINE
— — — — — PROJECT LIMITS
PROPOSED SHRUB
PROPOSED PLUG OR POT
PROPOSED LAWN
PROPOSED REINFORCED LAWN
COIR MATRESS PLANTING
EXISTING TREE
PROPOSED TREE

NOTES:
1. CONTRACTOR TO VERIFY PLANT QUANTITIES.
2. SEE N-001.00 FOR NOTES REGARDING WETLAND ZONES.

LANDSCAPE ARCHITECT :
james corner field operations
475 Tenth Ave, Tenth Floor, New York, NY 10018

CONSULTANT TEAM :
eDesign Dynamics

LANGAN Engineering & Environmental Services

Halcrow Yolles

Brandston Partnership Inc.

OWNER :
Columbia University
c/o Capital Project Management
410 West 118th Street   New York, NY 10027
Tel 212.854.2450

PROJECT NAME
BOATHOUSE MARSH

DRAWING TITLE
PLANTING PLAN MATCH LINE 01

SEAL AND SIGNATURE

DATE:	3.25.2011
PROJECT No.:	100% CD
DRAWING BY:	GT
CHECKED BY:	KT
DWG No.	

L-141.00

CADD FILE No:

25 OF 80

Drawing labels

LAWN
EXISTING PERMEABLE PAVER
CENTER TREE BETWEEN BENCHES
LAWN
CENTER TREES BETWEEN WINDOWS OF BUILDING
PLANTING BED 2 SEE PLANTING PLAN- ENLARGEMENT 3
PLANTING BED 3 SEE PLANTING PLAN- ENLARGEMENT 3
TREE PLANTING, TYP.
SEE L-140.00
PLANTING BED 1 SEE PLANTING PLAN- ENLARGEMENT 2
TREE PLANTING, TYP.
SHRUB, TRANSPLANTED, SEE L-544.00 FOR NOTES ON DESIGN INTENT
TREE PLANTING IN STONE SCREENINGS
SHADE PLANTING & MULCH BENEATH TRANSPLANTED HEDGE
TREE PLANTING, TYP.
SEE PLANTING PLAN - ENLARGEMENT 1
EXISTING RIP RAP
PROJECT LIMIT LINE
PROPERTY LINE
SEE PLANTING PLAN - ENLARGEMENT 1
WETLAND ZONE 4
WETLAND ZONE 3
WETLAND ZONE 2
WETLAND ZONE 1
WETLAND ZONE 2
WETLAND ZONE 3
WETLAND ZONE 4
ALIGN TREE @ CENTER OF DECK CURVE
ALIGN TREES W/ CL OF BENCHES
LOW SALT MARSH ZONE
SALT MARSH TRANSITION ZONE
HIGH SALT MARSH ZONE
PLANTING BED 4 SEE PLANTING PLAN- ENLARGEMENT 1
DOT ROW
PLANTING BED 4 SEE PLANTING PLAN- ENLARGEMENT 1
SHADE PLANTING SEE PLANTING PLAN- ENLARGEMENT 2
TREE PLANTING, TYP.
TREE PLANTING IN STONE SCREENINGS
(8) NEW STREET TREES, TYP. ALL
WEST 218 STREET
EX. GAS LINE
LAWN

PLANTING SCHEDULE

TREES

SYM	QTY	BOTANICAL NAME	COMMON NAME	SIZE
CC	8	Cercis canadensis	Eastern Redbud	3" cal.
NS	5	Nyssa sylvatica	Black Gum	3" cal.
QA	4	Quercus acutissima	Sawtooth Oak	3" cal.
QP	3	Quercus palustris	Pin Oak	3" cal.
QRo	2	Quercus robur	English Oak	3" cal.
QRu	3	Quercus rubra	Northern Red Oak	3" cal.

STREET TREES

SYM	QTY	BOTANICAL NAME	COMMON NAME	SIZE
NS	9	Nyssa sylvatica	Black Gum	3" cal.

HEDGE PLANTING

SYM	QTY	BOTANICAL NAME	COMMON NAME	SIZE
S- Bha(t)		Baccharis halimifolia	Groundsel Tree	transplanted

LAWN   Area = 7422 SF

SYM	QTY	BOTANICAL NAME	COMMON NAME	SIZE
G- fa	33%	Festuca arundinacea	Tall Fescue	SOD
G- lp	33%	Lolium perenne	Perennial Rye Grass	SOD
G- pp	33%	Poa pratensis	Bluegrass	SOD

SHADE PLANTING

SYM	QTY	BOTANICAL NAME	COMMON NAME	SIZE
GC- ac	488	Asarum canadense	Canada Wild Ginger	#4 pot
F- aff	99	Athyrium filix-femina	Lady Fern	#4 pot
P- aq	25	Anemone quinquefolia	Twoleaf anemone	#4 pot
F- dcr	99	Dryopteris cristata	Crested Shield Fern	#4 pot
GC- gc	428	Geum canadense	White Avens	#4 pot
F- os	99	Onoclea sensibilis	Sensitive Fern	#4 pot
GC- ps	428	Phlox stolonifera	Creeping Phlox	#4 pot
GC- tc	428	Tiarella cordifolia	Heart-leafed Foamflower	#4 pot
P- vc	25	Viola canadensis	Canadian Violet	#4 pot
P- vp	25	Viola pubescens	Downy Yello Violet	#4 pot
F- wv	99	Woodwardia virginica	Virginia Chain Fern	#4 pot

WETLAND ZONE 1

SYM	QTY	BOTANICAL NAME	COMMON NAME	SIZE
P- pev	526	Peltandra virginica	Arrow Arum	2"
P- pc	526	Pontederia cordata	Pickerelweed	2"
P- sce	526	Saururus cernuus	Lizard Tail	2"
P- si	526	Sagittaria latifolia	Duck Potato	2"
P- st	225	Scirpus tabernaemontanii	Soft-Stem Bulrush	2"

WETLAND ZONE 2

SYM	QTY	BOTANICAL NAME	COMMON NAME	SIZE
G- cco	104	Carex comosa	Longhair Sedge	2"
G- ccr	104	Carex crinita	Fringed Sedge	2"
P- cg	69	Chelone glabra	Turtlehead	2"
G- cl	104	Carex lurida	Shallow Sedge	2"
G- cs	104	Carex stricta	Tussock Sedge	2"
G- cv	104	Carex vulpinoidea	Fox Sedge	2"
P- hm	69	Hibiscus moscheutos	Swamp Rose-Mallow	2"
P- iv	69	Iris versicolor	Blueflag Iris	2"
P- jc	104	Juncus canadensis	Canada Rush	2"
P- jm	104	Juncus militaris	Bayonet Rush	2"
G- lo	104	Leersia oryzoides	Rice Cutgrass	2"

WETLAND ZONE 3

SYM	QTY	BOTANICAL NAME	COMMON NAME	SIZE
P- ai	37	Asclepias incarnata	Swamp Milkweed	2"
P- anb	37	Aster novi-belgii	New York Aster	2"
G- ev	185	Elymus virginicus	Virginia Wild-Rye	2"
G- je	185	Juncus effusus	Soft Rush	2"
P- lc	37	Lobelia cardinalis	Cardinal Flower	2"
P- mr	37	Mimulus ringens	Monkey Flower	2"
G- scy	185	Scirpus cyperinus	Woolgrass	2"
G- spu	185	Scirpus pungens	Common 3 Square	2"
P- vh	37	Verbena hastata	Blue Vervain	2"

SALT MARSH TRANSITION ZONE

SYM	QTY	BOTANICAL NAME	COMMON NAME	SIZE
G- ag	138	Andropogon gerardii	Big Bluestem	2"
G- pav	138	Panicum virgatum	Switch Grass	2"
G- ssc	138	Schizachyrium scoparium	Little Bluestem	2"
G- sse	138	Solidago sempervirens	Seaside Goldenrod	2"
G- sn	138	Sorghastrum nutans	Indian Grass	2"

HIGH MARSH ZONE

SYM	QTY	BOTANICAL NAME	COMMON NAME	SIZE
G- spa	199	Spartina patens	Saltmeadow Cordgrass	2"

LOW MARSH ZONE

SYM	QTY	BOTANICAL NAME	COMMON NAME	SIZE
G- sa	2715	Spartina alterniflora	Smooth Cordgrass	2"

PLANTING BEDS 1, 2, 3, 4

SYM	QTY	BOTANICAL NAME	COMMON NAME	SIZE
S- aa	5	Aronia arbutifolia	Red Chokeberry	2 gal.

SYM	QTY	BOTANICAL NAME	COMMON NAME	SIZE
P- ec	105	Eupatorium coelestinum	Blue Mistflower	2"
P- epe	105	Eupatorium perfoliatum	Boneset	2"
P- epu	105	Eupatorium purpureum	Purple Joe-Pye Weed	2"
P- rh	105	Rudbeckia hirta	Black-Eyed Susan	2"
G- ssc	524	Schizachyrium scoparium	Little Bluestem	2"
G- sn	524	Sorghastrum nutans	Indian Grass	2"
G- cp	634	Carex pensylvanica	Pennsylvani sedge	#4 pot
G- df	634	Deschampsia flexuosa	Wavy Hairgrass	#4 pot
P- ec	124	Eupatorium coelestinum	Blue Mistflower	#4 pot
P- epe	124	Eupatorium perfoliatum	Boneset	#4 pot
P- epu	124	Eupatorium purpureum	Purple Joe-Pye Weed	#4 pot
S- gb	48	Gaylussacia baccata	Black Huckleberry	2 gal.
S- ig	5	Ilex glabra	Inkberry	2 gal.
S- Lb	5	Lindera benzoin	Northern spicebush	2 gal.
G- sn	60	Sorghastrum nutans	Indian Grass	#4 pot
G- pav	60	Panicum virgatum	Switchgrass	#4 pot
P- rh	124	Rudbeckia hirta	Black-Eyed Susan	#4 pot
S- Va	21	Vaccinium angustifolium	Lowbush Blueberry	2 gal.
S- Vc	21	Vaccinium corymbosum	Highbush Blueberry	2 gal.
S- Vd	5	Viburnum dentatum	Southern arrowwood	2 gal.

APPENDIX 2: PLANT INVENTORY

ID	Scientific Name	Common Name	Last Observed	Taxa	Citizen Science Platform	Note on FQI
1	Acer platanoides	Norway Maple	7/11/2024	Plantae	iNaturalist	
2	Actaea racemosa	Black Cohosh	7/11/2024	Plantae	iNaturalist	
3	Ailanthus altissima	Tree-of-heaven	7/11/2024	Plantae	iNaturalist	
4	Amelanchier arborea	Common Serviceberry	6/4/2024	Plantae	iNaturalist	
5	Amorpha fruticosa	False Idigo Bush	7/11/2024	Plantae	iNaturalist	
6	Arctium minus	Lesser Burdock	7/11/2024	Plantae	iNaturalist	
7	Aronia arbutifolia	Red Chokeberry	7/11/2024	Plantae	iNaturalist	
8	Artemisia vulgaris	common mugwort	3/14/2024	Plantae	iNaturalist	
9	Asarum canadense	CanadianWild Ginger	7/11/2024	Plantae	iNaturalist	
10	Asclepias syriaca	Common Milkweed	7/11/2024	Plantae	iNaturalist	
11	Baccharis halimifolia	Groundsel Tree	6/6/2024	Plantae	iNaturalist	
12	Calystegia sepium	Hedge bindweed	7/11/2024	Plantae	iNaturalist	
13	Cercis canadensis	Eastern Redbud	4/29/2024	Plantae	iNaturalist	
14	Cirsium arvense	Creeping Thistle	7/11/2024	Plantae	iNaturalist	
15	Clematis occidentalis	Purple Clematis	6/1/2024	Plantae	iNaturalist	
16	Daucus carota	Queen Anne's lace	7/11/2024	Plantae	iNaturalist	
17	Eutrochium purpureum	Sweet Joe-Pye-weed	7/11/2024	Plantae	iNaturalist	
18	Galium aparine	Catchweed Bedstraw	4/30/2024	Plantae	iNaturalist	
19	Hibiscus moscheutos	Swamp Rose Mallow	6/4/2024	Plantae	iNaturalist	
20	Hydrangea petiolaris	Climbing Hydrangea	5/20/2024	Plantae	iNaturalist	
21	Hylotelephium spectabile	Iceplant	7/11/2024	Plantae	iNaturalist	
22	Iris sanguinea	Japanese Iris	5/12/2024	Plantae	iNaturalist	Sub with *I. Versicolor*
23	Iva frutescens	Marsh Elder	6/4/2024	Plantae	iNaturalist	
24	Juncus tenuis	Slender Path Rush	6/4/2024	Plantae	iNaturalist	
25	Juniperus virginiana	Eastern Redcedar	3/18/2024	Plantae	iNaturalist	
26	Liatris pycnostachya	Prairie Blazing Star	7/11/2024	Plantae	iNaturalist	

27	Lindera benzoin	Northern Spicebush	7/11/2024	Plantae	iNaturalist	
28	Lotus corniculatus	Bird's-foot Trefoil	5/28/2024	Plantae	iNaturalist	
29	Lythrum salicaria	Purple Loosestrife	7/11/2024	Plantae	iNaturalist	
30	Maianthemum racemosum	Solomon's plume	7/11/2024	Plantae	iNaturalist	
31	Morella pensylvanica	Northern Bayberry	7/11/2024	Plantae	iNaturalist	
32	Morus alba	White mulberry	7/11/2024	Plantae	iNaturalist	
33	Myosotis arvensis	Field forget-me-not	6/4/2024	Plantae	iNaturalist	
34	Myosotis scorpioides	water forget-me-not	5/19/2024	Plantae	iNaturalist	
35	Narcissus	Daffodils	4/13/2024	Plantae	iNaturalist	
36	Oenothera biennis	Common Evening-primrose	6/4/2024	Plantae	iNaturalist	
37	Peltandra virginica	Green Arrow Arum	7/11/2024	Plantae	iNaturalist	
38	Phragmites australis	Common Reed	7/11/2024	Plantae	iNaturalist	
39	Quercus palustris	Pin Oak	7/14/2024	Plantae	iTree Inventory	
40	Quercus rubra	Northern Red Oak	7/15/2024	Plantae	iTree Inventory	
41	Plantago lanceolata	Ribwort Plantain	6/4/2024	Plantae	iNaturalist	
42	Ranunculus acris	Meadow buttercup	6/4/2024	Plantae	iNaturalist	
43	Rudbeckia hirta	Black-eyed Susan	7/11/2024	Plantae	iNaturalist	
44	Rumex crispus	Curly Dock	6/4/2024	Plantae	iNaturalist	Sub with *R. altissimus*
	Rumex cristatus	Greek Dock	6/4/2024	Plantae	iNaturalist	
45	Saururus cernuus	Lizard's tail	7/11/2024	Plantae	iNaturalist	
46	Securigera varia	Purple Crownvetch	6/6/2024	Plantae	iNaturalist	
47	Solidago sempervirens	Northern Seaside Goldenrod	7/11/2024	Plantae	iNaturalist	
48	Trifolium pratense	Red Clover	6/4/2024	Plantae	iNaturalist	
49	Verbena hastata	Blue Vervain	7/11/2024	Plantae	iNaturalist	
50	Viburnum dentatum	Southern Arrowwood	6/4/2024	Plantae	iNaturalist	
51	Vicia sativa	Common Vetch	5/19/2024	Plantae	iNaturalist	
52	Vicia villosa	Hairy Vetch	6/4/2024	Plantae	iNaturalist	
53	Viola canadensis	Canada Violet	6/4/2024	Plantae	iNaturalist	
54	Woodwardia virginica	Virginia Chainfern	7/11/2024	Plantae	iNaturalist	

Helleboreae	Hellebores and Lenten Roses	3/14/2024	Plantae	iNaturalist	Not included in FQI
Hydrangea quercifolia	Oakleaf Hydrangea	6/4/2024	Plantae	iNaturalist	Not included in FQI
Magnoliopsida	Dicots	6/4/2024	Plantae	iNaturalist	Not included in FQI
Melilotus albus	White Sweetclover	7/11/2024	Plantae	iNaturalist	Not included in FQI
Nepeta racemosa	Eastern Cat-mint	6/4/2024	Plantae	iNaturalist	Not included in FQI
Quercus acutissima	Sawtooth Oak	7/12/2024	Plantae	iTree Inventory	Not included in FQI
Quercus robur	English Oak	7/13/2024	Plantae	iTree Inventory	Not included in FQI
Ranunculus bulbosus	Bulbous Buttercup	5/28/2024	Plantae	iNaturalist	Not included in FQI
Ulva	Sea Lettuces	4/7/2024	Plantae	iNaturalist	Not included in FQI

APPENDIX 3: ANIMAL OBSERVATIONS

Birds

	Scientific Name	Common Name	Last Observed	Taxa	Citizen Science Platform
1	Ardea alba	Great Egret	6/25/2024; 7/11/2024	Aves	eBird; iNaturalist
2	Branta canadensis	Canada Goose	6/18/2024; 4/30/2024	Aves	eBird; iNaturalist
3	Anas platyrhynchos	Mallard	6/18/2024; 2/8/2024	Aves	eBird; iNaturalist
4	Larus delawarensis	Ring-billed Gull	5/11/2024; 4/7/2024	Aves	eBird; iNaturalist
5	Agelaius phoeniceus	Red-winged Blackbird	6/28/2024	Aves	eBird
6	Melospiza melodia	Song Sparrow	6/27/2024	Aves	eBird
7	Mimus polyglottos	Northern Mockingbird	6/26/2024	Aves	eBird
8	Icterus galbula	Baltimore Oriole	6/18/2024	Aves	eBird
9	Chaetura pelagica	Chimney Swift	6/18/2024	Aves	eBird
10	Quiscalus quiscula	Common Grackle	6/18/2024	Aves	eBird
11	Nannopterum auritum	Double-crested Cormorant	6/18/2024	Aves	eBird
12	Sturnus vulgaris	European Starling	6/18/2024	Aves	eBird
13	Corvus ossifragus	Fish Crow	6/18/2024	Aves	eBird
14	Larus marinus	Great Black-backed Gull	6/18/2024	Aves	eBird
15	Larus argentatus	Herring Gull	6/18/2024	Aves	eBird
16	Passer domesticus	House Sparrow	6/18/2024	Aves	eBird
17	Zenaida macroura	Mourning Dove	6/18/2024	Aves	eBird
18	Cardinalis cardinalis	Northern Cardinal	6/18/2024	Aves	eBird
19	Stelgidopteryx serripennis	Northern Rough-winged Swallow	6/18/2024	Aves	eBird
20	Columba livia	Rock Pigeon	6/18/2024	Aves	eBird
21	Vireo gilvus	Warbling Vireo	6/18/2024	Aves	eBird
22	Turdus migratorius	American Robin	6/2/2024	Aves	eBird
23	Corvus brachyrhynchos	American Crow	5/19/2024	Aves	eBird
24	Setophaga striata	Blackpoll Warbler	5/19/2024	Aves	eBird
25	Thryothorus ludovicianus	Carolina Wren	5/19/2024	Aves	eBird
26	Bombycilla cedrorum	Cedar Waxwing	5/19/2024	Aves	eBird

27	Dumetella carolinensis	Gray Catbird	5/19/2024	Aves	eBird
28	Icterus spurius	Orchard Oriole	5/19/2024	Aves	eBird
29	Zonotrichia albicollis	White-throated Sparrow	5/19/2024	Aves	eBird
30	Spinus tristis	American Goldfinch	5/15/2024	Aves	eBird
31	Falco sparverius	American Kestrel	5/15/2024	Aves	eBird
32	Hirundo rustica	Barn Swallow	5/15/2024	Aves	eBird
33	Megaceryle alcyon	Belted Kingfisher	5/15/2024	Aves	eBird
34	Cyanocitta cristata	Blue Jay	5/15/2024	Aves	eBird
35	Tyrannus tyrannus	Eastern Kingbird	5/15/2024	Aves	eBird
36	Haemorhous mexicanus	House Finch	5/15/2024	Aves	eBird
37	Cistothorus palustris	Marsh Wren	5/15/2024	Aves	eBird
38	Catharus ustulatus	Swainson's Thrush	5/15/2024	Aves	eBird
39	Melospiza georgiana	Swamp Sparrow	5/15/2024	Aves	eBird
40	Dryobates pubescens	Downy Woodpecker	5/11/2024	Aves	eBird
41	Parkesia noveboracensis	Northern Waterthrush	5/11/2024	Aves	eBird
42	Buteo jamaicensis	Red-tailed Hawk	5/11/2024	Aves	eBird
43	Geothlypis trichas	Common Yellowthroat	5/10/2024	Aves	eBird
44	Setophaga coronata	Yellow-rumped Warbler	5/6/2024	Aves	eBird
45	Spizella passerina	Chipping Sparrow	5/1/2024	Aves	eBird
46	Colaptes auratus	Northern Flicker	5/1/2024	Aves	eBird
47	Setophaga americana	Northern Parula	5/1/2024	Aves	eBird
48	Setophaga palmarum	Palm Warbler	5/1/2024	Aves	eBird
49	Passerculus sandwichensis	Savannah Sparrow	5/1/2024	Aves	eBird
50	Spizella pusilla	Field Sparrow	4/7/2024	Aves	eBird
51	Cathartes aura	Turkey Vulture	4/7/2024	Aves	eBird
52	Bucephala albeola	Bufflehead	1/23/2024	Aves	eBird
53	Accipiter cooperii	Cooper's Hawk	1/13/2024	Aves	eBird
54	Junco hyemalis	Dark-eyed Junco	12/26/2023	Aves	eBird
55	Mergus serrator	Red-breasted Merganser	12/8/2023	Aves	eBird
56	Haliaeetus leucocephalus	Bald Eagle	11/11/2023	Aves	eBird
57	Sayornis phoebe	Eastern Phoebe	11/5/2023	Aves	eBird
58	Pandion haliaetus	Osprey	10/15/2023	Aves	eBird

59	Butorides virescens	Green Heron	9/23/2023	Aves	eBird
60	Ardea herodias	Great Blue Heron	9/17/2023	Aves	eBird
61	Falco peregrinus	Peregrine Falcon	9/10/2023	Aves	eBird
62	Nycticorax nycticorax	Black-crowned Night Heron	8/17/2023	Aves	eBird
63	Melanerpes carolinus	Red-bellied Woodpecker	8/13/2023	Aves	eBird
64	Calidris minutilla	Least Sandpiper	8/11/2023	Aves	eBird
65	Seiurus aurocapilla	Ovenbird	8/11/2023	Aves	eBird
66	Sitta carolinensis	White-breasted Nuthatch	8/11/2023	Aves	eBird
67	Egretta thula	Snowy Egret	7/28/2023	Aves	eBird
68	Corvus corax	Common Raven	6/25/2023	Aves	eBird
69	Megascops asio	Eastern Screech-Owl	5/13/2023	Aves	eBird
70	Troglodytes aedon	House Wren	5/13/2023	Aves	eBird
71	Vireo olivaceus	Red-eyed Vireo	5/13/2023	Aves	eBird
72	Tringa solitaria	Solitary Sandpiper	5/13/2023	Aves	eBird
73	Hylocichla mustelina	Wood Thrush	5/13/2023	Aves	eBird
74	Poecile atricapillus	Black-capped Chickadee	12/31/2022	Aves	eBird
75	Baeolophus bicolor	Tufted Titmouse	12/31/2022	Aves	eBird
76	Dryobates villosus	Hairy Woodpecker	12/4/2022	Aves	eBird
77	Falco columbarius	Merlin	11/25/2022	Aves	eBird
78	Cygnus olor	Mute Swan	11/17/2022	Aves	eBird
79	HawkButeo lineatus	Red-shouldered	11/7/2022	Aves	eBird
80	Corthylio calendula	Ruby-crowned Kinglet	10/22/2022	Aves	eBird
81	Sphyrapicus varius	Yellow-bellied Sapsucker	10/22/2022	Aves	eBird
82	Buteo platypterus	Broad-winged Hawk	10/12/2022	Aves	eBird
83	Circus hudsonius	Northern Harrier	10/12/2022	Aves	eBird
84	Anas crecca	Green-winged Teal	9/18/2022	Aves	eBird
85	Charadrius semipalmatus	Semipalmated Plover	9/4/2022	Aves	eBird
86	Actitis macularius	Spotted Sandpiper	9/4/2022	Aves	eBird
87	Coragyps atratus	Black Vulture	8/7/2022	Aves	eBird
88	Leucophaeus atricilla	Laughing Gull	8/5/2022	Aves	eBird
89	Tringa flavipes	Lesser Yellowlegs	8/4/2022	Aves	eBird
90	Calidris pusilla	Semipalmated Sandpiper	8/4/2022	Aves	eBird

91	Anas rubripes	American Black Duck	7/31/2022	Aves	eBird
92	Molothrus ater	Brown-headed Cowbird	7/2/2022	Aves	eBird
93	Tachycineta bicolor	Tree Swallow	6/12/2022	Aves	eBird
94	Pipilo erythrophthalmus	Eastern Towhee	5/14/2022	Aves	eBird
95	Setophaga petechia	Yellow Warbler	5/9/2022	Aves	eBird
96	Catharus guttatus	Hermit Thrush	5/3/2022	Aves	eBird
97	Tringa melanoleuca	Greater Yellowlegs	5/2/2022	Aves	eBird
98	Larus glaucoides	Iceland Gull	2/14/2022	Aves	eBird
99	Anser caerulescens	Snow Goose	2/14/2022	Aves	eBird
100	Podilymbus podiceps	Pied-billed Grebe	1/13/2022	Aves	eBird
101	Passerella iliaca	Fox Sparrow	12/11/2021	Aves	eBird
102	Accipiter striatus	Sharp-shinned Hawk	10/20/2021	Aves	eBird
103	Helmitheros vermivorum	Worm-eating Warbler	10/4/2021	Aves	eBird
104	Mniotilta varia	Black-and-white Warbler	9/4/2021	Aves	eBird
105	Egretta caerulea	Little Blue Heron	7/20/2021	Aves	eBird
106	Meleagris gallopavo	Wild Turkey	5/29/2021	Aves	eBird
107	Branta bernicla	Brant	5/20/2021	Aves	eBird
108	Melospiza lincolnii	Lincoln's Sparrow	5/10/2021	Aves	eBird
109	Charadrius vociferus	Killdeer	5/2/2021	Aves	eBird
110	Setophaga virens	Black-throated Green Warbler	4/28/2021	Aves	eBird
111	Vireo solitarius	Blue-headed Vireo	4/28/2021	Aves	eBird
112	Aythya marila	Greater Scaup	2/4/2021	Aves	eBird
113	Spinus pinus	Pine Siskin	10/24/2020	Aves	eBird
114	Ammospiza nelsoni	Nelson's Sparrow	10/19/2020	Aves	eBird
115	Zonotrichia leucophrys	White-crowned Sparrow	10/14/2020	Aves	eBird
116	Chordeiles minor	Common Nighthawk	9/29/2020	Aves	eBird
117	Myiarchus crinitus	Great Crested Flycatcher	9/29/2020	Aves	eBird
118	Setophaga caerulescens	Black-throated Blue Warbler	9/23/2020	Aves	eBird
119	Troglodytes hiemalis	Winter Wren	9/23/2020	Aves	eBird
120	Leiothlypis ruficapilla	Nashville Warbler	9/13/2020	Aves	eBird
121	Polioptila caerulea	Blue-gray Gnatcatcher	4/21/2020	Aves	eBird
122	Dryocopus pileatus	Pileated Woodpecker	4/17/2020	Aves	eBird

	Scientific Name	Common Name	Last Observed	Taxa	Citizen Science Platform
123	Certhia americana	Brown Creeper	3/21/2020	Aves	eBird
124	Regulus satrapa	Golden-crowned Kinglet	3/21/2020	Aves	eBird
125	Lophodytes cucullatus	Hooded Merganser	1/11/2020	Aves	eBird
126	Setophaga ruticilla	American Redstart	9/14/2019	Aves	eBird
127	Archilochus colubris	Ruby-throated Hummingbird	9/14/2019	Aves	eBird
128	Empidonax traillii	Willow Flycatcher	8/13/2019	Aves	eBird
129	Nyctanassa violacea	Yellow-crowned Night Heron	4/23/2019	Aves	eBird
130	Gavia stellata	Red-throated Loon	5/11/2018	Aves	eBird
131	Aythya valisineria	Canvasback	1/13/2018	Aves	eBird
132	Spatula clypeata	Northern Shoveler	11/21/2017	Aves	eBird
133	Passerina cyanea	Indigo Bunting	8/8/2017	Aves	eBird
134	Mareca strepera	Gadwall	7/31/2017	Aves	eBird
135	Contopus virens	Eastern Wood-Pewee	9/17/2016	Aves	eBird
136	Spizelloides arborea	American Tree Sparrow	11/8/2015	Aves	eBird
137	Setophaga fusca	Blackburnian Warbler	10/1/2015	Aves	eBird
138	Setophaga magnolia	Magnolia Warbler	10/1/2015	Aves	eBird
139	Haemorhous purpureus	Purple Finch	10/1/2015	Aves	eBird
140	Phalaropus fulicarius	Red Phalarope	10/1/2015	Aves	eBird
141	Calidris fuscicollis	White-rumped Sandpiper	10/4/2014	Aves	eBird
142	Calidris melanotos	Pectoral Sandpiper	10/2/2014	Aves	eBird
143	Numenius phaeopus	Whimbrel	8/29/2011	Aves	eBird

Insects

	Scientific Name	Common Name	Last Observed	Taxa	Citizen Science Platform
1	Bombus griseocollis	Brown-belted Bumble Bee	7/11/2024	Insecta	iNaturalist
2	Lycorma delicatula	Spotted Lanternfly	7/11/2024	Insecta	iNaturalist
3	Vanessa atalanta	Red Admiral	7/11/2024	Insecta	iNaturalist
4	Xenox tigrinus	Tiger Bee Fly	7/11/2024	Insecta	iNaturalist
5	Halticus apterus		6/6/2024	Insecta	iNaturalist

	Scientific Name	Common Name	Last Observed	Taxa	Citizen Science Platform
6	Apis mellifera	Western Honey Bee	6/4/2024	Insecta	iNaturalist
7	Harmonia axyridis	Asian Lady Beetle	6/4/2024	Insecta	iNaturalist
8	Sarcophagidae	Flesh Flies and Satellite Flies	6/4/2024	Insecta	iNaturalist
9	Coccinellini	Black-spotted Lady Beetles	5/29/2024	Insecta	iNaturalist
10	Ceratopogoninae		5/28/2024	Insecta	iNaturalist

Other

	Scientific Name	Common Name	Last Observed	Taxa	Citizen Science Platform
1	Brachycera	Brachyceran Flies	4/7/2024	Insecta	iNaturalist
2	Marmota monax	Groundhog	7/11/2024	Mammalia	iNaturalist
3	Macoma petalum	Atlantic Macoma	5/28/2024	Mollusca	iNaturalist

APPENDIX 4: SURVEY

LAF Case Study Investigation - Muscota Marsh User Survey

Q1 Landscape Performance Series Case Study Investigation: Muscota Marsh
<u>Key Information</u>
Principal Investigator: Sohyun Park, Ph.D., Associate Professor, Department of Plant Science and Landscape Architecture, College of Agriculture, Health and Natural Resources
Student Investigator: Zahra Ali, Ph.D. Student, Department of Plant Science and Landscape Architecture, College of Agriculture, Health and Natural Resources
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Telephone: 860-486-6069
Sponsor: Landscape Architecture Foundation

The following is key information to assist you in understanding why you might or might not want to participate in this survey.
- ➥ You are being asked to participate in a research study as a visitor to Muscota Marsh in New York City.
- ➥ Your participation is voluntary. You may refuse to participate or withdraw at any time without penalty or loss of benefits to which you are otherwise entitled. Your alternative is to not take part in the study.
- ➥ The purpose of the study is to evaluate the landscape performance of the Muscota Marsh restoration and assess whether the project objectives, including biodiversity and community impacts, have been met.
- ➥ The survey will take between 5-15 minutes to complete and allows you to submit your answers in multiple stages, so you may choose how much time to dedicate to answering questions.
- ➥ There are no foreseeable risks to participating in this study.
- ➥ There is no direct benefit to you from participating in this study. However, the information we learn from the study results may help landscape designers, city planners, and communities in decision-making for future restoration projects.

By continuing with this survey, you confirm that you are of legal age (18+), and you understand that your answers will be anonymous and used in a publicly published analysis of the site. The survey will take 5-10 minutes, and there is no direct benefit to you by participating in this study. All questions are optional and may be skipped at any time. You may use the back button to change your response but will not be able to return to complete the survey at a later time.
- o   I am under 18 years of age
- o   I am 18+ and I agree to continue with the survey
- o   I am 18+ and do not want to take the survey

Skip To: End of Survey If Q1 = I am under 18 years of age

Skip To: End of Survey If Q1 = I am 18+ and do not want to take the survey

End of Block: Informed Consent

Visitor Survey

Q2 Relation to place: How are you connected to this place? (Note: a community member may be a non-resident who actively participates in the community, for example, someone who owns a business, works, volunteers, or has family in the neighborhood).

- o Columbia University Faculty/Student/Staff
- o Inwood Resident or Community Member
- o New York City Resident or community member
- o New York State Resident
- o Out-of-State (No connection)
- o Other (Please describe) _____

BENEFIT: ACCESS & EQUITY

Q3 What is your ethnicity?

- o Black
- o Indigenous
- o Asian
- o Hispanic/Latinx
- o White
- o Mixed
- o Other (Please describe) _____

Q4 What is your highest level of education?

- o No High School
- o High School
- o Some College
- o Associate
- o Bachelor
- o Master
- o Doctorate

Q5 What is your annual household income?

- o $0-25K
- o $26k-50K
- o 51K-75K
- o 76K-100K
- o 100K-150K
- o 150K+

Q6 How old are you?

- 18-25
- 26-35
- 36-45
- 46-55
- 55-65
- 65-75
- 75+

BENEFIT: TRANSPORTATION

Q7 Do you ride your bike to Muscota Marsh and use the bicycle rack? (not the city bike program on the street)

- Yes
- No

BENEFIT: RECREATIONAL & SOCIAL VALUE / SOCIAL INTERACTIONS

Q8 Do you interact with strangers in the Marsh?

- Yes
- No

Q9 Is the Marsh a good place to meet new people?

- Yes
- No
- I don't know

Q10 Do you see people from different backgrounds at the Marsh?

- Yes
- No

Q11 Do you interact with people from different backgrounds from yourself at the Marsh?

- Yes
- No

Q12 Do you see people from different backgrounds interacting with one another at the Marsh?

- Yes
- No

Q13 Do you use the park Marsh as a gathering or meeting place for people you know?

- Yes
- No

Q14 Who do you visit the Marsh with?

- o   Alone
- o   With family
- o   With friends
- o   With colleagues
- o   Other (Please describe) _____

Q15 How often did you visit Muscota Marsh before its restoration in 2014?
- o   Daily
- o   Once a week
- o   2-3 times a week
- o   4-6 times a week
- o   Monthly
- o   Once
- o   Never

Q16 How often do you visit Muscota Marsh now, after the restoration?
- o   Daily
- o   Once a week
- o   2-3 times a week
- o   4-6 times a week
- o   Monthly
- o   first time, but plan to return
- o   first time, do not plan to return
- o   one-time "vacation" visitor

BENEFIT: SENSE OF COMMUNITY OWNERSHIP
Q17 To what degree do you feel there is community ownership in the Marsh
- o   High
- o   Medium
- o   Low
- o   None
- o   I don't know

Q18 What sentence best describes your relationship with Muscota Marsh [select all that apply]
- o   Muscota Marsh is my nature spot in the city
- o   Muscota Marsh is my community garden
- o   Muscota Marsh is where my community gathers
- o   Muscota Marsh provides me and my community with access to waterfront we would not otherwise have
- o   Muscota Marsh is my picnic spot
- o   I feel welcome at the Marsh

- I feel like I belong at the Marsh
- I do not feel attached the Marsh at all
- Other _____

BENEFIT: WELL-BEING

Q19 Generally, how do you feel when you arrive at the Marsh?
- Great
- Good
- Okay/Neutral
- Not Good
- Bad

Q20 Generally, how do you feel when you leave the Marsh?
- Great
- Good
- Okay/Neutral
- Not Good
- Bad

Q21 What aspect of the Marsh contributes the most to improving your mood?
- Scenery and views
- Weather
- Sounds
- Plants at the Marsh
- Wild animals at the Marsh
- Other people
- Other / Comment _____

BENEFIT: SCENIC VIEWS

Q22 Have you enjoyed scenic views at the Marsh?
- Yes
- No

Q23 Have you used the picnic tables and benches at the Marsh?
- Yes
- No

BENEFIT: EDUCATIONAL VALUE

Q24 Have you visited the Marsh for a school field trip?

o Yes

o No

Q25 Have you read the educational signage at the Marsh?

o Yes

o No

Q26 What is one thing you have learned about wetland habitats from your visits to the Marsh?

Q27 Did visiting the Marsh prompt you to further research marsh and wetland habitats or wildlife you encountered there?

BENEFIT: ECOLOGICAL VALUE

Q28 Have you encountered wildlife at the Marsh?

o Yes

o No

Q29 If you answered yes, what type of wildlife have you encountered?

o Insects (Bees, Butterflies, Dragon Flies, etc.)

o Birds

o Amphibians and Reptiles (Frogs, Salamanders, Snakes, etc.)

o Fish

o Small Mammals (Rabbits, Groundhogs, Mice, etc.)

o Large Mammals (Deer, Fox, etc.)

Q30 If you have encountered wildlife at Muscota Marsh, do you know if any were endangered or at-risk species? (Please List. FYI - You can participate in the iNaturalist Muscota Marsh project and upload pictures!)

Q31 Did you encounter wildlife at the Marsh prior to its restoration in 2014?

o Yes

o No

o I did not have access or did not visit the Marsh before its restoration in 2014.

o I do not recall.

Q32 If you answered yes, what type of wildlife have you encountered prior to the Marsh restoration in 2014?

o Insects (Bees, Butterflies, Dragon Flies, etc.)

o Birds

o Amphibians and Reptiles (Frogs, Salamanders, Snakes, etc.)

- o Fish
- o Small Mammals (Rabbits, Groundhogs, Mice, etc.)
- o Large Mammals (Deer, Fox, etc.)

Q33 If you have encountered wildlife at Muscota Marsh before the 2014 restoration, do you know if any were endangered or at-risk species? (Please List. FYI - You can participate in the iNaturalist Muscota Marsh project and upload pictures!)

Q34 Did you participate in the iNaturalist biodiversity survey project?
- o Yes
- o No
- o Not yet, but I plan to

BENEFIT: ECONOMIC

Q35. If you own a business within 1-mile of Muscota Marsh, would you be willing to answer a few additional questions?
- o Yes
- o No
- o Not Applicable

CONDITIONAL (YES ON Q35)

Q36. Was your business established before or after the Marsh restoration in 2014?
- o Before the 2014 Marsh Restoration
- o After the 2014 Marsh Restoration
- o Unsure, but around that time

Q37. If your business was established after 2014, did Muscota Marsh influence your decision to open it?
- o Yes
- o No

Q38. If your business was established before 2014, do you think the Marsh restoration had a positive, negative, or no impact on your business?
- o Yes
- o No

Q39. How do you think the proximity of your business to the Marsh has contributed to the number of customers you have?
- o I've had an increase in customers due to the Marsh restoration.
- o I've had an increase in customers, but I don't think it has to do with the Marsh restoration.

- o I've had a decrease in customers due to the Marsh restoration.
- o I've had a decrease increase in customers, but I don't think it has to do with the Marsh restoration.
- o No Change / I do not know

Q40. How do you think the proximity of your business to the Marsh has contributed to your profits?
- o I've had an increase in profit due to the Marsh restoration.
- o I've had an increase in profit, but I don't think it has to do with the Marsh restoration.
- o I've had a decrease in profit due to the Marsh restoration.
- o I've had a decrease in profit, but I don't think it has to do with the Marsh restoration.
- o No Change / I do not know

Q41. How do you think the proximity of your business to the Marsh has contributed to your property taxes or rent?
- o I've had an increase in property tax due to the Marsh restoration.
- o I've had an increase in rent due to the Marsh restoration.
- o I've had an increase in property tax/rent, but I don't think it has to do with the Marsh restoration.
- o I've had a decrease in property tax due to the Marsh restoration.
- o I've had a decrease in rent due to the Marsh restoration.
- o I've had a decrease in property tax/rent, but I don't think it has to do with the Marsh restoration.
- o No Change / I do not know

Q42. Please share additional comments or clarification here if you wish. _____