



VCU

College of Engineering

Project 25-306 CodeRVA

Preliminary Design Report

Prepared for
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CodeRVA

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Executive Summary

The Richmond Pump House, once a historic structure used to supply Richmond with drinkable water, has been in a state of disrepair since its closure in 1924. For almost a century it lay in that state, until Joseph Costello founded the Friends of the Pump House, an organization dedicated to restoring the Pump House to its former glory. However, restoring the Pump House is an expensive process. Even though they have received a significant amount of funding, the Friends of the Pump House will need even more if their goals of reopening the Pump House as a social gathering hub and museum are to be realized.

To help raise awareness of this effort by the Friends of the Pump House, our VCU Capstone team has partnered with a select group of CodeRVA seniors to produce a replica of the Richmond Pump House in Fortnite using Unreal Editor for Fortnite (UEFN). By creating this replica, along with an interactive island, we aim to engage and educate a younger generation, particularly ages 18-24, on the Pump House in an effort to make them invested in the Pump House's revival.

We created a fully functioning Fortnite Island, similar to the one created by the TIMES in order of Martin Luther King Jr, of the Richmond Pump House. This island includes a model of the Richmond Pump House's exterior, the land and rivers that surround it, and interactive elements that will engage and educate players. CodeRVA students assisted in the process during the spring semester by working on island development and modeling tasks.

Table of Contents

Section A. Problem Statement	4
Section B. Engineering Design Requirements	6
B.1 Project Goals (i.e. Client Needs)	6
B.2 Design Objectives	6
B.3 Design Specifications and Constraints	6
B.4 Codes and Standards	7
Section C. Scope of Work	8
C.1 Deliverables	8
C.2 Milestones	8
C.3 Resources	11
Section D. Concept Generation	12
Concept 1: Historical Tour Adventure	12
Concept 2: Puzzle-Based Exploration	12
Concept 3: Open-World Exploration with Mini-Games	13
Section E. Concept Evaluation and Selection	14
Selection Criteria and Metrics	15
Section F. Design Methodology	16
F.1 Validation Procedure	16
Section G. Results and Design Details	17
G.1. Final Design Details/Specifications	17
Section H. Societal Impacts of Design	19
H.1 Public Health, Safety, and Welfare	19
H.2 Societal Impacts	19
H.3 Political/Regulatory Impacts	19
H.4. Economic Impacts	20
Section I. Cost Analysis	21
Section J. Conclusions and Recommendations	22
Appendix 1: Project Timeline	23
Appendix 2: Team Contract (i.e. Team Organization)	24
References	30

Section A. Problem Statement

Pump House Park has fallen into a state of disrepair since its closure in 1924 (Schuhart, 2021). In its heyday, it was tasked with moving 12 million gallons of drinkable water into the nearby reservoir, which is now Byrd Park (Friends of James River Park, 2020). Not only was the facility located on the park responsible for providing drinkable water to Richmond population (Historic Richmond, 2020), but the second floor Ballroom hosted parties, weddings, and other events for Richmond's social elite (Joachim, 2024).

However, upon its closure in 1924, the Pump House fell into disarray. The Pump House barely avoiding destruction by the City of Richmond in the 1950s, and was left to rot for almost a century (Friends of Pump House, n.d). In May of 2017, Joseph Costello founded the Friends of the Pump House in order to rejuvenate this once-pristine gem of Richmond (Schuhart, 2021).

One of the primary concerns is the cost of the project. Twelve million dollars of funding were secured in 2022 by the James River Park Service Master Plan (Joachim, 2024), but even then, the executive director of the Friends of the James River Park, Josh Stutz, stated that the budget was "a moving target" (Joachim, 2024). Even with more recent funding from the Roller-Bottimore Foundation, spokesperson Chris Crews stated that they'd need about "\$5 million [more] to properly open it for public events" (Peifer, 2023). That means that until then, the Pump House will not be able to generate its own revenue, and will require external funding.

With this problem in mind, we set our sights on advertising the Richmond Pump House through the creation of a Fortnite Island, using Unreal Editor for Fortnite (UEFN). We decided on creating a virtualized version of the Richmond Pump House in Fortnite for two main reasons.

Our primary reason for creating a Fortnite Island was to expand the reach of a younger, wider demographic and not only educate them on the Richmond Pump House, but also get them both excited about and invested in its restoration.

Fortnite, released to the public in 2017, has been one of the most popular video games of all time. For reference, Fortnite reported an all-time peak of 44.7 million players on November 5, 2023, in response to the company releasing their limited-time game mode "Fortnite OG" (Davis, 2023). This puts it leaps and bounds beyond its previous rival in the Battle Royale sphere, PUBG Battleground, which had an all-time peak of 3,257,248 players (steamdb, n.d.). Within the millions of active Fortnite players, an article from Esports.net claims that 62.7% of players are between the ages of 18-24, which is the target demographic for our project (Ashley, 2024).

Educational islands are not new to the endless expanse of Fortnite. In 2021, Fortnite partnered with the Times to produce "March Through Time," a Fortnite recreation of Washington D.C. during Martin Luther King Jr.'s famous "I Have a Dream" speech (Epic Games, n.d.). The island allows players to travel to places such as the "Lincoln Memorial and United States National Mall" (Epic Games, n.d.), along with "museum-inspired points of interest" where players can further learn about Martin Luther King Jr. (Epic Games, n.d.). Players can also participate in "quests" and "mini-games" (Epic Games, n.d.). This map was advertised as an

educational experience for anyone, including teachers who could use it to teach their students (Epic Games, n.d.).

Our secondary goal in this project was to provide the Friends of the Pump House with a highly detailed 3D model of the exterior of the Pump House, as it looked back when it was in operation. Although the organization has a physical miniature of the Pump House and a Unity asset of the interior in the works, they do not have a 3D recreation of the exterior in any software, to our team's knowledge. We aimed to fix that problem using photos, floor plans, and resources found either online, or provided by the Friends of the Pump House, as key references in this island's creation.

With the "March Through Time" island as our main inspiration, we created a model of the Richmond Pump House Park, where players can explore, and interact with NPCs to learn more about the history of the area. This goal was achieved with the assistance of CodeRVA students in their junior and senior years, who helped with modeling and island design.

By creating Pump House Park as an island in the hit video game Fortnite, we aim to reach a wider and younger demographic. We hope that by showing this demographic Pump House Park in an exciting and historical light, public interest in Pump House Park will increase, and additional funds might be secured to help those working to preserve this hidden gem of a landmark in Richmond.

Section B. Engineering Design Requirements

B.1 Project Goals (i.e. Client Needs)

The main objective of this project was to develop a recreation of The Richmond Pump House in Fortnite using Unreal Editor for Fortnite (UEFN), in order to create an interactive educational experience. To achieve this goal, this team partnered with CodeRVA's junior-senior students in order to develop The Richmond Pump House. Our clients needs include:

- Develop The Richmond Pump House in Fortnite using Unreal Editor for Fortnite
- Develop an interactable environment that will engage players in learning more about The Richmond Pump House through exploration and interaction.

B.2 Design Objectives

The extent to which goals were achieved varied based on student performance. There are some primary goals which were prioritized, after which additional objectives were pursued. Our design objectives are as follows:

- The recreation of The Richmond Pump House is to be faithful to how the pump house was in operation, using the blueprints and other resources we have obtained from The Friends of the Pump House.
- The Richmond Pump House recreation in Fortnite will include not only the pump house, but also the land that makes up the Richmond Pump House Park.
- The recreation will use aspects of Fortnite's gameplay loop (besides combat) in order to create an interactive experience.
- The recreation will display accurate educational information about The Richmond Pump House.

B.3 Design Specifications and Constraints

For our Richmond Pump House Fortnite Island to be a success, the following specifications must be met:

- The Project must match the exterior of The Pump House while it was in operation.
 - Every detail from the tiles on the roof to the glass stained windows must be exactly as they were.

- The Project must also include the surrounding area of The Pump House Park
 - Including any hills, trees, and bodies of water that will have to be following need to be modeled.
- The Project will need to include at least 1 quest with at least 1 mini-game in order to give players an interactive experience
 - The quest should be the main story that explains the history of the Pump House throughout
 - The mini game should be used to help progress the story
 - The mini game can not include any violence (gunplay, “knocking out” players or other entities, etc etc)
- The Project must display accurate information whenever speaking about the history of the Pump House or the surrounding area.

However, because of the nature of the project at hand we have found many unique constraints that will test our abilities during the timeframe of the project:

- Design must operate within the constraints of Fortnite and use the Unreal Editor for Fortnite.
 - Because of this, anyone working on the project will need a Windows computer or laptop in order to download Unreal Editor for Fortnite.
- For the fall semester, the task of island modeling will primarily be handled by CodeRVA students, with the VCU Capstone team being available to set goals, address problems, and integrate completed tasks as needed. This means that the VCU Capstone team needs to always be more than a few steps ahead of the CodeRVA students in order to keep operations running.
- The CodeRVA students will only be available for 12 weeks, 6 during fall semester and 6 during spring semester, so time will need to be spent wisely to maximize output.

B.4 Codes and Standards

N/A

Section C. Scope of Work

C.1 Deliverables

Our client will be provided with a fully functioning, well researched, accurately recreated Fortnite Island based around the Richmond Pump House and the Richmond Pump House park. Additionally, our partners at CodeRVA were assigned weekly tasks for both teams to perform for the duration of the project.

In order to meet these deliverables, we had to overcome the following obstacles:

- Hardware/Software:
 - Since this project is all digital, everyone working on it needed access to a Windows Operating System in order to run UEFN.
- Scheduling:
 - Between the four College seniors, CodeRVA's two representatives and CodeRVA students, we needed to find times when everyone was available to discuss the project.
- Students:
 - There were some difficulties in creating tasks of appropriate difficulty for interns' skill levels.

C.2 Milestones

Due to the open-ended nature of this project, many milestones, deliverables and other information in this document were written ambiguously on purpose. We aimed to work flexibly and adjust our timeline and scope based on how our collaborative work with CodeRVA students progresses. The Milestones for the project are as follows:

1. Contact Made Milestone 8/26 - 9/6

This milestone will be complete when we have organized ourselves as a team. This includes:

1. Meeting up and creating some form of communication between the four VCU students
2. Completing the Team Contract
3. Met with Dr. Leonard, our project mentor

2. Research Milestone 9/7 - 9/13

This milestone was completed when the team felt confident that we had enough materials to use to recreate The Richmond Pump House as it looked in operation. This milestone includes:

1. Visiting the Richmond Pump House
2. Talking to the Friends of the Pump House and acquiring resources
3. Getting additional resources on the Pump House and the surrounding area online
4. Getting resources for learning UEFN
5. Learning UEFN

3. Github Assignment: 9/13

This milestone was complete once we finished setting up our Github repository

4. Set Up Milestone: 9/14 - 10/7

This milestone was completed once we had a basic UEFN model of the land and the Pump House. This phase was considered completed when we had achieved the following:

1. Meeting with the CodeRVA representatives to set up our meetings with the students
2. Complete the Project Proposal
3. Have a functioning gray box model of the Pump House and basic models of the surrounding environment

5. Project Proposal Milestone: 10/1 - 10/11

This milestone was completed once the Project Proposal was completed!

6. UEFN Fortnite Island Completely modeled Milestone: 10/8 - 11/9

This milestone was completed when the entire pump house had been detailed and is as accurate as possible to its pre-1924 design. This milestone was achieved once:

1. Completed the recreation of the Pump House in as much detail as the students can achieve in 6 weeks.
2. Completed as much of the landmarks within the area of the Pump House Park as the students can achieve in 6 weeks.

7. Project Poster Milestone 10/8 - 11/15:

This milestone was completed once the Project Poster was completed!

8. Project Poster Milestone 11/1 - 11/11:

This milestone was completed once we had our current progress on our project reviewed and received ample feedback!

9. UEFN Fortnite Island Cleaned Up Milestone: 11/10 - 12/15

This milestone was completed once our first group of students had completed their 6 weeks of work and we had gone through and finished off any unfinished work left by the CodeRVA students. This milestone was achieved once:

1. When the Pump House recreation is fully detailed and complete.
2. When any surrounding landmarks are fully completed.

10. Preliminary Design Report Milestone: 11/25 - 12/9

This milestone was completed once the Preliminary Design Report was completed!

11. Gameplay and Story Milestone: 2/11 - 3/25

This milestone was completed once we had integrated a story and gameplay loop into the island. This milestone was achieved once:

1. The Fortnite island has a main story quest for players to do
2. The Fortnite island has at least one mini game for players to play
3. The Fortnite island as an ending and credit scene.

12. Abstract Milestone: 3/1 - 3/22

This milestone was completed once the Abstract for the project was completed!

13. Expo Poster Milestone: 3/15 - 3/22:

This milestone was completed when the Expo Poster was completed!

14. Wrapping up Milestone: 4/1 - 4/23

This milestone was completed once we did the following:

1. Complete the Final Design Report
2. The game is deployed and released for anyone to play

15. Expo Milestone: 4/24 - 4/25

This is the final milestone with the following achievements to meet it.

1. We survive both days of the expo

C.3 Resources

Our project was primarily virtual, and no physical materials or servers were required beyond basic technology access. VCU Capstone students and CodeRVA students only needed access to Windows OS computers and EpicGames accounts.

Other helpful resources, provided to the CodeRVA students by the VCU Capstone team, are as follows:

1. Floor plans of the Richmond Pump House
2. Photos of the Richmond Pump House while it was in operation
3. Photos of the area of Pump House Park
4. Research and details about the Richmond Pump House
5. Research and details about the area of the Pump House Park

Section D. Concept Generation

To address the design problem of creating an interactive educational experience for the Richmond Pump House within Fortnite, we brainstormed three primary design concepts. Each concept below shows the different approaches we had to engagement, historical accuracy, and gameplay integration along with each of their strengths, weaknesses, and potential risks.

Concept 1: Historical Tour Adventure

This concept focuses on recreating the Richmond Pump House and surrounding park in detail, integrating a guided historical tour within the game. Players would follow a linear path through the environment, learning about the history of the Pump House through narrated segments, interactive landmarks, and environmental storytelling.

Pros:

- Emphasizes historical accuracy and education.
- Simple and easy to implement with a clear structure.
- Suitable for players of all skill levels, focusing on exploration over skill-based challenges.

Cons:

- Limited replayability due to the linear gameplay.
- May not appeal to players seeking more interactive or challenging elements.

Risks:

- The historical information may become tedious if not balanced with engaging visuals or mini-games.

Concept 2: Puzzle-Based Exploration

This concept incorporates puzzles that players must solve to progress through the game and learn more about the Pump House. For example, players might need to assemble a piece of machinery, decipher a code based on historical artifacts, or navigate a maze representing the waterworks system.

Pros:

- Engages players in a more hands-on, interactive experience.
- Encourages critical thinking and problem-solving skills.
- Aligns well with Fortnite's creative gameplay elements.

Cons:

- May require more complex coding and design efforts.
- Could frustrate players if puzzles are too challenging or unclear.

Risks:

- Balancing difficulty levels for diverse player skills could be challenging.

Concept 3: Open-World Exploration with Mini-Games

This concept creates an open-world version of the Richmond Pump House Park where players can freely explore the environment and engage in optional mini-games. The mini-games could include activities such as collecting resources to "restore" parts of the Pump House, a trivia quiz about its history, or racing along the river.

Pros:

- Offers high replayability with a variety of activities.
- Appeals to a broad audience by combining free exploration with structured mini-games.
- Allows for both individual play and collaboration among players.

Cons:

- Development could require significant resources to implement multiple gameplay elements.
- May dilute the educational focus if the mini-games overshadow the historical aspects.

Risks:

- Risk of overwhelming players with too many options or unclear objectives.

Concept	Engagement	Educational Value	Replayability	Feasibility
Historical Tour Adventure	High	High	Low	High
Puzzle-Based Exploration	Medium	Medium	Medium	Medium
Open-World Exploration	High	Medium	High	Low

Section E. Concept Evaluation and Selection

To select the most suitable design concept for recreating the Richmond Pump House in Fortnite, we evaluated three proposed concepts using a systematic decision-making process. While the Historical Tour Adventure scored highest in our Decision Matrix, elements from all three concepts were incorporated into the final design. This approach allowed us to adapt to the skills and preferences of the CodeRVA students, and leverage the strengths of each concept to mitigate weaknesses and risks.

Blended Design Approach

Through collaboration and brainstorming, we identified the two primary gameplay elements that align with both the project goals and the creative ideas of the CodeRVA students:

1. Parkour Challenges:

- This gameplay mechanic blends the structured progression of the **Historical Tour Adventure** with the problem-solving aspects of **Puzzle-Based Exploration**.
- Players will navigate obstacle courses inspired by the Pump House's architecture and operational history, integrating historical context into the challenges.

2. Collectibles and XP Rewards:

- Inspired by the open-ended gameplay of the **Open-World Exploration** concept, this mechanic encourages players to explore the entire map.
- Players can discover hidden items, earning experience points and learning historical facts tied to specific landmarks. This rewards curiosity and reinforces the educational goals.

Recognizing that CodeRVA students are part of the target demographic for this project, we asked them for their feedback during the concept evaluation process. Their input helped shape the focus on parkour and collectible-based gameplay, which also played into their technical abilities. This collaborative approach ensured the final design is engaging for the intended audience while accommodating the skill sets of the student developers.

While the Historical Tour Adventure provided the foundation for the project, the final design incorporates elements from all three proposed concepts. By combining linear historical storytelling, interactive challenges, and open-world exploration, we created a Fortnite experience that is both educational and engaging. This blended approach made use of the creativity and preferences of the CodeRVA students, ensuring the project remains flexible and adaptive to team contributions.

Selection Criteria and Metrics

The following selection criteria were developed based on discussions with the client and project team. Each criterion was assigned a weight to reflect its relative importance to the project. Metrics were then defined to provide a measurable basis for evaluation:

Table 1. Decision Matrix

Selection Criteria	Weight	Metric
Engagement	0.3	How well the concept captures and retains player interest (1–10 scale).
Educational Value	0.3	The depth and accuracy of historical information conveyed (1–10 scale)
Replayability	0.2	The likelihood that players will return to the experience (1–10 scale).
Feasibility	0.2	Ease of implementation given team skills, time, and resources (1–10 scale).

Section F. Design Methodology

Our plans for the product (the Fortnite island) are mostly open ended. Our main priorities for the island are accuracy of the pump house and landscape, with additional features for engagement purposes. In order to recreate the pump house as accurately as possible we visited the site and met with the restoration team, obtained 3D models of the site and followed it up with our own independent research. These resources can and have been used as a reference when developing the island.

When working with CodeRVA, the interns had primary control over specific design elements. They were provided with the necessary resources for factual and visual accuracy as they worked on the island. After the collaboration with CodeRVA completed, the VCU capstone group made further edits to the island as needed.

When designing tasks for CodeRVA interns to complete, we aimed for a combination of challenge and achievability. We made sure to stay in regular contact with interns, and help as needed. Additionally, task assignments were edited according to intern feedback. If tasks could not be completed within a week, we gave them more time, or gave them a more reasonable task. When they requested more challenging tasks, we provided additional tasks, or increased the scope of the given task(s).

F.1 Validation Procedure

The sponsor of this project is CodeRVA, which we provided a service to, in the form of internships for the students. For the duration of the internship periods - October 8, 2024 to January 7, 2025 - we met with CodeRVA on a weekly basis, excepting holidays and school closure. As such, we received feedback as needed from the teachers representing CodeRVA.

While not official sponsors, the Friends of the Pump House are also benefited by this project. After making our final edits, we plan to share the island with them, and request their thoughts on its design. The Friends of the Pump House are familiar with the pump house and surrounding areas, so we hope that they will have insight to offer about possible improvements or features to add, as well as any mistakes we may have made. Since the nature of the feedback will be varied, we will ask that they provide it in the form of emailed comments.

Section G. Results and Design Details

As our time with the project comes to an end, here are our finalized results of our capstone.

G.1. Final Design Details/Specifications

Design specifications for this project (referenced from section B.3) largely consist of qualitative measures. Of the specifications listed, the following have been partially or completely fulfilled:

- The Project matches the exterior of The Pump House while it was in operation.



- As part of work for the scaffold level we provided to CodeRVA students as a starting point, we modeled the basic structure of the Pump House. Textures are placeholders pending replacement to a more faithful recreation.
- We referenced Google Maps as a resource to model the Pump House and its surroundings at roughly 1:1 compared to real life scale. To do this, we downloaded images and applied them as a 2D decal over the main “floor” element in the level, using the scale indicator as a guide. The decal’s visibility is toggleable.
- We were able to create a near accurate model of the Pump House, however we were not able to go as in detail as we originally set out to (tiles on roof, stained glass).
- The Fortnite Island extends to the electrical building next to it and the surrounding forest and the important rivers that flow through it.

- The Project contains 2 quests (Given by Ahlia and Fisherman) and a small section of parkour near the front of the Pump House model.
 - The quest given by Ahlia is meant to take the player on a tour of the Pump House by having you find and talk to her 5 friends. Each of her friends is located in a unique part of the Pump House and will give details on the Pump House once you interact with them.
 - The second quest given by the Fisherman is meant as a more fun inclusion to reward players that were paying attention to their surroundings and are able to clear the easy parkour course.
- The Project displays accurate information whenever speaking about the history of the Pump House or the surrounding area.
 - Using a number of resources we were able to gather accurate information for the Ahlia's friends (the NPCs) to tell the player.

Section H. Societal Impacts of Design

As a free-to-play interactive level in the popular video game Fortnite, the release of this project is expected to serve the purpose of increasing public awareness and knowledge of The Pump House, a historical landmark, to an audience that may not know of its existence.

However, video games often face scrutiny over its impact on the well-being and safety of its players. Epic, the parent company of Fortnite, recently faced allegations from the Federal Trade Commission for violating children's privacy laws and implementing dark patterns for in-game purchases (Federal Trade Commission, 2022). Roblox, a platform for user-created experiences similar to Fortnite, faces pervasive issues with grooming and cyberbullying due to its relaxed safeguards on user interaction (Carville & D'Anastasio, 2024).

Although many of these issues don't directly affect this project, it is pertinent to consider the resulting negative impressions imprinted on community-made maps on platforms such as Fortnite or Roblox. Care should be taken to ensure that the island's functions and design decisions solely serve to enhance the objective of raising awareness for the Pump House. Additionally, any implemented game mechanics should be reviewed to ensure there is no potential for misuse.

H.1 Public Health, Safety, and Welfare

As the level exists in a virtual space, there is minimal to zero physical risk for the player. We plan for the level to be enjoyed within a short (<1 hour) timespan, mitigating the risk of addiction. Indirect social elements (e.g. inclusion of the social hall, built-in chat functions such as emotes) could encourage positive interactions amongst visitors. The release of this project

could contribute to public welfare by fostering appreciation for preserving historical landmarks such as the Pump House.

H.2 Societal Impacts

The project takes the unconventional approach of promoting historical preservation through video games. If successful, its release could encourage younger generations (who form the demographic for Fortnite) to learn about these topics in an accessible way. This would ultimately enable a broader audience to engage with Richmond's heritage and foster civic pride.

H.3 Political/Regulatory Impacts

Although the project itself does not directly intertwine with political matters, the topic of a historical site undergoing renovations could stimulate discussion on the government's and the community's role in funding such preservation efforts. Should the level leave a positive impression on its visitors, it could serve as an advocacy tool to influence future policy decisions on similar landmarks.

H.4. Economic Impacts

The success of this project would drive interest in visitations to the Pump House, which can be directly linked to revenue from tourism or donors to support the sustained growth of the Friends of Pump House organization. Additionally, as a showcase of intersectionality between gaming and education, interest in the project could contribute to the growing markets for education games.

Section I. Cost Analysis

This project has no financial cost. Every aspect of the project, from the software used to recreate the pump house to the people working on it has been completely free. We do not expect to have a final billing for the project nor do we wish to go commercial with it, so in order our net cost for this project will be \$0.

Section J. Conclusions and Recommendations

In total, our project was quite the accomplishment for all of us to get through. Each step along the engineering design process brought us new challenges that we had to face down, but with each of those challenges came a better understanding of our own capabilities.

After being given our problem to solve we quickly moved into research, which led us to the Richmond Pump House where we got to meet the restoration team and gained insight on the property and its structure. Through this event we quickly realized the power in communication needs and direction, which would just as quickly help us as we started to come up with ideas for the project.

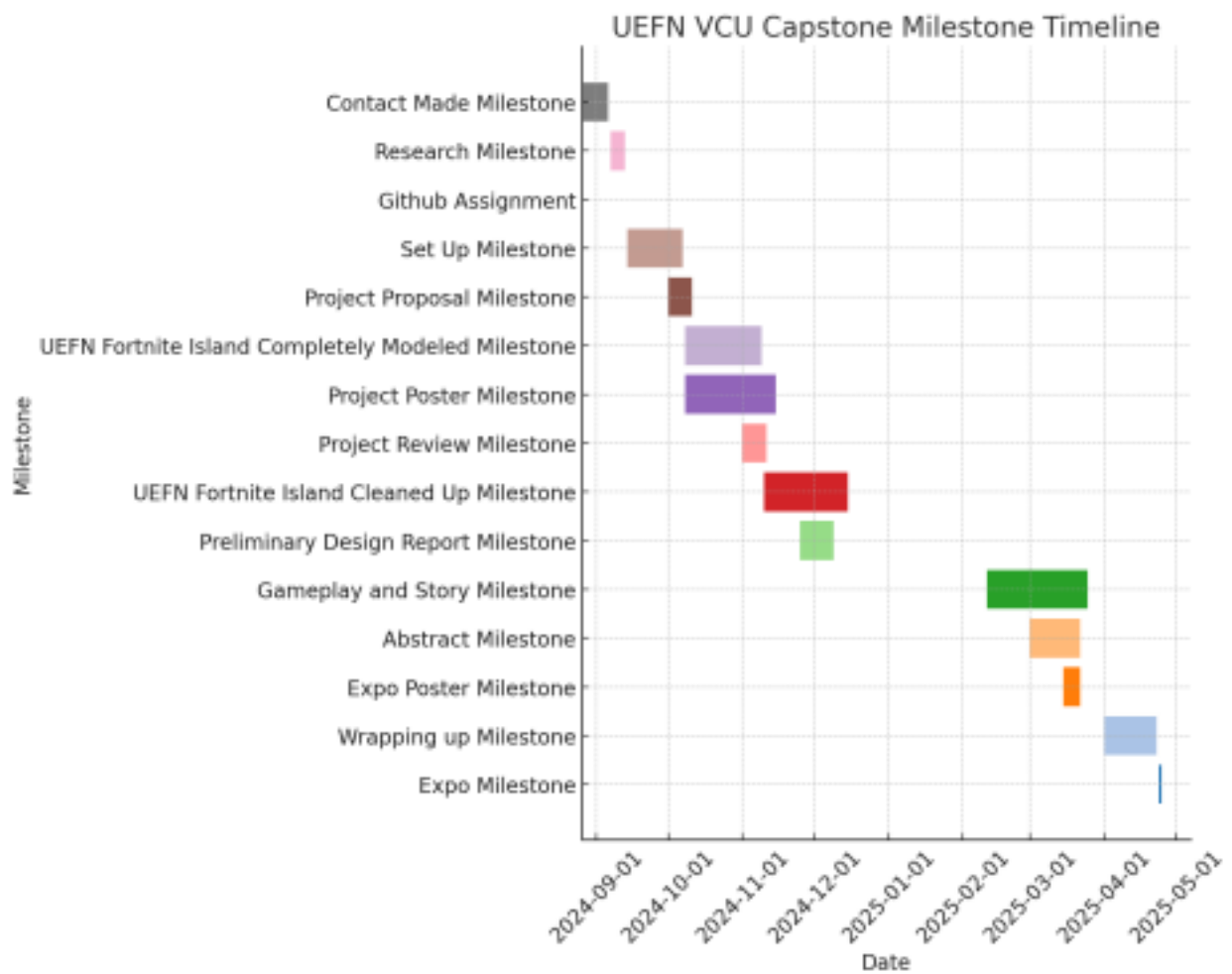
The long and short of it is that we had none. We had collected as much data as we could on our subject, but the project of “Rebuild the Richmond Pump House in UEFN with CodeRVA” left us all wondering what we were meant to do exactly. But then we contacted and met with Dr. Leonard, our advisor and mentor, and after a discussion on possible solutions we completely understood what we needed to do to make this project a reality.

From there we moved into planning, writing out every aspect that we wanted the CodeRVA students to work on while relegating certain pieces of the project for ourselves to complete. Finally, after working on the project for about two months we're just about to start the cycle over again after our meeting to discuss what needs improving.

As the spring semester rolled in we were able to enhance the work done by the CodeRVA interns. This included fixing and detailing models, creating more accurate and realistic landscaping, adding in quest and parkour that they left undone and adding proper lighting to the island. Then by the end of April we had the island in a good enough condition to show at the Capstone Expo to the rolling success of passers by!

Finally we move to complete our last milestone: **Wrapping up Milestone**. To complete this we will be turning in this report and the island to our sponsors other at CodeRVA, our mentor Dr. Leonard and the wonderful people at Friends of the Pump House. Once we get the clear from the Friends of the Pump House we will be releasing this creation in all of its glory for the masses to play on! It will be available and stored on Fortnite, where it will hopefully inspire the masses to get involved with the recreation of the Pump House!

Appendix 1: Project Timeline



Appendix 2: Team Contract (i.e. Team Organization)

Step 1: Get to Know One Another. Gather Basic Information.

Task: This initial time together is important to form a strong team dynamic and get to know each other more as people outside of class time. Consider ways to develop positive working relationships with others, while remaining open and personal. Learn each other's strengths and discuss good/bad team experiences. This is also a good opportunity to start to better understand each other's communication and working styles.

Team Member Name	Strengths each member	Other Info	Contact Info
	bring to the group		
Kel Raphael	Organized, hard-working, proactive, creative	I have worked on 3d modeling in the past, and enjoyed it	raphaelke@vcu.edu 703-488-8023
Kibria Malik	Communication, hard worker, open minded	I enjoy being a part of a team and meeting new people. I am not the most technically advanced but am willing to learn and work very hard for my team.	Malikkz@vcu.edu 571-397-6428

Ken Mikawa	Communication, problem-solving, creativity	Willing to learn the necessary skills on-the-fly for the project. I've recently played a lot of Fortnite (the game) but haven't really enjoyed the new season, so I'm excited to approach the platform from a different angle	mikawake@vcu.edu du 804-937-8561
Bryce Strobel	Hardworking, creative, solution orientation	Alongside enjoying being a part of a team I also have some minor experience in unreal engines.	strobelb2@vcu.edu du 804-307-1567

<i>Other Stakeholders</i>	<i>Notes Contact Info</i>
John Leonard	<i>VCU Capstone Mentor</i> Jdleonard@vcu.edu
Kume Goranson	<i>Club organizer for CodeRVA</i> kume.goranson@coderva.org

Step 2: Team Culture. Clarify the Group's Purpose and Culture Goals.

Task: Discuss how each team member wants to be treated to encourage them to make valuable contributions to the group and how each team member would like to feel recognized for their efforts. Discuss how the team will foster an environment where each team member feels they are accountable for their actions and the way they contribute to the project. These are your Culture Goals (left column). How do the students demonstrate these culture goals? These are your Actions (middle column). Finally, how do students deviate from the team's culture goals? What are ways that other team members can notice

when that culture goal is no longer being honored in team dynamics? These are your Warning Signs (right column).

Resources: More information and an example Team Culture can be found in the Biodesign Student Guide “Intentional Teamwork” page ([webpage](#) | [PDF](#)).

<i>Culture Goals</i>	<i>Actions</i>	<i>Warning Signs</i>
Being on time to every meeting	<ul style="list-style-type: none"> - Be in Discord meeting room on time - Post meetings in Discord - Just alert if anyone is running late 	<ul style="list-style-type: none"> - Student misses first meeting – warning is granted - Student misses meetings afterwards – issue is brought up with faculty advisor
Being communicative about project work	<ul style="list-style-type: none"> - Stay up to date with each other’s project responsibilities - Set reasonable deadlines and note when an extension is needed 	<ul style="list-style-type: none"> - Student shows up for weekly meeting with no considerable work done
Actively participating	<ul style="list-style-type: none"> - Volunteer before being voluntold - Proactively contribute to the project 	<ul style="list-style-type: none"> - Imbalanced group workload

Step 3: Time Commitments, Meeting Structure, and Communication

Task: Discuss the anticipated time commitments for the group project. Consider the following questions (don’t answer these questions in the box below):

- What are reasonable time commitments for everyone to invest in this project? ●

- What other activities and commitments do group members have in their lives? •
 How will we communicate with each other?
- When will we meet as a team? Where will we meet? How Often?
 - Who will run the meetings? Will there be an assigned team leader or scribe? Does that position rotate or will the same person take on that role for the duration of the project?

Required: How often you will meet with your faculty advisor, where you will meet, and how the meetings will be conducted. Who arranges these meetings?

See examples below.

<i>Meeting Participants</i>	<i>Frequency Dates and Times / Locations</i>	<i>Meeting Goals Responsible Party</i>
Students Only	Thursdays at 6 p.m.	Actively work on project; discuss deadlines, communication and delegate work as necessary
Students + Faculty advisor	Thursdays at 6:30 p.m.	Update faculty advisor and get answers to our questions
Project Sponsor	Once or twice a month (or as needed); virtual or in-person depending on sponsor preference	Update project sponsor and make sure we are on the right track

Step 4: Determine Individual Roles and Responsibilities

Task: As part of the Capstone Team experience, each member will take on a leadership role, *in addition to* contributing to the overall weekly action items for the project. Some common leadership roles for Capstone projects are listed below. Other roles may be assigned with approval of your faculty advisor as deemed fit for the project. For the entirety of the project, you should communicate progress to your advisor specifically with regard to your role.

● **Before meeting with your team**, take some time to ask yourself: what is my “natural” role in this group (strengths)? How can I use this experience to help me grow and develop more? ● **As a group**, discuss the various tasks needed for the project and role preferences. Then assign roles in the table on the next page. Try to create a team dynamic that is fair and equitable, while promoting the strengths of each member.

Communication Leaders

Suggested: Assign a team member to be the primary contact for the client/sponsor. This person will schedule meetings, send updates, and ensure deliverables are met.

Suggested: Assign a team member to be the primary contact for faculty advisor. This person will schedule meetings, send updates, and ensure deliverables are met.

Common Leadership Roles for Capstone

1. **Project Manager:** Manages all tasks; develops overall schedule for project; writes agendas and runs meetings; reviews and monitors individual action items; creates an environment where team members are respected, take risks and feel safe expressing their ideas.

VCU College of Engineering 16

Required: On Edusourced, under the Team tab, make sure that this student is assigned the Project Manager role. This is required so that Capstone program staff can easily identify a single contact person, especially for items like Purchasing and Receiving project supplies.

2. **Logistics Manager:** coordinates all internal and external interactions; lead in establishing contact within and outside of organization, following up on communication of commitments, obtaining information for the team; documents meeting minutes; manages facility and resource usage.
3. **Financial Manager:** researches/benchmarks technical purchases and acquisitions; conducts pricing analysis and budget justifications on proposed purchases; carries out team purchase requests; monitors team budget.
4. **Systems Engineer:** analyzes Client initial design specification and leads establishment of product specifications; monitors, coordinates and manages integration of sub-systems in the prototype; develops and recommends system architecture and manages product interfaces.
5. **Test Engineer:** oversees experimental design, test plan, procedures and data analysis; acquires data acquisition equipment and any necessary software; establishes test protocols and schedules; oversees statistical analysis of results; leads presentation of experimental finding and resulting recommendations.
6. **Manufacturing Engineer:** coordinates all fabrication required to meet final prototype requirements; oversees that all engineering drawings meet the requirements of machine shop or vendor; reviews designs to ensure design for manufacturing; determines realistic timing for fabrication and quality; develops schedule for all manufacturing.

<i>Team Member</i>	<i>Role(s)</i>	<i>Responsibilities</i>
Kel Raphael	Project Manager	<ul style="list-style-type: none"> - Develop project timeline - Keep project on task
Ken Mikawa	Systems Engineer	<ul style="list-style-type: none"> - Analyze client initial design specification - - Communicate logistical requirements to project manager and stakeholder
Kibria Malik	Financial Manager Test Engineer	<ul style="list-style-type: none"> - See what we need - See prices of needed items
Bryce Strobel	Logistics Manager	<ul style="list-style-type: none"> - Make and have consistent communication with sponsor and mentor - Manage resources

Step 5: Agree to the above team contract

Team Member: Kel Raphael Signature: Kel Raphael

Team Member: Ken Mikawa Signature: Ken Mikawa

Team Member: Kibria Malik Signature: Kibria Malik

Team Member: Bryce Storbel Signature: Bryce Strobel

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