



GI PROJECT: FINAL REPORT

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PRESENTED TO:

Christina Dismore, Ashwin Gupta, and Marina Radovanovic

PREPARED BY:

Emma Briggs, Marina Pinheiro, Avery Cole, and Maeve Buchan

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1 Purpose

The purpose of this project was to create an informative and engaging resource for Quinte Conservation (QC) to educate local municipal staff members in Quinte Region about the uses of Green Infrastructure (GI) in stormwater management.

For decades, stormwater runoff has caused serious ecological damage to the Bay of Quinte, creating severe social and economic impacts on the surrounding communities (Munawar et al., 2018). Effective stormwater management is key to mitigating the negative impacts that local urban populations have on the bay. To improve the existing stormwater management systems in Quinte Region municipalities, QC identified GI as an important tool to reduce stormwater's negative impacts.

In stormwater management, GI technologies draw on the natural qualities of soil and vegetation to help filter, store, and slow the rate of flow of stormwater (US EPA, 2020). By filtering the stormwater, GI helps reduce the amount of excess nutrients like phosphorus and other pollutants that are carried out to local bodies of water (Binstock, 2011). This is an important step in reducing the amount of phosphorus carried from urban and residential areas out to the Bay of Quinte via municipalities' stormwater.

Despite GI becoming increasingly popular in stormwater management across Western Europe and the USA; there are very limited examples of GI stormwater management in Canada on a large scale (Binstock, 2011). GI remains a relatively new concept for many municipalities, including those in Quinte Region. GI is a new technology that requires technical knowledge, policy planning and public buy-in. For this reason, municipal staff may be hesitant to adopt it into their existing stormwater management technologies, despite its benefits. To bridge the gap between proponents of GI and the municipal staff in Quinte Region, Quinte Conservation requested the Queen's University team to create an informative and interactive resource, accompanied by a written pamphlet to educate municipal staff about GI.

2 Project Scope

2.1 Project Deliverables

The deliverables for this project included a printable brochure or pamphlet, and an interactive educational resource. Through extensive discussions with the client, the team was able to establish the most important criteria for both deliverables to ensure we were selecting the best mode of delivery as seen in Table 1.

2.1.1 Interactive Resource

After completing a series of brainstorming activities (Post-It Note Method, SCAMPER, Mind Map), the team came up with several options for the interactive resource. These included a video series, different animated videos, an educational module, an interactive website, and an online slide deck with a voiceover. After researching the benefits and drawbacks of each option and developing weighted evaluation matrix criteria in consultation with the client, the team selected the mode of delivery for the interactive resource based on the weighted evaluation matrix (Appendix A – Mind Maps and Evaluated Decision Matrix). Because both the interactive website and video series received the highest scores in the weighted evaluation matrix, the team elected to combine the two and create an interactive website with a video series included as part of the website content. The team also conducted a second evaluation matrix to determine the best platform to create the website through and landed on Google Sites.

While creating the website, the team kept the criteria used in the evaluation matrices in mind to ensure the content reflected the key requirements of the deliverable. Almost every section of the website includes some written content, a short video, and graphics created by the team to create an engaging and interactive experience for the user.

2.1.2 Pamphlet

The pamphlet is a standard trifold pamphlet designed on Canva. The pamphlet is simply designed and is meant to complement the website in its aesthetic and content. The pamphlet was selected as the mode of delivery for the accompanying written piece. The team discussed this choice of medium with the client extensively and offered a range of other options including a large sized poster, an online infographic, and an online flipbook. However, after a comprehensive discussion of each option, the client and team both decided that the easiest and most effective way to create an accompanying piece for the website would be a digital pamphlet. This pamphlet does not require printing and can be distributed as a png or jpeg file,

or PDF. Quinte Conservation and the local municipalities can decide whether they would like to print and distribute this pamphlet to members of the public.

Besides the design, the second main consideration that went into the pamphlet content and design was the intended audience. While the main audience of both deliverables is the municipal staff in Quinte Region, the team created the pamphlet with the possibility of it being distributed to the broader public as part of future community education and consultations about GI projects in the region. While the pamphlet has been developed with municipal staff as the end-users in mind, it is easy to understand for any member of the public wanting to learn more about GI and stormwater in the Bay of Quinte.

2.2 Project Content

The scope of the content for the deliverables was refined during discussions between the Queen's team and the clients. As the users only have a limited amount of time to engage with the resource, the website and pamphlet's scope had to be narrowed. It was ensured that the content remained comprehensive and engaging while satisfying the time limitation of 30 minutes or less. The scope was limited to GI in stormwater practice and how GI can impact the Bay of Quinte on a municipal level. Information about private landowner uses of GI or GI in other applications was left out of the deliverable to ensure a more concise presentation. To provide content that was relevant to the Bay of Quinte region, the examples used in the case studies drew mainly on Canadian cities with similar climates to Quinte Region. Through collaboration with the client, the team landed on the following topics for the final draft of the deliverables: Stormwater Issues in the Bay of Quinte, Overview of GI, GI Examples, Case Studies of GI in Stormwater Management, Benefits of GI, and GI Implementation.

2.3 Project Constraints

2.3.1 Time

This project was restricted to a timeline of approximately 13 weeks. Both deliverables are required to be completed by the end of the project deadline and handed over to the client for dissemination to the municipal staff users.

The time constraints on this project required the team to carefully consider what content was feasible to create in the allotted time frame. To ensure there was enough time to develop, edit, and review the final deliverables several times with the client, the team elected to not develop an original video series for the final interactive aspect. Instead, it was decided to focus efforts on creating a well-written brochure and

informative graphics for the website. This was completed in conjunction with drawing on videos from other sources to maintain the core idea of the combined video series and website design.

With respect to deliverables, the users must be able to consume the information in both the interactive component and the brochure in under 30 minutes. This restriction was selected to avoid losing user interest and improving the likelihood of them fully engaging with the resource. Therefore, resulting in a final product that was concise and easily navigable to reduce the amount of time that users would have to spend sifting through the information.

2.3.2 User Knowledge

The target audience were municipal staff members who may have limited to no prior knowledge of stormwater, GI, and stormwater issues in the Bay of Quinte. Therefore, the deliverable needed to address the basics of these aspects to ensure the content was relevant and easy to understand.

2.3.3 Budget

The project had no agreed-upon budget for the purchasing of video, graphic or web designing software. Therefore, this limited the options available to the team in terms of design software that would be used to create the final product. The high cost of many design programs limited the team's choices for platforms to create and disseminate the final product. However, despite budgetary constraints, the team was able to find suitable free programs to build the different aspects of the final deliverable on.

2.3.4 Copyright

The team wanted to ensure that the images and resources included in the pamphlet and website did not infringe on copyright. Therefore, all images and graphics used in the final deliverables are either free stock images or have been created by the team. All resources are cited using endnote style and included at the bottom of the website for both transparency of information and crediting the authors. The YouTube videos included on the website are hyperlinked to avoid infringing on video copyright.

2.3.5 Validation

We were unable to contact the end users (the municipal staff members at Quinte Region municipalities) to validate our product's efficacy and gain feedback from the user-end. To ensure we still were able to test the deliverables, we distributed our website and pamphlet to friends, family and colleagues. After receiving feedback on the website and pamphlet, we were able to improve them by reducing the written content on the website and breaking it down into more clearly defined sections. It is important to note the potential limitation in this, as there may have been biases in the feedback received. Therefore, throughout the project, the team also relied on consistent interaction from the team at Quinte

Conservation, as well as the teaching team, and incorporated their feedback into the final products throughout the different stages of development.

2.3.6 Data and Research

As green infrastructure for municipal stormwater management in Canada is new, there is a limited amount of quantitative data available on the efficacy of GI on improving water quality in similar contexts to Quinte Region. The lack of data posed a major challenge to the team, as the intention was to create graphics displaying the quantitative improvements that came with GI stormwater management. To work around this obstacle, the team reached out to both the client and a professor at Queen's to collect more data on GI's impacts on water quality in Canadian cities. While we were able to find some data on water quality improvements, it was highly technical and detailed. The team decided that these resources were intended for a higher level of discussion that fell outside of the project's scope. Therefore, the team decided to link these resources in the "Additional Resources" section of the website.

3 Instructions for Use

QC will distribute the two components of the deliverable (an interactive website and online pamphlet) to local municipal staff members, who will read through the resources on their own time. The website contains different sections for users to scroll through and read, as well as additional resources for further le. The website also includes directions on how to access the QC website and social media for additional information as well. The website will be accessible on both laptop or mobile phones and will also be incorporated into the Quinte Conservation webpage for public access.

3.1 Instructions for Website Use

The website opens with a large hero image on the home page and the phrase “GI is important for your municipality” followed by “Explore this website to learn why.” This title is intended to quickly identify who the website is for and draw users in. This can be seen below in Figure 1.

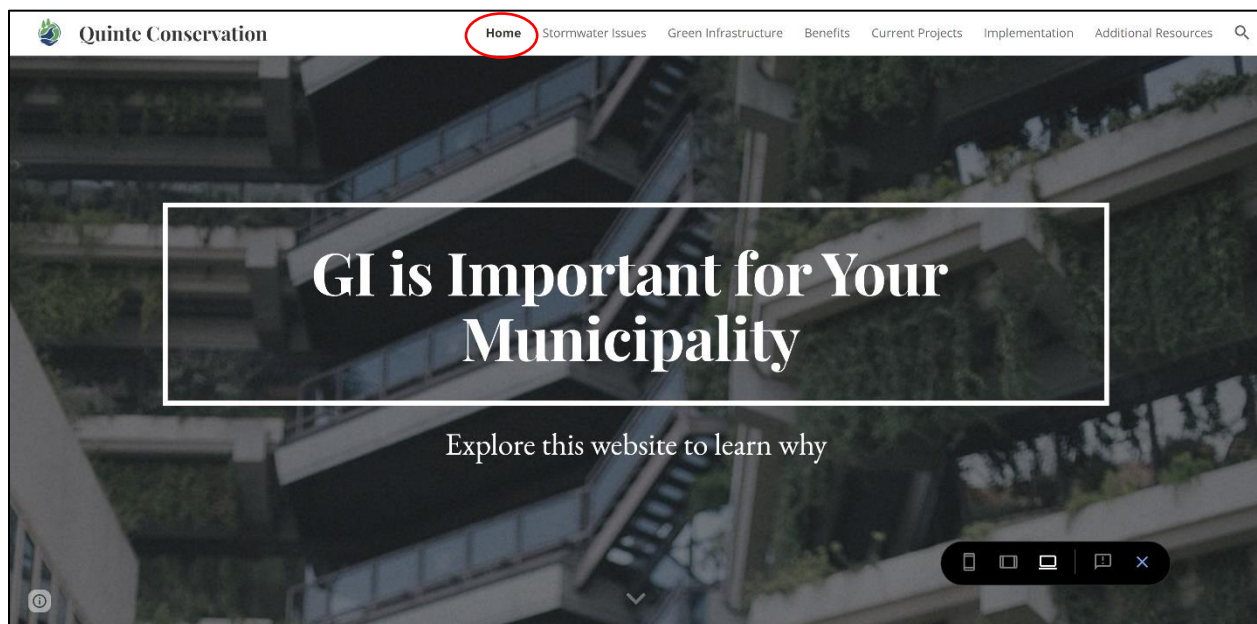


Figure 1: Website homepage – Hero Image.

The website contains seven tabs across the top navigational bar. These tabs outline each subsection of the website and allow for easy navigation between the different topics. This can be seen in Figure 2.

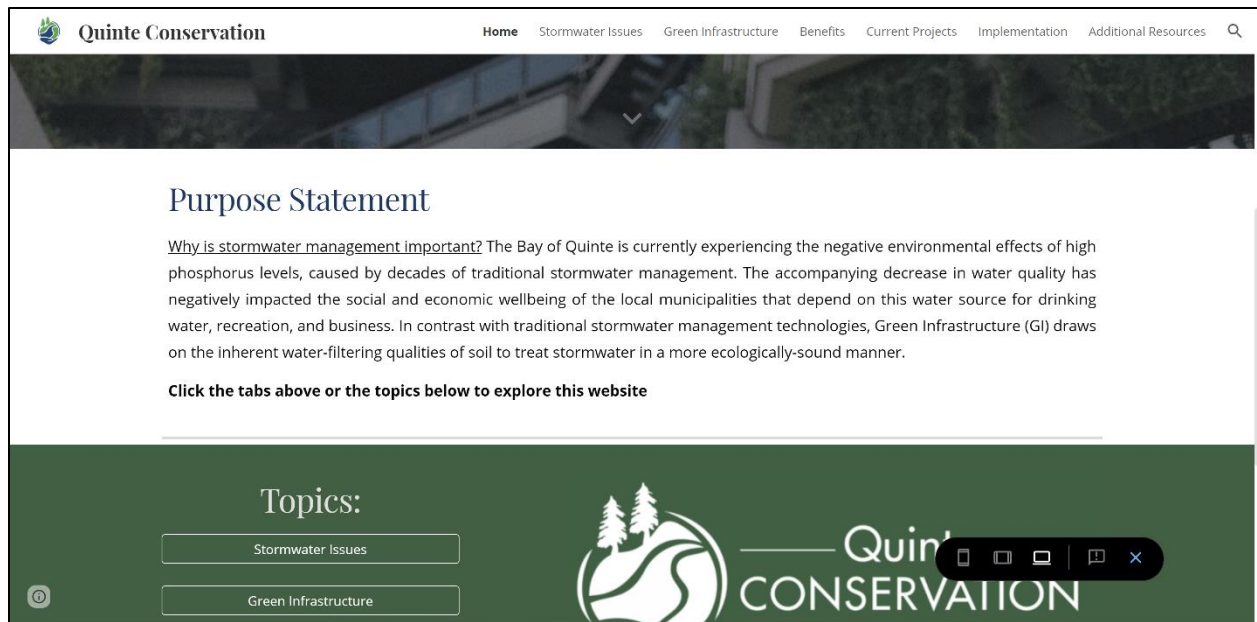


Figure 2: Website homepage – Purpose Statement.

After the image, a short purpose statement is included, introducing the reader to the topic of stormwater issues and GI in the Bay of Quinte.

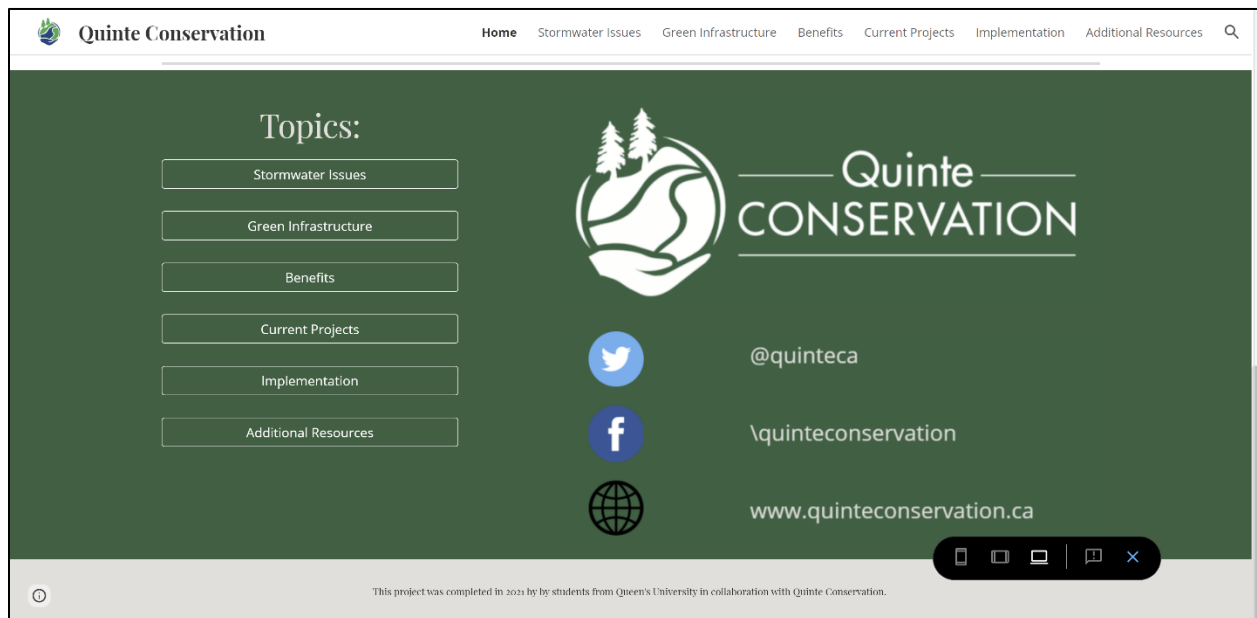


Figure 3: Website homepage – Footer.

Scrolling down from the purpose statement takes the user to the footer which includes several elements. The first element is the topic list; this section includes buttons that further support user navigation to the website's different sub-topics. The second element is Quinte Conversation's contact information including

links to their social media and website. The last element is a note in the white box that describes this website as a joint project between QC and Queen's University students.

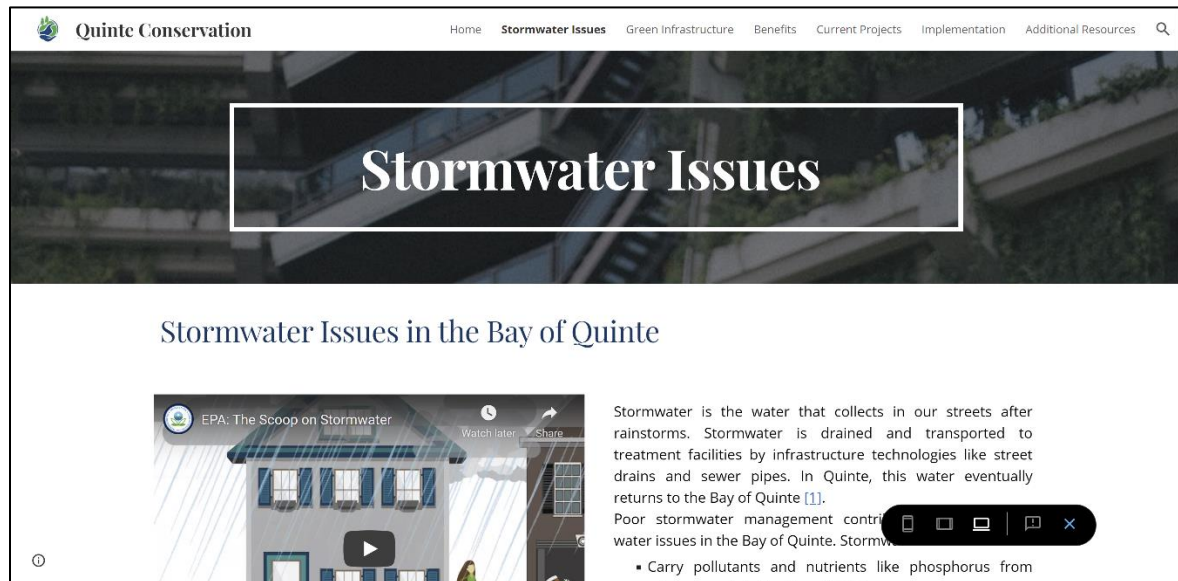


Figure 4: Stormwater Issues - Landing Page.

Clicking on the second tab takes the user to the subsection focused on Stormwater Issues in the Bay of Quinte (Figure 4). This section includes some written content and a short video from the United States Environmental Protection Agency outlining what stormwater is and how it can cause water quality problems. The graphics included in this section outline both how stormwater contributes to water pollution and how the water pollution-related algae blooms that the Bay of Quinte experiences has negatively impacted the community's economic and social well-being.



Figure 5: Green Infrastructure - Landing Page.

The “Green infrastructure” tab describes to users what green infrastructure is at a high level, as seen in Figure 5. The written content is accompanied by a video by the Trust for Public Lands.

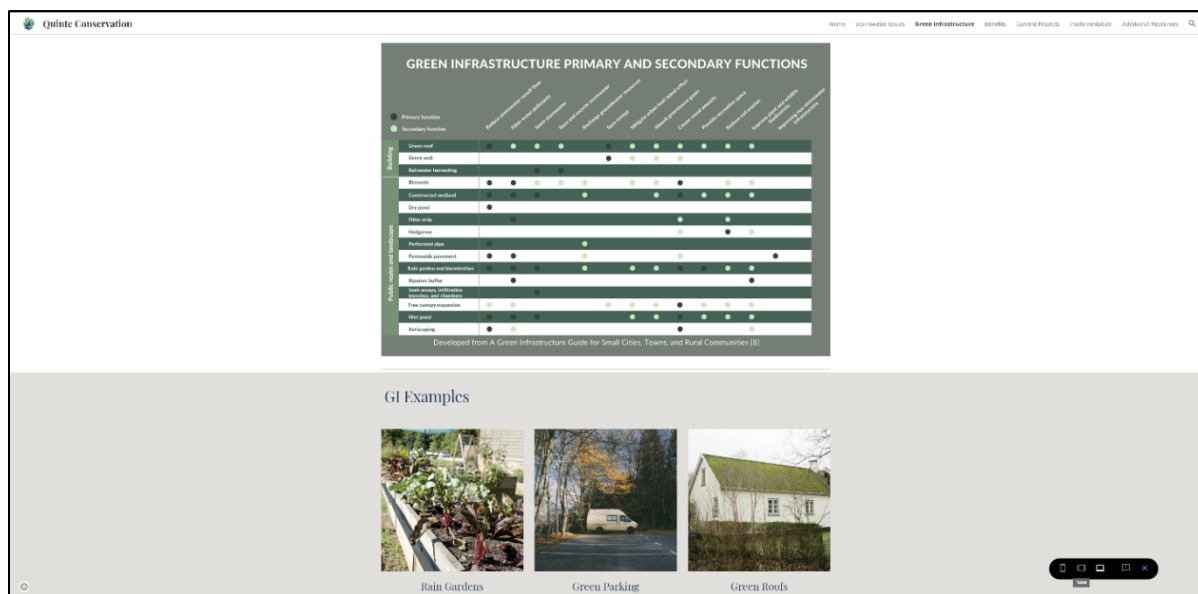


Figure 6: Green Infrastructure – Content (Please note the screenshot has been zoomed out to include more content).

Scrolling down on the page brings the user to a graphic outlining the primary and secondary functions of various GI implementation methods (Figure 6). Additionally, it also lists three examples of GI: rain gardens, green parking lots and green roofs. These examples of GI have hyperlinks to YouTube videos which explain

the GI technologies in more detail. This section is intended to introduce the concepts of GI to viewers and spark their interest on how they can incorporate GI into their municipalities.

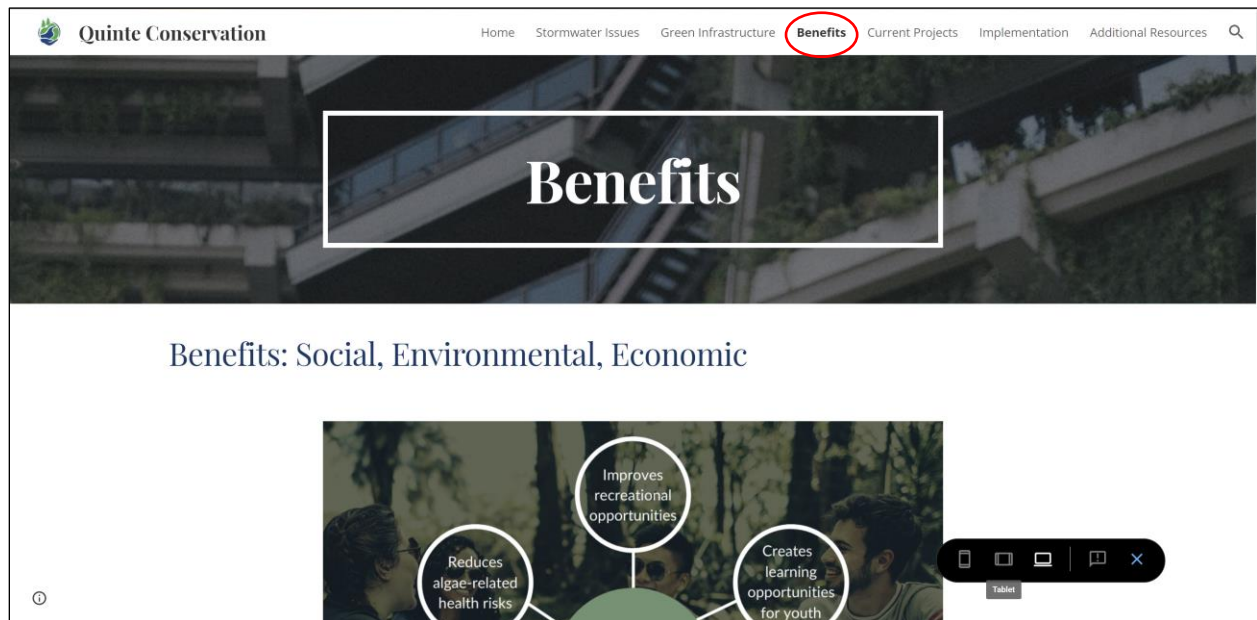


Figure 7: Benefits - Landing Page.

The fourth tab on the site illustrates the various benefits of GI. This encompasses the social, environmental, and economic benefits of implementing GI into municipal stormwater management. This information is highlighted in a series of graphics presented in a slideshow format (Figure 8).

To change graphics on the slideshow simply wave your cursor over the image in desktop mode or tap the screen in mobile mode. Two grey arrows on the left and right will appear. Click on the right to move through the slideshow. The grey and blue circles beneath the slideshow illustrate where in the slideshow you are, with the blue circle moving from left to right as you click through.

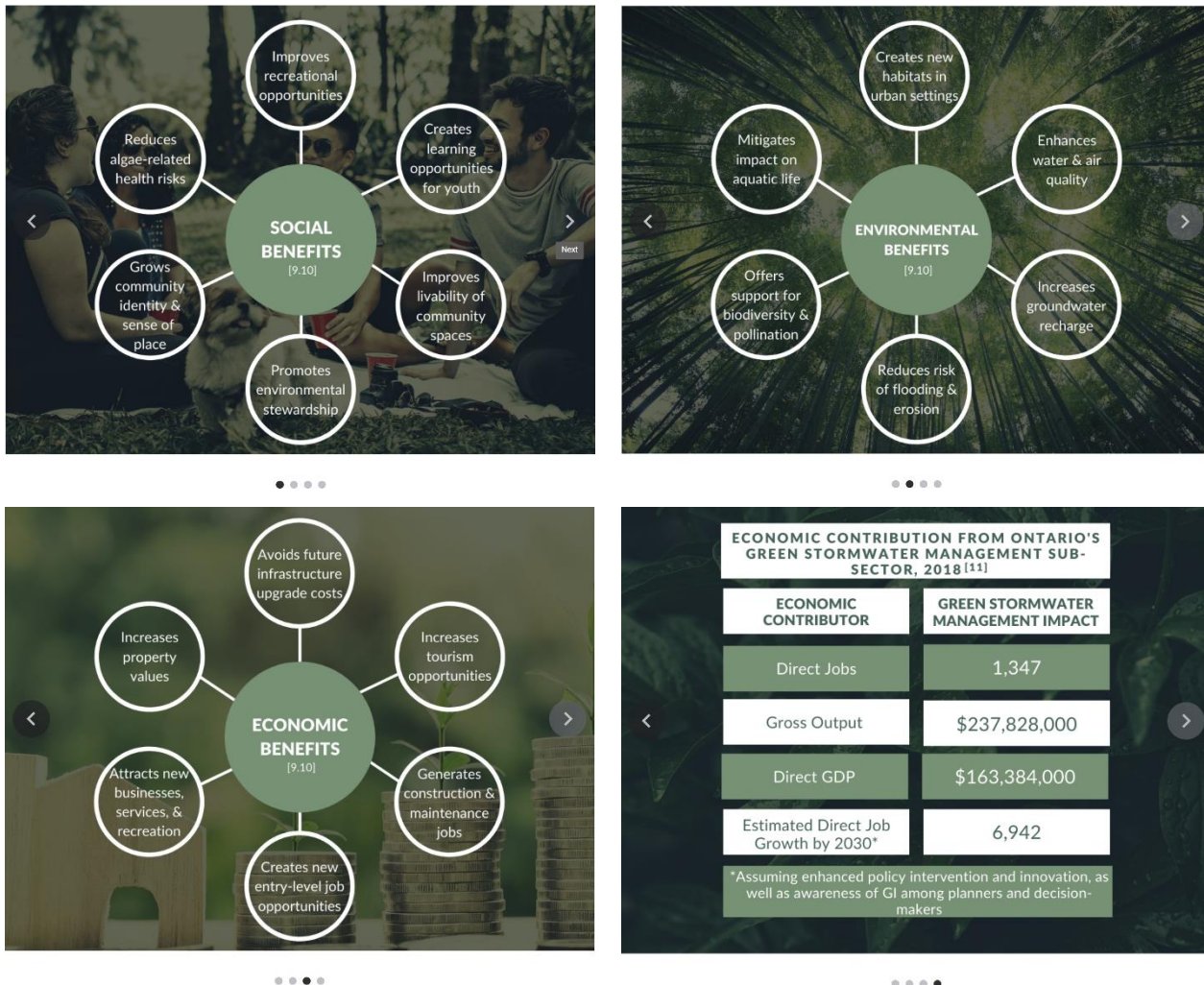


Figure 8: Slideshow of GI benefits on website.

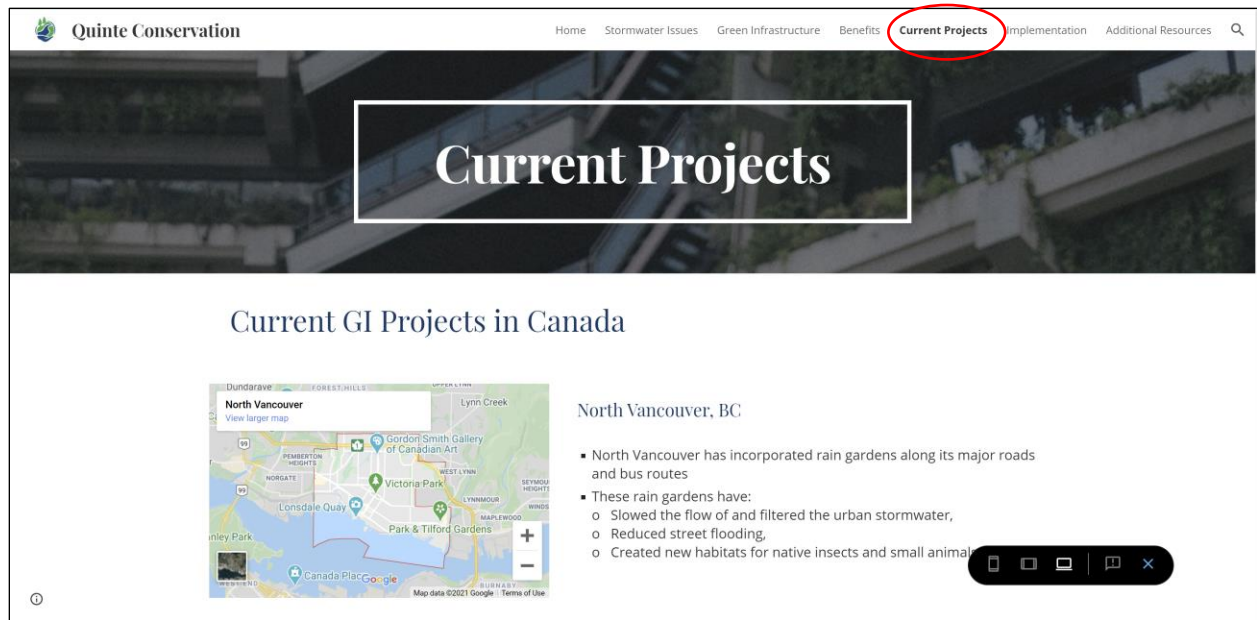
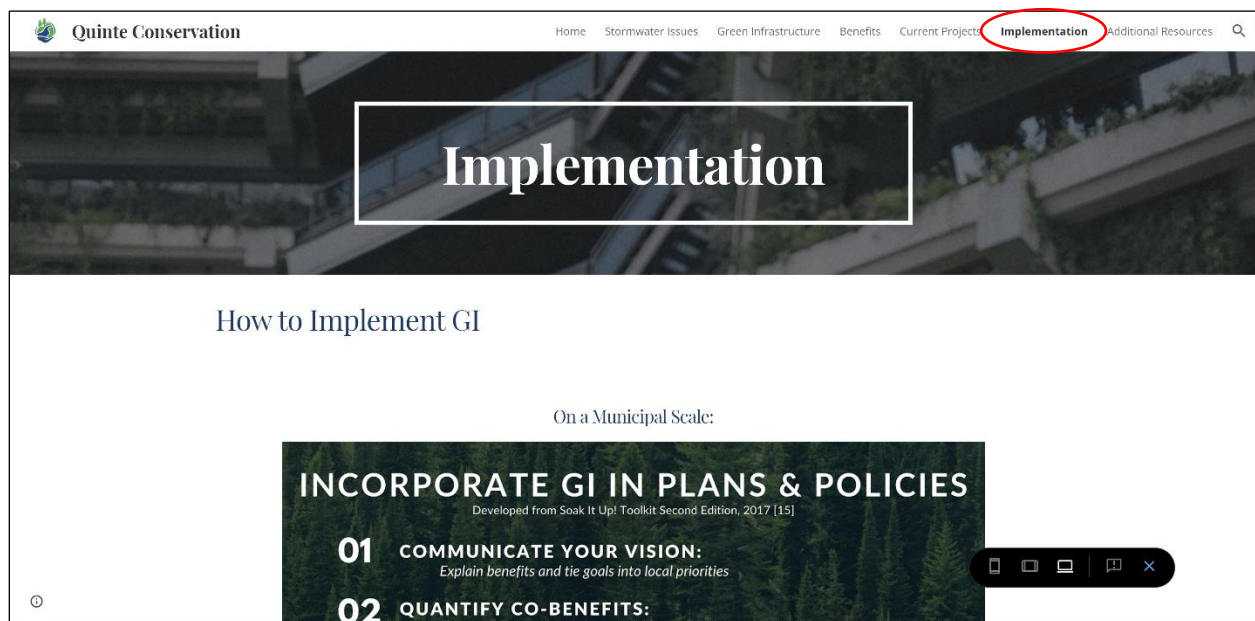


Figure 9: Current Projects - Landing Page.

The next tab illustrates three case studies of GI projects in North Vancouver, Lake Simcoe, and Coquitlam. Here the user can explore the location via an integrated map and learn more about how other municipalities are integrated GI into their stormwater management.

Figure 10: Implementation - Landing Page.



In the “How to Implement GI” Tab (Figure 10), two sets of graphics illustrate the implementation process of GI on both the municipal and individual level. At the bottom of the main content page, the sources used in the website content are provided (Figure 11).

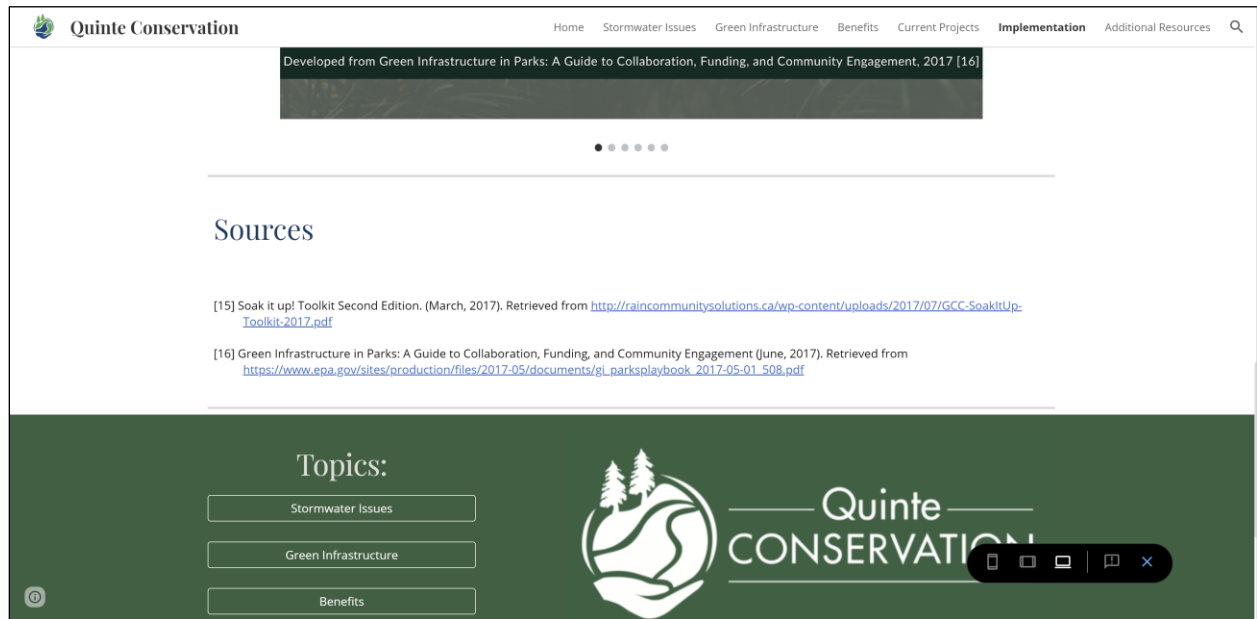


Figure 11: Sources on website.

On the final tab on the top navigation bar, “Additional Resources,” the website lists a series of resources that interested users can engage with for more in-depth information about GI projects and water quality monitoring.

3.1.1 Instructions for Updating the Website

The website allows anyone with access to the editorial link listed below in Appendix B to edit the webpage. One of the reasons Google Sites was selected as the website platform in the selection phase was its straightforwardness and ease of use. Therefore, updates to the site and design changes will be easy to implement when required. Furthermore, a helpful tutorial video is linked below. This video provides a comprehensive overview of editing and working in Google Sites. The team has made the team from Quinte Conservation editors on the website and a link to the website with editing access is provided below in Appendix B.

YouTube tutorials on Google Sites

https://www.youtube.com/watch?v=OsNat-3-D3s&ab_channel=TechnologyforTeachersandStudents

Google Sites: Edit and Update

3.1.2 Instructions for Tracking Analytics of Website

Selecting Google Sites as the medium for website design provides the associated benefits of Google Analytics. This tool allows users the opportunity to track website traffic, user engagement, and time spent on the website. To set up analytics click on the “settings” gear button as shown in Figure 12 below.

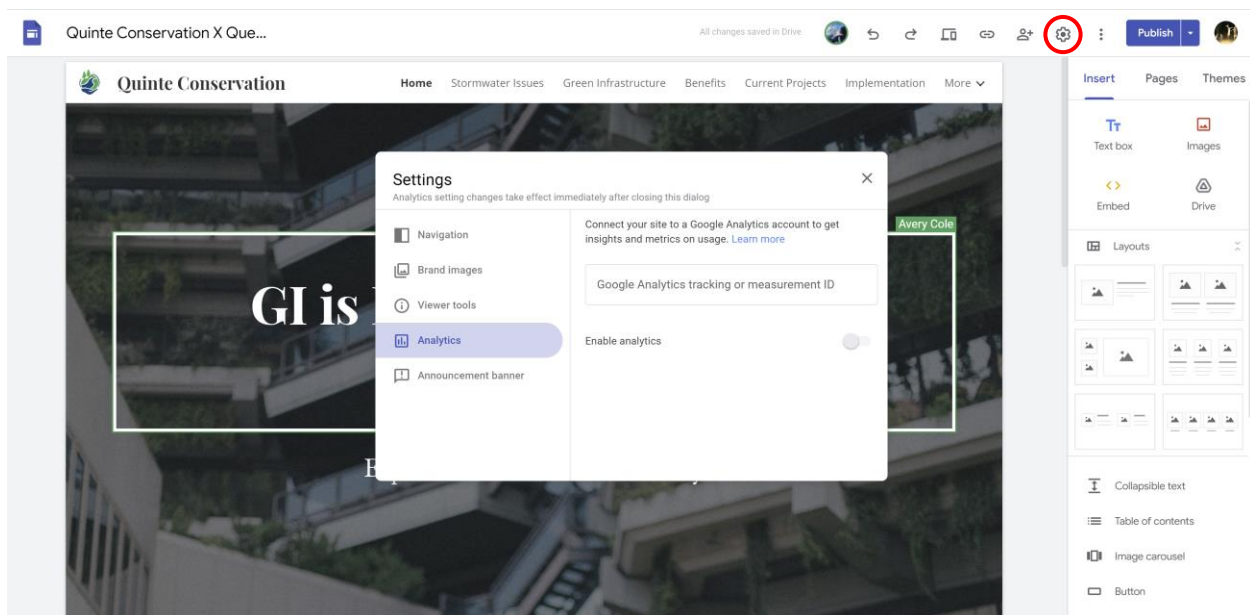


Figure 12: Setting up analytics on the website.

Next an analytics account must be created on the email intended to access the results. The following link provides a detailed explanation on how to set up an account for free and how to access the analytics for the website: <https://support.google.com/sites/answer/97459>

3.2 Instructions for Pamphlet Use

The pamphlet is available for both online and print distribution (Figure 13: Front side of pamphlet. Figure 13 and Figure 14). The front-side of the pamphlet contains a QR code that directs users to the website when scanned using a smartphone camera. In addition to linking to the website, the pamphlet provides a limited summary of the main topics of the website. The pamphlet is intended to direct users to the website, provide a brief introduction to the idea of the website content to users prior to engaging with the website, and act as a review tool for after the user has read through the website.

3.2.1 Instructions for Updating Pamphlet and Graphics

The pamphlet and graphics used in both the pamphlet and website were designed on Canva, allowing for the Queen's University team to transfer editing privileges to the Quinte Conservation team. To edit in Canva, open the Canva app and select the graphic or document you wish to edit. When in the document, you can upload and insert new images, text, or graphics by clicking on the left-hand sidebar and scrolling through the different media options listed. By clicking on the graphics or text that is already on the page, you can edit these for content, size, or change their position in the document. The team has added the clients as editors on the pamphlet and graphics on Canva and have linked to the pamphlet and graphics below in Appendix B.

POSITIVE IMPACTS

SOCIAL

- Improve livability of community spaces
- Improve recreational opportunities

ENVIRONMENTAL

- Create habitats for wildlife
- Improve water and air quality
- Reduce algae-related health risks
- Reduce flooding and landslide risk

ECONOMIC

- Increase property values
- Create job opportunities
- Avoid infrastructure costs
- Extend asset life

ONTARIO GREEN STORMWATER MANAGEMENT CONTRIBUTION (2018)

Economic Contributor	Green Stormwater Management Impact
Jobs (direct only)	1,347
Gross Output	\$237,828,000
GDP (direct only)	\$163,384,000
Estimated Job Growth by 2030 (direct only)	6,942

Source: An Economic Impact Assessment of the Green Infrastructure Sector in Ontario, 2020

CONTACT US!

PHONE:
(613) 968-3434

WEBSITE:
QUINTECONSERVATION.CA

VISIT OUR GI WEBPAGE FOR
MORE DETAILS AND
SUPPORTING EDUCATIONAL
INFO!



ADDRESS:
2061 Old Hwy 2.
Belleville, ON
K8N 4Z2

GREEN INFRASTRUCTURE & STORMWATER MANAGEMENT

.....



Quinte
CONSERVATION

Figure 13: Front side of pamphlet.

WHAT IS GI?

GI is a range of measures to store, infiltrate, and evapotranspire stormwater to reduce the flow that goes to sewer systems of surface waters, while contributing to groundwater recharge. GI:

- Is cost effective and versatile
- Uses vegetation, soil, and other elements to restore & mimic natural processes to create healthier environments
- Incorporates the natural environment into pre-existing stormwater systems

WHAT IS STORMWATER AND WHAT DOES IT DO?

Stormwater is the 'run-off' water that flows from our streets into the sewers, and eventually into the Bay of Quinte.

The Bay of Quinte has had a severe drop in water quality and environmental health due to increased human activity, causing pollutants and phosphorous to enter the environment through stormwater.



Stormwater

Increased Phosphorus

Algae Bloom Increase

Decreased Oxygen

Negative impact on:

- Fish
- Aquatic plants
- Plankton
- Shorelines
- Wildlife habitats
- Sediment
- Human health

Algae blooms can also produce toxins that pose a threat to human health through contact or toxin bioaccumulation in fish.

Stormwater overflow can also cause damage to property and infrastructure!



IMPLEMENTING GI

- 1 COMMUNICATE YOUR VISION
- 2 QUANTIFY CO-BENEFITS
- 3 FORM A TASK FORCE
- 4 ADOPT TARGETS
- 5 REVIEW BYLAWS

POTENTIAL SOLUTIONS

RAINWATER HARVESTING

- Collect and store rainwater for later use
- Slow and reduce runoff, and provide a source of water

RAIN GARDENS

- Collect and absorb runoff from roofs, sidewalks, and streets
- Mimics natural processes

PERMEABLE PAVEMENTS

- Infiltrate, treat, store rainwater where it falls
- Can be used for infrastructure such as roads and parking lots

PERVIOUS SURFACES

These decrease the volume & speed of runoff, filtering out pollutants and sediment before stormwater goes downstream:



Source: Green Infrastructure Toolkit, Georgetown Climate Centre

Figure 14: Back side of created pamphlet.

4 Next Steps and Recommendations

4.1 Add New Projects

A recommendation for the project is to track municipalities that have decided to implement GI into their respective stormwater management systems. These projects should be highlighted on the website to encourage other municipalities in and out of Quinte Region to follow suit. Displaying projects from municipalities in Quinte Region will motivate other regions to do the same and promote knowledge sharing between different municipalities looking to implement GI into their stormwater management.

4.2 Add More Statistics on GI as Implementation Increases

One of the obstacles that the team faced during this project was finding suitable statistics on the implementation and use of GI in Canada. As GI stormwater technologies are relatively new in Canada, there is very little quantitative data published on its success in reducing phosphorous levels in Canadian municipalities. As data becomes more available, the team recommends that new data and statistics are incorporated into the website to further sell the feasibility of GI.

5 Bibliography

Bay of Quinte Remedial Action Plan. (2016). Beneficial Use Impairment #3 Assessment Report - Degradation of Fish and Wildlife Populations.

https://www.bqrap.ca/cms_lib/BQ%20BUI%203%20Assessment%20FINAL.pdf

Binstock, M. (2011). Greening Stormwater management in Ontario: An Analysis of Challenges and opportunities. *Canadian Institute for Environmental Law and Policy*.

<http://cielap.org/pdf/GreeningStormManOntario.pdf>

Ellwood, N., Winston, R., Zhang, H., Sharvelle, S. (2019) Green Infrastructure Life Cycle: Performance, Cost and Maintenance. Water Environment Federation.

<https://www.wef.org/globalassets/assets-wef/3---resources/online-education/webcasts/presentation-handouts/presentation-handouts-072519-final.pdf>

Environmental Protection Agency (EPA). (2020). What is Green Infrastructure?

<https://www.epa.gov/green-infrastructure/what-green-infrastructure>

Flynn, K.M. (2011). Evaluation of Green Infrastructure Practices Using Life Cycle Assessment. Villanova University. <https://www1.villanova.edu/content/dam/villanova/engineering/vcase/vusp/Flynn-THesis-11.pdf>

Government of Canada. (2017). Bay of Quinte: Area of Concern.

<https://www.canada.ca/en/environment-climate-change/services/great-lakes-protection/areas-concern/bay-of-quinte.html>

Green Infrastructure Ontario Coalition. (2020). An Economic Impact Assessment of the Green Infrastructure Sector in Ontario.

https://greeninfrastructureontario.org/app/uploads/2020/07/Economic-Impact-Assessment-of-GI-Sector-in-Ontario_UPDATED_july20-20.pdf

Kelly, N., Javed, A., Shimoda, Y., Zastepa, A., Watson, S., Mugalingam, S., Arhonditsis, & G.B. (2019). A Bayesian risk assessment framework for microcystin violations of drinking water and

- recreational standards in the Bay of Quinte, Lake Ontario Canada. *Water Research* 162: (pp. 288-301). [https://www.sciencedirect-com.proxy.queensu.ca/science/article/pii/S004313541930510X?via%3Dihub](https://www.sciencedirect.com.proxy.queensu.ca/science/article/pii/S004313541930510X?via%3Dihub)
- Koops M., Dermott, R.M., Leisti, K.E., Johannsson, O.E., Millard, E.S., Minns, C.K., Munwar, M., Nicholls, K.H., & Hoyle, J.A. (2009). The Bay of Quinte: a model for large lake ecosystem management. *Verhandlungen des International Verein Limnologie* 30(7), (pp. 1024-1029).
file:///Users/Avery/Downloads/Koopsetal2009VerhInternatVereinLimnol30_1024.pdf
- Li C., Peng, C., Chiang, P.C., Cai, Y., Wang, X., and Yang, Z. (2019). Mechanisms and applications of green infrastructure practices for stormwater control: a review. *Journal of Hydrology* 568: (pp. 626-637).
https://www.sciencedirect.com/science/article/pii/S0022169418308539casa_token=i_cHm7YWw_eCMAAAAA:TfU2NY2r948umjhdJHYC17OMr2u5RSxdCZbXa2YN2uiMgFXSSyzYs5iHre3yb0fNGN-jkmmTa0E
- Metro Vancouver. (2015). Connecting the Dots.
<http://www.metrovancouver.org/services/regionalplanning/PlanningPublications/ConnectintheDots.pdf>
- Metro Vancouver. (2015). Green infrastructure in Metro Vancouver.
<http://www.metrovancouver.org/services/regionalplanning/PlanningPublications/PolicyBackground-GreenInfrastructure.pdf>
- Ministry of Environment Ontario. (2014). Information about Blue-Green Algae.
https://www.bqrap.ca/cms_lib/Fact%20Sheet%20%20Information%20About%20Blue%20Green%20Algae%20R.pdf
- Munawar, M., Fitzpatrick, M., Niblock, H., Kling, H., Lorimer, J. & Rozon, R. (2018). Phytoplankton ecology in the Bay of Quinte, Lake Ontario: Spatial distribution, dynamics and heterogeneity. *Aquatic Ecosystem Health & Management* 21(2): (pp. 213-226).
<https://doi.org/10.1080/14634988.2018.1474058>

O'Neill, S.J. & Cairns, S. (2016). New Solutions for Sustainable Stormwater Management in Canada. Sustainable Prosperity.

<https://institute.smartprosperity.ca/sites/default/files/stormwaterreport.pdf>

Seattle Public Utilities. (2020). Improving Our Communities with Natural Drainage Systems.

<https://www.seattle.gov/Documents/Departments/SPU/EnvironmentConservation/ThorntonFAQ.pdf>

6 Appendix A – Mind Maps and Weighted Evaluation Matrix

6.1 Mind Map of Solution

The primary idea generation tactic used was mind mapping. The brief mind map below outlines the Quinte Conservation project goals, assumptions, and various presentation mediums we brainstormed.

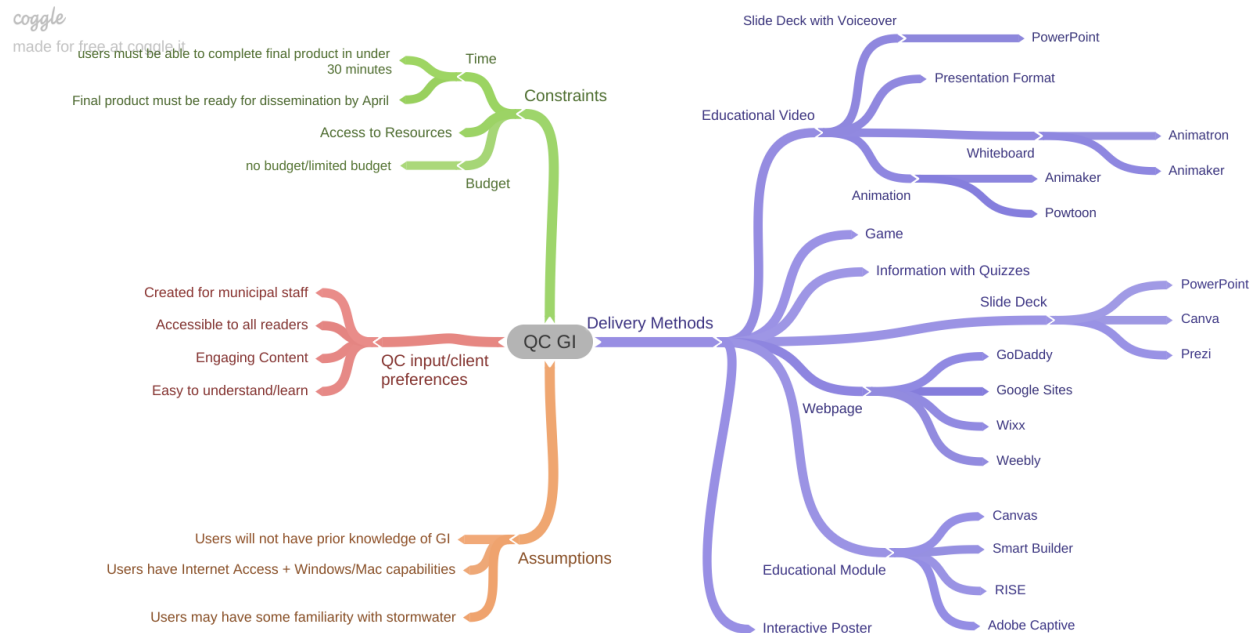


Figure 15: Mind map of problem and possible solutions.

6.2 Evaluation Matrix: Delivery Method

6.2.1 Design Criteria

The first step taken to create an evaluated decision matrix was coming up with criteria to assess the various potential mediums. In creating the evaluated decision matrix, we identified what the team and the client considered to be the most essential criteria for the medium based on our discussions with the client and gave each criterion a weight associated with its importance. The justification for the weighting and criterion the team chose is shown below. Further consultation with the client to confirm the client agrees with the criteria weighting.

Table 1: Design Criteria, Weighting, and Justification

Design Criteria	Description	Weighting	Justification
Accessibility	The deliverable should be accessible to all users.	10	For the deliverable to be effective, all users must be able to engage with it. The design must therefore consider different accessibility needs (e.g., closed captions on videos or transcript for audio files).
Time	Deliverable must be reviewed and understood in 30 minutes or less.	20	In order to maintain the interest of the staff and not detract from their other work, the deliverable must respect the time limits proposed by the client.
Engaging	Deliverable must captivate the attention of the user to ensure that all information provided in the final product is fully engaged with.	15	Many online resources already have the necessary information to understand GI but fail to deliver it in a captivating way. This makes it difficult for readers to absorb all the necessary information to make informed decisions on GI implementation.
Easy to Understand	Deliverable should be able to be understood by any municipal staff members.	20	Making the deliverable easy to understand is essential for its future success. Users of the resource must be able to interpret the information provided. The materials should serve as a comprehensive resource for those who have little to no prior knowledge on the subject matter.
Cost of Product	Cost should be as low as possible and ultimately under \$90.	10	The cost of the project should be considered however will not play a large role in the design of the final solution. Expensive software will be avoided, and cheap alternatives will be utilized.
Aesthetic	Deliverable should be pleasing to the eye and flow nicely.	5	Aesthetic factors into whether a resource is engaging and should be considered when selecting a medium. However, as this is an educational resource, aesthetic will not direct the route of the project. As a result, it has scored the lowest rating.
Feasibility	Deliverable will be achievable based on the knowledge and	20	Due to project time constraints, the team will have limited time to put together the final deliverable.

Design Criteria	Description	Weighting	Justification
	capabilities of the group members.		

6.2.2 Evaluation Matrix

Following the creation of the design criteria and weighting, each project idea was ranked as either a 1, 3, or 5, with 1 being low in the associated category and 5 being high. Through the Evaluation Matrix, the video series produced the highest score, while a web page came in second.

Table 2: Evaluation Matrix

Design Criteria	Weight (%)	Slide deck with voiceover	Video (whiteboard)	Video (animation)	Educational Module	Web page	Video series
Accessible	10	3	3	3	3	5	3
Time	20	5	5	5	5	5	5
Engaging	15	1	5	5	3	3	5
Easy to understand	20	3	5	5	5	3	5
Cost	10	5	5	5	1	5	5
Aesthetic	5	1	3	5	3	5	5
Feasibility	20	5	1	1	3	5	5
Score	-	72%	78%	80%	72%	86%	96%

Table 3: Evaluation Matrix Justification

Design Criteria	Slide deck with voiceover	Video (whiteboard)	Video (animation)	Educational Module	Webpage	Video series
Accessible	A slide deck with voice-over was given a score of 3 as the audio may not be an appropriate speed for all listeners to experience. Additionally, some users may struggle with an overload of audio.	A whiteboard video was assigned a score of 3 as videos may not be the ideal speed for all viewers making it difficult to digest. Moreover, with a whiteboard video, users may have difficulty focusing on the information with visuals.	An animated video was assigned a score of 3 as videos may not be the ideal speed for all viewers making it difficult to digest. Furthermore, with a whiteboard video, users may have difficulty focusing on the information with visuals.	An educational module was given a score of 3. This is due to its structure; users may find it difficult to interact with.	A webpage was given an accessibility score of 5 as it is easy for anyone to interact with online and at their own pace.	Video series were assigned a score of 3 as videos may not be the ideal speed for all viewers.
Time	A score of 5 was given to all categories as they will be created to meet the time requirement (<30 minutes). Time will be considered for each deliverable and an appropriate length will be determined.					
Engaging	Slide decks were rated as a 3 for engaging because they are less interactive and less visually appealing than videos.	Whiteboard videos were rated as a 5 for engaging. Short videos with interesting graphics and music tend to hold the viewer's attention better than reading.	Animated videos were rated as a 5 for engaging. Graphic-heavy and aesthetically pleasing animated videos that combine audio and visuals tend to hold the viewer's attention better than reading written content.	Educational modules were rated as a 3 for engaging. While educational modules can include graphics, audio, and videos, having a user click through a module, might become repetitive.	Webpages were rated as a 3 for engaging. Well-designed webpages can include animations and smooth-running content; however, webpages are less interactive and place a higher emphasis on written content than other formats.	Video series were rated as a 5 for engaging. Short videos with interesting graphics and music tend to hold the viewer's attention better than reading.

Design Criteria	Slide deck with voiceover	Video (whiteboard)	Video (animation)	Educational Module	Webpage	Video series
Easy to understand	Slide decks were rated as a 3 for being easy to understand. The format of having a combination of writing, audio, and graphics will allow for them to appeal to all types of learners.	Whiteboard videos were rated as a 5 for being easy to understand. Whiteboard videos can utilize graphics and audio to demonstrate concepts to viewers.	Animated videos were rated as a 5 for being easy to understand. Animated videos can utilize graphics and audio to demonstrate concepts to viewers.	Educational modules were rated as a 5 for being easy to understand. Educational modules are user-friendly and direct the user from each section of the content.	Webpages were rated as a 3 for being easy to understand. The webpage requires more involvement from the user to navigate the information.	Video series were rated as a 5 for easy to understand. Video series utilize graphics and audio to demonstrate concepts to viewers, and can be organized by topic, making the information easier to digest for the users.
Cost	Various slide deck tools are available free to users, and voice overs can be easily added using other free applications, as well.	We have found a free tool to allow us to create a whiteboard animation video.	We have found free tools to allow us to create animated informational videos.	The sites to create educational modules within all require a subscription that is quite costly to keep up with.	We have found a tool that gives us 30 days to create a webpage that can help teach about GI. Once the webpage is complete, it remains intact even if a subscription is not made and will remain sharable to different entities.	The team all have access to cameras to film and record a video series. Various tools such as iMovie are available to edit and produce these as well.
Aesthetic	A slide deck with voice over received a score of 1 for aesthetics.	A whiteboard video received a score of 3 for aesthetics. This is because there is	An animated video received a score of 5 for aesthetic. This is because factors such as	The educational module received a score of 3 for aesthetics. This is because an	A webpage received a score of 5 for aesthetics. This is because videos and photos can be	A video series received a score of 5 for aesthetics because photos

Design Criteria	Slide deck with voiceover	Video (whiteboard)	Video (animation)	Educational Module	Webpage	Video series
	Despite being able to personalize the slides, this solution does not have any animated components that would draw in the viewer.	an artistic aspect to this solution. Live-drawn images may, however, not be aesthetically appealing depending on the team's drawing abilities.	color, movement, and patterns are included in this solution. Additionally, such cartoons would not be hand-drawn, therefore the teams' artistic abilities will not compromise the aesthetics.	educational module would allow for the addition of videos and photos, but the team would be limited to using premade templates that cannot be altered significantly.	added. Additionally, website templates are easily alterable to improve text font, background colors, and how the material is presented.	and animations can be added, and colors and fonts can be altered to improve appearance.
Feasibility	A slide deck with voice over received a score of 5 for feasibility, as all team members are familiar with the required software for creation. Additionally, product components including scripts, a PowerPoint, and recording would be easy to complete in the given timeframe.	A whiteboard video received a score of 1 for feasibility. This is because researched software's to create whiteboard videos are complex. Additionally, it would take too much time to brainstorm each frame/drawing needed to go in line with the voice over.	A video animation received a score of 1 for feasibility. This is because researched software's to create such animations are very complex and time consuming. The video would not be able to be completed within the given timeframe.	The educational module received a score of 3 for feasibility, as it is more difficult than the other proposed options. This is because software used is more complex. Additionally, creating interactive aspects such as video clips and quizzes would be difficult to accomplish with the team's given timeframe.	The webpage received a score of 5 for feasibility. This is because website creators are easy to manipulate due to provided instructional videos and pre-made templates. Additionally, the timeframe to complete and edit the website is realistic.	The video series received a score of 5 for feasibility. This is because the team has access to all necessary software/tools required to create a video series. This includes a free video editor, a webcam and microphone to elaborate on the topics.

6.2.3 Selection

Based on the decision matrix presented above, the team concluded that the best course of action is to create a series of small videos that outline various aspects of green infrastructure and its application in addressing stormwater issues in Quinte region. Furthermore, the second highest rated medium was an interactive webpage. Through discussion with the client, the team has decided that a video series will be created and posted to a unique webpage alongside other learning resources and written content. This allows municipality members to have a place to go where they can find all information needed, in one location, organized in a helpful way.

6.3 Evaluation Matrix: Delivery Software

As discussed in Section 4.1, the chosen delivery method was a webpage with a video series component. Before creating the webpage, different platforms must be evaluated to select which will best deliver the project.

6.3.1 Design Criteria

Website platform criteria were selected based on the requirements of the project. All criteria were weighted based on their relative importance, out of 100. Justifications for criteria weightings are also summarized in Table 4. Similar to the previous evaluation matrix, the justification for the weighting and criterion was determined by the team. Hence, further consultation with the client is needed to ensure that it also aligns with their expectations.

Table 4: Platform Criteria, Weighting, and Justification

Design Criteria	Description	Weighting	Justification
Features	Website templates must include insertable features such as buttons, video links, and analytics tracking.	30	Many online resources already have the necessary information to understand GI but do not deliver it in a captivating way. This will aid in captivating the attention of the user and ensure that all information provided in the final product is fully engaged with. Additionally, analytics tracking will provide the client with feedback on the number of users that are interacting with the resource.
Cost	Cost to create and keep the website should be as low as possible and ultimately under \$90.	20	The cost of the project should be considered however will not play a large role in the design of the final solution. Expensive software will be avoided, and cheaper alternatives will be favoured.
Aesthetic	Available website templates should be pleasing to the eye and flow nicely.	20	Aesthetic should be considered when designing the solution however it will not direct the route of the project. As a result, it has scored the lowest rating.
Feasibility	Website completion will be achievable based on the knowledge and capabilities of the group members.	30	Due to project time constraints, the team will have limited time to put together the final deliverable.

6.3.2 Evaluation Matrix

Based on research conducted on each platform, the team completed the following evaluation matrix for selecting a website platform. Justifications for each score are outlined in Table 6.

Table 5: Evaluation Matrix

Design Criteria	Weighting (%)	Google Sites	Wix	WordPress	Weebly
Features	30	3	5	5	5
Cost	20	5	1	1	1
Aesthetic	20	3	5	5	5
Feasibility	30	5	3	3	3
Score	-	80%	72%	72%	72%

Table 6: Platform Score Justification

Design Criteria	Justification
Features	Wix, Wordpress, and Weebly each received a score of 5 because they have a variety of add-in features available for website creation. Google Sites received a score of 3 as it has less features, but still enough to create an engaging and functional website.
Cost	Because Wix, Wordpress, and Weebly all require yearly payments for custom domains, they all received a score of 1 for cost. Google Sites is a free website creator that does not require payment for custom domains.
Aesthetic	Wix, Wordpress, and Weebly each received a score of 5 for aesthetics. This is because they have hundreds of templates available, which are all customizable. Google Sites received a lower score of 3 as they only have a dozen templates, with few layouts available.
Feasibility	Wix, Wordpress, and Weebly each received a score 3 for feasibility. This because the websites are harder to construct compared to Google Sites.

6.3.3 Selection

As shown in Section 4.2.2, Google Sites received the highest score compared to other platforms. Despite having a smaller number of features and templates, Google Sites received the highest score because it has free custom domains and is creator friendly. The number of features and templates is sufficient to create a high-quality product for Quinte Conservation.

7 Appendix B – Links for Future Content Editing

7.1 Link to Website for Editing Access

<https://sites.google.com/d/1CxebQD58R-OqP4UdrJwpydDy4xBUBTYR/p/1F4a2BFlyyYvv2L-YIIEflhBhhdHsM7jg/edit>

7.2 Links to Website Videos

The US Environmental Protection Agency Video: <https://youtu.be/grWVQjNtLus>

Trust for Public Land Video: <https://youtu.be/2NVAS1BE3bg>

7.3 Links to Graphics and Pamphlet

Links to Graphics with editing access:

Benefits:

https://www.canva.com/design/DAEY80JxX6s/share/preview?token=dOexXBHK59y3tsvfLUSZBQ&role=EDITOR&utm_content=DAEY80JxX6s&utm_campaign=designshare&utm_medium=link&utm_source=sharebutton

Algae Blooms:

https://www.canva.com/design/DAEZsm8EKAAo/share/preview?token=7dISL7JIG6rdMS_yI5OXiw&role=EDITOR&utm_content=DAEZsm8EKAAo&utm_campaign=designshare&utm_medium=link&utm_source=sharebutton

Stormwater Pollution Diagram:

https://www.canva.com/design/DAEbALpF6rA/share/preview?token=mgdqQEV15jk-9QCoKxdDug&role=EDITOR&utm_content=DAEbALpF6rA&utm_campaign=designshare&utm_medium=link&utm_source=sharebutton

Primary and Secondary Sources:

https://www.canva.com/design/DAEZsd4mi2Q/share/preview?token=-AEmA85L_dWOWQRX2ncEVQ&role=EDITOR&utm_content=DAEZsd4mi2Q&utm_campaign=designshare&utm_medium=link&utm_source=sharebutton

Incorporate GI Into Plans and Policies:

https://www.canva.com/design/DAEaesaRugg/share/preview?token=ZcDdjWyKM5ksKHCyCgt-IA&role=EDITOR&utm_content=DAEaesaRugg&utm_campaign=designshare&utm_medium=link&utm_source=sharebutton

GI Guide to Collaboration, Finding, and Community Engagement:

https://www.canva.com/design/DAEZsBuAORc/share/preview?token=HJU836ukTSOedGRRK3krqQ&role=EDITOR&utm_content=DAEZsBuAORc&utm_campaign=designshare&utm_medium=link&utm_source=sharebutton

Link to Pamphlet with editing access:

https://www.canva.com/design/DAEZtcmbXFQ/share/preview?token=V9vlejWjKXgB3ISffYHj9g&role=EDITOR&utm_content=DAEZtcmbXFQ&utm_campaign=designshare&utm_medium=link&utm_source=sharebutton