

Bridgwater Forest Fountain Rehabilitation Study

71 Bridlewood Road

Winnipeg, MB

R3Y 0K4



Prepared For:

Jason Bell

Parks Capital Projects Manager

City of Winnipeg

MB PERMIT TO PRACTICE No. 540

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Prepared By:

Richard Granger, P. Eng.

DGH Engineering Ltd.

12 Aviation Blvd.

St. Andrews, Manitoba

R1A 3N5

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CIVIL | STRUCTURAL | MECHANICAL | ELECTRICAL | INDUSTRIAL

Executive Summary

The City has identified the need to complete a rehabilitation study on the Bridgwater Forest Fountain as it has faced several challenges including vandalism, and functionality. Most recently in the summer of 2021, the system was pressure tested when a leak was identified. At the time of the test the leak was suspected to be at the connection under the bowl.

It is the City's intent to maintain the fountain as a feature for the residents in the local area. As a result of their intent, the City's Public Works Department has engaged the services of DGH Engineering Ltd. to:

- Conduct site visits to review the existing site, and the mechanical components within the service building located on the site.
- Coordinate the services of a video inspection of the existing supply and return pipes.
- Provide a report outlining a minimum of three options that include a scope of the anticipated work with conceptual design writeups and sketches but not detailed drawings or specifications suitable for construction.

This rehabilitation report has been prepared for the City to meet the requirements outlined in the "Request for Consultant Services Proposal" dated April 25, 2022.

DGH has identified five options for the Bridgwater Forest Fountain rehabilitation:

Option #1: Status Quo

For Option #1, The City would proceed no further than this rehabilitation study. The water feature will continue to deteriorate and may require emergency repairs in the future in the event of a major failure. No further capital costs will be incurred as a direct result of this study.

Option #2: Convert the Water Feature into a Landscape Planter

For Option #2, the existing water feature would be decommissioned and converted into a landscape planter. The supporting infrastructure will be abandoned in place or repurposed. The exact details of this option should be finalized at the detailed design phase if the City chooses to forgo all other options. It is expected that the supply and return pipes will be abandoned in place while the pump house would be repurposed as a water pipe connection point for quick couplers to be used by The City. This option is estimated to incur a minimum capital cost of \$42,000 based on preliminary budgetary estimates. Should the City proceed with this option detail design documents should be developed to provide a more accurate capital cost. Though this option is considered viable, the City does not have a desire to proceed with this option. Should sufficient capital funding not be secured to rehabilitate this infrastructure this option or complete demolition should be considered.

Option #3: Selective CIPP Sleeving of the Existing Supply and Return Piping Only

For Option #3, the existing PVC supply and return piping between the pumphouse and water feature will be repaired at 13 locations. One location will be replaced by excavating and exposing the pipe to replace a section of it with a SCH80 pipe. The 12 remaining locations (7 supply and 5 return) will be repaired using a sleeve consisting of a spray-on-liner that is sprayed on the interior of the pipe with multiple passes to buildup the wall thickness. If installed correctly the liner is anticipated to have a useful service life equivalent to new pipe, or approximately 50 years. At this time a NSF-64 certified liner for potable water is not available so a risk assessment and an engineering judgement will be required to allow for a non-code compliant liner to be installed. This option is estimated to incur a minimum capital cost of \$100,000 based on preliminary budgetary estimates.

Option #4: Complete CIPP Sleeving of the Existing Supply and Return Piping Only

For Option #4, the existing PVC supply and return piping between the pumphouse and water feature will be completely repaired. The supply and return piping will be repaired using a liner consisting of a spray-on-liner that is sprayed on the interior of the pipe with multiple passes to buildup the wall thickness. The liner is anticipated to have a useful service life equivalent to new pipe, or approximately 50 years. At this time a NSF-64 certified liner for potable water is not available so a risk assessment and an engineering judgement will be required to allow for a non-code compliant liner to be installed. This option is estimated to incur a minimum capital cost of \$180,000 based on preliminary budgetary estimates.

Option #5: Install New Supply, New Return Piping, and a New Water Feature

For Option #5, the existing water feature basin will be demolished as a new one will be installed in its place. After the demolition of the existing basin the supply and return piping will be replaced with new HDPE pipes installed by open trenching. The existing pumphouse infrastructure will remain and be connected to the new works. This option is estimated to incur a minimum capital cost of \$740,000 based on preliminary budgetary estimates. Should the City proceed with this option detail design documents should be developed to provide a more accurate capital cost.

Though the request for consulting services identified an option to replace the lines with new HDPE lines, DGH Engineering believes this is not a viable option due to the information available at the time of this report. DGH understands that the most cost-effective method to replace the lines with new HDPE lines is to directional drill new lines. Directionally drilling new lines would require a minimum of two access pits, one by the tank and another within the fountain's bowl. At the time of this report DGH was unsuccessful in obtaining the original shop drawings for the pre-cast bowl. The uncertainty in the bowl's construction presents too much risk, as creating an access pit may lead to a complete failure of the bowl's structure. Should an access pit be

successfully, there will be difficulty in perfectly water sealing the bowl to prevent cracking or water infiltration. In addition, after a rough preliminary cost analysis the cost of repairing the lines will provide a better value than a replacement.

After reviewing the five options provided for the rehabilitation of the Bridgwater Forest Fountain, DGH Engineering recommends proceeding with Option #4: Complete CIPP Sleeving of the Existing Supply and Return Piping Only.

Option #1 and #2 are not recommended as The City has indicated that they are non-viable options and undesirable.

Option #3 is not recommended as it only addresses issues that were identified during the video inspection completed by Mr. Rooter for this project.

Option #5 is not recommended due to its higher total cost. In addition, without detailed design documents there is potential no upset limit to the capital costs that can be incurred by the City.

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1 Introduction

The City of Winnipeg (City) owns and operates a water fountain feature found off Bridlewood Road in the subdivision of Bridgwater Forest. The fountain and supporting infrastructure was constructed and originally owned by the subdivision developer. The infrastructure was eventually turned over as an asset to the City as per the development agreement. The fountain designated as “Waverly West Phase 1B Fountain” is believed to have been constructed and put into operation between 2008 and 2009. Remediation work due to high humidity levels in the pumphouse were completed during the original warranty period prior to the asset turnover. Between 2015 and 2016, the holding tank was replaced. At the time of this report DGH Engineering Ltd. (DGH) has not been made aware of any additional remediation work completed on the water feature basin or supporting infrastructure. The City Council and residents of the area have identified this asset as a defining characteristic of the subdivision that is frequently enjoyed when in operation.

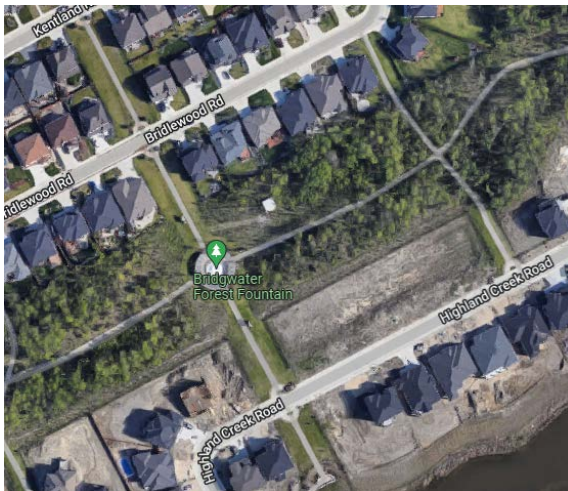


Figure 1: Aerial of Bridgwater Forest Fountain Location

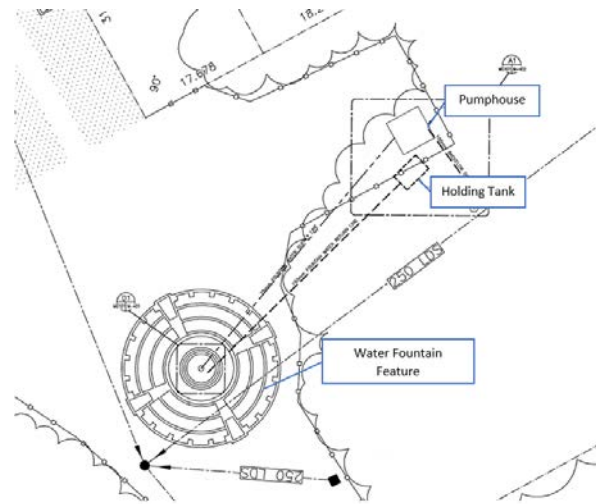


Figure 2: Excerpt from Smith-Carter Construction Drawings dated 2008-06-06

1.1 Project Background

The City has identified the need to complete a rehabilitation study on the Bridgwater Forest Fountain as it has faced several challenges including vandalism and functionality. Most recently in the summer of 2021, the supply and return piping was pressure tested and a leak was identified and is believed to be causing functionality challenges. At the time of the test, the leak was suspected to be at the connection under the bowl.

It is the City's intent to maintain the fountain as a feature for the residents in the local area. As a result of their intent, the City's Public Works Department has engaged the services of DGH Engineering Ltd. to:

- Conduct site visits to review the existing site, and the mechanical components within the service building located on the site.
- Provide a report outlining a minimum of three options that include a scope of the anticipated work with conceptual design writeups and sketches but not detailed drawings or specifications suitable for construction.

This rehabilitation report has been prepared for the City to meet requirements outlined in the "Request for Consultant Services Proposal" dated April 25, 2022.

1.2 Scope

This rehabilitation report will:

- Report on an initial site visit where project requirements and site conditions; influencing the design are assessed;
- Consider scope, budget, schedule, and risks, as well as any conflicts;
- Identify the codes, acts, regulations, and standards relevant to the project;
- Prepare rough order cost estimates for each options provided;
- Provide at least three options with one recommendation for the water fountain feature considering feasibility, cost, and ease to implement;

2 Owner Project Requirements

The following documents and visits have been relied on to summarize the owner project requirements:

- Request for Consultant Services Proposal dated April 25, 2022, which includes:
 - Conducting site visits to review the existing site, and the mechanical components within the service building located on site.
 - Attend up to three client requested meetings each up to 1-hr in duration for review and presentation of reports to the City of Winnipeg team.
 - Arrange for all necessary concept development, and coordination.
 - Prepare a report outlining a minimum of three options for the fountain's rehabilitation.
- 2022-04-26 Preliminary Site Visit Discussions with the City's Team.

As indicated by the City the following services have been excluded from this report:

- Construction contract administration services.
- Modeling of options/concepts.
- Utility or government incentive program modeling or applications.
- Maintenance cost studies or life cycle costing.
- Construction cost estimates beyond an order of magnitude.
- Preparations of manuals of any kind.

3 Existing Conditions

The following section discusses site observations for the water feature infrastructure that was reviewed as part of the scope of work for this project.

3.1 Site Visit Observations

On April 25, 2022, David Dy, P. Eng. visited the Bridgwater Fountain to review the documents on site, have discussions with personnel from Public Works and City Representatives to visually evaluate the existing water feature and all supporting infrastructure. The City was represented by: Rob Zanewich (Project Coordinator), Jason Bell (Project Manager), Mike Mudry (Superintendent of Park Services), Glen Stefanyshen (Superintendent of Building Services), and Todd McDonald (Supervisor of Area and Aquatic Assets).



Figure 3: Initial Visit Site Conditions

To gather more information on the fountain DGH retained the serviced of Mr. Rooter Plumbing (Mr. Rooter) to complete a video inspection of the supply and return piping. A video inspection of the supply pipe was completed on October 26, 2022. For the supply pipe inspection Rob Zanewich (Project Coordinator, City of Winnipeg), Geoff Maloney (DGH Engineering), and Jake Silvestri (Mr. Rooter) were in attendance. The scope of the video inspection was limited to the supply pipe based on information provided in the Request for Consulting Services where it was identified that "the City has already determined that there is a pressure loss/leak in the supply line".

At the request of the City to ensure all information was available to provide a recommendation Mr. Rooter Plumbing was brought back to site on November 3, 2022 to complete a video inspection of the return pipe. For the return pipe inspection Rob Zanewich (Project Coordinator, City of Winnipeg) and Jake Silvestri (Mr. Rooter) were in attendance.

Based on the video inspection the following issues were identified:

- A significant break was identified at approximately 0.30 meters into the return pipe (measured from the scope point of entrance).

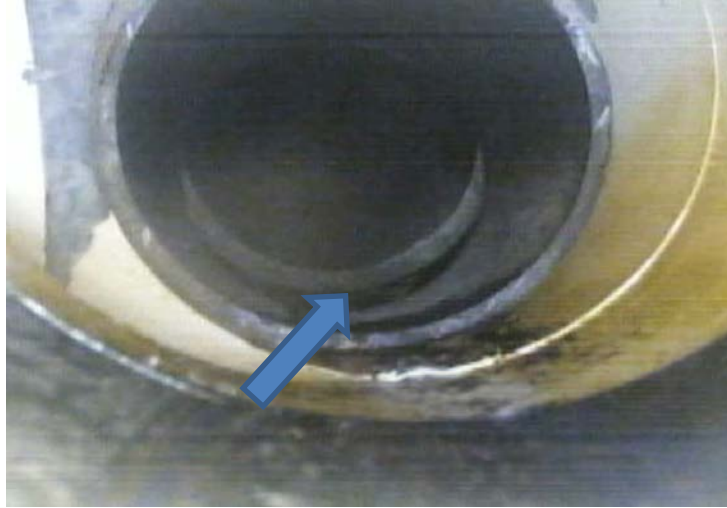


Figure 4: Break Identified at 0.30 meters (Return Pipe)

- Five breaks were identified in the return pipe at various distances.
- Seven breaks were identified in the supply pipe at various distances.



Figure 5: Break Identified in the Supply Pipe

The records from the video inspection can be provided upon request.

3.2 Important Dates

Revisions to the water feature and supporting infrastructure include the following:

Table 1: Important Infrastructure Dates

Year	Event Description
2012	Responsibility of care and maintenance transferred to The City.
2013	First fountain failure
2015/2016	Holding tank replacement
2017	Water pipe breaks at the holding tank resulting from the freeze-thaw cycle
2018	Water consumption records analyzed which resulted in a leak becoming detected.
2018	Structural assessment completed

4 Code Review

At a minimum the following codes, acts, standards, and guidelines apply to the Bridgwater Fountain Rehabilitation project:

1. NRC National Building Code of Canada 2015;
2. NRC National Plumbing Code of Canada 2015;
3. The Canada Labour Code (CLC) and The Canada Occupational Health and Safety Regulations;

4.1 Findings of Code Review

This section summarizes the findings of a code review completed for each of the applicable codes identified above. The review includes assessment of existing systems that are relevant to the anticipated repairs and construction.

4.1.1 National Building Code of Canada 2015 (NBCC)

The proposed rehabilitations do no change or affect the functionality of the site. The NBCC will be consulted if significant site changes are required.

4.1.2 National Plumbing Code of Canada 2015 (NPCC)

The proposed rehabilitations do no change or affect the functionality of the site. The NPCC will be consulted if significant site changes are required.

4.1.3 Canadian Labour Code & Occupational Health and Safety Regulations

All work shall be carried out in compliance with the current Canadian Labour Code and Canada Occupational Health and Safety Regulations. The project specifications will oblige the contractor to ensure that construction workers are protected.

5 Proposed Options

DGH Engineering has identified five options for the rehabilitation of the water fountain to address the owner's requirements and expectations, which are presented below. Order of Magnitude cost estimates can be found in Section 6. While a recommendation to the City can be found in Section 7 of this report.

5.1 Option #1: Status Quo

5.1.1 Option Description

Though the Public Works department has identified issues with the water feature's supporting infrastructure, an option available to the City is to continue as per the current status quo. In this option, The City will proceed no further than this rehabilitation study. The water feature will continue to deteriorate and may require emergency repairs in the future in the event of a major failure. No further capital costs will be incurred as a direct result of this study.

5.1.2 Option Advantages

Proceeding with this option will provide the following advantages:

- No further capital costs resulting from this study will be incurred.

5.1.3 Option Disadvantages

Proceeding with this option will provide the following disadvantages:

- The water feature and supporting infrastructure will continue to deteriorate.
- As the infrastructure continues to deteriorate there is a potential risk to the Public's safety.
- The City will incur higher than originally designed water consumption.
- As the water pipe continues to deteriorate, additional water will be discharged to the surrounding area. This may result in the ground becoming over saturated and possibly impact ground water levels in the area. At this time it is not clear where the lost water is discharging to or what damage it may have caused.
- Maintenance costs are unpredictable and uncontrollable. As such funding deficiencies may impact the site.

5.1.4 Option Risks

Proceeding with this option will provide the following risks:

- A major pipe failure may occur resulting in the need for emergency repairs. This may result in access to the park/feature being significantly impacted for an undetermined amount of time.
- There is a potential risk to the Public's safety in the event of a catastrophic failure of the infrastructure.

5.2 Option #2: Convert the Water Feature into a Landscape Planter

5.2.1 Option Description

For Option #2, the existing water feature will be decommissioned and converted into a landscape planter. The supporting infrastructure will be abandoned in place or repurposed. It is expected that the supply and return pipes will be abandoned in place while the pump house will be repurposed as a water pipes connection point with quick couplers to be used by The City for watering. Should the City proceed with this option detail design documents should be developed to provide a better option description, advantages, disadvantages, and risks. Though this option is considered viable, the City does not have a desire to proceed with this option. Should sufficient capital funding not be secured to rehabilitate this infrastructure this option or complete demolition should be considered.

5.2.2 Option Advantages

Proceeding with this option will provide the following advantages:

- Utility costs related to the operation of the feature will be eliminated.
- Water costs related to the operation of the feature will be eliminated.
- Asset management costs related to the operation of the feature will be reduced.
- Maintenance costs are predictable and controllable. As such funding deficiencies should not impact the site.
- No additional ground saturation will result from the previously identified leak.
- This is the least disruptive to the area's residents.
- Expected to have the shortest construction schedule.
- The presence of a Construction Crew will be less significant than the other options presented.
- Useable equipment service life is no longer a concern.

5.2.3 Option Disadvantages

Proceeding with this option will provide the following disadvantages:

- Bridgwater Forest will lose one of its prominent landscape features.
- Depending on the vegetation planted, a City landscaping crew may be required to maintain the site.

5.2.4 Option Risks

Proceeding with this option will provide the following risks:

- Public opinion resulting from the removal of the prominent landscape feature may become unfavorable.
- Unexpected site conditions.

5.3 Option #3: Selective CIPP Sleeving of the Existing Supply and Return Piping Only

5.3.1 Option Description

For Option #3, the existing supply and return piping will be selectively repaired. The selective repairs will include the following work:

- Dig up one major break identified during the video inspection of the return pipe.
- Complete 5 spot repairs on the return pipe utilizing a cured-in-place pipe (CIPP).
- Complete 7 spot repairs on the supply pipe utilizing CIPP.

The CIPP liner will consist of a spray-on-liner that can withstand a pressure of 35 PSI. The 35 PSI design pressure is based on information provided to DGH from the City. The liner will be constructed of 5 passes of the liner at each spot repair as per the manufacturer's recommendations. If installed correctly the liner is anticipated to have a useful service life equivalent to new pipe, or approximately 50 years. At this time a NSF-64 certified liner is not available so a risk assessment and an engineering judgement will be required to allow for a non-code compliant liner to be installed. This option has had a preliminary review completed by Mr. Rooter who has the ability to install the CIPP liner.

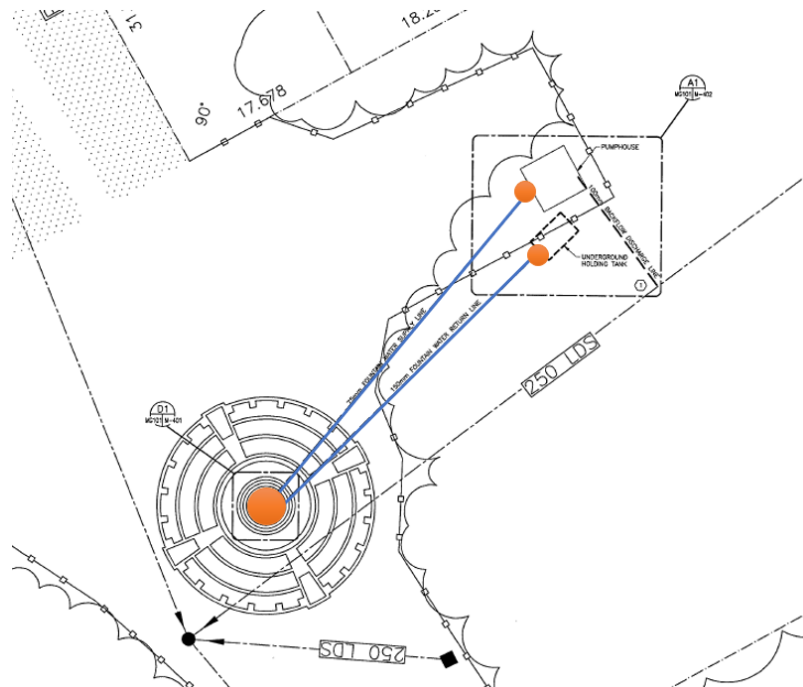


Figure 6: Option #3 Scope

5.3.2 Option Advantages

Proceeding with this option will provide the following advantages:

- The water feature will remain in-place which will reduce the risk of damage to the basin.
- Water costs related to the existing leak will be reduced/eliminated.
- Bridgwater Forest will keep one of its prominent landscape features.
- No additional ground saturation will result from the previously identified leak.
- Expected to have a shorter construction schedule than the below presented options with less impact to the site.
- The presence of a Construction Crew will be less significant than Option #5.
- The usable service life of the water pipes is extended.

5.3.3 Option Disadvantages

Proceeding with this option will provide the following disadvantages:

- The water feature's supporting infrastructure will be PVC. The Public Works Department's current construction standard is to use HDPE.
- Addresses only the issues visible during the video inspection completed by Mr. Rooter Plumbing.

5.3.4 Option Risks

Proceeding with this option will provide the following risks:

- This feasibility of this option is completely dependant on a Contractor's ability to sleeve the existing pipework.
- The sleeving will be limited to a total of 12 locations only, if the leak is outside this scope, it would remain.
- Assumes a non-compliant NSF-64/potable water pipe will receive favourable engineering judgement to proceed.
- Unexpected site conditions.

5.4 Option #4: Complete CIPP Sleeving of the Existing Supply and Return Piping

5.4.1 Option Description

For Option #4, the existing supply and return piping will be completely repaired. The complete repair will include the following work:

- Dig up one major break identified during the video inspection of the return pipe.
- Reline approximately 50 meters of return pipe utilizing CIPP.
- Reline approximately 50 meters of water supply pipe utilizing CIPP.

The CIPP liner will consist of a spray-on-liner that can withstand a pressure of 35 PSI. The liner will be composed of 5 passes along the entire length of pipe as per the

manufacturer's recommendations. If installed correctly the PVC liner is anticipated to have a useful service life equivalent to new pipe, or approximately 50 years. At this time a NSF-64 certified liner is not available so a risk assessment and an engineering judgement will be required to allow for a non-code compliant liner to be installed. This option has had a preliminary review completed by Mr. Rooter who has the ability to install the CIPP liner.

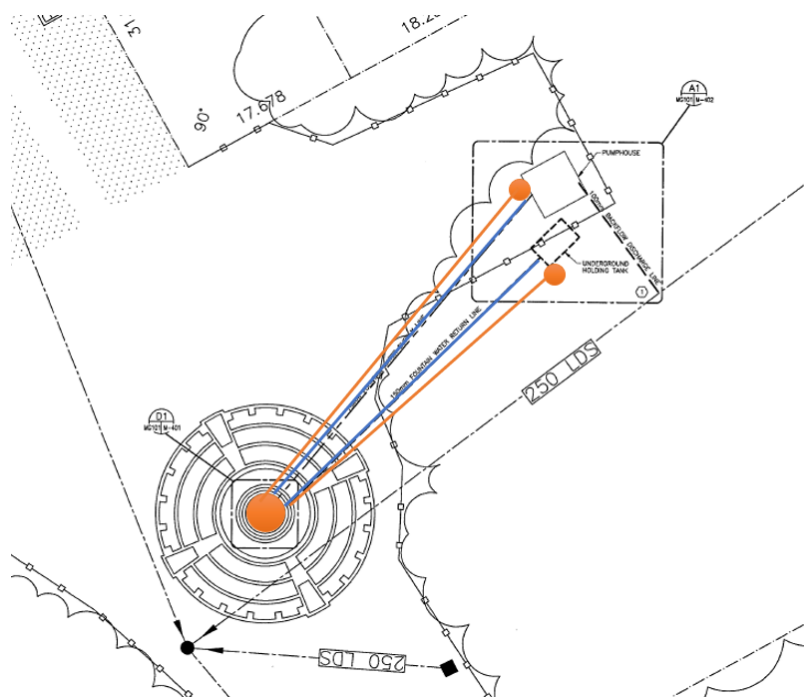


Figure 7: Option #4 Scope

5.4.2 Option Advantages

Proceeding with this option will provide the following advantages:

- The water feature will remain in-place which will reduce the risk of damage to the basin.
- Water costs related to the existing leak will be reduced/eliminated.
- Bridgwater Forest will keep one of its prominent landscape features.
- No additional ground saturation will result from the previously identified leak.
- Expected to have a shorter construction schedule than the below presented options with less impact to the site.
- The presence of a Construction Crew will be less significant than Option #5.
- The usable service life of the water pipes is extended.

5.4.3 Option Disadvantages

Proceeding with this option will provide the following disadvantages:

- The water feature's supporting infrastructure will be PVC. The Public Works Department's current construction standard is to use HDPE.

- Addresses only the issues visible during the video inspection completed by Mr. Rooter.

5.4.4 Option Risks

Proceeding with this option will provide the following risks:

- This feasibility of this option is completely dependant on a Contractor's ability to sleeve the existing pipework.
- Assumes a non-compliant NSF-64/potable water line will receive favourable engineering judgement to proceed.
- Unexpected site conditions.

5.4.5 CIPP vs HDPE Replacement

Though the request for consulting services identified an option to replace the lines with new HDPE lines, DGH Engineering believes this is not a viable option due to the information available at the time of this report. DGH understands that the most cost- effective method to replace the lines with new HDPE lines is to directional drill new lines. Directionally drilling new lines would require a minimum of two access pits, one by the tank and another within the fountain's bowl. At the time of this report DGH was unsuccessful in obtaining the original shop drawings for the pre-cast bowl. The uncertainty in the bowl's construction presents too much risk, as creating an access pit may lead to a complete failure of the bowl's structure. Should an access pit be successfully, there will be difficulty in perfectly water sealing the bowl to prevent cracking or water infiltration. In addition, after a rough preliminary cost analysis the cost of repairing the lines will provide a better value than a replacement.

5.5 Option #5: Install New Supply, New Return Piping, and a New Water Feature

5.5.1 Option Description

For Option #5, the existing water feature basin will be demolished as a new one will be installed in its place. After the demolition of the existing basin the supply and return piping will be replaced with new HDPE pipes installed by open trenching. The existing pumphouse infrastructure would remain and be connected to the new works.

5.5.2 Option Advantages

Proceeding with this option will provide the following advantages:

- Water costs related to the existing leak will be reduced/eliminated.
- Bridgwater Forest will keep one of its prominent landscape features.
- No additional ground saturation will result from the previously identified leak.
- Site works will be completed as per the City's current construction standards and guidelines.

- The cosmetic damage to the water feature basin will be eliminated.
- The City would be able to influence the design of the new water feature to allow for easy repair and maintenance.
- Costs can be shared with the paving stone repair project on site as they will be disturbed by the installation of the new HDPE pipes.
- The usable service life of the water pipes is renewed.
- The usable service life of the water feature basin is renewed.

5.5.3 Option Disadvantages

Proceeding with this option will provide the following disadvantages:

- More costly than the previously identified options.
- The presence of a Construction Crew will be most significant than the other presented options.

5.5.4 Option Risks

Proceeding with this option will provide the following risks:

- Construction schedule delays resulting from the expanded scope of the project.
- Project funding may not be available.
- Unexpected site conditions.

6 Cost Estimates

Order of Magnitude cost estimates have been prepared for the construction costs associated with the Bridgwater Forest Fountain Rehabilitation. A summary of the estimates is provided below. Refer to Appendix A for details of each estimate.

	Description	Order of Magnitude Estimate
Option #1	Status Quo	Not Applicable
Option #2	Convert the Water Feature into a Landscape Planter	\$42,000
Option #3	Selective CIPP Sleeving of the Existing Supply and Return Piping Only	\$100,000
Option #4	Complete CIPP Sleeving of the Existing Supply and Return Piping Only	\$180,000
Option #5	Install New Supply, New Return Piping, and a New Water Feature	\$740,000

6.1 Option #1: Status Quo

There is no estimated cost for completing Option #1: Status Quo. As the project would proceed no further than this study.

6.2 Option #2: Convert the Water Feature into a Landscape Planter

The estimated cost for completing Option #2: Convert the Water Feature into a Landscape Planter is \$42,000. This estimate includes the following:

1. Decommissioning and abandoning approximately 35 meters of PVC water supply pipes between the pumphouse and the water feature basin.
2. Decommissioning and abandoning approximately 35 meters of PVC water return pipes between the pumphouse and the water feature basin.
3. Decommissioning and capping the water discharge nozzles in the water feature basin.
4. Filling the basin with soil and vegetation.

6.3 Option #3: Selective Sleeving of the Existing Supply and Return Piping Only

The estimated cost for completing Option #3: Selective Sleeving of the Existing Supply and Return Piping Only is \$100,000. This estimate includes the following:

1. Disconnecting the supply and return pipes from the nozzle discharge in the water feature basin.
2. Dig up a large identified break in the return water pipes and repair the single location with a SCH80 pipe.
3. Complete 5 selective repairs on the return pipes as identified by Mr. Rooter using CIPP.
4. Complete 7 selective repairs on the supply pipes as identified by Mr. Rooter using CIPP.
5. Reconnect the supply and return pipes to the nozzle discharge in the water feature basin.
6. An allowance of \$10,000 has been included for landscape restoration.

The above-mentioned pricing is based on an estimate prepared for DGH by Mr. Rooter. The details of the estimate can be found in Appendix B. It should be noted that the provided estimate does not include unusual site conditions and additional charges may apply if excavation exceeds 1.2 meters as shoring will be required.

6.4 Option #4: Complete Sleeving of the Existing Supply and Return Piping Only

The estimated cost for completing Option #4: Complete Sleeving of the Existing Supply and Return Piping Only is \$180,000. This estimate includes the following:

1. Disconnecting the supply and return pipes from the nozzle discharge in the water feature basin.
2. Dig up a large identified break in the return water pipe and repair the single location with a SCH80 pipe.
3. Complete 50 meters of return pipe relining using CIPP.
4. Complete 50 meters of supply pipe relining using CIPP.
5. Reconnect the supply and return pipes to the nozzle discharge in the water feature basin.
6. An allowance of \$10,000 has been included for landscape restoration.

The above-mentioned pricing is based on an estimate prepared for DGH by Mr. Rooter. The details of the estimate can be found in Appendix B. It should be noted that the provided estimate does not include unusual site conditions and additional charges may apply if excavation exceeds 1.2 meters as shoring will be required.

6.5 Option #5: Install New Supply, New Return Piping, and a New Water Feature

The estimated cost for completing Option #5: Install New Supply, New Return Piping, and a New Water Feature is \$740,000. This estimate includes the following:

1. Disconnecting the supply and return pipes from the nozzle discharge in the water feature basin.
2. Decommission, demolish, and remove the existing water feature.
3. Open excavate a 35 meter long trench between the pumphouse and water feature basin location to expose the PVC water pipes.
4. Decommission and remove approximately 35 meters of PVC water supply pipes between the pumphouse and the water feature basin.
5. Decommission and remove approximately 35 meters of PVC water return pipes between the pumphouse and the water feature basin.
6. Install 35 meters of HDPE water supply pipes between the pumphouse and the water feature basin.
7. Install 35 meters of HDPE water return pipes between the pumphouse and the water feature basin.
8. Fill the trench and repair the surface to pre-construction conditions.
9. Install the new water feature basin.

7 Recommendations

After reviewing the options provided five options for the Bridgwater Forest Fountain Rehabilitation, DGH Engineering Ltd. recommends proceeding Option #4: Complete CIPP Sleeving of the Existing Supply and Return Piping Only.

Option #4 is recommended as it meets the following Owner Project Requirements in that it provides a cost-effective solution for the rehabilitation of the Bridgwater Forest Fountain. Based on estimates provided by Mr. Rooter, Option #4 the City is estimated to incur a capital cost of \$180,000.

8 Risks

We perceived there to be little risk to the project scope for the recommendation provided within this report.

It should be recognized that there are risks associated with the cost of implementing any recommendations provided within this report due to current market conditions.

Should this project proceed to construction DGH would be happy to provide a fully risk assessment. It is anticipated that a majority of the risks can be mitigated by strict adherence to the project schedule and clear and frequent communication with the Construction Team, City Project Manager, and Prime Consultant.

9 Summary

The City has identified the need to complete a rehabilitation study on the Bridgwater Forest Fountain as it has faced several challenges including vandalism, and functionality. Most recently in the summer of 2021, the system was pressure tested when a leak was identified. At the time of the test the leak was suspected to be at the connection under the bowl.

It is the City's intent to maintain the fountain as a feature for the residents in the local area. As a result of their intent, the City's Public Works Department has engaged the services of DGH Engineering Ltd. to:

- Conduct site visits to review the existing site, and the mechanical components within the service building located on the site.
- Provide a report outlining a minimum of three options that include a scope of the anticipated work with conceptual design writeups and sketches but not detailed drawings or specifications suitable for construction.

This rehabilitation report has been prepared for the City to meet requirements outlined in the "Request for Consultant Services Proposal" dated April 25, 2022.

DGH Engineering has identified five rehabilitation options for the Bridgwater Forest Fountain Rehabilitation:

Option #1: Status Quo

For Option #1, The City would proceed no further than this rehabilitation study. The water feature will continue to deteriorate and may require emergency repairs in the future in the event of a major failure. A major failure of this infrastructure may create a potential risk to the Public's safety. No further capital costs will be incurred as a direct result of this study.

Option #2: Convert the Water Feature into a Landscape Planter

For Option #2, the existing water feature would be decommissioned and converted into a landscape planter. The supporting infrastructure will be abandoned in place or repurposed. The exact details of this option should be finalized at the detailed design phase if the City chooses to forgo all other options. It is expected that the supply and return pipes will be abandoned in place while the pump house would be repurposed as a water pipe connection point for quick couplers to be used by The City. This option is estimated to incur a minimum capital cost of \$42,000 based on preliminary budgetary estimates. Should the City proceed with this option detail design documents should be developed to provide a more accurate capital cost. Though this option is considered viable, the City does not have a desire to proceed with this option. Should sufficient capital funding not be secured to rehabilitate this infrastructure this option or complete demolition should be considered.

Option #3: Selective CIPP Sleeving of the Existing Supply and Return Piping Only

For Option #3, the existing PVC supply and return piping between the pumphouse and water feature will be repaired at 13 locations. One location will be replaced by excavating and exposing the pipe to replace a section of it with a SCH80 pipe. The 12 remaining locations (7 supply and 5 return) will be repaired using a sleeve consisting of a spray-on-liner that is sprayed on the interior of the pipe with multiple passes to buildup the wall thickness. If installed correctly the liner is anticipated to have a useful service life equivalent to new pipe, or approximately 50 years. At this time a NSF-64 certified liner for potable water is not available so a risk assessment and an engineering judgement will be required to allow for a non-code compliant liner to be installed. This option is estimated to incur a minimum capital cost of \$100,000 based on preliminary budgetary estimates.

Option #4: Complete CIPP Sleeving of the Existing Supply and Return Piping Only

For Option #4, the existing PVC supply and return piping between the pumphouse and water feature will be completely repaired. The supply and return lines will be repaired using a liner consisting of a spray-on-liner that is sprayed on the interior of the pipe with multiple passes to buildup the wall thickness. The liner is anticipated to have a useful service life equivalent to new pipe, or approximately 50 years. At this time a NSF-64 certified liner for potable

water is not available so a risk assessment and an engineering judgement will be required to allow for a non-code compliant liner to be installed. This option is estimated to incur a minimum capital cost of \$180,000 based on preliminary budgetary estimates.

Option #5: Install New Supply, New Return Piping, and a New Water Feature

For Option #5, the existing water feature basin will be demolished as a new one will be installed in its place. After the demolition of the existing basin the supply and return piping will be replaced with new HDPE pipes installed by open trenching. The existing pumphouse infrastructure will remain and be connected to the new works. This option is estimated to incur a minimum capital cost of \$740,000 based on preliminary budgetary estimates. Should the City proceed with this option detail design documents should be developed to provide a more accurate capital cost.

Though the request for consulting services identified an option to replace the lines with new HDPE lines, DGH Engineering believes this is not a viable option due to the information available at the time of this report. DGH understands that the most cost-effective method to replace the lines with new HDPE lines is to directional drill new lines. Directionally drilling new lines would require a minimum of two access pits, one by the tank and another within the fountain's bowl. At the time of this report DGH was unsuccessful in obtaining the original shop drawings for the pre-cast bowl. The uncertainty in the bowl's construction presents too much risk, as creating an access pit may lead to a complete failure of the bowl's structure. Should an access pit be successfully, there will be difficulty in perfectly water sealing the bowl to prevent cracking or water infiltration. In addition, after a rough preliminary cost analysis the cost of repairing the lines will provide a better value than a replacement.

After reviewing the options provided for the five rehabilitation options for the Bridgwater Forest Fountain Rehabilitation, DGH Engineering recommends proceeding with Option 4: Complete CIPP Sleeving of the Existing Supply and Return Piping Only.

Option #1 and #2 are not recommended as The City has indicated that they are non-viable options.

Option #3 is not recommended as it only addresses issues that were identified during the video inspection completed by Mr. Rooter for this project.

Option #5 is not recommended due to its higher total cost. In addition, without detailed design documents there is potential no upset limit to the capital costs that can be incurred by the City.

APPENDIX A: Mr. Rooter Plumbing Estimates

The following pages are the estimates prepared by Mr. Rooter Plumbing for Option #3 and #4.

Note: Appendix omitted for RFP