Community Partnerships Center at Roger Williams University

SITE FEASABILITY ACCESS PROJECT

An environmental study and design of river access sites along the historic Blackstone River Corridor in Rhode Island.

Community Partner: The Blackstone Valley Tourism Council

Academic Partner: School of Engineering, Computing & Construction Management

Fall 2013 & Spring 2014

The Roger Williams University Community Partnerships Center

The Roger Williams University (RWU) Community Partnerships Center (CPC) provides project based assistance to non-profit organizations, government agencies and low- and moderate-income communities in Rhode Island and Southeastern Massachusetts. Our mission is to undertake and complete projects that will benefit the local community while providing RWU students with experience in real-world projects that deepen their academic experiences.

CPC projects draw upon the skills and experience of students and faculty from RWU programs in areas such as:

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- Architecture and Urban Design
- Business
- Community Development
- Education
- Engineering and Construction Management
- Environmental Science and Sustainability
- Finance
- Graphic Design
- Historic Preservation
- History
- Justice Studies
- Law
- Marketing and Communications
- Political Science
- Psychology
- Public Administration
- Public Relations
- Sustainable Studies
- Visual Arts and Digital Media
- Writing Studies

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Community Partnerships Center
Roger Williams University
One Old Ferry Road
Bristol, RI 02809
cpc@rwu.edu
http://cpc.rwu.edu

SITE FEASABILITY ACCESS PROJECT

AN ENVIORNEMENTAL STUDY AND DESIGN OF RIVER ACCESS SITES

ALONG THE

HISTORIC BLACKSTONE RIVER CORRIDOR IN RHODE ISLAND

Project Team IV

B.E.S.T.

BLACKSTONE ENVIRONMENTAL SERVICE TEAM

TEAM MEMBERS: TIMOTHY CLARKIN, MEAGEN CONNELY, NOELLE LAFLAMME AND TAYLA MELLO

PROFESSIONAL CLIENT: THE BLACKSTONE VALLEY TOURISM COUNCIL

FACULTY ADVISORS: DR. ANTHONY RUOCCO AND DR. JANET BALDWIN

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Abstract

The Blackstone River once was integral to life and industry to many towns in northern Rhode Island, but industrial pollution caused it to become unusable. As environmental remediation continues to improve the river, the Site Feasibility Access Project focuses on assessing the environmental risk of five potential river access sites located along the Blackstone River in Pawtucket, Central Falls, North Smithfield, and Cumberland; determining which site is ideal for development, and formulating river access designs for river rescue. The Blackstone Environmental Service Team (BEST) completed Corridor Land Use Evaluations (CLUE) for the sites by inspecting each site and collecting historical data and information from Government Offices and the Rhode Island Historical Society. Each site was rated using the CLUE rating system developed by BEST and a feasible site was selected based on those results. Research on river accessibility was conducted and Rhode Island state standards and specifications were collected. Two river access designs were developed for the Pawtucket Water Supply Board site: one based on current land use conditions and one to integrate with the proposed Blackstone River Bikeway. The initial results suggest that this process of Corridor Land Use Evaluations and river access design can be used in future developments along the river for safety, recreation and limited commercial purposes.

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List of Acronyms

ADA	American Disabilities Act
ASTM	American Society of Testing and Materials
BEST	Blackstone Environmental Service Team
BRNHCC	Blackstone River National Heritage Corridor Commission
BVTC	Blackstone Valley Tourism Council
CLUE	Corridor Land Use Evaluation
CRMC	Costal Resource Management Council
DPW	Department of Public Works
EPA	Environmental Protection Agency
ESA	Environmental Site Assessment
OEP	Office of Environmental Programs
SECCM	School of Engineering, Computing and Construction Management
SFA	Site Feasibility Access Project
SOBA	States Organization for Boating Access
RIDEM	Rhode Island Department of Environmental Management
RIDOT	Rhode Island Department of Transportation
ROW	Right of Way
RTK	Right to Know
RWU	Roger Williams University
U-RAD	Universal River Accessibility Design

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1– Introduction

The Blackstone River has always been vital to the communities located along its banks. From the wild life that once grazed there to the Narragansett tribes, European and Canadian settlers, it has always sustained life. However, with the birth of the American Industrial Revolution beginning in the little town of Pawtucket, the role of this river was changed forever. Factories were constructed along the river, taking full advantage of the Blackstone's hydraulic potential. With the factories, came industrial byproducts: waste and pollution. By the middle of the 1900's, the river was notoriously polluted and stagnant to life.

With increased remediation efforts to restore the river to its original vitality, much progress has been made. As the river becomes suitable for recreational boating and other activities, it is the aim of local organizations to reconnect the community to the river. Since 1985, the Blackstone Valley Tourism Council (BVTC) has been working on these efforts to revitalize the river. They have focused on river tourism for many years with their *Explorer* boat, which has allowed the community to observe the river from a cultural and educational perspective.

BVTC also began an initiative to create launch sites along the river for safety and recreation. The most infamous of these sites is known as Manville Landing. In 1990, this site was donated to be developed as a park. The preliminary designs were drawn up and federal funding became available. However, as the project began, toxic pollutants were soon found beneath the surface of the ground. This led to a series of remediation efforts in order to clean the site and complete the proposed park. The project intended to only cost $500,000 grew to a startling $1.2 million. Had the developer researched the history of the site, the costly remediation could have been avoided. As a result of this project, BVTC has developed a new approach to site development: preliminary land use evaluations.

For this purpose, Blackstone Environmental Service Team (BEST) – a team of four senior engineering students from Roger Williams University – was recruited by BVTC to complete the Site Feasibility Access Project for sites preselected by BVTC and local municipalities.

1.1 – Client Project Description

"Since its creation in 1985, the Blackstone Valley Tourism Council has been a leader in transforming Rhode Island's Blackstone Valley into a tourist destination -- a strong, vibrant region for visitors and residents alike. Working in conjunction with local communities, state and federal government, and like - minded nonprofits and business, the Council has not only increased the number of visitors and enhance their visitor experience, but strengthened the region's economy, created a stronger, cleaner environment, and improved the quality of life for Blackstone Valley residents.

The key to the Council's success has been quality planning, collaboration, and the use of sustainable tourism principles that encourage responsible destination development aimed at enhancing the environment, culture, aesthetics, heritage, and well-being without compromising the Blackstone Valley for future generations. With no mountains or ocean beaches, the Council built on many of the assets existing in the region prior to the Council's creation: a rich, cultural heritage and historic legacy, ethnic diversity, the Blackstone River, parks and recreational facilities, and existing attractions such as the Pawsox, Lincoln Park (now Twin River), Slater Mill, and a number of other historical attractions. The Blackstone Valley Tourism council looks forward to continuing its efforts to build a stronger, more vibrant Blackstone Valley, and strengthen the strong tourism industry that exists today. It will continue building on its past accomplishments while initiating new projects and programs to enhance the experience and opportunities for visitors and residents. It will continue ensuring that the region is a part of any

positive economic changes enjoyed by the rest of the state. Some of the things to look forward to in the coming years.

- Completion of the Blackstone Valley Bikeway by 2018 and increase usage of the Bikeway via general cycling and special events
- Continuation of our annual events
- Re-launch of the Samuel Slater Canal Boat
- Completion of the Blackstone River Cleanup by 2015, allowing at least limited fishing
- Designation of the Blackstone Valley as a national park

One of its major initiatives, just getting underway, is the development of a series of launch sites along the river. Maintaining its belief in sustainable tourism, the intent is for these launch sites to support small, human-powered vessels such as kayaks, canoes, and paddle boards. The sites would support a few cars each, but in generally unpaved areas. Several locations have been considered, but none have been actually sited for such things as ramps, approaches, access or egress. The Tourism Council is not in a position to actually approve locations, but does have access to agencies that can. However, nothing can move forward without understanding some of the underlying environmental impacts of such development. This project is broadly described and can be developed as a large - scale environmental impact study with some preliminary design remediation work, to a more detailed review of a few specific sites."[1]

[1] See Virginia State Government. "Building a Dock." http://www.dgif.virginia.gov/boating/building-boat-ramps.asp

The first meeting between Bob Cox of BVTC and the BEST team took place on 18 September, 2013. An initial project description was discussed. This description began with an informative history of the Blackstone River Valley. After the historical background information was completed, a broad description of BVTC and its work was presented, the team moved on to the presentation of the agenda from a meeting held on April 26, 2013 between BVTC and RWU faculty. This document broadly outlined the goals of BVTC in regards to this initiative:

- Plan, design, acquire ROW, construct & provide maintenance for three additional boat landings in North Smithfield, Lincoln & Pawtucket
- Conduct site assessments & feasibility studies
- Include in #2 a corridor land use evaluation to identify potential areas & sources of contamination using DEM's Rule 3.67
- Select – using a RFP – a consultant to design the Project & bid documents
- Working together, BVTC & State to obtain Environmental Determination of no significant impact before construction can proceed
- BVTC to construct Project.

In addition, it narrowed the scope of work by listing the intended "Senior Design Projects":

- Analysis & site design of one or more landing sites.
- Address the environmental requirements required by the RIDOT/BVTC Project Agreement
- Design of one or more dam safety systems

- CPC portfolio includes all RWU's resources; architecture, environmental science, business.

After the short hiatus of winter break, BEST and Bob Cox met in late January to discuss the plan for the upcoming spring semester. During the meeting, the decision to split into two smaller groups was discussed and a rough project timeline was determined. Also, a fifth site was added, Albion Bridge, to the CLUE scope of work by the BVTC.

1.1.1 – Project Requirements

As mentioned, the initial project was slated as a "Large-scale environmental impact study." The main requirements of the project were as follows:

- Completing CLUEs for many sites along the river
    - Collecting historic, regulatory and observed data for each site.
- Recommending sites for further development
    - If CLUEs suggest low risk, BVTC should continue plans for development
    - If CLUEs suggest high risk, BVTC should discard the site
    - Site must meet requirements for intended use: safety, recreational and limited commercial.

1.1.2 – Previous Work

The Blackstone Valley Tourism Council has worked to reclaim the river since its inception in 1985. With public officials and other nonprofit agencies, it has provided the community with a vibrant image of the river and its heritage. In pursuit of sustainable tourism for the river, BVTC has given tours on the *Explorer* boat, advocated for the creation of a bike path, and promoted use of the river with new recreational areas for easy river access.

The *Explorer* boat currently has launch sites in Woonsocket and Central Falls, RI. One of these sites is Valley Falls Landing, located in Central Falls. While this site was originally promising as a

recreation site and launch site for the *Explorer*, it was damaged by a hurricane and is now in need of repair. This site was among the first projects in the shift toward sustainable tourism.

The Blackstone River Bikeway runs along much of the river, running through Providence and ultimately ending in Worcester, Massachusetts. Many of the launch sites under consideration by BVTC are shared by the bikeway's "Right of Way" (ROW). While both projects hold the same goal of improving the community, they both infringe on each other's intended locations. In addition, the Bikeway will require environmental studies, such as CLUEs, before it can move on to construction.

One recreational site that has been completed by BVTC is Manville Landing site in Cumberland, RI. As previously mentioned, the construction of this site in many ways initiated the SFA Project. However, this site is still a good example of sustainable tourism work completed by BVTC. It provides safe and easy access to the river for small, recreational vessels.

1.1.3 – Purpose

The purpose of this project is to promote sustainable tourism by restoring the river to the community. With the implementation of rescue sites between the dams, the water Rescue teams will be able to safely enter the water, perform the rescue, and safely exit the water with ease. Also, people in the community will be able to bring their human powered vessels such as kayaks and canoes to these launch sites and easily place the boat in the water and take it out of the water when finished. Even though the focus of the project has altered to specifically rescue sites, these sites could easily transition to recreational use. The ease of use will provide the community with a more vitalized area as well as promote tourism along the river. With the possibility of new launch sites for the *Explorer* boat, the BVTC will be able to expand their tours along the river bringing a new source of revenue to each town, boosting its economy, which in turn makes the town more desirable. Ultimately, creating launch sites along the river, will allow for increased access by safety teams, recreational use and commercial tourism ventures, and benefit the valley.

2 – BEST Project Description

After the fall semester, BEST and Bob Cox had meeting to discuss the progress of the SFA project and what was to be done for spring semester. During this meeting the BVTC added Albion Road to the CLUE scope of work. Also, the BVTC asked for two preliminary designs; one U-RAD and one site-specific design. The new scope of work is listed below and contained in **Error! Reference source not found.**.

2.1 – BEST Scope of Work

"The following tasks will be completed by, the Blackstone Environmental Service Team (BEST) in cooperation with the Blackstone Valley Tourism Council (BVTC) and local town agencies:

Corridor Land Use Evaluation (CLUE) - Including, but not limited to, the following sites:

Central Falls:

- Department of Public Works - River Street (Plats 2-200/200A/201)
- Saul Tarlow/High Street Ballfield - High Street (Plat 2-189)

North Smithfield:

- The Meadows - Mill Street (Plat 3-183)

Pawtucket:

- Pawtucket Water Authority - Branch Street (Plat 6a-587)

Cumberland

- 30 Albion Road and 83 Park Street (Plat 33-187, 431)

Universal River Accessibility Design (U-RAD)

Preliminary Plan Site Specific Design

- Integration with Blackstone River Bikeway

Preliminary Plan U-RAD

- Combination of uses (Rescue, Recreation, Limited Commercial)

Rescue Team River Entry

- Boat Launch Specifications
- ADA accessible

Recreation Use River Entry

- A Launch area
- ADA Accessible

Explorer River Entry

BVTC Launch Specifications”

2.2 – B.E.S.T. Objectives

Ultimately, BEST will make an informed recommendation on which site or sites are feasible for development and will present a preliminary site-specific plan for one of the feasible sites and a preliminary U-RAD plan.

2.3 – Project Planning

In scheduling the project, BEST determined the focus of the fall semester would primarily be to understand the CLUE process, collect data for the sites and draft CLUE reports. The focus of the spring semester would be to finalize the CLUE reports, submit formal recommendations for each site and research and finalize the Universal River Accessibility Design.

A copy of the “Project Schedule” can be seen in **Error! Reference source not found.**.

3 – Research

The immensely industrial history of the Blackstone River is one of the driving forces behind the SFA project. Years of unrestricted dumping and poor waste management systems led to high pollution levels in the river and its banks. This section will help provide a stronger understanding of the Blackstone River Valley Corridor.

FIGURE 1: BLACKSTONE VALLEY CORRIDOR

The Blackstone River runs for about 45 miles from Worcester, Massachusetts, through eastern Rhode Island and into the Narragansett Bay, see Figure 1. The river and its surrounding communities commonly referred to as the Blackstone Valley, have a long, rich and tumultuous history. Prior to the arrival of English settlers and colonial times, Native Americans knew the river as the "Kittacuck," meaning "great tidal river". This river was full of aquatic life, sustaining the tribes at its banks with plentiful salmon and clean water. However, in the early 1600's settlers began arriving from across the

North Atlantic Ocean building homes and small farming communities around the river. Of these settlers was William Blackstone (originally William Blaxton), who is known as one of the first settlers of present day Boston. Blackstone made his way back to Rhode Island, building his home along the beautiful Kittacuck River, which was then renamed after him.[2]

The Blackstone Valley had developed into a large farming community, and as the home of tool and machine makers. In the late 1700's Providence businessman, Moses Brown, recognized the hydraulic potential of the Blackstone River as a source of power, and began to design and develop a hydraulically powered cotton-spinning factory. Brown had been highly invested in local productions, allowing him to put a vast amount of capital and effort into his new project. However, Brown's cotton mill was nonfunctioning, and he sought help from a recent immigrant, Samuel Slater. Slater had spent many years in English textile mills, developing a deep knowledge and understanding of the mills machinery and construction[3]. Together they constructed the first mill along the Blackstone River, Slater Mill, which is the first hydraulically powered mill in American history.

The successful construction of Slater Mill inspired other local entrepreneurs to develop their own mills along the river. The construction of these mills began to take off along the Blackstone River, but would soon spread to other waterways throughout New England, and eventually countrywide. The increasing number of mills led to an increasing demand for workers, and by the 1820's immigrants began to flood to America in need of work.

Within a few years, the Blackstone valley became diverse with new cultures. Ireland brought the first wave of migrants to America, who helped construct and work in the mills along the river. Soon after, French-Canadians were encouraged to leave their farms to work in the mills, followed by workers

[2] Blackstone Valley Tourism Council, "Who is William Blackstone?" http://www.tourblackstone.com /about2.htm
[3] National Park Service, "Blackstone River Valley History & Culture," http://www.nps.gov/blac/historyculture /index.htm

and families from Poland, Portugal and Sweden. With a growing community along the river, villages were built around the mills, providing homes, schools and churches for the new workers and their families.

FIGURE 2: SLATER MILL (YELLOW) AND WILKINSON MILL (STONE) ALONG THE BLACKSTONE RIVER

As communities and production along the river grew, new forms of transportation were in demand. The use of horse-drawn carriages was slow going and only allowed the transportation of small amounts of product. Thus, the Blackstone Canal project was initiated.[4] Construction of the Canal ran from 1825-1828, connecting Worcester, MA to Providence, RI through the Blackstone River. The canal allowed for cheaper, faster trading and transportation of both farming and mill products. However, the Worcester and Boston Railroad line, built in 1835, and the 1847 construction and operation of the Providence and Worcester Railroad overcame the need of the canal, leading to its closure in 1848, and

[4] National Park Service, "The Blackstone Canal in Worcester," http://www.nps.gov/blac/forteachers/classrooms/blackstone-canal-in-worcester.htm

resulted in the use of railroads for transportation. In turn, the overall costs of these products were reduced, further sustaining the growing community and its economy.

As the 20th century began, war and economic depression plagued the country. For the Blackstone Valley, this meant a conversion of mill products; commercial to military. Many mills and local factories began to produce uniforms and other necessities for war. However, the increasing use of steam power, the Great Depression and lack of upgraded machinery lead to the demise of many mills along the river. The American jobs once flooded to were shipped overseas for cheaper labor, leaving those who remained with little work. With this, the vibrant life surrounding the Blackstone River began to dull, and the river itself lost the vitality it once supported, leading to the need of remediation of the Blackstone valley.

The initiative to remediate waterways was born with a need to understand the environmental impacts being made throughout the country. As environmental consciousness grew, pollution studies began along waterways in America. By 1990, these studies identified the Blackstone River as one of the most polluted rivers in America, and as the leading cause of pollution in the Narragansett Bay.[5]

In 1948 the Federal Water Pollution Control Act was initiated, sanctioning state and local authorities to develop programs that would reduce and/or control the amount of pollution in a waterway. The act shed light on the dwindling quality of public water supplies and native aquatic life, as well as the diminishing recreational usability of the affected waterways. The Federal Water Pollution Control Act led to the creation of the Clean Water Act in 1972. The Clean Water Act requires any entity that is a source of pollution in a waterway to obtain permits and follow strict requirements and regulations regarding the amount and type materials that are being discharged into a waterway. These

[5] Rhode Island Rivers Council, "Blackstone River Watershed," http://www.ririvers.org/wsp/Watersheds /BlackstoneRiverWatershed.htm

Acts reduced the amount of pollution entering a waterway, and in time, the waterway would begin to recover itself.[6]

Life in the Blackstone valley however, was not as easily fixed. August 1955 brought back-to-back Hurricanes Connie and Diane to New England.[7] These hurricanes led to the failure of several dams along the Blackstone River, flooding its riverbanks and surrounding communities. In turn, the Blackstone Valley suffered greater loss to the vibrant life it once sustained. Unemployment was as well known in the valley as the pollution at its banks. The strong, diverse culture built by the mill workers was being forgotten, and the Blackstone River was becoming another name in the history books.

In hopes to restore life to the Blackstone River and its communities, the Blackstone Valley Tourism Council was created in 1985. The goal of the tourism council is to revitalize the valley by restoring life to the river and providing sustainable tourism to passersby. Sustainable tourism as described by the BVTC is to "improve our lifestyle and the quality of a region while preserving and building on the region's environment and natural resources, culture and heritage, health and safety needs, and other positive components. To be sustainable, a community must strive to: avoid decreasing bio diversity, avoid consuming resources faster than they are renewed, recycle and reuse virtually all materials, and rely primarily on resources of its own region."[8] By creating a place desired by tourists, the council encourages its residences to take pride in their home, and provides the initiative to improve the overall quality of life for the valley. Promoting the history of the valley to both tourists and residences alike, BVTC provides tours through the Blackstone River on their *Explorer* boat, and throughout the surrounding communities via trolley and bus tours and bike paths (planned and existing) along the river.

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[6] United States Environmental Protection Agency, "History of the Clean Water Act," http://www2.epa.gov/laws-regulations/history-clean-water-act

[7] National Weather Service, "The Floods of Hurricane Connie and Diane," http://www.erh.noaa.gov/nerfc/historical/aug1955.htm

[8] Blackstone Valley Tourism Council, "Our Story & Mission," http://www.blackstonevalleytourismcouncil.org/blackstone_valley_rhode_island_tourism_council_our_story.htm

Furthermore the Council promotes the revitalization of the Blackstone River, in hopes to clean and improve the river to sustain healthy aquatic life and any other possible future use.

FIGURE 3: MANVILLE LANDING

As part of the revitalization of the river, the Blackstone Valley Tourism Council sought to build small parks and river access points along the banks of the river. The parks would provide a quiet, historic place for families and tourists to relax along the banks of the river. One of these parks includes Manville Landing. Manville Landing is a small park in Cumberland, RI along the Blackstone River. The park provides recreational access to the river, and a scenic area for tourists and locals alike. However, as the first piling was driven on the site, pollutants and other materials discharged from the soil. As required by the DEM and EPA, the soil was remediated to remove the materials found. In turn, the overall cost of the Manville project skyrocketed to over twice the original estimated price.

This project, referred to as “Manville Landing”, setback river revitalization plans. BVTC maintained hopes of restoring the river to the community, but did not want to risk a similar environmental and financial disaster. BVTC recognized the need to develop an approach to evaluating sites and preventing another “Manville Landing.” This was the beginning of the SFA project.

4 - General Approach

The Site Feasibility Access project was assigned to the Blackstone Environmental Service Team from Roger Williams University. It is the job of BEST to identify the feasibility of potential access points along the river. The overall feasibility of a site is dependent on the location of the property, possibility of hazardous materials within the soil, and the suitability of a site for an access design.

During the Fall semester, the BEST team focused solely on the CLUE process. They visited four of the five sites: North Smithfield, Pawtucket and both of the Central Falls sites. They also visited the town halls in North Smithfield and Central Falls to collect historic information. The CLUE reports for these sites were drafted. In the area of design, only research was accomplished during the first semester. At the completion of the semester, the project still needed one more site visit, the CLUE reports to be completed and the U-RAD design to be developed and finalized.

At the outset of the Spring semester, the BEST team determined that the most efficient way to continue the project would be by splitting into two focus groups: the Research and Development team and the Corridor Land Use Evaluation team. The CLUE team would be focusing on completing the site assessments and selecting the site for further development. The RAD team would focus on researching the regulations and guidelines for river access and drafting preliminary design plans. The following sections will describe the approach taken by each team in their individual focus.

4.1 – CLUE Methodology

A Corridor Land Use Evaluation is a subsection of DPM 450.23 Environmental Site Assessment Investigation and is defined by the Rhode Island Department of Transportation (RIDOT) as,

> "A Corridor Land Use Evaluation identifies properties along a project alignment that may be a potential source of contamination/threat to the project alignment in which excavation is required. Any properties identified as potential concerns would be subject to more rigorous

investigation. This evaluation is also useful to assess the potential for contamination on properties abutting the alignment in the event of 'strip-taking/condemnation' as a result of road reconstruction."

The CLUE is an essential part of the early evaluation of a project and is part of the Environmental Site Assessment process. Stated in the American Society for Testing and Materials Standards, "no samples are to be collected and/or analyzed during the first stages of the Environmental Site Assessment process."[9] The tasks to be conducted are a site visit, historical review, and regulated facilities review for each site and its abutting properties. A more detailed Methodology, created by BEST, can be reviewed in **Error! Reference source not found.**.

4.1.1 – Site Visit

A site visit consists of visiting the site in question and carefully documenting any visible environmental concerns on or surrounding the site. For record-keeping purposes, the site and any concerns on the potential site or abutting properties must also be photo documented. The site visit is the initial part of the CLUE process and is able to give an initial judgment on the land in question.

4.1.2 – Historical Review

The Historical Review is the part of the CLUE process that is most thorough. For the historical review, one must visit the town hall to obtain the chain of title for the potential site and its abutting properties. All information regarding previous ownership of the site, including previous plat and lot numbers must be documented. Once the chain of title has been obtained, preliminary research on the possible chemicals used by the previous owners must be conducted. In order to completely understand the sites context, historical maps and aerial views must also be evaluated. Historical maps can be found at the local historical society and most aerial views can be found through the states local GIS software. If available, documentation and the characterization of hazardous waste should consist of a description of:

[9] ASTM Standards

1. Source and extent of release
2. Properties and transport characteristics
3. Migration pathways such as soil, groundwater, and surface water
4. Current/past runoff into surface water

4.1.3 – Regulated Facilities Review

A regulated facilities review consists of contacting the Department of Environmental Management (DEM) to determine if the property or abutting properties have previously been remediated. It is important to include in the CLUE report a search from the DEM database that describes any regulated facilities that have previously occupied or are currently occupying the site and/or abutting sites. Examples of regulated facilities include: Transfer Stations, underground storage tanks, and aboveground storage tanks. Also note of any facilities subject to NPDES permits, as they allow storm water runoff from manufacturing, processing, material storage, and waste material disposal areas.

4.1.4 – Site Risk Rating System

Once all the CLUEs were performed for the selected sites, each site was rated based on the Site Risk Rating System, as shown in Table 1. The rating system does not give information regarding whether the site is the best site to use, but helps to determine which site has the lowest risk of finding unknown hazardous material. It should be noted that if a site is rated well on this rating system, it does not confirm that no hazardous materials are present on the site, but that there is a lower risk of finding unknown hazardous material on the site.

The rating system developed is based upon the following factors; previous ownership, previous occupation, property remediation, and abutting property factors. The sites were evaluated on these factors, and based on each rating the site was either determined to be of a high or low risk site for containing unknown hazardous waste.

Each site is evaluated and given an overall risk score. The lowest, and best score a site could receive is a 5. Receiving this score signifies that, from historical data, there is a lower risk in finding unknown hazardous waste. The highest, and worst score a site could receive is a 30. Scores ranging

from 20 to 20 are considered high-risk sites for finding unknown hazardous material and therefore will not be recommended for the use of the BVTC. Sites with scores ranging from 15 to 20 are considered of moderate risk for finding unknown hazards and sites with scores ranging from 5to 15 are considered a low-risk of finding unknown hazardous material.

Again, it should be noted that the risk of hazardous contamination at a site was determined solely from historical land use information. Non-documented dumping of hazardous materials would not necessarily have been identified using this approach. Only soil and water testing can determine the full extent of contamination.

Rating System	5	4	3	2	1
Previously Owned by A Company Which Used:	Highly Toxic Chemicals	Mildly Toxic Chemicals	Mildly Toxic Chemicals (Likely)	No Toxic Chemicals (Likely)	No Toxic Chemicals (Definitely)
Previously Occupied by:	A factory or building which used/stored Highly Toxic Chemicals	A factory or building which used/stored mildly toxic Chemicals	A factory or building which used/stored non-toxic chemicals	A commercial or residential building which did not use chemicals	Vacant Lot
Property Remediation	Has not been tested or remediated	Has been tested but has not been remediated	Has been entirely capped but not remediated	Mostly remediated but contains caps	Entirely Remediated
Abutting Property Previously Owned by A Company Which Used:	Highly Toxic Chemicals	Mildly Toxic Chemicals	Mildly Toxic Chemicals (Likely)	No Toxic Chemicals (Likely)	No Toxic Chemicals (Definitely)
Abutting Property Previously Occupied by:	A factory or building which used/stored Highly Toxic Chemicals	A factory or building which used/stored mildly toxic Chemicals	A factory or building which used/stored non-toxic chemicals	A commercial or residential building which did not use chemicals	Vacant Lot
Abutting Property Remediation	Has not been tested or remediated	Has been tested but has not been remediated	Has been entirely capped but not remediated	Mostly remediated but contains caps	Entirely Remediated

TABLE 1: SITE RISK RATING SYSTEM PARAMETERS

4.2 – U-RAD Methodology

The research and design team began by researching requirements and information on river accessibility and safety in Rhode Island. They took two major approaches to this: they contacted Captain Robert Shields with Cumberland Fire Rescue to learn about the needs and procedures used by rescue teams, and contacted James McGinn from the RI DEM to learn about guidelines used for boating access sites. Each source provided helpful information in the design process.

4.2.1 Regulation Research

Captain Shields was able to explain the needs of a water rescue team. Typically, when there is a need for rescue, the boat is launched at the easiest access point, while the majority of the rescue personnel are deployed directly to the point of interest. Boats are typically transported on trailers towed by either pickup trucks or fire engines. At the launch site, ideally, the trucks would be able to turn around and back the boat and trailer down a ramp; however, there is provision for the trucks to simply get as close to the water as possible and to then hand carry the boats to the water. Clearly, the former of the two options is better. There is a need for both room to allow maneuvering, as well as a staging area for the trucks and trailers, especially in the event that a boat launch is not an option for design.

James McGinn was able to direct the team to the two major guidelines used in Rhode Island: States Organization for Boating Access (SOBA) and California Division of Boating. The team was able to access the California Division of Boating requirements online. These requirements set the specifications on minimum parking spots, turning radius, materials use, etc. The SOBA handbook took a few weeks to obtain by mail. When it arrived, it was very similar to the California Division of Boating document. Once again, it outlined all of the specifications that are necessary for boating use and design. It mentioned information about master planning – property, finances, body of water, etc. – it then began to talk about boat launch siting and location, access road, parking lots, special purpose areas, obstructions, and, finally, ramp design. The design process continued primarily using the SOBA handbook.

4.2.2 ADA Considerations

In addition to the rescue and DEM regulations, the team researched American Disabilities Act (ADA) requirements. However, as the project goals changed with the semester, it soon became that the launch site would not be for public use – it would be purely for rescue purposes. This changed the requirements of what needed to be designed. There would be no parking area, no public access and no docs or platforms in need of meeting ADA regulations – the only users would be rescue teams.

4.2.3 Visits to Existing Sites

At the suggestion of Captain Shields, the team also visited two landings commonly used by the Cumberland Fire Rescue team: Manville Landing and Sycamore Landing. On February 26, the RAD team visited both sites in order to learn why Captain Shields deemed these sites to be excellent for rescue use. Unfortunately, there was still almost a foot of snow on the ground and the team was unable to inspect the materials used and the site in closer detail.

FIGURE 4: IMAGES OF SNOW COVERED MANVILLE LANDING AND SYCAMORE LANDING (FROM LEFT TO RIGHT).

With all of the state regulation information gathered together in the two handbooks, ADA requirements considered and two current sites visited for reference, the RAD team was prepared to begin designing a site. All of this information provided the guidelines for an approved site and ease of access for rescue teams. The only information still needed was which site should be developed.

4.2.4 Surveying and Site Information

With the completion of the CLUEs and the results of the comparison, the RAD team had their site: the Pawtucket Water Supply Board (PWSB) on Branch Street in Pawtucket, RI. The next step was for the team to visit the site and survey it for elevations, obstructions and any other pertinent site information. This information was collected and used to create an AutoCAD plan of the site with trees, elevation contour lines and property lines. The team began developing a design. Shortly afterward, staff from PWSB sent AutoCAD files of the pre-existing site conditions. These plans revealed two drainage pipes that bisected the property, causing the team to reconsider their designs. In addition, the team was given plans for the proposed Blackstone Bikeway. This also shifted the intended plans.

Finally, the team determined there was a need to draft two designs; one under the assumption that there would be no bikeway and the other to allow for the bikeway. More information on these designs will be given in Chapter 6 – Universal River Accessibility Design.

5 – Corridor Land Use Evaluations

As mentioned, the Blackstone Environmental Service Team (BEST) was recruited by BVTC to complete a Site Feasibility Access Project for sites preselected by BVTC and local municipalities. The sites selected for evaluation by BEST in fall of 2013 were located in Central Falls (River Street and High Street) and North Smithfield (Mill Street). In January of 2014, the Pawtucket (Branch Street), and Cumberland (Albion Road) sites were added to the scope of work. Every site was evaluated with the consistent and streamlined CLUE process. The sites were researched to the most thorough extent, and were carefully documented. In February 2014 the idea to create a guideline for our newly developed CLUE methodology was introduced. This CLUE Methodology is available in **Error! Reference source not found.**. The following subsections will explain the CLUE for each site, the findings and results.

5.1 – Mill Street, North Smithfield

5.1.1 Site Location

The Mill Street site is the northern-most potential landing site and is located just south of the Massachusetts border. It is identified on the tax assessor's map: Lot 183, Plat 3 in North Smithfield, Rhode Island. The Mill Street site is located in a neighborhood called Slatersville and is located very close to the Massachusetts border. Highlighted in green in Figure 2 is the surrounding area studied for the CLUE.

Plat Number	3	**Proposed Use**	
Lot Number(s)	183	Rescue/Recreation	

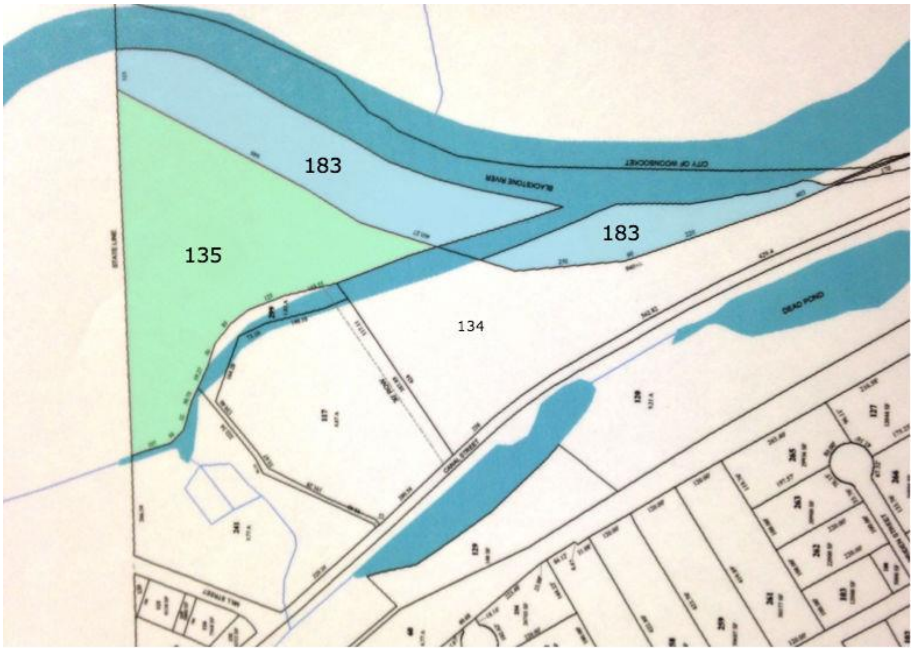

FIGURE 5: MILL STREET SITE PLAT MAP 2013[10]

[10] City of North Smithfield Town Hall

5.1.2 Current Land Use

Photos taken on the site visit in November 2013 are shown in Figure 3. The site is proposed for Lot 183, which is a 6.535-acre parcel. The site is wooded and is currently not in use. The U.S. Army Corp of Engineers stabilized the banks of the river with riprap along this section. The abutting property (lot 135) currently has a baseball field, as shown in Figure 4. Other abutting sites include the BFI transfer station, which, according to RIDEM records, has a tendency to overfill.

FIGURE 6: MILL STREET CURRENT USE

FIGURE 4: PRESENT AERIAL OF POTENTIAL SITE AND ABUTTING LOT (LOTS 135 AND 183 ARE OUTLINED IN RED)[11]

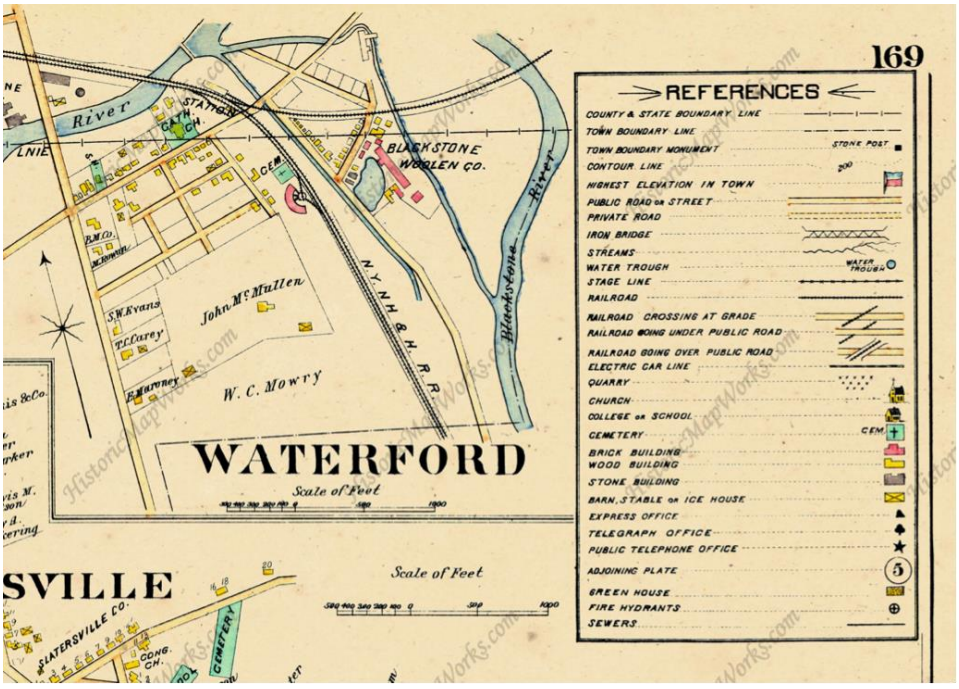

FIGURE 5: NORTH SMITHFIELD, 1985[12]

5.1.3 Former Land Use

[11] Google Earth™ 2014 Aerial Photo
[12] Everts and Richards, 1895; Atlas of Providence County; http://www.proquest.historicmapworks.com

The history of the site was compiled from the City North Smithfield Tax Assessor's records, Rhode Island Department of Environmental Management (RIDEM) ArcGIS maps, aerial photographs, Rhode Island Historical Society Library, and Historic Map Works. The following are former land uses that may have the possibility of using chemicals on site. Mill Street's (Lot 183) aerial photos and the historical atlas maps indicate that from 1870 on, the site has been vacant. Although it was owned by the Blackstone Woolen Company and could have been used as storage or a dump for dyes or other hazardous material. As for 35 Mill Street (Lot 135) the historical maps indicate that the Blackstone Woolen Company has owned the site in 1870 and there previously was a building on the lot. The aerial photos indicate since 1939, the site has been vacant and then in 1995 was changed to a Baseball field.

5.1.4 Hazardous Contamination Risk Evaluation

The Mill Street site housed the American Woolen Company. Mill Street could be a potential hazard in regards to dyes and other materials used to process wool. Mill Street also has a few surrounding industrial companies as well as a site which houses yard waste. Mill Street also is abutting the BFI transfer station, which houses disposed of batteries, glass, and other hazardous materials.

Property	Current Owner	Current Use	Former Use	Risk
Abutting	Town of North Smithfield (1978)	Baseball Field	American Woolen Company and Textile Realty Company (1916-1934)	Moderate: Possible Industrial waste or petroleum products
Site location	Town of North Smithfield (1978)	None	Originally part of lot 135; Potentially the American Woolen Company and Textile Reality (1916-1934)	Moderate: Possible Industrial waste or petroleum products
Abutting	BFI Transfer	BFI Transfer Station		Moderate: Possible waste contamination due to overflow.

TABLE 2: LAND USE DATA FOR MILL STREET.

Site Rating

Category	Rating	Explanation
Previously Owned by A Company Which Used:	5	American Woolen Company; Dyes, Coal tar
Previously Occupied by:	1	Vacant
Property Remediation	5	Not remediated
Abutting Property Previously Owned by A Company Which Used:	4	Train Track; Arsenic
Abutting Property Previously Occupied by:	4	Train Station
Abutting Property Remediation	5	Has not been remediated
	Total	24

TABLE 3: MILL STREET SITE RATING

The Mill Street site has been surrounded by industry and railroads since the 1940's. Trains have a tendency to release Arsenic and other carcinogens, while the woolen companies use dyes and other products that consist of coal tar. Mill Street is considered a high-risk site.

5.2 Albion Road, Cumberland

5.2.1 Site Location

The Albion Road site location, Lot 187 and 431, plat 33 is in Cumberland Rhode Island. Albion Road has been a residential area since 1988 and is now a vacant lot owned by the DEM. It proves to be a moderate risk area for environmental hazards. The potential launch site's proposed location is the southern part of lot 33-187 or the northern part of lot 33-431.

Plat Number	33	**Proposed Use**	Rescue
Lot Number(s)	187, 431		

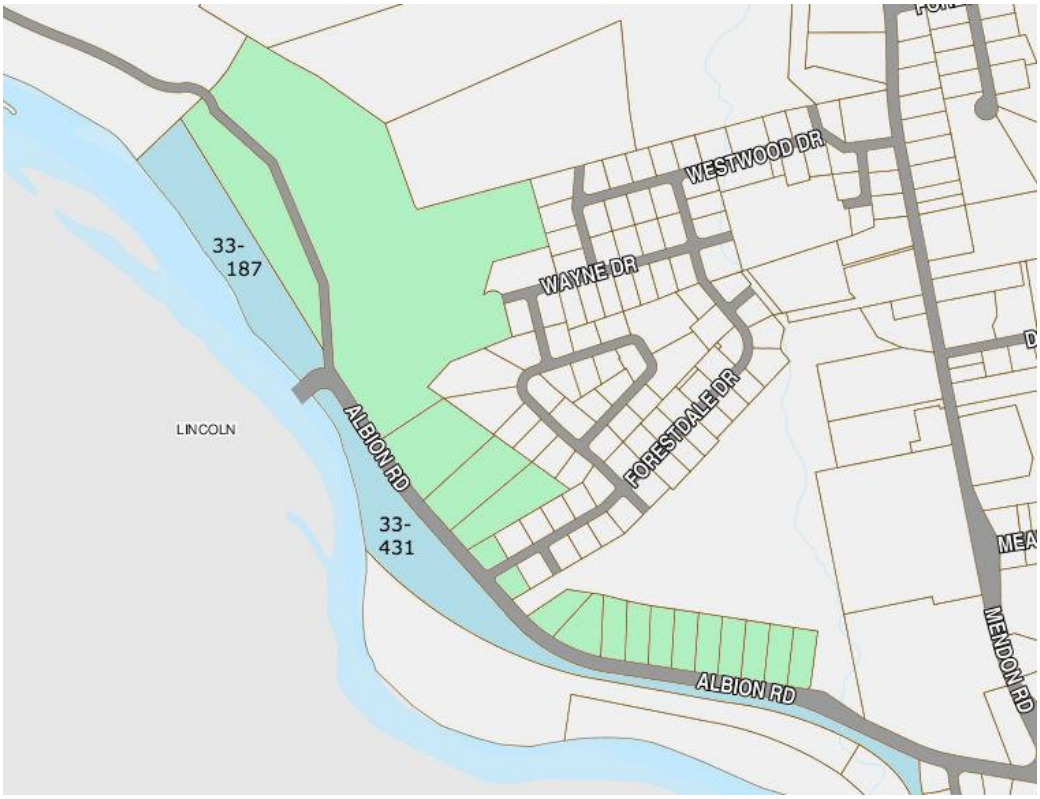

FIGURE 7: ALBION ROAD SITE PLAT MAP[13]

[13] Cumberland Town Hall

5.2.2 Current Land Use

Photos taken on the site in February, 2014 are shown in Figure 8. The lot is currently wooded and vacant. The property is owned by the Rhode Island Department of Environmental Prodectino (RIDEM). The all abutting properties are residential and have been since the 1940's. Aerial views of the sites can be seen in Figure 9 and Figure 10 on page 31.

FIGURE 8: ALBION ROAD CURRENT USE

FIGURE 9: PRESENT AERIAL VIEW OF ALBION STREET SITE AND SURROUNDING LOTS

FIGURE 10: ALBION ROAD AND PARK STREET SITE[14]

5.2.3 Former Land Use

[14] Google Earth™ 2014 Aerial Photo

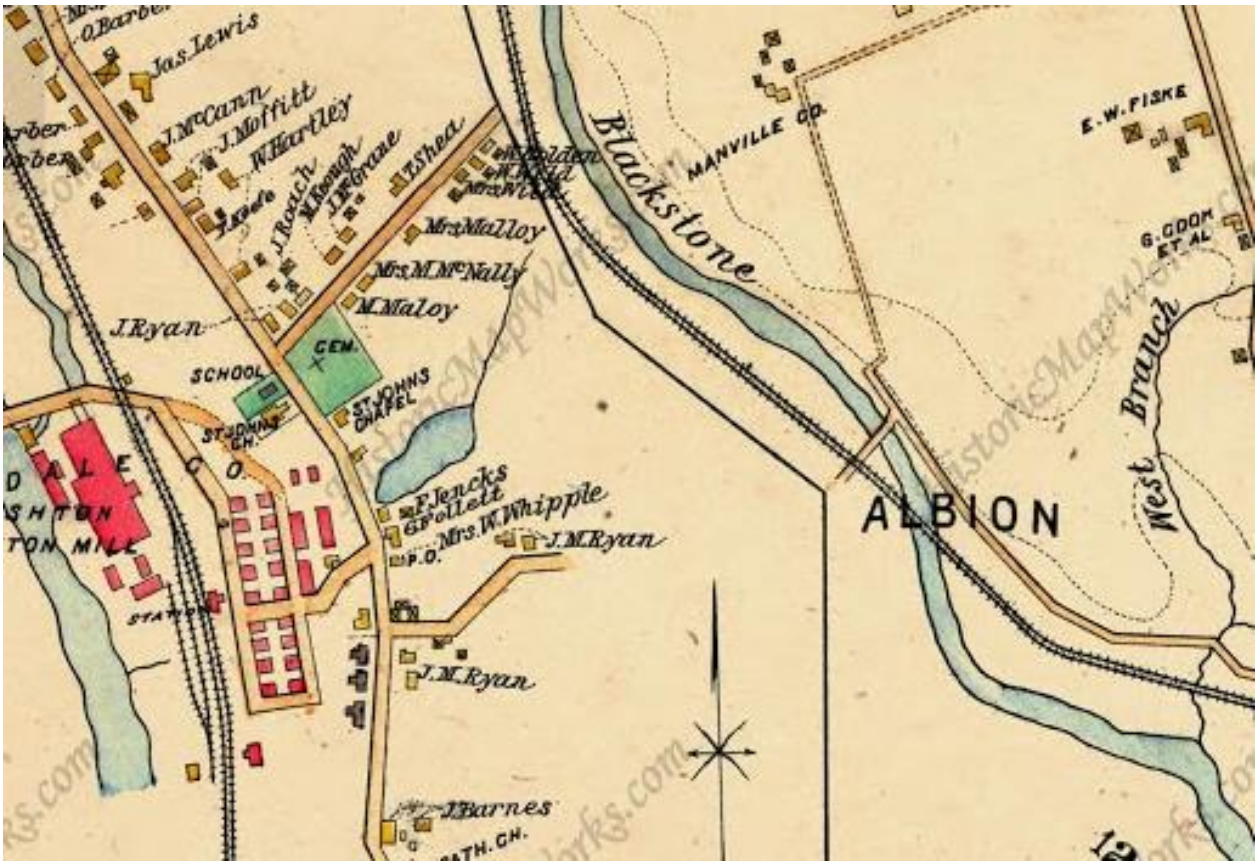

FIGURE 11: SECTION OF CUMBERLAND MAP, 1895[15]

The history of the site was compiled from the City of Cumberland Tax Assessor's records, Rhode Island Department of Environmental Management (RIDEM) Arc GIS maps, aerial photographs, Google Earth and Historic Map Works. The research indicates 30 Albion Road (Lot 33-187) is across the river from a lot that contained a railroad and station. The railroad track remained in use until 1954. Berkshire Fine Spinning Company owned the lot from 1955 to 1959. New England Homes Inc. owned the lot from 1959 to 1988. Since then it has been owned by the RIDEM. Currently 83 Park Street (Lot 33-431*)* is currently a vacant lot. The historical maps indicate that this lot has always been vacant. The previous ownership of the lots across the river is of moderate concern due to the location of the railroad. The

[15] Everts and Richards, 1895; Atlas of Providence County; http://www.proquest.historicmapworks.com

other abutting sites have previously been vacant, but as of now are completely residential.5.2.4 Hazardous Contamination Risk Evaluation

The Albion Road sites are of moderate risk for finding unknown hazardous material. The main concern is finding petroleum products and other containments from the railroad station and tracks from the abutting properties.

Map-Lot No.	Property	Current Owner	Current Use	Former Use	Risk
33-187	PLS	Rhode Island Department of Environmental Protection	Vacant Lot	Berkshire Fine Spinning Company (1955-59), New England Homes Inc. (1959-88), Residential (1988-2009)	Moderate
33-431	PLS	Rhode Island Department of Environmental Protection	Vacant Lot	Rhode Island Department of Environmental Protection	Moderate

TABLE 4: LAND USE SUMMARY FOR THE ALBION SIT

Site Rating

Category	Rating	Explanation
Previously Owned by A Company Which Used:	4	Possible Coal Tar from Spinning Company
Previously Occupied by:	1	Was owned but never occupied by a building
Property Remediation	5	No remediation was done
Abutting Property Previously Owned by A Company Which Used:	3	Rail Road company
Abutting Property Previously Occupied by:	3	Rail Road Station
Abutting Property Remediation	5	No remediation has taken place
Total	21	

TABLE 5: ALBION ROAD SITE RATING

The Albion Road site received a score of 21, which is considered a site of moderate risk for finding unknown hazardous material. There is a moderate risk of petroleum and arsenic contamination from the railroad both abutting the Park Street location and from being on the Albion Road location.

5.3 – River Street, Central Falls

5.3.1 Site Location

The River Street site, located at Lots 200, 200A, and 201 on plat map 2 in Central Falls, is under consideration for a potential launch site. River Street has been a mostly residential area since 1900 and proved to be a low risk area for environmental hazards such as heavy metals, petroleum based products, and other hazardous chemicals. The two Potential Launch Sites (PLS) associated with River Street are lots 2-201 and 2-200 (highlighted in blue in Figure 12 below). The entire corridor studied includes lots 2-27, 2-68, 2-70, 2-71, 2-72, 2-78, and 2-80 (highlighted in green in Figure 12 below).

Plat Number	2	**Proposed Use**	Rescue
Lot Number(s)	200/200A/201		

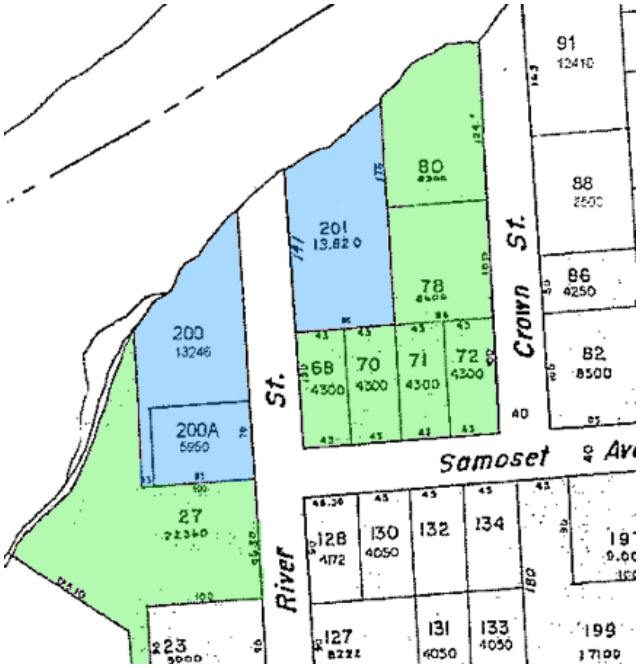

FIGURE 12: RIVER STREET SITE PLAT MAP[16]

[16] Central Falls Town Hall

5.3.2 Current Land Use

Photos take on the site visit in October 2013 are shown in Figure 13. The site is proposed for Lot 201 or 200, which are two 0.4-acre parcels. The site is currently owned by the Town of Central falls and used as storage for the DPW. The abutting properties are all residential homes and have been since the early 1900's. Current aerial views of the site can be seen in Figure 14 on page 36.

FIGURE 13: RIVER STREET CURRENT USE

FIGURE 14: PRESENT AERIAL OF RIVER STREET SITE[17]

5.3.3 Former Land Use

The history of the site was compiled from the Central Falls Tax Assessor's records, RIDEM, ArcGIS maps aerial photographs, Rhode Island Historical Society Library, and Historic Map works. The River Street Site has been surrounded by residential homes since the 1900's. The River Street Site (lot 201) itself has previously been the location of the Central Beverage Corporation from 1939 to 1975. The aerial photos of Lot 200 indicate that there was previously a building on the property for a short period between 1939 and 1962. As of before 1939 the sites both show to be undeveloped, shown in Figure 15.

[17] Google Earth™ 2014 Aerial Photo

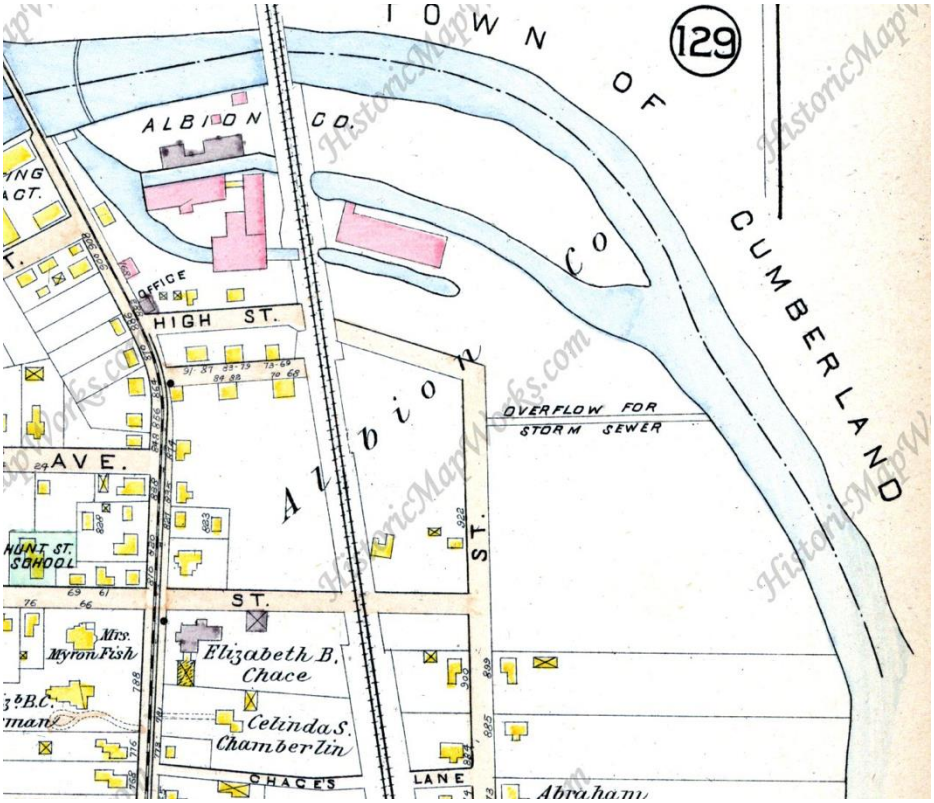

FIGURE 15: SELECTION OF CENTRAL FALLS MAP, 1895[18]

5.3.4 Hazardous Contamination Risk Evaluation

Although a residential area has surrounded River Street since 1900, it has also been the location of the

Central Beverage Corporation and DPW storage making it of moderate concern for petroleum products.

Land use data can be seen on the following page.

[18] Everts and Richards, 1895; Providence County Atlas; http://www.proquest.historicmapworks.com

Address	Map Lot No.	Property	Current Owner	Current Use	Former Use	Risk
53 River Street	2-201	PLS	City of Central Falls (As of 1975)	Storage Garage for DPW	Central Beverage Corp. Factory (Until 1965)	Moderate: Possible Industrial waste or petroleum products
38 River Street	2-200	PLS	City of Central Falls (As of 1975)	Storage for DPW	W.S.L Inc. (1946), Gold's Industries (1965), Central Beverage Corp. (1970)	Moderate: Possible Industrial waste or petroleum products
85 Samoset Ave	Feb-70	Abutting	Hilda M. Cabral	Residential	Residential (1900)	Low
81 Samoset Ave	Feb-71	Abutting	Noel Linback	Residential	Residential (1900)	Low
72 Samoset Ave	Feb-72	Abutting	Maurice Giovanni	Residential	Residential (1900)	Low
20 Crown Street	Feb-78	Abutting	Vitor Lopes	Residential	Residential (1900)	Low
28 Crown Street	Feb-80	Abutting	Walter Seminick	Residential	Residential (1900)	Low
16 River Street	27-Feb	Abutting	Kenneth Castle	Residential	Residential (1900)	Low

TABLE 6: RIVER STREET LAND USE SUMMARY

Site Rating

Category	Rating	Explanation
Previously Owned by A Company Which Used:	5	Use of petroleum products
Previously Occupied by:	4	Use of petroleum products
Property Remediation	5	Has not been tested
Abutting Property Previously Owned by A Company Which Used:	1	Abutters mostly residential
Abutting Property Previously Occupied by:	2	Abutters mostly residential
Abutting Property Remediation	5	Has not been tested
	Total	21

TABLE 7: RIVER STREET SITE RATING

River Street is of moderate risk for finding unknown hazardous material. The concern for the River Street site is due to the use of petroleum products from both the DPW and the Central Falls Beverage Company.

5.4 – High Street, Central Falls

5.4.1 Site Location

The High Street site located at Lot 189 plat 2 is under consideration for a potential launch site. High Street has been a mostly industrial area since 1895 and proved to be a high-risk area for environmental hazards such as heavy metals, petroleum based products, and dyes. The Potential Launch Site (PLS) associated with High Street is lot 2-189 (highlighted in blue in Figure 16 below). The entire corridor studied includes lots 2-198, 2-204, and 2-203 (highlighted in green in Figure 16 below).

Plat Number	2	**Proposed Use**	Rescue
Lot Number(s)	189		

FIGURE 16: SELECTION OF CENTRAL FALLS PLAT MAP 2, PROJECT CORRIDOR[19]

[19] Central Falls Town Hall

5.4.2 Current Land Use

Photos taken on the site visit in October, 2013 are shown in Figure 17. The site is proposed for Lot 189. The site is relativly wooded and located next to a baseballfield. The abbutting sites include the Pierce Street River walk, and the Wyatt detention facility parking lot.

FIGURE 17: HIGH STREET WINDSHIELD SURVEY

FIGURE 18: PRESENT AERIAL OF POTENTIAL LAUNCH SITE AND SURROUNDING LOTS[20]

[20] Google Earth™ 2014 Aerial Photo

5.4.3 Former Land Use

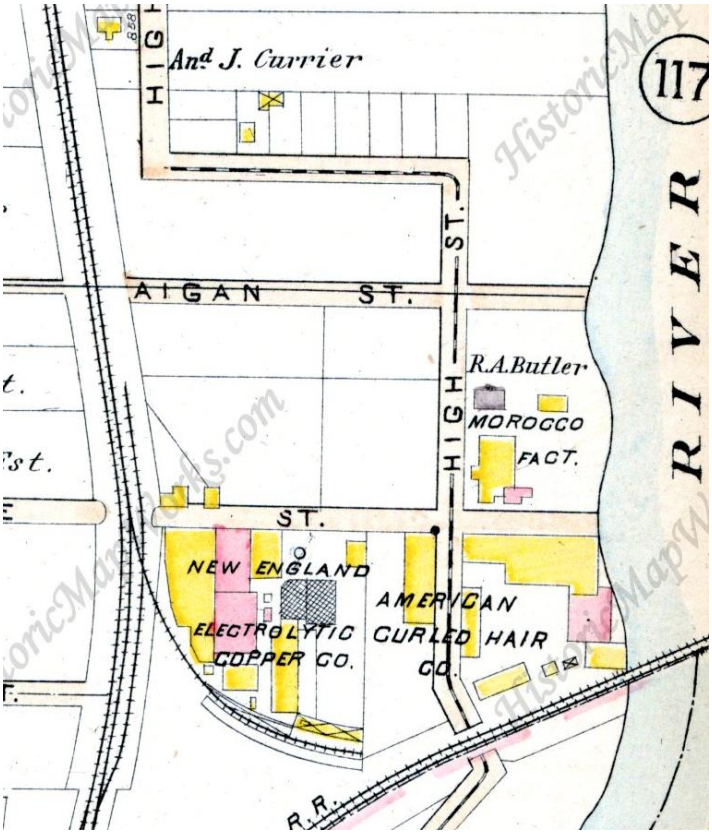

FIGURE 19: SELECTION OF CENTRAL FALLS MAP, 1895[21]

The history of the sites was compiled from the City of Central Falls Tax Assessor's records, Rhode Island Department of Environmental Management (RIDEM) ArcGIS maps, aerial photographs, and Historic Map Works. The following are former land uses that may have the possibility of using chemicals on site. 987 High Street (Lot 189) shows the property was previously owned by the New England Electrolytic Copper Co., even though maps show there is no building located on the lot, it is assumed that there is a possibility the site was used as a dump. On 935 High Street (Lot 198) DEM shows that prior to the parking lot and the training facility, the site was remediated, therefore making it a low risk site.

[21] Everts and Richards, 1895; Providence County Atlas; http://www.proquest.historicmapworks.com

5.4.4 Hazardous Contamination Risk Evaluation

The High Street site was once owned by the Electrolytic Copper Company making it a high risk for the possibility of heavy metal containments. The abutting site (the Wyatt Detention Facility parking lot) was previously remediated and large amount of heavy metals were found.

Address	Map-Lot No.	Property	Current Owner	Current Use	Former Use	Risk
987 High Street	2-189	PLS	City of Central Falls	Baseball Field, Pierce Park, River Walk	Previously owned by New England Electrolytic copper Co (1892)	High Risk - Possibility of Dump site
935 High Street	2-198	Abutting	Fink Francine	Parking Lot, Wyatt Training Center	Previously Owned by NE Electrolytic Copper Company, Was remediated	Low
High Street	2-204	Abutting	City of Central Falls	River Walk	Vacant	Low
1075 High Street	2-203	Abutting	City of Central Falls	River Walk	Vacant	Low

TABLE 8: HIGH STREET LAND USE SUMMARY

Site Rating

Category	Rating	
Previously Owned by A Company Which Used:	5	Electrolytic Copper Co.
Previously Occupied by:	3	Kings Auto Parts (petroleum)
Property Remediation	5	Not remediated
Abutting Property Previously Owned by A Company Which Used:	3	Petroleum
Abutting Property Previously Occupied by:	3	Kings Auto Parts
Abutting Property Remediation	1	Was remediated
	Total	20

TABLE 9: HIGH STREET SITE RATING

The High Street site presented a score of 20, which puts it in the moderate risk category for finding unknown hazardous material.

5.5 – Branch Street, Pawtucket

5.5.1 Site Location

The Branch Street site located at Lot 587, plat 6a is under consideration for a potential launch site. Branch Street is the site of the Pawtucket Water Supply board. This has been the site of the Pawtucket Water Supply board since 1890 and has previously been surrounded by industry and a small residential area. The PLS associated with Branch Street (highlighted in green) is lot 6a-587.

Plat Number	6a	**Proposed Use**	Rescue
Lot Number(s)	587		

FIGURE 20: BRANCH STREET SITE PLAT MAP[22]

[22] Pawtucket Town Hall

5.5.2 Current Land Use

Photos taken on the site visit in October 2013 are shown in Figure 21. The site is proposed for lot 587, along the Blackstone River. 85 Branch Street (Lot 587) a 5.65acre parcel containing the Pawtucket Water Works Facilities. Across the Street of the Water Supply Facilities, there is a small plot of land (part of Lot 587) in which the BVTC is interested in putting a rescue launch site. The Branch Street site is surrounded by vacant lots, owned by the city, and a residential area.

FIGURE 21: PAWTUCKET WINDSHIELD SURVEY

FIGURE 22: PRESENT AERIAL OF POTENTIAL LAUNCH SITE AND SURROUNDING LOTS[23]

[23] Google Earth™ 2014 Aerial Photo

5.5.3 Former Land Use

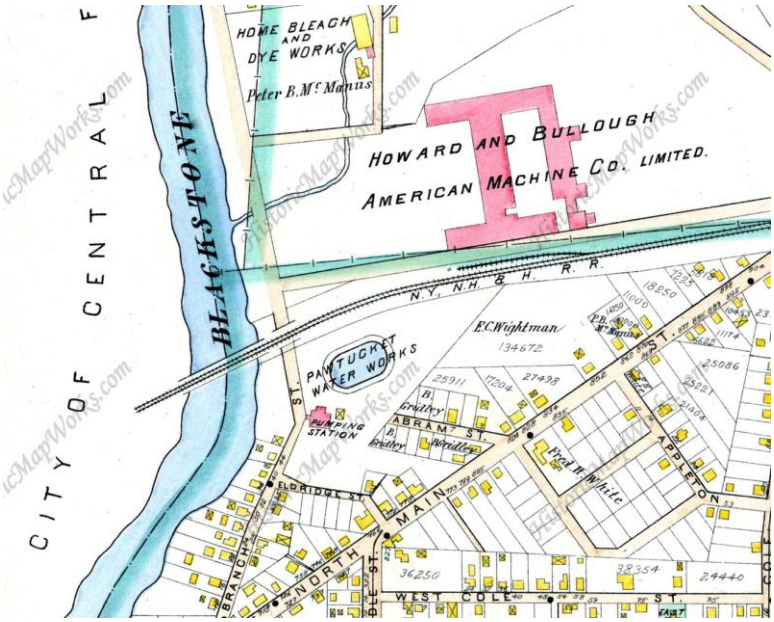

FIGURE 23: SELECTION OF PAWTUCKET MAP, 1895[24]

The history of the site was compiled from the City of Pawtucket Tax Assessor's records, Rhode Island Department of Environmental Management (RIDEM) ArcGIS maps, aerial photographs, and Historic Map Works. The following are former land uses that may have the possibility of using chemicals on site.

Branch Street (Lot 7) – The aerial photos indicate that this once contained the Home Bleach and Dye Works. This is of some concern, but considering the size of the lot and distance away, the ownership is not of significant concern.

Branch Street (Lot 117) – The aerial photos indicate that there was once a building on the property. The historical maps indicate that Howard and Bullough American Machine Co. once occupied the lot. Due to the distance from the PLS, the previous ownership of the abutting lot is of no significant concern.

[24] Everts and Richards, 1895; Providence County Atlas; http://www.proquest.historicmapworks.com

5.5.4 Hazardous contamination Risk Evaluation

The Branch Street Site has been remediated and some heavy metals were found. Because the site has already been remediated, the chemicals found in the remediation are of relatively low concern.

Address	Map-Lot No.	Property	Current Owner	Current Use	Former Use	Risk
85 Branch Street	6a-587	PLS	City of Pawtucket	Pawtucket Water Supply	Pawtucket Water Works	Low Risk
80 Branch Street	6a-42	Abutting	Wrzesien Bronislaw	Residential	Residential	Low

TABLE 10: LAND USE SUMMARY FOR THE PAWTUCKET SITE.

Site Rating

Category	Rating	
Previously Owned by A Company Which Used:	1	No toxic Chemicals Used
Previously Occupied by:	1	Water Supply Board
Property Remediation	2	Previously remediated
Abutting Property Previously Owned by A Company Which Used:	3	Residential areas
Abutting Property Previously Occupied by:	3	American Machine Co.
Abutting Property Remediation	2	Remediated with some caps
	Total	12

TABLE 11: BRANCH STREET SITE RATING

Branch Street showed a rating of 12 for the risk of using this site. This is the best score out of all the sites making this site a relatively low risk site in regards to knowing what hazards are on the site. Considering companies using hazardous chemicals have not previously owned the site and the property has been previously remediated, the site is highly recommended for further soil testing and possible use.

6 – Universal River Accessibility Design

From Pawtucket to the Massachusetts state line, industry prospered along the Blackstone River. The Blackstone Valley consists of twenty-one communities in Massachusetts and Rhode Island. Rhode Island: Burrillville, Central Falls, Cumberland, Gloucester, Lincoln, North Smithfield, Pawtucket, Smithfield, and Woonsocket, and Massachusetts: Blackstone, Douglas, Grafton, Hopedale, Mendon, Millbury, Millville, Northbridge, Sutton, Upton, Uxbridge and Worcester are located on the Blackstone River Valley National Heritage Corridor. The heritage corridor is meant to preserve historic lands, and waterways in the Valley, and to boost the economy. There is currently a water trail network in the making, to promote water safety, conservation, and recreation. The Blackstone River National Heritage Corridor Commission (BRNHCC) is the organization in charge of the revitalization of the Blackstone River. Their mission states:

> "Our goals for the Corridor are to retain and renew the Blackstone Valley's distinctive historic and natural character on a continuous basis for its entire length in a way that supports and enhances what is best about the way of life of current residents. New developments that reinforce and enhance the Corridor's historic, social and natural assets will be encouraged. Similarly, tourism will be encouraged and guided in such a manner as to provide recreation and education to visitors and to reinforce the goals of Corridor." [25]

The Universal River Accessibility Design (U-RAD) is an integral part of our project. U-RAD is the next step in fulfilling the BRNHCC goal to revitalize the Blackstone River. The concept is a river accessibility unit such as a ramp, stair, dock or other element that is able to accommodate the needs of three different types of uses: safety, recreation and limited commercial. Keeping these uses in mind, BEST must design an access unit while meeting the specifications for each use.

[25] http://www.tourblackstone.com/

At this point, BEST has collected limited data and specifications for the design process. As mentioned in section 2.3 – Project Planning; research, development and design will begin in spring 2014.

6.1 – Site Selected

There are multiple possibilities for our sites. The site itself needs to integrate with the Blackstone River Bikeway, have easy access and sufficient parking. In addition, the U-RAD design must consider the needs of rescue boats, the *Explorer* boat, ADA accessibility and human-powered vessels.

BVTC has provided little to no launch specifications, but RIDEM standards must be met. First the division of Coastal Resource Management Council (CRMC) must classify the type of body of water and determine whether or not the body of water can support a dock. The nature of the project automatically falls under the category of wetlands, which unavoidably falls under the jurisdiction of both RIDEM and CRMC. Because of the wetlands, BEST must proceed to request RIDEM verification and permission.

In general, water depth should be no less than three feet at the end of the ramp during mean low tide. For rescue boats that need a drive on trailer for launching and retrieving boats a five-foot depth is preferred. It is important to note that a dock meant for drive on trailers should not have an overhang or drop off. Siltation rates of the river are a factor in dock design because water depth in a river is not constant, and river channels sweep left and right, making an uneven ground to start with. [26] In general, one launch site should have 30 or more parking spots available. For a rescue site, a parking lot must still have room for the parked cars, but in addition, it must accommodate an emergency vehicle and supply ample room for a truck and trailer to access the launch ramp quickly.

Cost, maintenance, and sustainability are of concern for BVTC and BEST. BEST plans to take public and environmental safety very seriously in the implementing of our future design. We are striving

[26] Virginia State Government. ”Building a Dock.” http://www.dgif.virginia.gov/boating/building-boat-ramps.asp

for a positive economic, environmental and societal impact. Our goal is to make the best river access design possible to fit these many needs. The following information has been collected as we begin preliminary research.

6.2 – Current BVTC River Access Sites

There are a few already existing river access points related to BVTC. BEST will take the design of the existing sites into consideration when developing U-RAD. By relating the anticipated use of the universal site to the previously existing site, BEST can create a U-RAD usable for all intended purposes. When considering site design, Central Falls Landing has a ramp and adequate parking making it a desirable site for the Explorer and other limited commercial use. Manville Landing has a green park area and floating dock making it desirable for relational use. Both designs can provide insight into the implementation of U-RAD.

6.2.1 – Central Falls Landing

One access site in Central Falls is called the Central Falls Landing. This is located at Valley Falls off of Madeira Avenue in Central Falls, RI. This land ramp and floating dock combination has sloped access for kayaks and lightweight trailers at a city landing. From here, recreational users can do a short upstream flat-water paddle, turning around just before the Pratt Dam. Paddling south from here is not recommended considering the Valley Falls dam is about 50 yards downstream from the dock. The Blackstone Valley *Explorer* tour boat docks at this site in the summer. The *Explorer* runs public tours of the Blackstone River and Valley Falls Pond. One downfall of this site is that it is not ADA accessible.

FIGURE 24: CENTRAL FALLS LANDING

6.2.2 – Manville Landing

The second pre-existing site to be considered when developing U-RAD is Manville Landing. Despite all of the dramatic findings and costly remediation, Manville Landing is now a successful park and launch site. Unlike Central Falls Landing, Manville Landing does not accommodate large boats but is solely intended for use by small human-powered vessels – kayaks, canoes, rowboats, etc. The site features a boat launch ramp in addition to a floating dock.

FIGURE 25: FLOATING DOCK AT MANVILLE LANDING

6.3 – Design Specifications

As previously mentioned, BEST is to adhere to RIDEM's design specifications for boating access. These specifications include the ones set by the States Organization for Boating Access (SOBA) and California Division of Boating, as well as ADA requirements.

The SOBA Design Handbook (2006) for Recreational Boating and Fishing Facilities provides an in-depth explanation for all aspects of a boating facility. Site planning, design and construction of components, operation and maintenance, and accessibility are but a few of the topics covered in the handbook. For the scope of the SFA Project, the BEST RAD team focused on the design of waterside components and landside facilities. The components discussed and focused on in these sections include boat launching ramps and turnaround/maneuvering areas.

The California Division of Boating specifications closely align to those within the SOBA Handbook. Specifications for launching ramps are consistent throughout both documents, including desired slopes and design for low and high water levels.

ADA requirements are set to meet potential users with a disability. However, since site-specific design is intended for rescue use only, these requirements were not included in design.

The following specifications were compiled from all design documents and implemented in the actual design.

Site Evaluation:

1. Access site must be on Cutting side, not Depository Side of wake, but not where cutting access is strongest.
2. Determination of Minimum water depth (Design Low Water).
3. Determination of Maximum water depth (Design High Water).
4. Evaluation of existing structures and roadways for boat/trailer usage, obstructions to potential boat/trailer approach, natural waterside features.

Turnaround/Maneuvering Area:

1. Provide 60-ft (outside diameter) turnaround for vehicle-trailers to align with launch ramp.
2. Counter-clockwise direction desirable.
3. Vertical curve aligned with ramp.

Launching Ramp:

1. Orient ramp slightly downstream of predominant current.
2. Protect banks at sides of launch ramp with rip-rap at least 3 to 5 feet wide and 12 to 18 inches deep.
3. For single lane use, launching ramps should be 20 feet wide.
4. Launching ramps should have a 12 to 15 percent slope.
5. Top of launching ramp should be at least 2 feet above design high water level
6. Toe (bottom) of launching ramp should be at least 3 feet below design low water.
7. Transition from shore to slope of ramp should be made with a 20 to 30 foot long vertical curve.
8. Launching ramps can be constructed with cast-in-place concrete, concrete slabs, reinforced rebar, welded wire fabric and/or fiberglass strands.
9. Surface of ramp should be finished with a 1” by 1” V-groove design at a 60-degree angle to centerline, for vehicle traction.

To aid in design, the RAD team sought the input of Captain Shields, the Water Rescue Coordinator in Cumberland, RI. Captain Shields is familiar with the process that ensues for a rescue mission, and understands what it takes to have a smooth, successful rescue. His input and desired aspects of a rescue site, as previously described, were vital in developing a successful design.

6.4 Conceptual Designs

After selecting the Branch Street site as a design site, the team set to develop two designs for the site. The first design is a more general concept and disregards the plans for a bike path and focuses on maneuverability throughout the site. Ideally, this design can be used for multiple sites and can be easily altered to fit on a new site. The second design considers the proposed bike path along and is a more site-specific design. This design minimizes the intersection of bike path and turnaround area, promoting user safety. Both designs, however, share a common ramp. This ramp has the specific slope, vertical curve, height and length for the site.

To begin the design process, various conceptual designs were developed. Rough sketches and designs for turnaround areas and ramps were drawn-up and worked with to meet the specifications. Upon completing a survey of the Branch Street site, the BEST RAD team drafted an AutoCAD plan of the site. The plan included elevations and other significant aspects located on the site, such as existing trees, structures and property lines. The team was also provided with a detailed file of the site from the PWSB. Revealed in the file, were two effluent pipes on the site. As a result, initial designs were redeveloped to account for these features. This included changing the entire launching ramp location and an adjusted turnaround area.

Once the new ramp location was confirmed, the team worked to design a turnaround area that would meet the specifications and provide adequate space for all vehicle-trailer maneuvering. This was

met with some trouble due to the relatively small size of the site. To accommodate maneuvering needs, and to minimize construction costs, both designs utilize the existing entrance for the site as both an entrance and exit. A further description of the designs is provided in **Error! Reference source not found.**.

6.4.1 Evaluation and Comparison of Designs

Within the SOBA and California Boating Access documents were a number of possible river access designs. Launching ramps, boarding floats, floating docks and other abutments may be used to provide access to a waterway. The design team made the decision to utilize a single launching ramp to provide quick, easy access. Launching ramps meet the design needs for the site as well as require minimum construction costs and are relatively easy to maintain.

The team also used the input from Captain Shields and other sources regarding successful existing sites. An evaluation of these sites was made to determine what aspects play a role in its desirability. Manville Landing is the site with the most positive feedback (excluding the contamination and price issues). The site allows for ample maneuverability, parking and recreational areas. The river is accessed by use of a ramp or floating dock. Upon the site visit it was noticed, however, that the Manville Landing access point did not follow ADA requirements.

6.4.2 Patent Searches

No patent searches were completed for this project.

6.5 – Detailed Product Design

The design process produced two preliminary designs: one working with the site as is and another considering the proposed bikeway. The first design is intended to require minimum changes in the site configuration, while providing space for trucks to turn around and back the trailers and boats into the Blackstone River. The site features an gravel access road passing through the pre-existing gate, curving

to the right and forming a hammerhead loop which allows for a clockwise turning motion and backing approach to the boat launch. This design is helpful because it provides mobility to the vehicles and ease of access to the river.

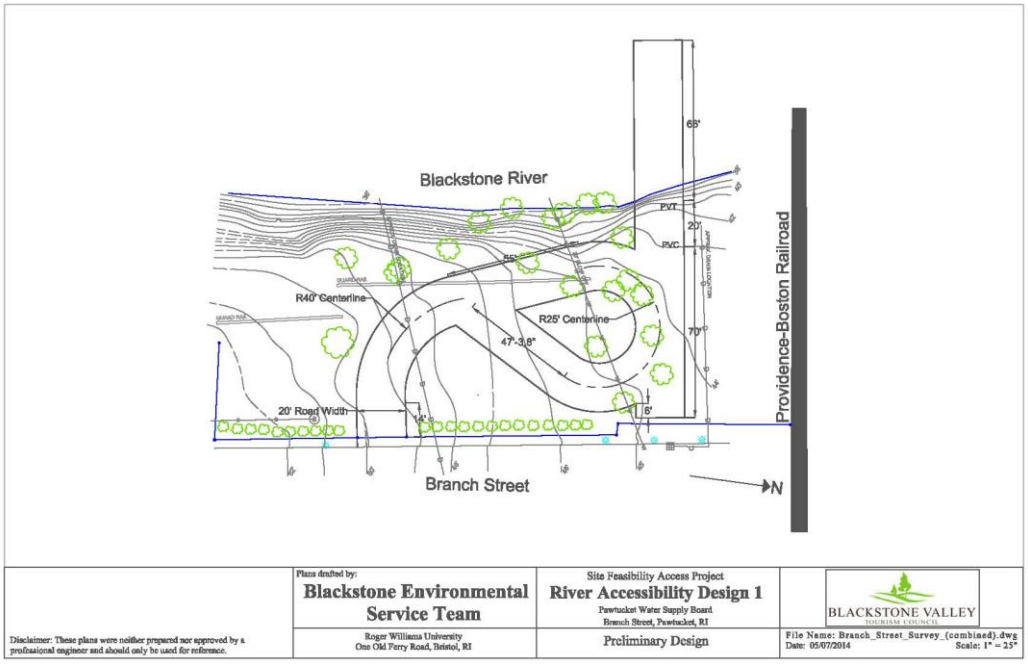

FIGURE 26: DESING 1, INCORPORATING THE ENTIRE SITE

The second design is configured with considerations of the proposed bikeway. It also features a gravel access road passing through the pre-existing gate. It then curves to the right and runs parallel to the bikeway and extends past the boat launch in order to allow trailers to approach the ramp by backing (counter-clockwise) down the ramp. This design is very tightly packed onto the site. It is difficult to design for a small space like this one.

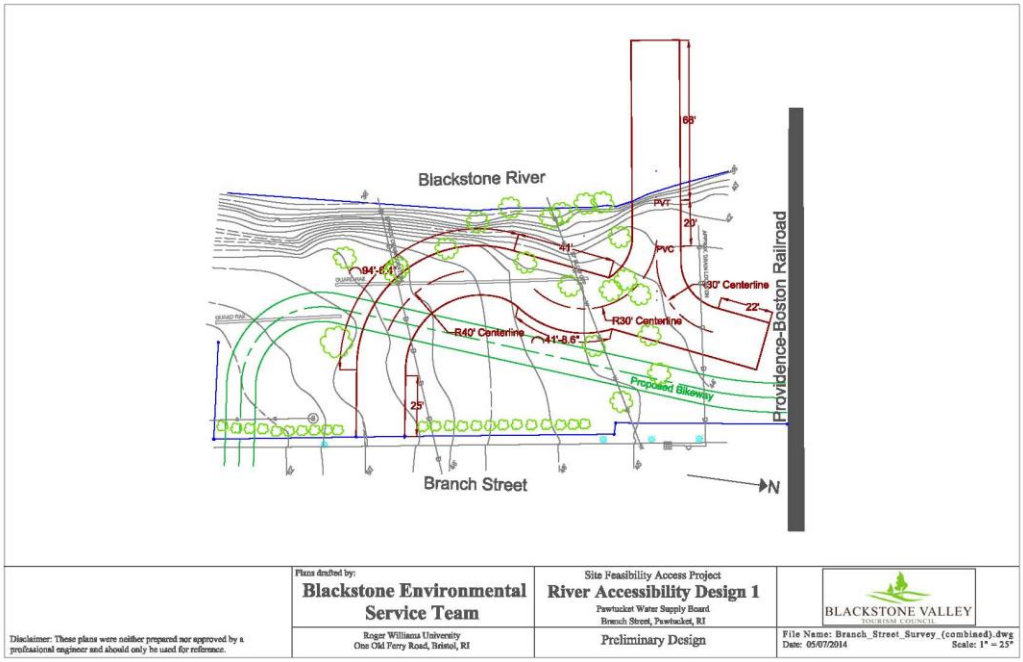

FIGURE 27: DESIGN 2, CONSIDERING THE PROPOSED BIKEWAY

Both designs share a common boat ramp design. This ramp will be constructed from concrete. It consists of a 20' vertical curve transferring the access road from horizontal to a 15% grade. The concrete, cast-in-place ramp will then extend 66 feet until it reaches the toe of the ramp, located three feet beneath the design low water.

Both designs and the ramp are described in more detail in **Error! Reference source not found.**.

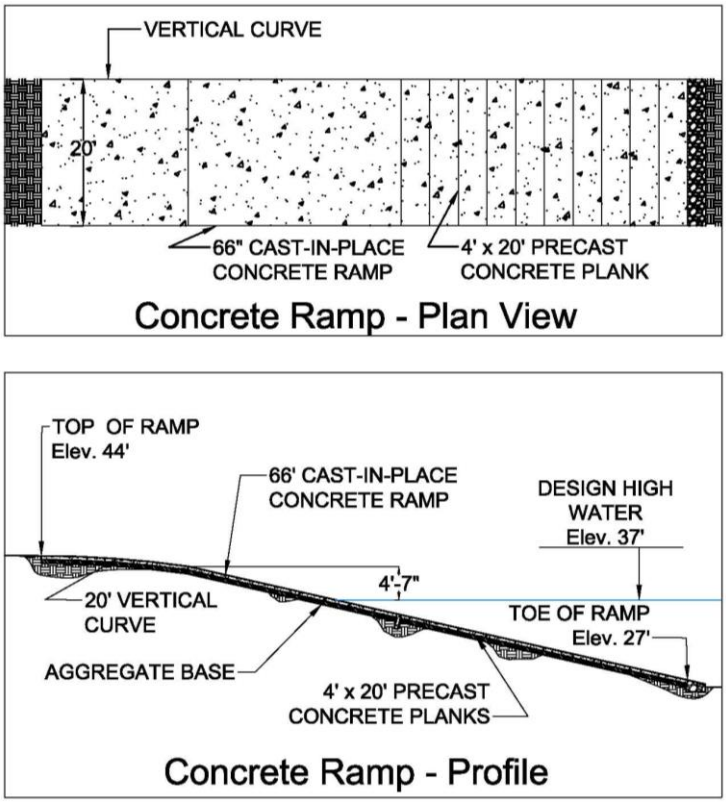

FIGURE 28: PLAN AND PROFILE VIEWS OF THE CONCRETE RAMP DESIGN

6.5.1 Implementation

In order for this project to be implemented, the first step for BVTC will be to complete actual environmental soil tests. If these tests return positively and the site is cleared for development, the site will be good. The next determination would be on the bikeway. If the bikeway is not to be developed, design 1 should be used. If the bikeway is to go through and be constructed, design 2 should be used.

The appropriate design would then be presented to a professional engineer to revise and approve. BVTC and RIDOT would then contract a construction company to implement the design.

6.5.2 Maintenance

Given the nature of the site as a solely rescue site, it will hopefully be used only on rare occasions. This means general wear on the access road surfaces and ramp will be minimal. The primary concerns will be frost heaves and flooding during rainy seasons and hurricanes. The former issue can be

closely monitored and repaired periodically to prevent the road's decay. The latter issue can be approached with limited predictability and almost no preventative action. BVTC and RIDOT can invest in flood insurance according to FEMA flood requirements.

6.5.3 Additional Considerations

A project like this is likely to have several types of impact in its implementation. Economically, it should be a fairly affordable project, especially if environmental remediation is avoided through the CLUE process. Environmentally, the project will remove a few trees and change the site topography; however the increased use by responsible parties (fire department, etc.) should imply that the site would be more closely monitored and kept clean of petty pollution. Socially, it will greatly increase safety between the Valley Falls Dam and the Roosevelt Hydroelectric Dam. Politically, if the site is successful, it will provide an example project for BVTC to use in lobbying for more funds to be used for developing the Blackstone Valley Historic Corridor. Ethically, the site being used is public property and will not infringe on anyone's rights or privacy. As a matter of sustainability, the design is very simple and will use low permeable materials in all cases, except the boat ramp itself.

7 – Results from Project Dissemination

As a part of our participation in the senior design course, our presence at the American Society for Engineering Education conference (ASEE), Student Academic Showcase and Honors conference (SASH) and the RWU Community Partnership Center conference was necessary. The ASEE conference features our poster as well as professional student papers and posters from various engineering disciplines. We represented RWU amongst engineering educators, graduate students, undergraduate students, and STEM educators at the University of Bridgeport on April 4th, 2014. For the SASH conference, Meagan Connelly presented our poster to undergraduate and graduate students and faculty from RWU. The goal of this presentation was to celebrate the community connections and contributions that we have made and the client relationships we have started. Tim and Tayla attended the CPC conference, which was a great opportunity to share our project's accomplishments with the RWU community. It is important that we show our work and are ready to explain our project work so that it may be expanded upon or implemented in the future.

A positive project outcome would be to promote sustainable commercial tourism to raise money and benefit the community by restoring and revitalizing the Blackstone River for recreational use. The SFA Project aims to increase access for rescue teams by providing rescue sites for community safety. The BVTC will be able to use boat launch access sites for their Explorer Boat to expand their river tours, which would help increase general interest and raises money to maintain our waterways for future generations.

To achieve completion of the project, CLUEs are done for many sites along the river. Historic information is collected, and a risk rating system is employed to determine risk severity. A CLUE report is then used to aid in a professional recommendation of sites that are being studied for recreational development.

Possible changes that the SFA project hopes to stimulate are the completion of the Blackstone Valley Bikeway by 2018, increasing public usage of the Bikeway, enabling the continuation of BVTC annual events, re-launching of the Samuel Slater Canal Boat, completion of the Blackstone River Cleanup by 2015, changing the status of the river to allow some limited fishing, and the ultimate designation of the Blackstone Valley as a national park.

The SFA project has developed guidelines for the CLUE report format, such as the CLUE methodology, Site Risk Rating System, etc. These items should be available in the future so this project can be replicated. The adoption of the methodology and formatting will make for an efficient, streamlined process for the next project. Our strategy is to promote our methods through BVTC, RIDOT, and RIDEM.

Accessibility of the project deliverables after the project deadline occurs and the project engineers' end their work will be available to the Roger Williams University SECCM technical mentors and advisors, BVTC, RIDOT, and RIDEM. Each of these organizations will be provided a copy of CLUE Reports and CLUE Methodology upon request. Every project engineer for the SFA project has been in contact and directly working alongside the mentioned agencies.

B.E.S.T.'s findings are based on professional judgment concerning the significance of the data gathered during the CLUE Methodology process. B.E.S.T.'s risk assessment has been conducted in accordance with generally accepted engineering practices. B.E.S.T. recommendations cannot represent that the Site contains no hazardous material. The CLUE process involved reliance on information obtained from State and local agencies and officials. B.E.S.T. claims no responsibility for the accuracy of this obtained information. No special permissions are necessary to distribute the project deliverables. This is to make sure deliverables can be freely accessible to the teaching, learning, community and

government agencies after the project ends. There are no intellectual property rights associated with the SFA Project.

The important project documentation is preserved on an external flash drive labeled "Blackstone Valley", which is RWU property. All records are also shared within the project members' Google Drive. There is no cost to maintaining the deliverables. Bound paper copies will cost more than $50.00 to print at an office supply store.

City planners, civil engineers, geographers, landscape architects, and surveyors may have an interest in obtaining a copy of the design criteria and final U-RAD designs created. These designs may prove to be a very useful tool to use for a different project that has similar outcome goals. Similarly, environmental engineers, consultants, and restoration planners may be interested in obtaining a copy of the CLUE reports, CLUE methodology or Site Risk Rating System. The CLUE Methodology is a great guide for conducting a CLUE for a project with a similar scope. The deliverables for the SFA Project are meant to maintain long-term sustainability. The site assessments risk ratings and design plan will remain relevant and so that environmental assessments with a similar scope may be finished efficiently with the use of the CLUE methodology.

The SFA project has captured interest all around Rhode Island. The revitalization of the Blackstone River is a popular topic among locals and tourists alike. Presentations to the RWU faculty, the ASEE conference, and project managers and mentors have been utilized to present the findings from the project and all have all resulted in favorable feedback and requests for further information.

B.E.S.T. predicts that any future project will include unlimited possibilities, all for the benefit of the Blackstone River. Future participants in this project may extend B.E.S.T.'s scope of work or create their own. The SFA project has laid most necessary groundwork to lead the BVTC in the correct direction with planning, permitting and building of an access site.

Recommendations for possible RWU students if the Senior Design Project shall recur next semester would be to use the CLUEs and do further research such as a geotechnical investigation to bring the project into the next phase. After that, work with the BVTC to obtain "Environmental Determination of no Significant Impact" and the proper permits from RIDEM so that construction can proceed. Ideally, the next step is to design and price the project while working alongside the BVTC. All of these components need to be addressed should there be a recurring RWU Senior Design Project with the BVTC. This project will prove to be an excellent learning experience for civil and environmental engineers as it is community based, and complementary to entry level engineering jobs. It also has introduced B.E.S.T. with Bob Cox (SFA Project Manager), Robert Billington (President and CEO of the Council), and countless others who are dedicated to bringing vitality back to the Blackstone River.

B.E.S.T. has learned from project managers and mentors, and formed new contacts and networks that will continue to be useful to Roger Williams University following the completion of this project. Across the two-semester length, the project team has fully met all of the Senior Design requirements and scope of work. B.E.S.T. hopes that the deliverables made and outputs of this project will continue to be relevant long after the SFA Project has ended, and continues on to completion in the near future.

8 – Final Cost Analysis

A benchmarked figure will fit into a range determined by researching and comparing a variety of sources. The resources used in this report to find an average salary are: Salary.com, Job Search Intelligence.com and Bureau of Labor Statistics, bls.gov. These websites offer the most accurate compensation data available according to education level, region, and sector. The entry-level salary results are, respectfully, $50,249, $59,000 and $64,940. The benchmarked figure is equal to the average

of all salaries researched. A typical starting salary for an associate level Environmental Consultant in the Providence, Rhode Island area is $58,063. Incorporating this into the cost analysis:

Project Length (months):	8
Days/month worked:	20
Hours/day:	4
Hours worked:	640
Benchmark Rate: **(Entry Level Environmental Consultant)**	$58,063.00
# of Environmental Consultants:	4
Total Projected Rate:	**$232,252.00**

TABLE 12: ESTIMATED COST TO HIRE BEST FOR THE SFA PROJECT.

Mileage for the Blackstone SFA Project is figured with the standard mileage rates from 2014 of $0.56 per mile. The following table is a log of the dates on which we conducted Preliminary Site Visits. For example, Preliminary Site visits for Mill Street, High Street and River Street were conducted all together on 10/18/2013. Along with potential launch sites, we traveled to multiple City Halls, the Rhode Island Historical Society Library, the Rhode Island Department of Environmental Management, and the BVTC office.

Mileage Log- Blackstone SFA Project

Rate Per Mile	$0.56
Period	August 2013 – May 2014
Total Mileage	520.9
Total Cost	$291.70

Date	Description	Starting Location	Destination	Miles	Mileage Cost
10/18/2013	Initial Site Visit Start Location	Roger Williams University	987 High Street, Central Falls, RI	21.26	$11.91
10/18/2013		987 High Street, Central Falls, RI	53 River Street, Central Falls, RI	0.42	$0.24
10/18/2013		53 River Street, Central Falls, RI	45 Medeira Avenue, Central Falls, RI	0.37	$0.21
10/18/2013		45 Medeira Avenue, Central Falls, RI	85 Branch Street, Pawtucket, RI	1.71	$0.96
10/18/2013	Initial Site Visit End Location	85 Branch Street, Pawtucket, RI	Roger Williams University	21.1	$11.82
10/19/2013	Mill Street Site Visit	Roger Williams University	35 Mill Street, North Smithfield	36	$20.16
10/19/2013		35 Mill Street, North Smithfield	Roger Williams University	36	$20.16
10/24/2013	Central Falls City Hall	Roger Williams University	580 Broad Street, Central Falls, RI	24.77	$13.87
10/24/2013		580 Broad Street, Central Falls, RI	Roger Williams University	24.77	$13.87
11/22/2013	North Smithfield City Hall	Roger Williams University	64 Farnum Pike Smithfield, RI	8.22	$4.60
11/22/2013	Pawtucket City Hall	64 Farnum Pike Smithfield, RI	42 S Main Street Woonsocket RI	9.96	$5.58
11/23/2013	Museum of Work and Culture	42 S Main Street Woonsocket RI	Roger Williams University	32.7	$18.31
11/23/2013	RI Historical Society	Roger Williams University	121 Hope Street, Providence, RI	17.91	$10.03
11/23/2013		121 Hope Street, Providence, RI	Roger Williams University	17.91	$10.03
12/4/2013	RI Department of	Roger Williams University	83 Park St, Providence, RI	19.61	$10.98
12/4/2013	Environmental Management	83 Park St, Providence, RI	Roger Williams University	19.61	$10.98
2/3/2014	Cumberland City Hall	Roger Williams University	137 Roosevelt Ave, Pawtucket, RI	23.9	$13.38
2/3/2014	Albion Road Site Visit	137 Roosevelt Ave, Pawtucket, RI	30 Albion Road, Cumberland, RI	15.8	$8.85
2/3/2014	Park Street Site Visit	30 Albion Road, Cumberland, RI	83 Park Street, Cumberland, RI	4.22	$2.36
2/3/2104		83 Park Street, Cumberland, RI	Roger Williams University	25.8	$14.45
3/3/2014	Meeting with BVTC	Roger Williams University	175 Main St #4, Pawtucket, RI	23.57	$13.20
3/3/2014		175 Main St #4, Pawtucket, RI	Roger Williams University	23.57	$13.20
2/28/2014	R&D Site Visit	Roger Williams University	Manville Landing, Lincoln, RI	30.51	$17.09
2/28/2014		Manville Landing, Lincoln, RI	Sycamore Landing, Manville, RI	0.49	$0.27
2/28/2014		Sycamore Landing, Manville, RI	Roger Williams University	30.58	$17.12
4/7/2104	R&D Site Survey	Roger Williams University	85 Branch Street, Pawtucket, RI	25.07	$14.04
4/7/2014	Round Trip		Roger Williams University	25.07	$14.04
				520.9	$291.70

TABLE 13: MILEAGE AND TRAVEL COSTS DATA FOR BEST.

All other economics to consider are the cost of the Design Manual ($80), the cost of printing out the first final report at Staples ($100) and our visit to The Museum of Work and Culture ($60). The final Cost of this project, incorporating mileage and expenses is $531.70.

9 – Recommendations

Although the DEM has this property on record as having been previously remediated, BEST recommends the implementation of further study and soil testing to ensure without a reasonable doubt that this property does not exceed any toxic levels of contamination. Hydrogeological studies, which implement topographical maps with test pits and wells, are invaluable to forming an opinion about any possibility that Branch Avenue is the down gradient recipient of contamination. Also, the Pawtucket

Water Supply Board across the road is a current Small Quantity Generator of waste oil, so there is a potential for contamination if an accident should occur.

It is important to note that URAD plans and CLUE methodology do not cover the replication of wetlands, yet this does not imply that wetlands will not be a significant factor in feasibility. There must be land available in order to replicate the appropriate amount of wetlands to comply with permit requirements. In order to satisfy the DEM and the conservation commission, a plan must be submitted which shows existing elevation contours of the wetland replication area on the site as well as the intended final elevation.

10 – Conclusion

In the Spring Semester, BEST was able to complete the CLUE reports and U-RAD site designs. All five sites were visited and windshield reviews were completed. The team visited town halls, the DEM and the Rhode Island Historic Society to collect information on each of the sites. The CLUE reports were completed for all sites and a comparison was made to determine which site would be best for use as a U-RAD site. The process of CLUE has had significant impact within the Rhode Island community. The team prepared a CLUE Methodology document to explain the process involved in conducting CLUEs and comparing sites. This methodology will most likely change the way RIDOT conducts such land use evaluations.

Beyond the CLUEs, the team also came up with two Universal River Accessibility Designs for the Branch Street site. These designs were developed to best use the property as well as integrate with current and proposed infrastructure. The design team was successful in developing a compelling design to be presented to BVTC for consideration in future developments.

Despite major changes in scope and focus, the project still maintained value as a learning opportunity for the students and a benefit to the client. The work of the BEST has helped BVTC in their endeavors and had a significant impact on RIDOT. The Site Feasibility project was a complimentary partnership between the university, state and a non-profit organization. This project was a great success.

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Appendix A – Project Documents

BEST Scope of Work

The following tasks will be completed by, the Blackstone Environmental Service Team (BEST) in cooperation with the Blackstone Valley Tourism Council (BVTC) and local town agencies:

Corridor Land Use Evaluation (CLUE)* - Including, but not limited to, the following sites:

- Central Falls:
  - River Street - Department of Public Works (Plats 2-200/200A/201)
  - High Street - Saul Tarlow/High Street Ballfield (Plat 2-189)
- North Smithfield:
  - Mill Street - The Meadows (Plat 3-183)
- Pawtucket:
  - Branch Street - Pawtucket Water Authority (Plat 6a-587)

Universal River Accessibility Design (U-RAD)

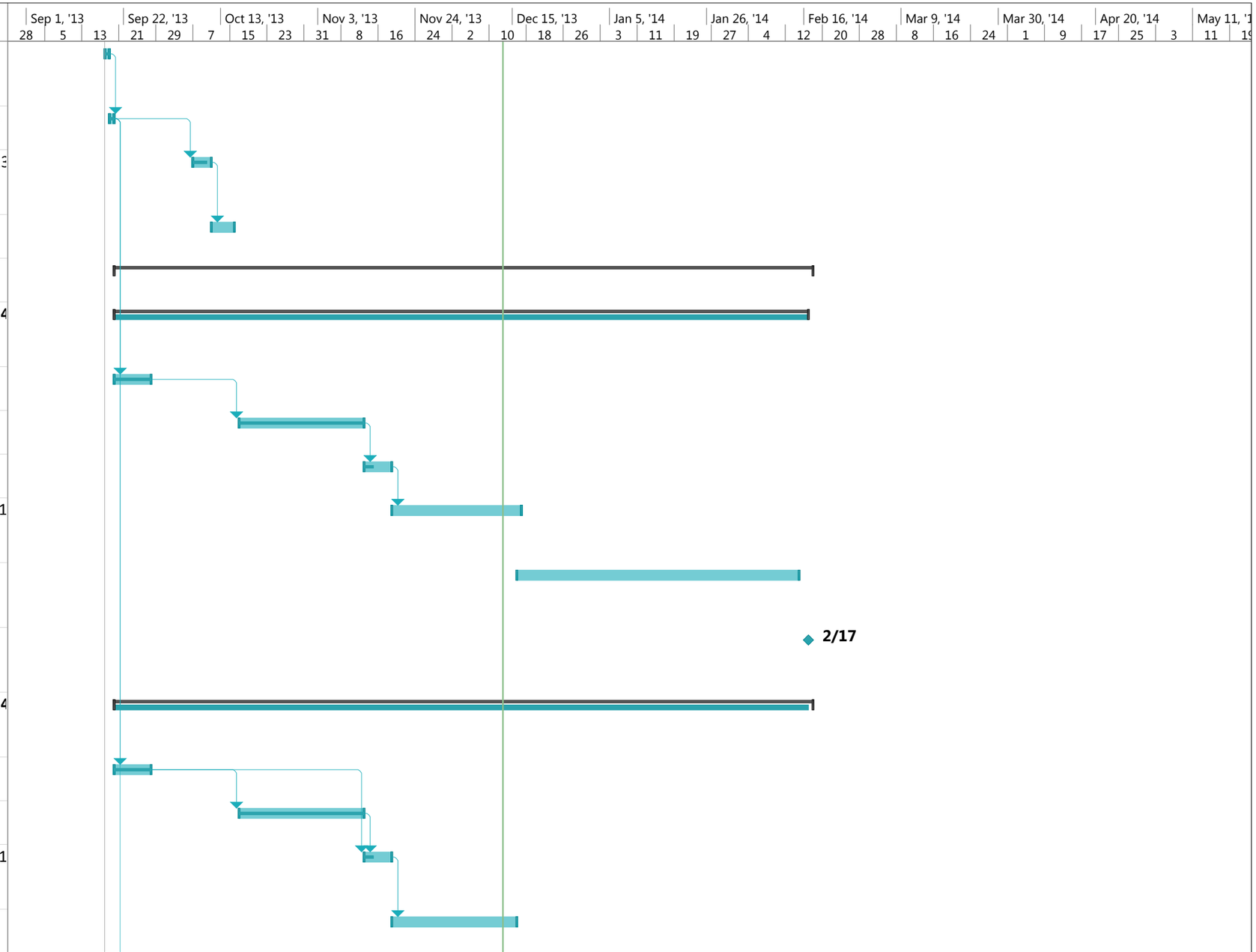
- Integration with Blackstone River Bikeway
- Combination of uses (Rescue, Recreation, Explorer)
- Rescue Team River Entry
  - Boat Launch Specifications
  - Possible design for Hoyer lift
  - ADA accessible
- Recreation Use River Entry
  - A Launch area
  - ADA Accessible
- Explorer River Entry
  - BVTC Launch Specifications

*CLUE is defined as A Corridor Land Use Evaluation identifying properties along a project alignment that may be a potential source of contamination or threat to the project alignment in which excavation is required. Any properties identified as potential concerns would be subject to more rigorous investigation. CLUE is also used to assess the potential for contamination on properties abutting the alignment. The evaluation should consist of a description of all properties abutting project alignment and their uses. Tasks to be conducted:

(A) Regulatory Review
(B) Historical Review
(C) Preliminary Site Survey

Appendix B – Project Schedule

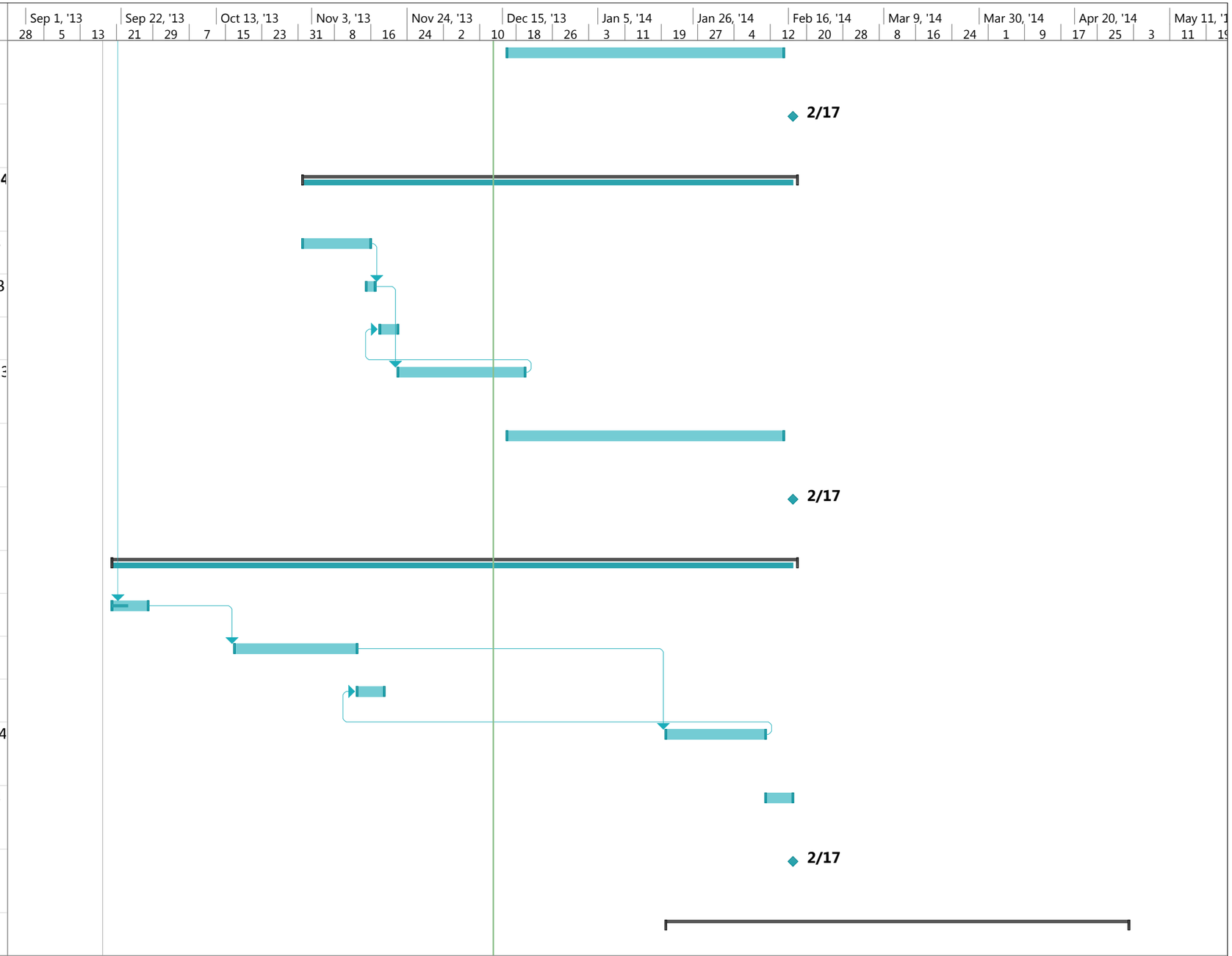
ID	Task Mode	Task Name	Duration	Start	Finish
1		Meet with BVTC Representative (Bob Cox)	1 day	Wed 9/18/13	Wed 9/18/13
2		Visit Sites in Central Falls and Pawtucket	1 day	Thu 9/19/13	Thu 9/19/13
3		Draft Scope of Work	4 days	Mon 10/7/13	Thu 10/10/13
4		Finalize Scope of Work	3 days	Fri 10/11/13	Tue 10/15/13
5		**Corridor Land Use Evaluations**	**107 days**	**Fri 9/20/13**	**Mon 2/17/14**
6		**High Street**	**106 days**	**Fri 9/20/13**	**Mon 2/17/14**
7		Windshield Review	6 days	Fri 9/20/13	Fri 9/27/13
8		Detailed Research with	19 days	Thu 10/17/13	Tue 11/12/13
9		Site Analysis	4 days	Wed 11/13/13	Mon 11/18/13
10		Draft CLUE	20 days	Tue 11/19/13	Mon 12/16/1
11		Refine CLUE	45 days	Mon 12/16/1	Fri 2/14/14
12		Final CLUE Report and Recommendatior	0 days	Mon 2/17/14	Mon 2/17/14
13		**River Street**	**107 days**	**Fri 9/20/13**	**Mon 2/17/14**
14		Windshield Review	6 days	Fri 9/20/13	Fri 9/27/13
15		Detailed Research with	19 days	Thu 10/17/13	Tue 11/12/13
16		Site Analysis	4 days	Wed 11/13/1	Mon 11/18/1
17		Draft CLUE	20 days	Tue 11/19/13	Sun 12/15/13



Project: BEST Project Outline
Date: Fri 12/13/13

Task	Project Summary	Manual Task	Start-only	Deadline	
Split	Inactive Task	Duration-only	Finish-only	Progress	
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress	
Summary	Inactive Summary	Manual Summary	External Milestone		

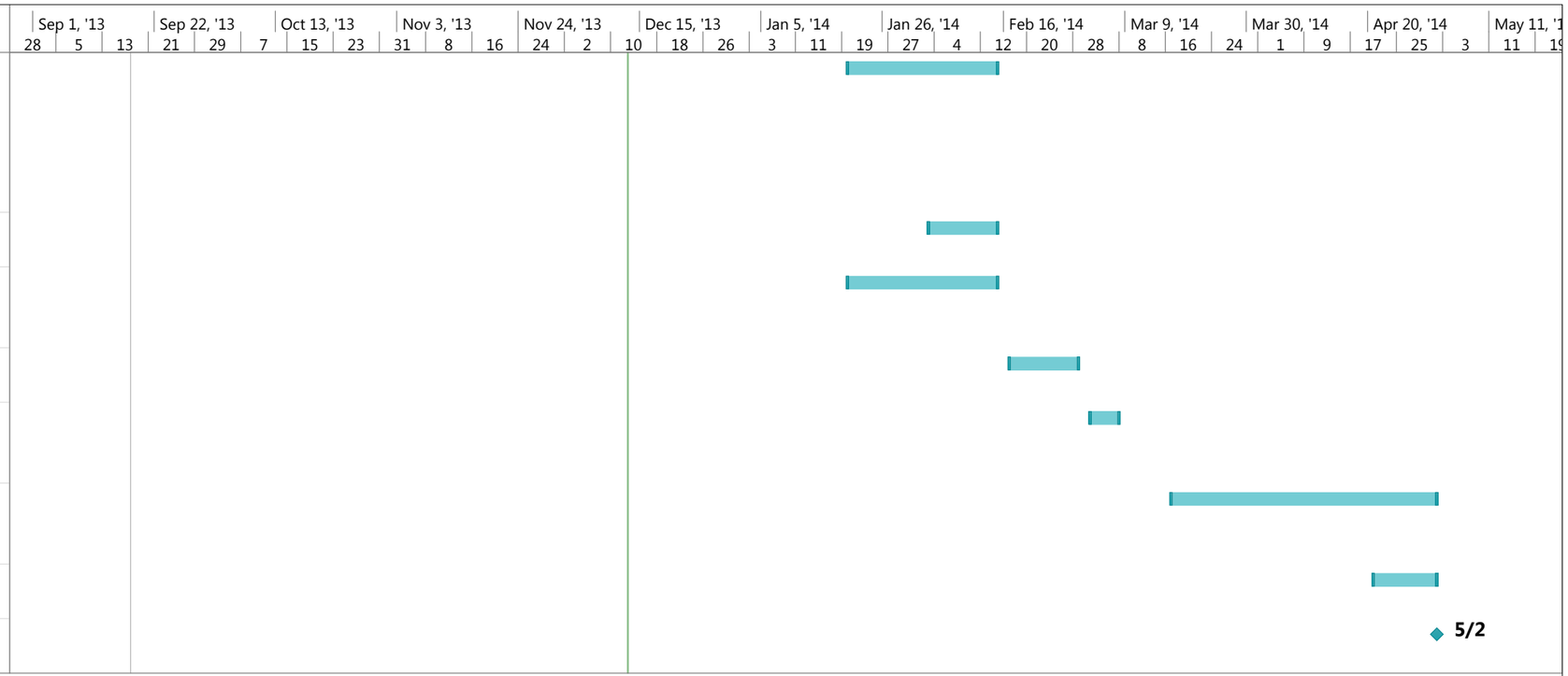
ID	Task Mode	Task Name	Duration	Start	Finish
18		Refine CLUE	45 days	Mon 12/16/1	Fri 2/14/14
19		Final CLUE Report and Recommendatior	0 days	Mon 2/17/14	Mon 2/17/14
20		**Mill Street**	**77 days**	**Fri 11/1/13**	**Mon 2/17/14**
21		Windshield Review	11 days	Fri 11/1/13	Fri 11/15/13
22		Detailed Research with	2 days	Fri 11/15/13	Sat 11/16/13
23		Site Analysis	4 days	Mon 11/18/13	Thu 11/21/13
24		Draft CLUE	20 days	Fri 11/22/13	Thu 12/19/13
25		Refine CLUE	45 days	Mon 12/16/1	Fri 2/14/14
26		Final CLUE Report and Recommendatior	0 days	Mon 2/17/14	Mon 2/17/14
27		**Pawtucket Water Authority**	**107 days**	**Fri 9/20/13**	**Mon 2/17/14**
28		Windshield Review	6 days	Fri 9/20/13	Fri 9/27/13
29		Detailed Research with	19 days	Thu 10/17/13	Tue 11/12/13
30		Site Analysis	4 days	Wed 11/13/13	Mon 11/18/13
31		Draft CLUE	16 days	Mon 1/20/14	Mon 2/10/14
32		Refine CLUE	5 days	Tue 2/11/14	Sun 2/16/14
33		Final CLUE Report and Recommendatior	0 days	Mon 2/17/14	Mon 2/17/14
34		**Universal River Accesability Design**	**74 days**	**Mon 1/20/14**	**Fri 5/2/14**



Project: BEST Project Outline
Date: Fri 12/13/13

Task	Project Summary	Manual Task	Start-only	Deadline	
Split	Inactive Task	Duration-only	Finish-only	Progress	
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress	
Summary	Inactive Summary	Manual Summary	External Milestone		

ID	Task Mode	Task Name	Duration	Start	Finish
35		Collect Specifications (Safety, Recreation, Limited Commercial)	20 days	Mon 1/20/14	Fri 2/14/14
36		Survey Access Points at Sites	10 days	Mon 2/3/14	Fri 2/14/14
37		Research Designs	20 days	Mon 1/20/14	Fri 2/14/14
38		Conceptualize Designs	10 days	Mon 2/17/14	Fri 2/28/14
39		Select Design	5 days	Mon 3/3/14	Fri 3/7/14
40		Finalize Design	34 days	Mon 3/17/14	Thu 5/1/14
41		Analyze Financials	9 days	Mon 4/21/14	Thu 5/1/14
42		Present Final Design	0 days	Fri 5/2/14	Fri 5/2/14



Project: BEST Project Outline
Date: Fri 12/13/13

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone

Appendix C – CLUE Methodology

SITE FEASABILITY ACCESS PROJECT

CORRIDOR LAND USE EVALUATIONS METHODOLOGY

ROGER WILLIAMS UNIVERSITY

TEAM MEMBERS: MEAGAN CONNELLY AND NOELLE LAFLAMME

PROFESSIONAL CLIENT: THE BLACKSTONE VALLEY TOURISM COUNCIL

FACULTY ADVISORS: DR. ANTHONY RUOCCO AND DR. JANET BALDWIN

SUBMISSION DATE: 12 MAY 2014

Introduction

A CLUE is a way to evaluate the risk of the presence of unidentified hazardous material located on a parcel of land. The CLUE process is the initial step to an environmental assessment, and requires no environmental sampling and analysis. The American Society for Testing and Materials Standards states that "no samples are to be collected and/or analyzed during the first stages of the environmental site assessment process." After completion of the CLUE, samples should be taken to confirm the results prior to commencing construction activities.

The tasks to be conducted include a preliminary site visit, historical review, and regulated facilities review for each site and its abutting sites. Prior to the site visit, examination of available online aerial maps can help identify areas that should be further explored during the on-site visit. An on-site visit is necessary in order to further expose potential problems. During this visit, careful record keeping and photo documentation of the actual site is required. A site visit is followed by a thorough investigation of the historical records kept by the local historical society, town hall, and other local agencies. If the site requires even more investigation, the state department of environmental management should be visited to gather information on records of known environmental problems.

A combination of site visits and reviews of historical land use and regulated facilities will bring a great deal of insight into an otherwise undocumented chemical releases onto the property of interest. A CLUE incorporates historic evidence and visual evidence to determine if a property needs more rigorous investigation.

The CLUE Process:

The Preliminary Site Visit

The first step in performing a CLUE is the Preliminary Site Visit. A Preliminary Site Visit consists of locating and visiting the site in question. Any interactive map with clear aerial photography may be used to provide a general overview of a site and its surroundings.

Online applications provide the most current data available by satellite and are free and easy to use. By using the online applications, you can plan your trip to each site, view existing bike paths, understand traffic patterns, and create collaborative maps, which can be shared with project members. One way of keeping track of each site in the study is to use the placemark function on the Google Earth[1] application.

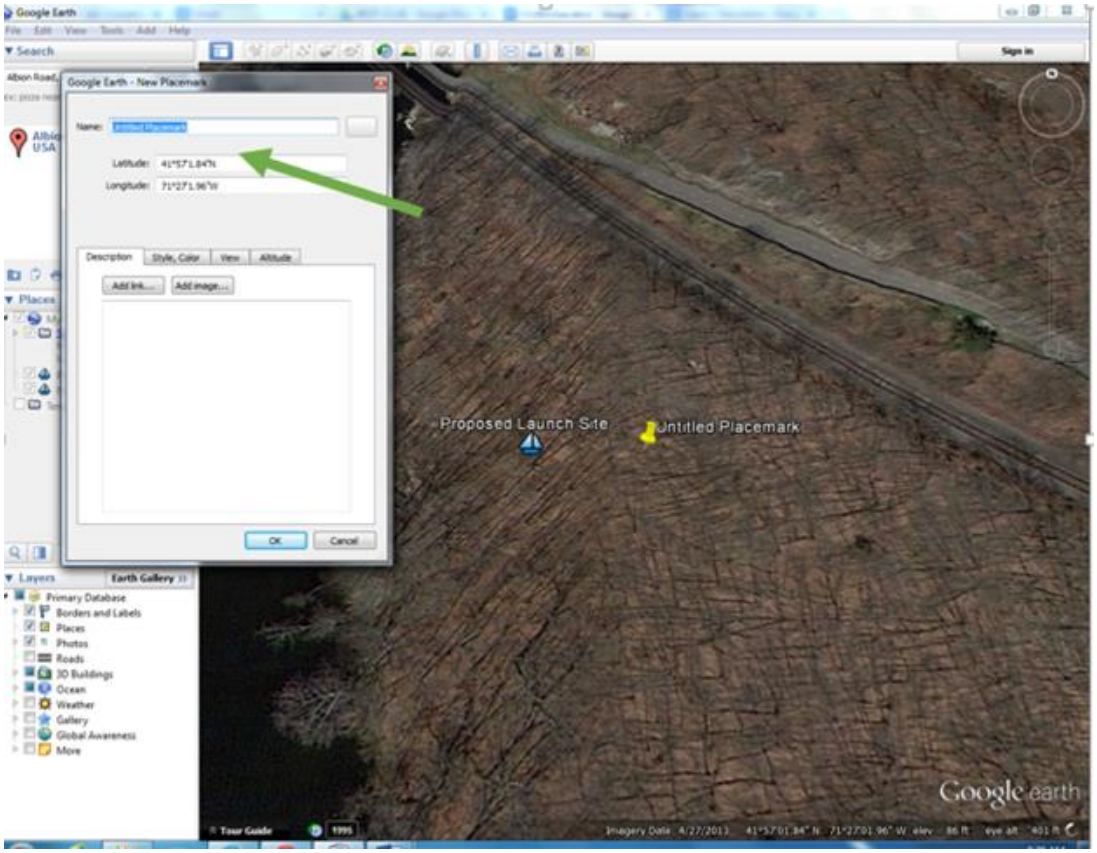


Figure 1: How to make placemarks in Google Earth

To view documented imagery from 1995-present, click on the clock icon in the lower left corner (See the blue arrow). A time slider will appear in the upper left hand corner. Slide left or right until a satellite

[1] http://www.google.com/earth/download/ge/agree.html

shot of the site appears. If even older site information is needed, most cities have old aerials photos (dating back to the 60s) in the local town hall or historical society.

Figure 2: How the placemarks are seen in Earth View

After examination of the site on the online aerial maps, the next step is to perform a physical site visit. A site visit requires more than a visual tour of the area. Careful documentation is critical to making a valid judgment of conditions. During the visit, the sites and its abutters must be carefully photo-document, making sure that any environmental concern is noted.

There are many details to note in the virtual and on site visit. Firstly, note how to access the area. If there is a convenient access road, research to find out if the road allows public access. If there are no access roads, there may be trails through wooded areas. Maintenance of these trails are variable, thus, it is important to take precautions to ensure safety in the woods. If the site is on private property, it is necessary to ask the landowner for access to the site. If the site is located near a river or lake, it may be necessary to access the site by waterway travel such as kayaks, canoes and boats.

If there are any existing structures, this may give an indication to the site's current use. Make sure to note if there is unlawful dumping of trash, fire pits, man made trails, dirt bike tracks, etc. Document if there are any signs of available utilities, such as public or private wells, electric poles or sewer lines. If

there are survey markers or property boundary lines that are clearly marked, note that this data was available because it may be useful later on. Any visible easements for electrical transmission lines should be located.

An important part of the investigation is to know how ecologically sound the area is. This may be the first indicator of a real issue. If there is burnt/stressed vegetation that is an indicator of soil pH issues that may need further attention. If the topography of the site is noticeably unnatural, this may mean that the site was previously excavated, which could have resulted in anything from oil drums buried deep within the soil or remediation. Erosion is also a sign of excavation of soil. If there are noticeable signs of water runoff eroding the soil, this could mean anything from a large rainstorm hit the area, or someone uphill is diverting water (whether it be storm or waste) onto the site. The age of trees is also important to note. In some situations, the height and girth of the trees is a tell tale sign of how long it has been since a site has been developed. Also, the species of tree will help to identify which kind of soil the site has. The condition of the trees is also important to note, because if the trees are leaning, they have shallow roots, indicating a possibility of waste buried shallowly beneath the surface.

The Historical Review

A historical review is done to find the ownership chain of title of a site. This begins at the town hall. The town clerk is the initial source of information based on deeds and tax records. Some clerks keep records locally, others may store the oldest records in libraries or at county offices. Once on the town's website the easiest method is to use the websites search feature to search for plat map, tax map, or tax assessor. If the tax/parcel maps cannot be founds, it might be easier to call the town hall and ask for them to give directions for their specific website. Emailing the tax assessor to schedule an appointment and explain the purpose of the visit allows the tax assessor to plan ahead to have information available upon arrival.

Go to the Tax Assessor's office and search for the plat map number for the location. Once the plat map number is found, a search for the historical chain of title may be performed. The historical chain of title includes the names of previous owners pre-dating any tax assessor database data available on the web. This is the best method for doing a complete investigation of previous land use.

The following are details to take note of while the investigation of historical use is being conducted. In addition to the site of interest, record any chain of title data for the abutting sites.

If you cannot photo-document the chain of title, collect the data in an organized fashion**.** Be sure to include the following information found on the Chain of Title:

- Plat and lot number for site and abutting lots
- Previous ownership (residential, industrial, governmental, etc.)
- Dates of ownership

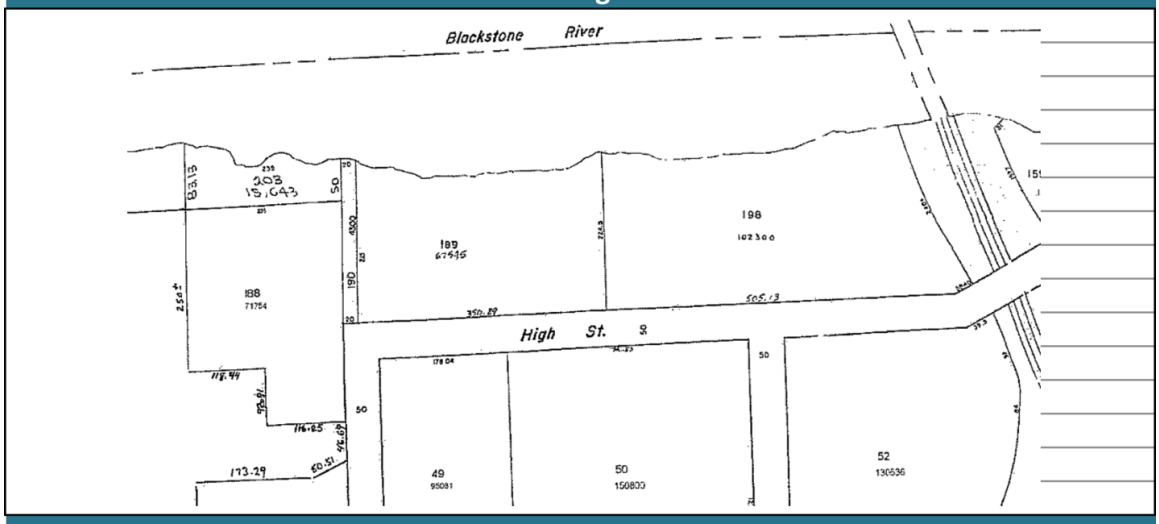
Please note that parcel numbers change throughout time and the lot number of the site may have been previously part of another lot or numbered differently. If this is the case, be sure to gather all information regarding the lot and the chain of title for the previous lot numbers as well.

Our example CLUE research form, pictured in figure 3 below, is an organized way to document the site name, plat map number, and land history from the chain of title. This is a simple sheet generated by the researcher to maintain organization throughout the data gathering. Note the space that has been left to draw (or copy/paste) a site diagram which fully explains the site locus. Other pieces of information to consider writing down are what the proposed site may be used for, the city the site is located in and the latitude and longitude.

CLUE Research Form

Site Name	High Street	**City**	Central Falls
Plat Map #	2	**Proposed Site use**	Rescue
Plat #	189A		

Site Diagram



Land History

Lot Number	Year	Past Owners Name	Type of Buisness	Hazardous Material
198	1989	Sanford Fink and Francine Fink	Furniture Production	Y / N
198	1960	Kings Trucking Co Inc	Auto Parts	Y / N
198		Kings Auto Parts Corp	Auto Parts	Y / N
56	1900	Five Gee Realty Corp	Realtors	N
56	1957	United Laces and Nets Inc	Lace Manufacturing	N
56	1967	Brewster Investment Corp	Investors	N
55	1892	New England Electrolytic copper Co started by H. R. Caulfield in 1892	Copper Refinery	Y
55	1905	J.H NR		N
55	1905	W. A Harris Steam Engine Co		Y
55	1929	Waypoiset Manufacturing Co		Y
55		City of Central Falls		N
189	1900	City of Central Falls	Municipal	N
189	1976	Brewster Industries Corp	Real Estate Brokers	N

Figure 3: Research Form Example

For a thorough investigation, find historical maps at the local historical society and/or their website. In the Rhode Island and Massachusetts area, the Sanborn Fire Insurance maps are useful. As for other states, using old atlas maps are usually sufficient enough for the historical maps part of the project. An example of an historical map is pictured in Figure 4**.** In addition to Interviews with neighbors, firefighters, and local officials may bring to light information about accidents that may have caused

chemical releases. Newspaper accounts may provide additional insight into an otherwise undocumented accident.

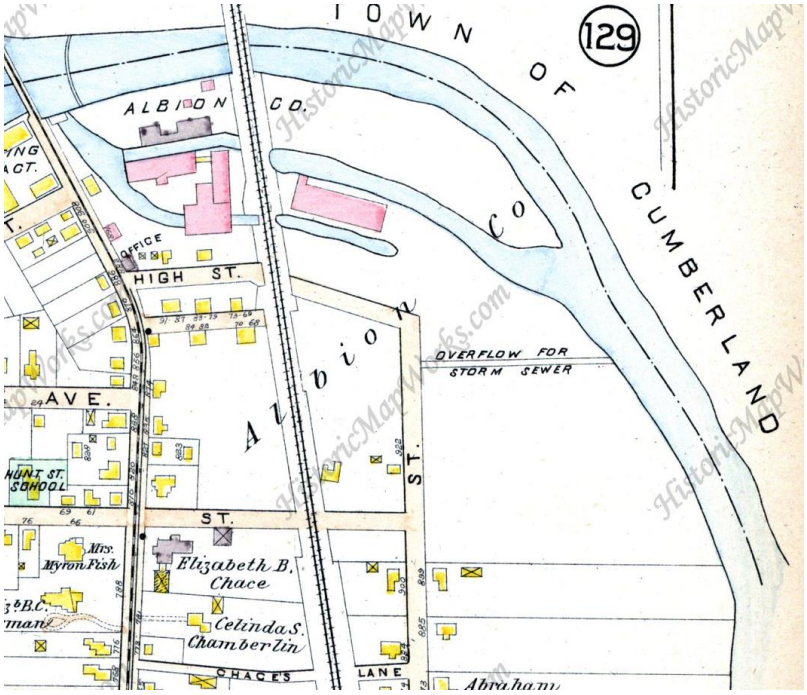


Figure 4: A historical map example

Another method of finding useful information is to search for the state's local Geographical Information System (GIS) software. There may be a variety of different maps available including interactive maps, screenshots of paper maps, historical aerial views, and the GIS maps. An example of how to find this GIS software is to visit the department of environmental management's site. The GIS software provided on RIDEMs website is easy to use and is much like Google earth. There is more detailed information to be found using GIS. The user may add layers to the map to personalize it. GIS displays the following:

- Water resources information such as lakes and ponds, rivers and streams, watershed boundaries, wellhead protection areas, dams, coastal water use types, and aquatic vegetation.
- Transportation location information such as public shoreline access points, airports, bike paths, roads, railroads and traffic counts
- Mapping and city planning information such as economic development zones, industrial zones, conservation lands (includes bird migratory patterns and protected forest), census demographic data, historic aerial photographs, and topographic maps

Of particular concern is evidence of any change in waterways, ponds, shorelines, etc. Historical maps may be used to determine if water bodies were natural or man made. In GIS, turning on the layer

“wetlands change” enables a viewer to see if a water system was filled in, where the waterways were, where they were moved to, and if the waterway still exists.

Once information on the type of resources, development history, and transportation is found, research on possible chemicals used by the industries must be done. After determining the possible chemicals used by the previously owned companies, the material safety data sheet (MSDS) must be obtained for each hazardous material.

Contaminants are any physical, chemical, biological, or radiological material that can be found in any media (air, water, soil) that may be harmful to the environment and human health. Federal regulations define a contaminant as a hazardous substance, waste, or pollutant by various policies including the comprehensive environmental response compensation liability act (CERCLA), Solid waste disposal act, clean water act, and clean air act. In Section 40 CFR302 of CERCLA, there are more than 700 substances listed as hazardous. Describing of the contaminants of concern is necessary for record keeping.

Evaluating potential risks involves estimating possibility of hazardous material, identifying possible hazards. The CLUE process also involves carrying out research as to which hazards are present, what characteristics they have, and how much it will cost to remediate the land/water containing them. The CLUE incorporates historic evidence and visual evidence in order to provide sufficient information to find if a hazardous material is present.

It is important to become familiar with local state regulations for remediation of sites and liability policies. Prepare a list of locations that warrant further investigation, and prepare to visit the local department of environmental management.

After all the data has been collected it is best to summarize the findings in an organized table such as the one pictured in

Table 1 below. Our example summary of findings from the town hall includes the site address, map/lot number, property, current owner, current use, former use and an estimation of risk. This is a simple sheet generated by the researcher to maintain organization throughout the data gathering. Keeping all gathered information in an organized chart ease the CLUE report writing process.

Address	Map-Lot No.	Property	Current Owner	Current Use	Former Use	Risk
53 River Street	2-201	PLS	City of Central Falls (As of 1975)	Storage Garage for DPW	Central Beverage Corp. Factory (Until 1965)	Moderate: Possible Industrial waste or petroleum products
38 River Street	2-200	PLS	City of Central Falls (As of 1975)	Storage for DPW	W.S.L Inc. (1946), Gold's Industries (1965), Central Beverage Corp. (1970)	Moderate: Possible Industrial waste or petroleum products
85 Samoset Ave	2-70	Abutting	Hilda M. Cabral	Residential	Residential (1900)	Low
81 Samoset Ave	2-71	Abutting	Noel Linback	Residential	Residential (1900)	Low
72 Samoset Ave	2-72	Abutting	Maurice Giovanni	Residential	Residential (1900)	Low
20 Crown Street	2-78	Abutting	Vitor Lopes	Residential	Residential (1900)	Low
28 Crown Street	2-80	Abutting	Walter Seminick	Residential	Residential (1900)	Low
16 River Street	2-27	Abutting	Kenneth Castle	Residential	Residential (1900)	Low

Table 1: Summarized Findings from Town Hall

The Regulated Facilities Review

A regulated facilities review consists of determining the facilities surrounding the site or on the site that are regulated by the local Department of Environmental Management (DEM). These regulated facilities consist of railroad stations, wastewater treatment plants, transfer stations, underground storage tanks, and aboveground storage tanks. It is important to note what sites have these or any types of regulated facilities surrounding the launch site due to the possibility of spills or any other types of activity that is against the DEM regulations. A site may not currently be regulated by the DEM, but it is important to check for any past regulated facilities on or near the site.

DEM also regulates the chemical activity on a lot of remediated land for a few years post remediation. Getting the remediation report and the regulated reports can provide information regarding what might be in the ground on or surrounding the site. When documenting the remediation, be sure to make copies of the important sections of the report for future reference when making a recommendation.

Site Risk Rating System

Once all the CLUEs have been performed for each specified site, each site can be rated based on the parameters you have collected. We call our particular system the "Site Risk Rating System" which does not give information regarding whether the site is the best site to use, but does give information regarding which site has the lowest risk of finding unknown hazardous material.

Our example rating system, pictured here, is based upon the following factors; Previous ownership, previous occupation, property remediation, and abutting property. Each site is examined based on the parameters shown.

Rating System	1	2	3	4	5
Previously Owned by A Company Which Used:	Highly Toxic Chemicals	Mildly Toxic Chemicals	Mildly Toxic Chemicals (Likely)	No Toxic Chemicals (Likely)	No Toxic Chemicals (Definitely)
Previously Occupied by:	A factory or building which used/stored Highly Toxic Chemicals	A factory or building which used/stored mildly toxic Chemicals	A factory or building which used/stored non-toxic chemicals	A commercial or residential building which did not use chemicals	Vacant Lot
Property Remediation	Has not been tested or remediated	Has been tested but has not been remediated	Has been entirely capped but not remediated	Mostly remediated but contains caps	Entirely Remediated
Abutting Property Previously Owned by A Company Which Used:	Highly Toxic Chemicals	Mildly Toxic Chemicals	Mildly Toxic Chemicals (Likely)	No Toxic Chemicals (Likely)	No Toxic Chemicals (Definitely)
Abutting Property Previously Occupied by:	A factory or building which used/stored Highly Toxic Chemicals	A factory or building which used/stored mildly toxic Chemicals	A factory or building which used/stored non-toxic chemicals	A commercial or residential building which did not use chemicals	Vacant Lot
Abutting Property Remediation	Has not been tested or remediated	Has been tested but has not been remediated	Has been entirely capped but not remediated	Mostly remediated but contains caps	Entirely Remediated

Table 2: Example Rating System

Each site is then either considered a high or low risk site for unknown hazardous waste. This CLUE rating system in particular has a best score of 30 meaning there is little risk of finding unknown hazardous waste. The worst score a site could receive is a 5. The recommendation ranges are as follows:

- Scores ranging from 5 to 15 - considered low risk
- Scores ranging from 15 to 20 -considered moderate risk
- Scores ranging from 20 to 30 - considered high risk (not recommended for use)

In

Category	Rating	Explanation

Previously Owned by A Company Which Used:	4	Use of petroleum products
Previously Occupied by:	4	Use of petroleum products
Property Remediation	5	Has not been tested
Abutting Property Previously Owned by A Company Which Used:	1	Abutters mostly residential
Abutting Property Previously Occupied by:	2	Abutters mostly residential
Abutting Property Remediation	5	Has not been tested
	Total	21

Table 3 below an example from a CLUE site rating prepared for the Blackstone Valley Tourism Council for the River Street site in Central Falls. Automatically we can tell that the potential site is located in a residential area, but contained a facility that may have stored or used mildly toxic or hazardous chemicals. This site would not be recommended for use.

Category	**Rating**	**Explanation**
Previously Owned by A Company Which Used:	4	Use of petroleum products
Previously Occupied by:	4	Use of petroleum products
Property Remediation	5	Has not been tested
Abutting Property Previously Owned by A Company Which Used:	1	Abutters mostly residential
Abutting Property Previously Occupied by:	2	Abutters mostly residential
Abutting Property Remediation	5	Has not been tested
	Total	21

Table 3: Site Rating Example

After all the sites have been rated, a recommendation based on environmental hazard/concern can be made.

Generating the Report

Once all the information talked about in the previous sections has been gathered, a report can be generated. The report should include all the information from town hall, the historical maps, the DEM, and the risk rating. Make sure to include the rating systems and parameters used for said ratings along with a quick explanation. The report can then be used as a basis for determining the feasibility and cost-effectiveness of proceeding with construction on a site, knowing the risk of encountering hazardous materials.

Appendix D – U-RAD Design

SITE FEASABILITY ACCESS PROJECT

RIVER ACCESSIBILITY DESIGN

ROGER WILLIAMS UNIVERSITY

TEAM MEMBERS: TIMOTHY CLARKIN AND TAYLA MELLO

PROFESSIONAL CLIENT: THE BLACKSTONE VALLEY TOURISM COUNCIL

FACULTY ADVISORS: DR. ANTHONY RUOCCO AND DR. JANET BALDWIN

SUBMISSION DATE: 12 MAY 2014

Abstract

The Blackstone River once was integral to life and industry to many towns in northern Rhode Island, but industrial pollution caused it to become unusable. As environmental remediation continues to improve the river, the Site Feasibility Project focuses on assessing the environmental risk of five potential river access sites located along the Blackstone River in Pawtucket, Central Falls, North Smithfield, and Cumberland; determining which site is ideal for development, and formulating river access designs for river rescue. Students from Roger Williams University (RWU) completed Corridor Land Use Evaluations (CLUE) for each site by inspecting the site and collecting historical data and information from Government Offices and the Rhode Island Historical Society. Each site was rated using the CLUE rating system developed by RWU and a primary site was selected based on those results. Research on river accessibility was conducted and Rhode Island state standards and specifications were collected. Two river access designs were developed for the Pawtucket Water Supply Board site: one based on current land use conditions and one to synthesize with the proposed Blackstone River Bikeway. The initial results suggest that this process of Corridor Land Use Evaluations and river access design can be used in future developments along the river for safety, recreation and limited commercial purposes.

Contents

List of Figures

1. Introduction

As part of the Site Feasibility Access Project, the Roger Williams University Senior Design Team (RWU) formed two separate focus groups: Corridor Land Use Evaluations (CLUE) and River Accessibility Design (RAD). The purpose of the River Accessibility Design team is to research and develop a Universal River Accessibility Design (U-RAD) for use by rescue teams and someday maybe even the community. The goal of U-RAD was to develop a river accessibility design that could be reproduced on multiple sites and for multiple intended purposes – safety, recreational and limited commercial. Ultimately, RWU developed two designs: one for universal application and one designed for a specific site. The following sections will outline the research completed, a brief explanation of the site selection process completed by the CLUE team, the design process itself and a formal explanation and presentation of the final designs.

2. Research

The RAD team began by researching information on river accessibility and safety in Rhode Island. There were two major sources in this: Captain Robert Shields with Cumberland Water Rescue Coordinator and James McGinn from the RI DEM. Each contact provided valuable information which contributed to the design process.

Captain Shields explained the needs of a water rescue team during a rescue mission. Typically, when there is a need for rescue, the boat is launched at the easiest access point, while the majority of the rescue personnel are deployed directly to the point of interest. Boats are typically transported on trailers towed by either pickup trucks or fire engines – resulting in an overall vehicle-trailer length of 25-45 feet. At the launch site, ideally, the trucks would be able to turn around and back the boat and trailer down a ramp; however, there is provision for trucks to approach the water and carry the boats to the

water by hand. This requires access roads to provide a very short distance to the water due to the weight and difficulty in transporting the boats by hand. Clearly, the former of the two options is better. There is a need for both room for maneuvering, as well as a staging area for the trucks and trailers, especially in the event that a boat launch is not an option for design.

James McGinn was able to direct the team to the two major guidelines used by Rhode Island in boating access design: States Organization for Boating Access (SOBA) and California Division of Boating. The team was able to access the California Division of Boating requirements online. These requirements set the specifications on minimum parking spots, turning radius, materials use, etc. The SOBA handbook took a few weeks to obtain by mail. When it arrived, it was very similar to the California Division of Boating document. Once again, it outlined all of the specifications that are necessary for boating use and design. It mentioned information about master planning – property, finances, body of water, etc. – it then began to talk about boat launch siting and location, access road, parking lots, special purpose areas, obstructions, and, finally, ramp design. The design process continued primarily using the SOBA handbook.

2.1 ADA Considerations

In addition to the rescue and DEM regulations, the team researched American Disabilities Act (ADA) requirements. However, as the project goals changed with the semester, it soon became apparent that the launch design would not be for public use, limiting design to rescue purposes only. This changed the requirements of what needed to be designed. There would be no parking area, no public access and no docks or platforms in need of meeting ADA regulations – the only users would be rescue teams.

2.2 Visits to Existing Sites

In addition to state regulations, RAD studied already existing river access points related to BVTC. By studying current sites, RAD learned which designs were more successful and were able to consider those findings in developing designs. The two sites that were visited and studied were Central Falls Landing in Central Falls and Manville Landing in Cumberland.

2.2.1 – Central Falls Landing

The first access site is Central Falls Landing. This is located at Valley Falls off of Madeira Avenue in Central Falls, RI. This land ramp and floating dock combination has sloped access for kayaks and lightweight trailers at a city landing. From here, recreational users can do a short upstream flat water paddle, turning around just before the Pratt Dam. Paddling south from here is not recommended considering the Valley Falls dam is about 50 yards downstream from the dock. The Blackstone Valley *Explorer* tour boat docks at this site in the summer. The *Explorer* runs public tours of the Blackstone River and Valley Falls Pond. One downfall of this site is that it is not ADA accessible. In addition, a flood damaged much of the structure and has caused the site to receive little use.

Figure 1: Central Falls Landing

2.2.2 – Manville Landing

The second site is Manville Landing. Despite environmental catastrophe and costly remediation as part of the sites development, Manville Landing is now a successful park and launch site. Unlike Central Falls Landing, Manville Landing does not accommodate large boats but is solely intended for use by small human-powered vessels – kayaks, canoes, rowboats, etc. – and rescue teams. The site features a boat launch ramp in addition to a floating dock. During the visit to the site, however, it was noted that the system does not meet ADA requirements.

Upon meeting and speaking with various members of BVTC's initiative to revitalize the river, the Manville Landing access point has been named the ideal site for rescue and recreational use. Captain Shields asserted that Manville Landing is a good site for rescue. It supplies ample maneuvering, easy access and has more than enough parking. At the suggestion of Captain Shields, the team also visited Sycamore Landing in Lincoln. Unfortunately, there was still almost a foot of snow on the ground and the team was unable to inspect the materials used or the site in close detail.

Figure 2: Images of snow covered Manville Landing and Sycamore Landing.

3. Site Selection

To continue in the design process, a site needed to be selected for further development. There were five possible sites being considered. The site design itself needed to integrate with the Blackstone River Bikeway, have easy access and sufficient parking for rescue teams. In addition, initially U-RAD needed to consider the needs of rescue boats, the *Explorer* boat, ADA accessibility and human-powered vessels. This focus changed to safety purposes only as the project progressed.

The nature of the project automatically falls under the category of wetlands, which unavoidably falls under the jurisdiction of both RI DEM and Coastal Resource Management Council (CRMC). While BVTC provided no specifications for the site design, RI DEM and CRMC standards still needed to be met. First, the division of (CRMC) classification of the type of body of water was used to determine whether or not the body of water could support a dock or ramp. Given the purpose of safety, it was permissible to develop a river access point. Because of the wetlands, BVTC will need to proceed with RI DEM's permission.

Specifically, for a site the water depth should be no less than three feet at the end of the ramp during mean low tide. For rescue boats that need a drive on trailer for launching and retrieving boats a five foot depth is preferred. It is important to note that a dock meant for drive on trailers should not have an overhang or drop off. Siltation rates of the river are a factor in dock design because water depth in a river is not constant, and river channels sweep left and right, making an uneven ground to start with. [1] In general, one launch site should have 30 or more parking spots available. For a rescue site, a parking lot must still have room for the parked cars, but in addition, it must accommodate an emergency vehicle and supply ample room for a truck and trailer to access the launch ramp quickly.

[1] Virginia State Government. "Building a Dock." http://www.dgif.virginia.gov/boating/building-boat-ramps.asp

3.1 CLUE Process

The primary process used for selecting a site was developed by the RWU - CLUE team. The CLUE team completed Corridor Land Use Evaluations of five sites located along the Blackstone River in northern Rhode Island. The results of these site evaluations were then compared using the CLUE Methodology and a premier site was selected. To learn more about this process, please see the CLUE report.

3.2 Selected Site

The CLUE process suggested that the RWU site for further development was the Pawtucket Water Supply Board located on Branch Street in Pawtucket, Rhode Island. This site had the lowest score and the lowest probability of pollutants being found beneath the top soil. The designs for U-RAD will therefore be developed for this site specifically.

Figure 3: Arial Photo of the Pawtucket Water Supply Board and the Branch Street Site

Figure 4: Photos of the Branch street site.

4. Design Development

With the completion of the CLUEs and the site selected, the RAD team could begin developing a design for the site across from the Pawtucket Water Supply Board on Branch Street (PWSB) in Pawtucket, RI. The team was now ready to begin collecting specific site information and developing designs for use on that site.

4.1 Surveying and Site Information

The first step for the team was to visit the site and survey it for elevations, obstructions and any other pertinent site information. This information was collected and used to create an AutoCAD plan of the site with trees, elevation contour lines and property lines. The team began developing a design. Shortly afterward, staff from PWSB sent AutoCAD files of the pre-existing site conditions. These plans revealed two drainage pipes that bisected the property, causing the team to reconsider their designs. In addition, the team was given plans for the proposed Blackstone Bikeway. This also shifted how the designs could be used on the property and still integrate with current and proposed infrastructure. The team determined there was a need to draft two designs; one as a design study assuming that there would be no bikeway and the other designed to integrate with the bikeway.

4.2 Design Specifications

As previously mentioned, RWU is to adhere to RIDEM's design specifications for boating access. These specifications include the ones set by the States Organization for Boating Access (SOBA) and California Division of Boating, as well as ADA requirements.

The SOBA Design Handbook (2006) for Recreational Boating and Fishing Facilities provides an in-depth explanation for all aspects of a boating facility. Site planning, design and construction of components, operation and maintenance, and accessibility are but a few of the topics covered in the handbook. For the scope of the SFA Project, the RWU RAD team focused on the design of waterside components and landside facilities. The components discussed and focused on in these sections include boat launching ramps and turnaround/maneuvering areas.

The California Division of Boating specifications closely align to those within the SOBA Handbook. Specifications for launching ramps are consistent throughout both documents, including desired slopes and design for low and high water levels.

ADA requirements are set to meet potential users with a disability. However, since site-specific design is intended for rescue use only, these requirements were not followed.

The following specifications were compiled and implemented in the actual design:

Site Evaluation:

1. Access site must be on Cutting side, not Depository Side of wake, but not where cutting access is strongest.
2. Determination of Minimum water depth (Design Low Water).
3. Determination of Maximum water depth (Design High Water).
4. Evaluation of existing structures and roadways for boat/trailer usage, obstructions to potential boat/trailer approach, natural waterside features.

Turnaround/Maneuvering Area:

1. Provide a 60-ft (outside diameter) turnaround for vehicle-trailers to line up with launching ramp.
2. Counter-clockwise direction desirable.

3. Vertical curve aligned with ramp.

Launching Ramp:

1. Orient ramp slightly downstream of predominant current.
2. Protect banks at sides of launch ramp with rip-rap at least 3 to 5 feet wide and 12 to 18 inches deep.
3. For single lane use, launching ramps should be 20 feet wide.
4. Launching ramps should have a 12 to 15 percent slope.
5. Top of launching ramp should be at least 2 feet above design high water level
6. Toe (bottom) of launching ramp should be at least 3 feet below design low water.
7. Transition from shore to slope of ramp should be made with a 20 to 30 foot long vertical curve.
8. Launching ramps can be constructed with cast-in-place concrete, concrete slabs, reinforced rebar, welded wire fabric and/or fiberglass strands.
9. Surface of ramp should be finished with a 1" by 1" V-groove design at a 60-degree angle to centerline, for vehicle traction.

To aid in design, the RAD team sought the input of Captain Shields, the Water Rescue Coordinator in Cumberland, RI. Captain Shields is familiar with the process that ensues for a rescue mission, and understands what it takes to have a smooth, successful rescue. His input and desired aspects of a rescue site were vital in developing a successful design.

4.3 Conceptual Designs

After selecting the Branch Street site as a design site, the team began the design process. Various conceptual designs were developed. Rough sketches and designs for turnaround areas and ramps were drawn-up and worked with to meet the specifications. Upon completing a survey of the Branch Street site, the RWU RAD team drafted an AutoCAD plan of the site. As mentioned previously, when the team received AutoCAD files from PWSB it drastically changed the direction of conceptual designs. Revealed in the file were two effluent pipes on the site. As a result, initial designs were redeveloped to account for these features and avoid any type of development that would interfere with these pre-existing pipes. This included changing the entire launching ramp location from the southern end of the property to the northern end and redesigning the turnaround area.

Once the new ramp location was confirmed, the team worked to develop site two designs. The first design is a more general concept and disregards the proposed plans for the Blackstone Bikeway and focuses on maneuverability throughout the site. Ideally, this design can be used for multiple sites and can be easily altered to fit on a new site. The second design considers the proposed bikeway and is a more site-specific design. This design minimizes the intersection of bike path and access roads, promoting user safety.

Within the SOBA and California Boating Access documents were a number of possible river access designs. Launching ramps, boarding floats, floating docks and other abutments may be used to provide access to a waterway. The design team made the decision to utilize a single launching ramp to provide quick, easy access. Launching ramps meet the design needs for the site as well as require minimum construction costs and are relatively easy to maintain. Both designs, therefore, share a common ramp. This ramp has the specific slope, vertical curve, height and length for the site.

The team worked to develop two designs that would meet the specifications and provide adequate space for vehicle-trailer maneuvering. This was met with some trouble due to the relatively small size of the site. To accommodate maneuvering needs, and to minimize construction costs, both designs utilize the existing entrance for the site as both an entrance and exit. A further description of the designs is provided in the following chapter.

5. Final Design

Ultimately, the team developed two designs. Both designs share the same design for the launch ramp. The following sections describe each design and the launch ramp in detail.

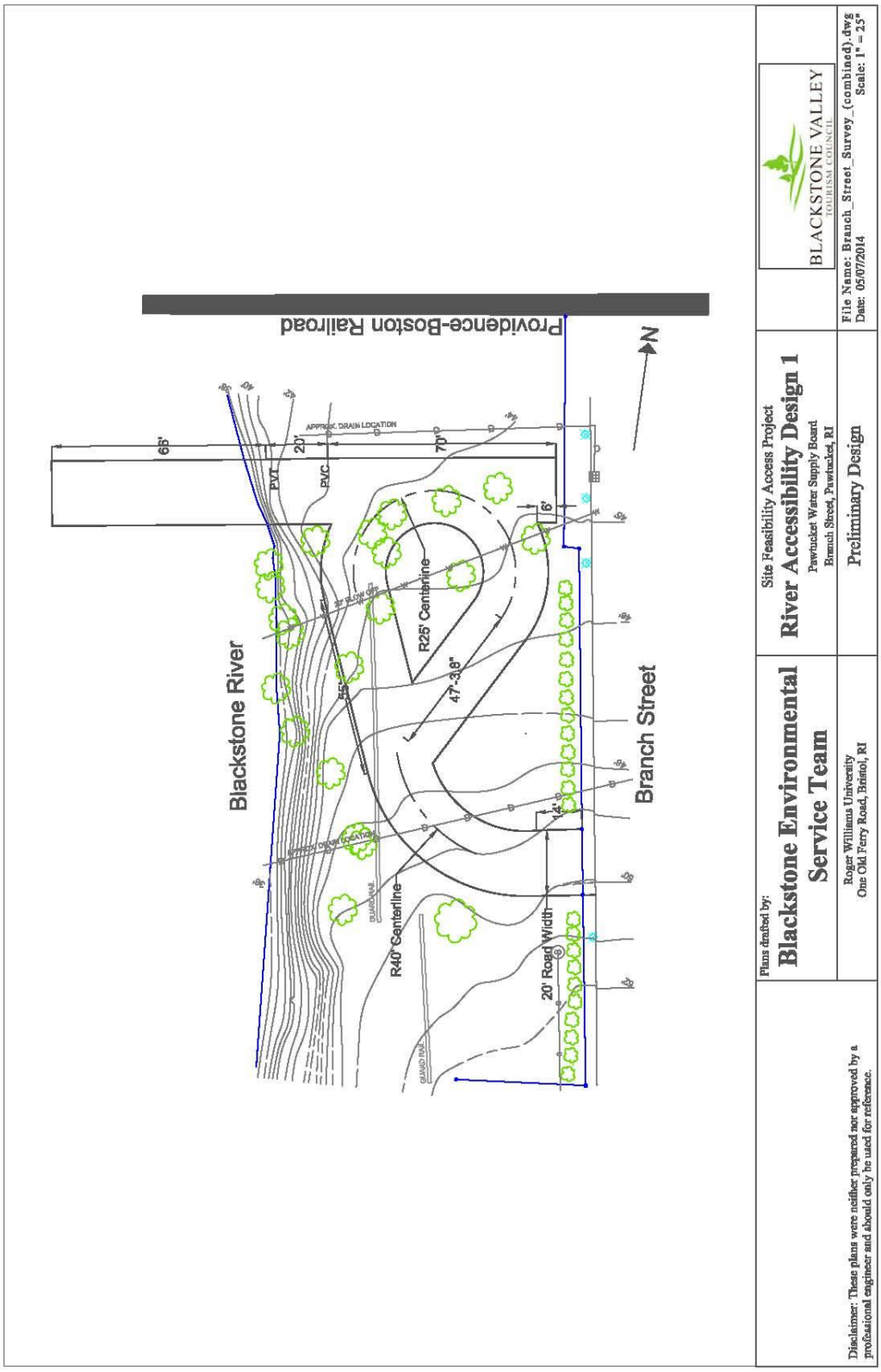


Figure 5: Site plan for Design 1

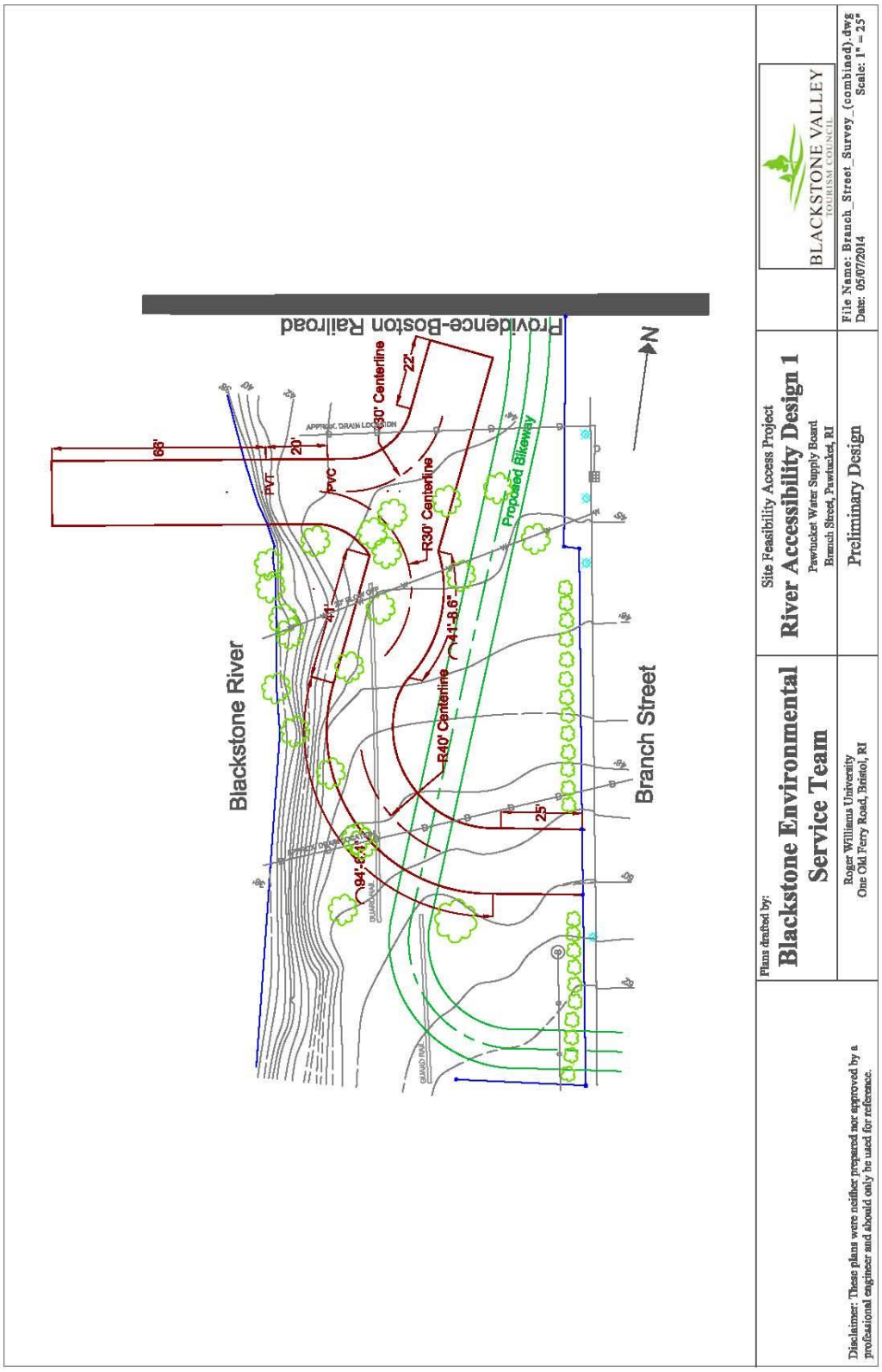


Figure 6: Site plan for Design 2

5.1 Design 1

The first design was developed under the assumption that the entire property is available for development – the proposed bikeway is ignored. This design is intended to best use the property in its entirety. This can also be used as an example for future site designs. This design was developed to have the least impact on presently existing infrastructure. Only a guard rail will need to be removed to accommodate this design. The design will incorporate the existing gate in the fence that runs parallel to Branch Street. This will reduce project costs and respect the Pawtucket Water Supply Board's property. The design consists of three major components: the access road, the maneuvering area and the ramp.

The access road has a gravel surface. Gravel was chosen because it is more cost effective for this site. As a rescue site, the yearly traffic on the road will be minimal and will therefore not require a more durable wearing surface. A gravel surface can withstand the damages accrued by limited safety vehicles. Such a surface will also be permeable and have less adverse effect on the site's environment, minimizing storm water management needs. The access road is 20 feet in width and enters the site from the East, off of Branch Street, by passing through the existing gate. The road continues for 14 feet before beginning a clockwise curve, with a centerline radius of 40 feet. After this, the road extends 55 feet before entering the boat launch maneuvering area.

The maneuvering area is also surfaced with gravel. It continues from the access road and maintains a 20 foot width. From the access road, it begins a clockwise curve with a centerline radius of 25 feet. While conventionally it is preferred that maneuvering areas have counter-clockwise curves, it is permissible for there to be exceptions. In this case, it is more convenient for the design to incorporate a clockwise curve than no curve at all or some other type of maneuvering area. Midway through the curve, the road extends straight toward Branch Street, directly opposite the ramp. This allows the vehicle and trailer to straighten out and become aligned before reversing toward the head of the ramp.

The previously mentioned curve also continues around a reconnects with the access road to allow for ease of departure.

The ramp is made from cast-in-place concrete. It is connected to the gravel maneuvering area by a 20 foot vertical curve. As mentioned, the same ramp is used in both designs. For a detailed description of the ramp, refer to section 5.3 Ramp Design.

5.2 Design 2

The second design was developed with the purpose of integrating with the proposed bikeway. This design is intended specifically for this property. The design was developed to have the least impact on presently existing infrastructure. To accommodate this project, only one of the guard rails will need to be removed and the existing gate will be used. This will reduce project costs; respect the Pawtucket Water Supply Board's property, and allow for integration with the bikeway. The design consists of three major components: the access road, the maneuvering area and the ramp.

The access road has a gravel surface. Gravel was chosen because it is more cost effective for this site. As a rescue site, the yearly traffic on the road will be minimal and will therefore not require a more durable wearing surface. A gravel surface can withstand the damages accrued by limited safety vehicles. A gravel surface will also be permeable and have less adverse effect on the site's environment, minimizing storm water management needs. The access road is 20 feet in width and enters the site from the East, off of Branch Street, by passing through the existing gate. The road continues for 25 feet before beginning a clockwise curve. The curve has a centerline radius of 40 feet and rotates until the access road runs nearly parallel to the bikeway. It then extends straight for 105 feet, bypassing the head of the ramp. Due to limited space, this extension beyond the head of the ramp is the primarily allowance for maneuvering.

The maneuvering area in this case consists of a simple clockwise curve that rotates toward the head of the ramp. It has a centerline radius of 30 feet. For departing from the ramp, another curve with a 30 foot centerline is superimposed on the access road to allow for ease of departure when exiting the ramp.

The ramp is made from cast-in-place concrete. It is connected to the gravel maneuvering area by a 20 foot vertical curve. As mentioned, the same ramp is used in both designs. For a detailed description of the ramp, refer to section 5.3 Ramp Design.

5.3 Ramp Design

The launching ramp was designed to meet the specifications set by SOBA and the California Department of Boating. As stated in these documents, a required slope of a launching ramp must be between 12%-15%, with 15% being the preferred value. These slopes have been determined over the years to provide safe access to the river, allowing vehicle-trailers to approach the ramp while maintaining traction to avoid falling down the ramp. The proposed ramp utilizes the preferred 15% slope. For single lane launching ramps, specifications set the desired widths between 15-ft. to 20-ft, with a preferred width of 20-ft. Again, the preferred value was used for this ramp.

Design high and low waters are used to determine the depths of different aspects of the ramp. These values can be obtained through various state entities, or through U.S. Geological Survey (USGS) maps. Due to the numerous dams located along the Blackstone River, its water elevations are generally stable throughout the year. It is required that the top of the ramp be a minimum of 1-ft. above design high water, and the toe of the ramp be a minimum of 3-ft. below design low water. The rescue boats that will typically be used at the Branch Street site require a minimum depth of 5-ft. to enter the water. For added security, it is suggested that the ramp extends an extra 5-ft. further. Launching ramp lengths

are not specified in the documents, as they can vary to meet the specific design needs of the project. The designed ramp is 66-ft. in length to meet this project needs.

A vertical curve, with a desired 20-ft. length, is required to connect the top of the ramp to the maneuvering area. The purpose of the vertical curve is to provide a smooth transition for users from the flatter driving surface to the ramp. For the Branch Street site, the vertical curve connects a nearly horizontal surface (with a slope less than -0.5%) to the 15% slope of the ramp.

Various materials and construction processes can be used to build a launching ramp. To minimize costs, and provide a quicker construction process, it is suggested that the ramp consists of a combination of cast-in-place concrete slabs with 4" x 20" concrete planks, both 6-inches in depth. The concrete planks are used to simplify the construction process, minimizing the required invasion into river. The cast-in-place concrete slabs are then constructed above these planks for the remaining portion of the ramp, and for the vertical curve. Below the concrete is a 6-inch deep aggregate base.

It should be noted that the launching ramp provided is a preliminary design. Due to limited resources, some properties that are required for a complete designed were not obtained. This includes the depth of the river, the slope its river banks and other such aspects.

A detailed drawing including the various aspects described above is presented below in Figure 7.

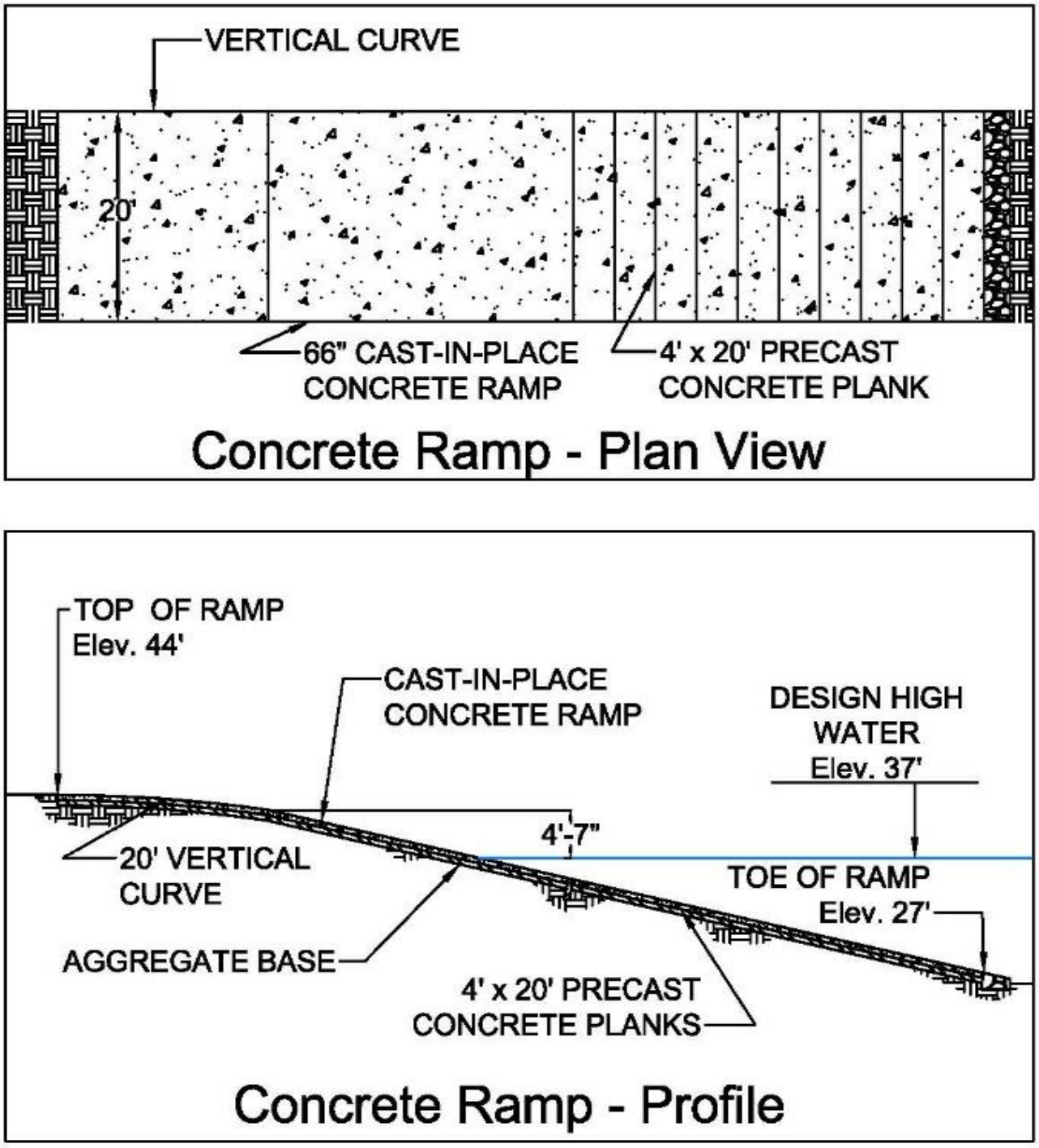
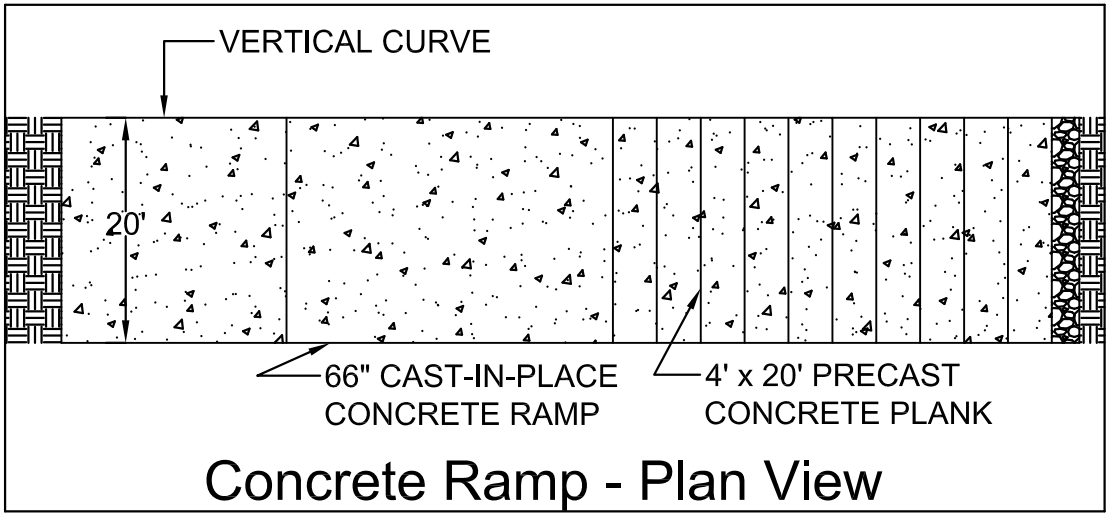


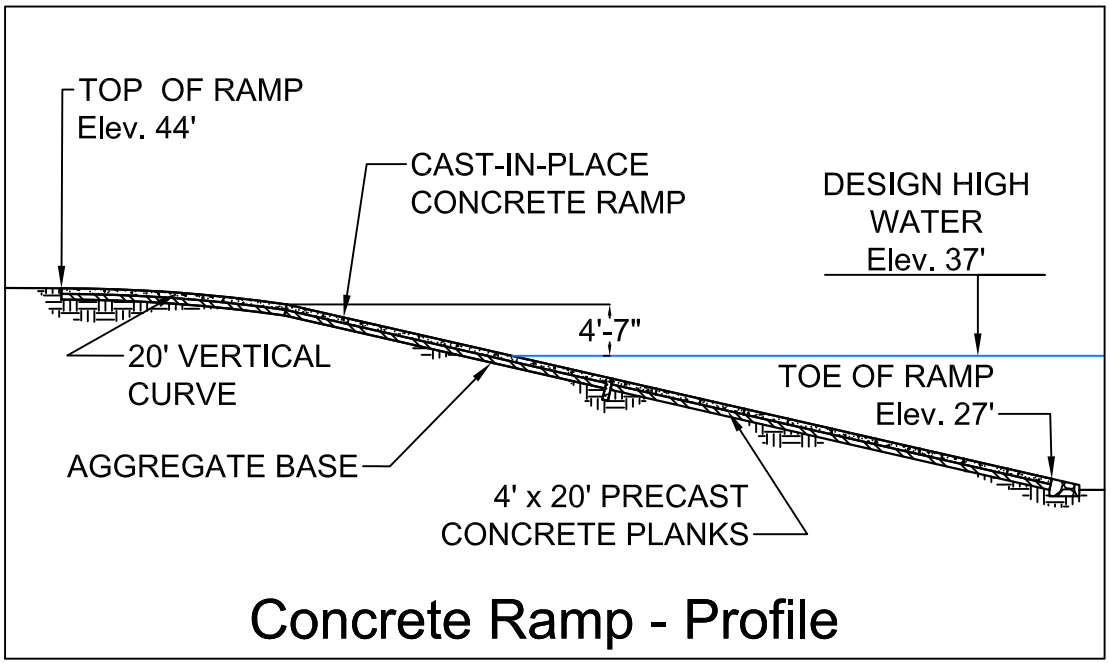
Figure 7: Plan and Profile views of the ramp design

6. Final Recommendations

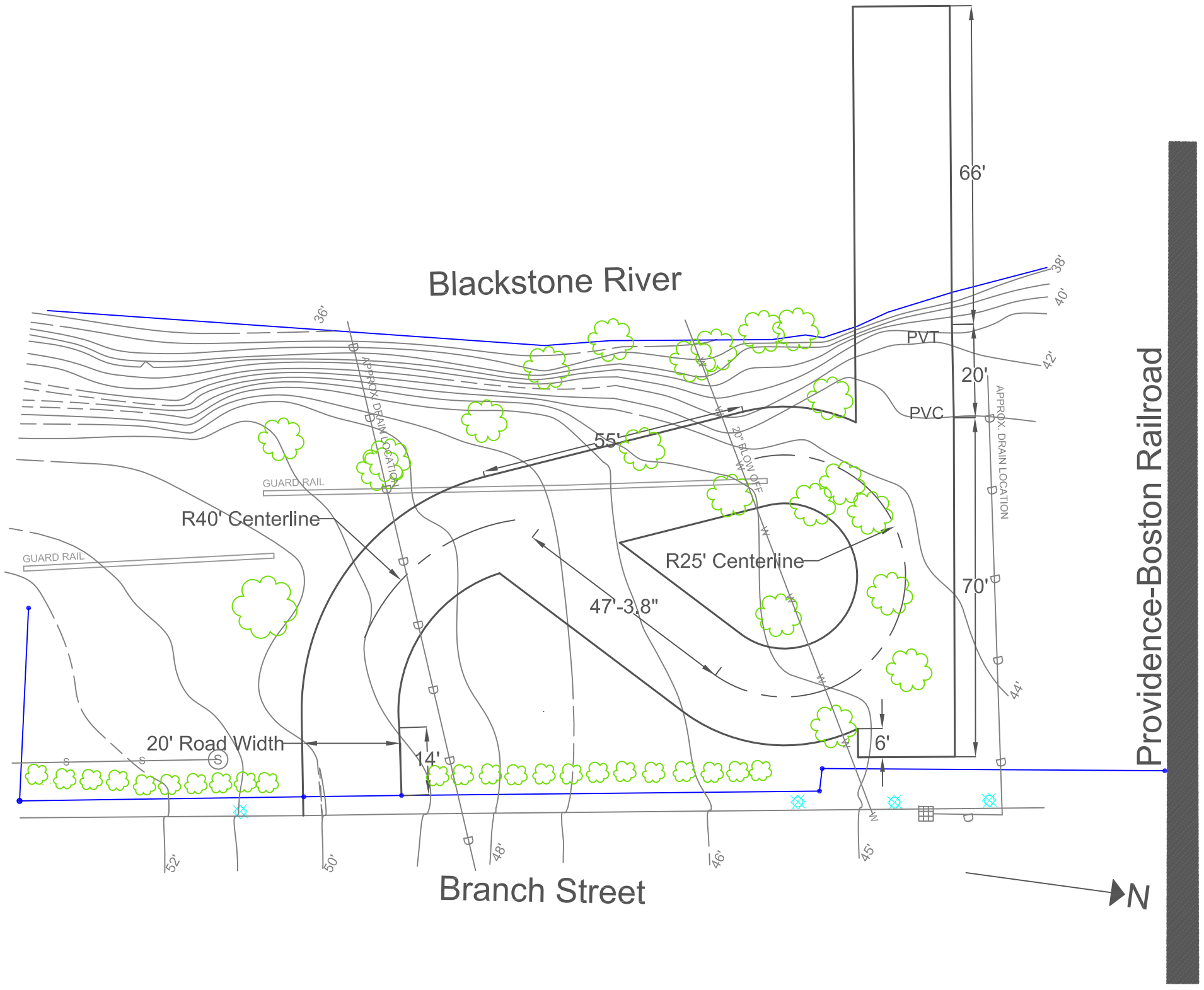
To move forward with the implementation of these designs, BVTC must first acquire the required wetlands and other permits from RIDOT, DEM and CRMC. These permits are required to build on the property. Furthermore, finalization of the designs must be undergone. Investigation into the depth of the river must be performed to ensure that the ramp can be used in the desired location. The designs must also be confirmed to meet the needs of the rescue teams, and receive approval from a professional engineer.



Concrete Ramp - Plan View



Concrete Ramp - Profile



Disclaimer: These plans were neither prepared nor approved by a professional engineer and should only be used for reference.

Plans drafted by:

Blackstone Environmental Service Team

Roger Williams University
One Old Ferry Road, Bristol, RI

Site Feasibility Access Project

River Accessibility Design 1

Pawtucket Water Supply Board
Branch Street, Pawtucket, RI

Preliminary Design

BLACKSTONE VALLEY TOURISM COUNCIL

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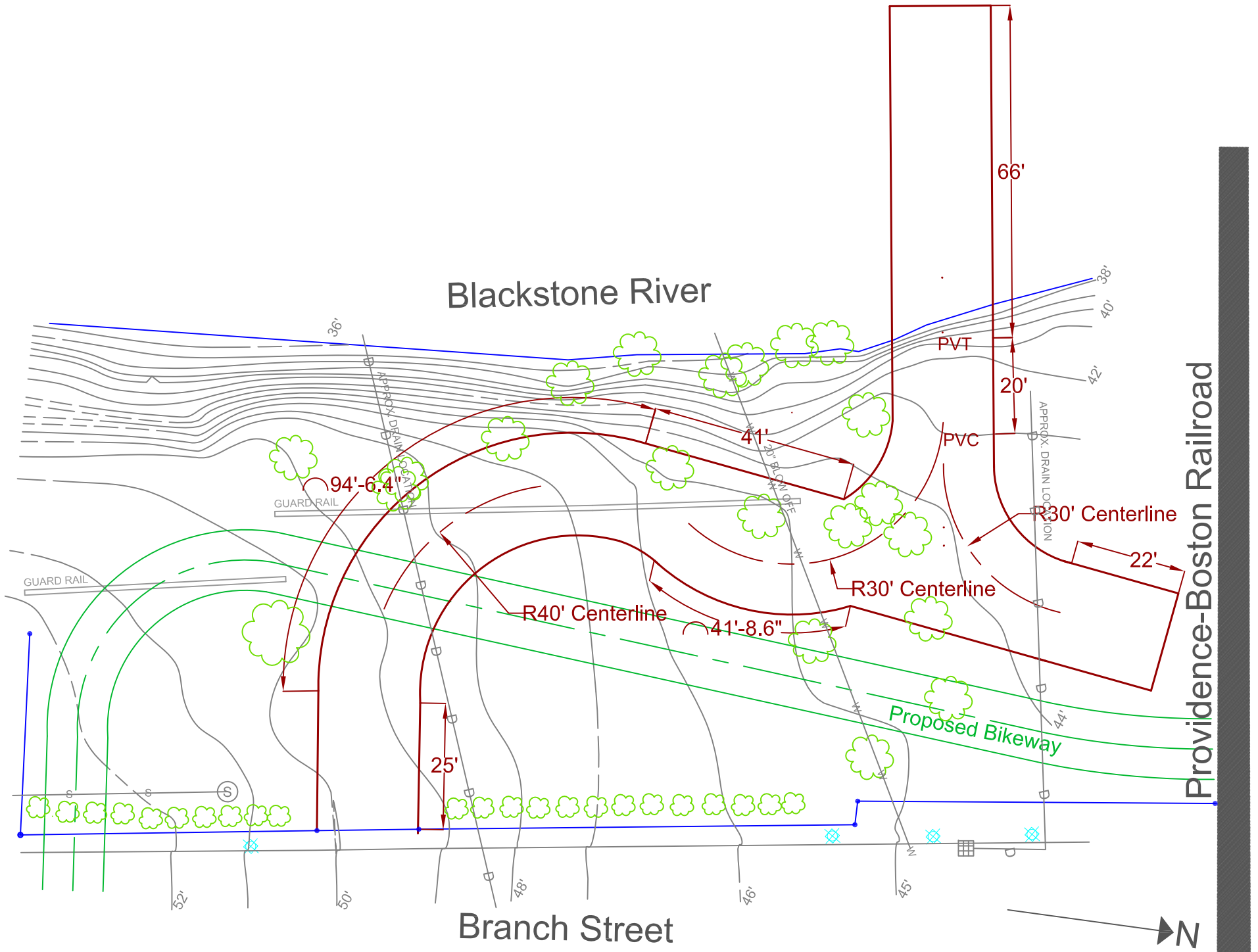
Date: 05/07/2014 Scale: 1" = 25"



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Roger Williams University
One Old Ferry Road
Bristol, Rhode Island 02809

cpc@rwu.edu
http://cpc.rwu.edu