



City of Richmond

Report to Committee

To: Public Works and Transportation Committee **Date:** April 29, 2016
From: John Irving, P.Eng. MPA **File:** 10-6060-04-01/2015-
 Director, Engineering Vol 01
Re: **Integrated Rainwater Resource Management Strategy**

Staff Recommendation

That the “Integrated Rainwater Resource Management Strategy” as attached to the staff report titled “Integrated Rainwater Resource Management Strategy,” dated April 29, 2016, from the Director, Engineering be endorsed for the purpose of public consultation.

John Irving, P.Eng. MPA
 Director, Engineering
 (604-276-4140)

Att. 1

REPORT CONCURRENCE		
ROUTED TO: Sewerage & Drainage Policy Planning	CONCURRENCE <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	CONCURRENCE OF GENERAL MANAGER
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	INITIALS: DW	APPROVED BY CAO

Staff Report

Origin

Municipal Commitment 3.4.7 of Metro Vancouver's May 2010 Integrated Liquid Waste Resource Management Plan (ILWRMP) commits member municipalities to:

Develop and implement integrated stormwater management plans at the watershed scale that integrate with land use to manage rainwater runoff.

Richmond's integrated stormwater management plan is titled the *Integrated Rainwater Resource Management Strategy* (IRRMS) and is presented to Council as Attachment 1. The strategy supports the Council Term Goals of demonstrating Leadership in Sustainability and providing Quality Infrastructure Needs. The purpose of this report is to present the IRRMS and a recommended public stakeholder consultation process.

Analysis

As required by Metro Vancouver under its ILWRMP, the integrated stormwater management plan primarily aims to minimize the negative impacts of manmade drainage systems on traditional watersheds with fish bearing creeks (e.g. bank erosion during storms and reduced flows during dry periods) and complex topography. As a floodplain municipality with soft soils and ground water close to surface, the City of Richmond has unique stormwater management issues, and as such developed an IRRMS with four main goals:

1. Minimize the impacts of future development and redevelopment;
2. Reduce potable water use;
3. Address existing and future sedimentation issues; and
4. Support the City's Ecological Network.

To meet the IRRMS's four main goals, the strategy includes four key strategies:

1. Strategic detention of water;
2. Water quality treatment and sediment control;
3. Rainwater harvesting and reuse; and
4. Protect, enhance and build green infrastructure.

Strategic Detention of Water

The City of Richmond's population is projected to grow substantially in the next 30 years. The extent of impervious land in West Richmond's urban areas is predicted to increase due to the projected growth identified in the City's Official Community Plan. This increase will primarily occur through the redevelopment of single-family homes that will increase the volume of stormwater runoff for this land use. Current planning and capital improvements such as pump station upgrades are designed to address these increases. Implementation of measures identified in the IRRMS could potentially allow deferral or elimination of some capital projects and/or improved system performance.

The strategy promotes strategic implementation of water detention measures, such as storage ponds, that have additional benefits for the City such as water reuse and ecological and aesthetic value. These storage features have increasing effectiveness the further they can be located inland from the dike. Examples of existing storage detention facilities include the pond in Garden City Community Park and the pond in the Fantasy Gardens development.

Water courses and ditches provide greater storage capacity than buried box culverts and pipelines. The IRRMS considers daylighting strategies to convert existing enclosed drainage systems to open water courses as a means to provide detention as well as ecological value.

The strategy also encourages stormwater detention on private property, particularly where it can be utilized for irrigation or other water reuse features.

Water Quality Treatment and Sediment Control

Sediment from construction activity is an issue in the City's stormwater collection system. The IRRMS promotes an initiative to strengthen and enforce erosion and sediment control requirements for construction activities. The program will review best management practices for application in Richmond with specific controls for pre-load activities.

The IRRMS promotes the implementation of bank protection works for areas of watercourses that are vulnerable to sloughing.

The strategy also encourages water quality improvement for runoff from impervious areas, such as driveways, to mitigate the migration of pollutants. Strategies for improving water quality include absorbent landscaping, rain gardens and oil-grit separators.

Rainwater Harvesting and Reuse

The IRRMS reviewed the potential to utilize rainwater for toilet flushing and irrigation, as a substitute for using drinking water.

The strategy includes an initiative to address barriers to implementing indoor rainwater reuse for non-potable uses, such as toilet flushing. There are a number of codes and bylaws that were written without considering rainwater reuse, thereby impeding their implementation. These codes and bylaws require review and, ultimately, amendment to allow indoor rainwater reuse. The strategy also includes an education initiative to improve public knowledge and acceptance of rainwater reuse practices.

Parks and conservation lands provide opportunity for various City departments, developers and community groups to collaborate on water reuse projects. For example, the stormwater pond on the Fantasy Gardens site is utilized for irrigation needs at a community garden.

Protect, Enhance and Build Green Infrastructure

The City of Richmond's Ecological Network Management Strategy is an interconnected system of natural areas that make up Richmond's distinctive landscape and provides essential ecosystem services such as water storage and filtration. It is composed of both terrestrial and marine (shoreline and intertidal) areas and includes prominent natural areas such as Richmond Nature Park, Sturgeon Bank and South Arm Wildlife Management Areas as well as larger urban parks, shorelines of the Fraser River, watercourses and riparian areas. The strategy describes Richmond's Ecological Network and recommends goals, strategies, and actions for conserving and restoring its ecological and economic values. The IRRMS seeks to address many of the challenges that the Ecological Network Management Strategy seeks to address, including water and habitat quality, impervious surfaces, bank erosion and slumping, and enhancement of green infrastructure to increase ecosystem services.

Richmond's inland watercourses flow year-round, are fed with a significant source of groundwater that mixes with slow-moving surface water, and flow into the Fraser River. Richmond's water quality is typified by low dissolved oxygen levels, elevated temperatures and elevated levels for particular metals. These conditions are related to the lack of vegetation buffering the open storm water system as well as the low gradient drainage network and naturally oxygen depleted groundwater. Richmond's Ecological Network is comprised of 119 kilometers of designated Riparian Management Areas with 5 and 15 meter setback requirements. Though background water quality conditions are generally inhospitable to salmon and trout, the Riparian Management Area network is protected under the Provincial Riparian Areas Regulation, draining into the Fraser River, one of the most productive salmon rivers in North America. Richmond's landscape is dominated by foreshore and inland wetlands. As a key constituent of the Ecological Network, these wetlands provide important ecosystem services for regulation of storm water, sediment trapping, temperature regulation and water quality improvements. The following list highlights a suite of green infrastructure options presented in the IRRMS:

- Support the use of public lands such as parks for the creation of green infrastructure
- Encourage the green infrastructure principles in the development process
- Develop new legislative tools to protect and enforce protection of the City's Riparian Management Areas in accordance with the Provincial Riparian Areas Regulation, and to better support riparian areas management and restoration
- Increase the use of rain gardens and small wetlands to filter and detain runoff from roads and parking areas

The IRRMS also introduces a framework for identifying areas where daylighting enclosed drainage systems has a high return on investment through provision of drainage services, ecosystem services and community amenities. Daylighting opportunities will be identified through assessments of daylighting benefits and triggers. Staff will identify and review potential daylighting projects and proposed green infrastructure options for future inclusion in capital plans and service agreements for Council's consideration.

Public and Stakeholder Consultation

Staff propose that the IRRMS public and stakeholder consultation process include the following:

- Digital Engagement: Let's Talk Richmond interactive discussion forum and survey
- Urban Development Institute and Small Builders: Presentation to the development community through these groups
- Association for Consultancy and Engineering: Presentation to the Association for Consultancy and Engineering and other interested associations or committees

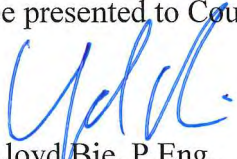
Through the public and stakeholder consultation process, staff will present the IRRMS and receive feedback on the initiatives identified in the report. Feedback will be utilized by staff to modify and prioritize recommendations, which will ultimately be presented to Council in future capital plans and service agreements.

Financial Impact

None.

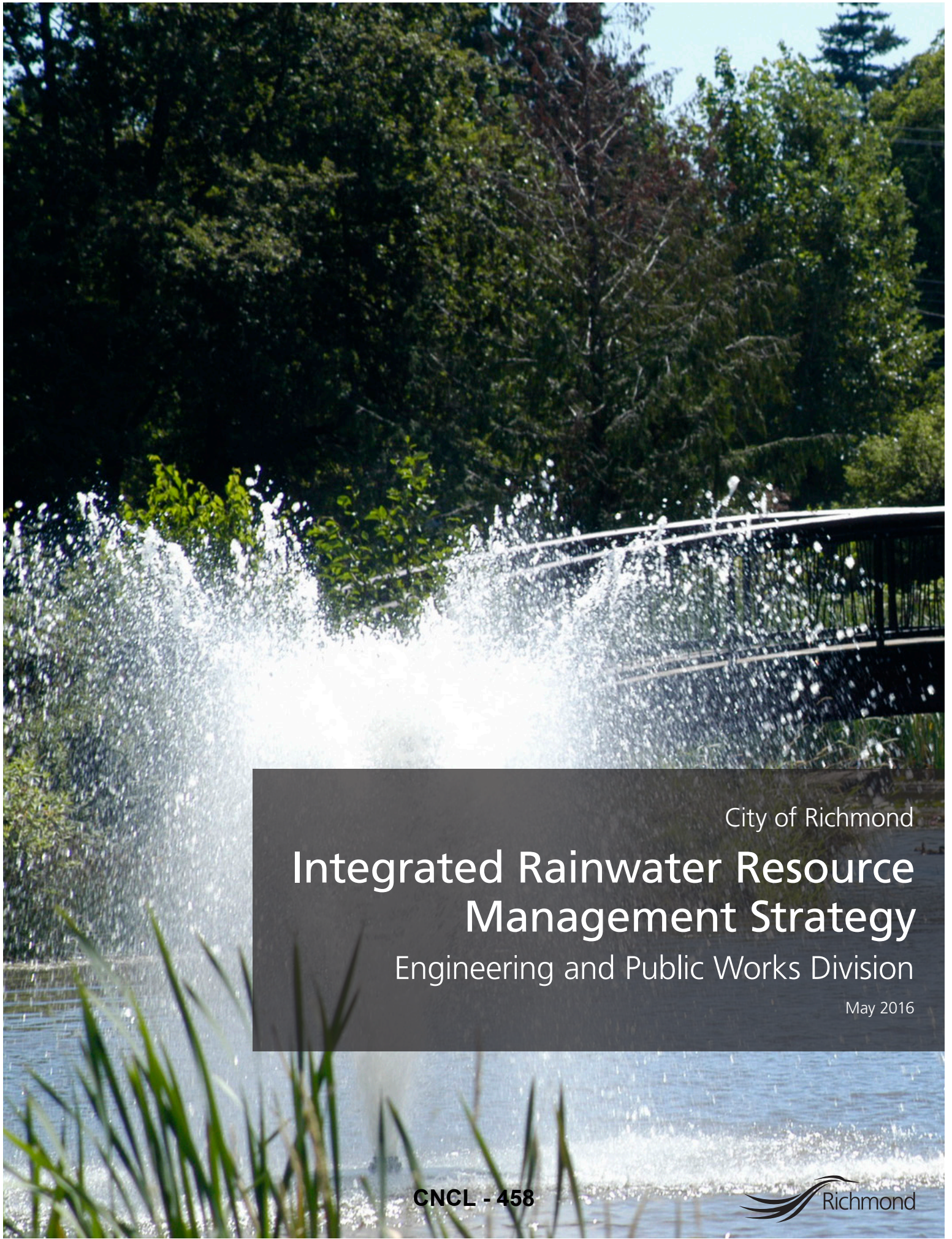
Conclusion

The IRRMS identifies a tool kit for utilizing stormwater as a resource, reducing the impact of development on stormwater flows, and reducing the impact of development on stormwater quality. The recently adopted Ecological Network Management Strategy provides complementary context and principles for improvements to green infrastructure as presented in the IRRMS. The IRRMS also fulfills Richmond's obligation in Metro Vancouver's Integrated Liquid Waste Resource Management Plan to develop an Integrated Stormwater Management Plan. The plan includes a number of initiatives and strategies that will be further reviewed by staff (incorporating stakeholder and public input) which will result in projects that will ultimately be presented to Council in future capital plans and service agreements.



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Att. 1: Integrated Rainwater Resource Management Strategy



City of Richmond

Integrated Rainwater Resource Management Strategy

Engineering and Public Works Division

May 2016

CNCL - 458



Table of Contents

Introduction	1
Geographic Context	1
Richmond’s Needs for Stormwater Management	2
Regulatory Context	2
Municipal Strategic Context	3
Goals.....	4
Strategies	4
Management Strategies	5
Strategy #1: Strategic Detention of Stormwater	5
Strategy #2: Water Quality Treatment and Sediment Control.....	7
Strategy #3: Rainwater Harvesting and Re-use.....	9
Strategy #4: Protect, Enhance and Build Green Infrastructure	11
Implementation Plan	12

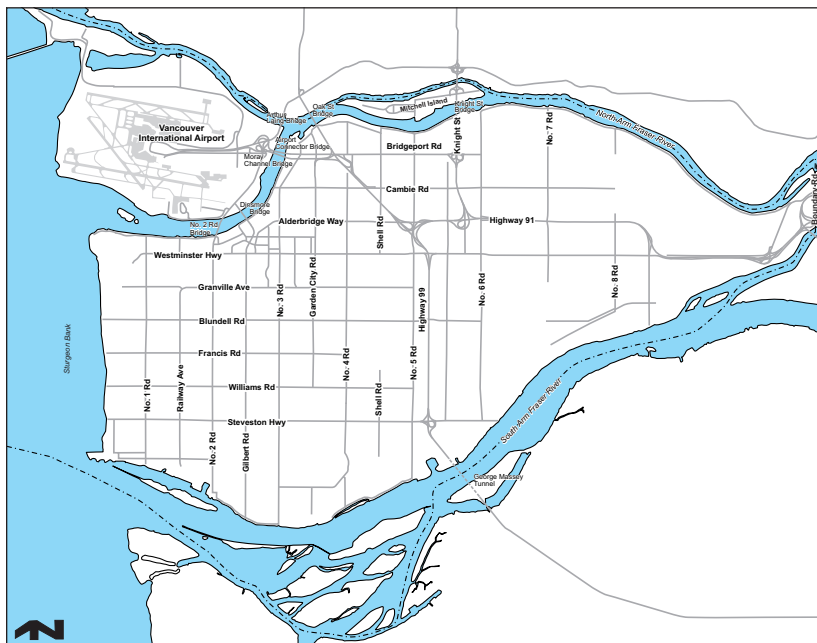
Introduction

Geographic Context

The City of is comprised of a series of islands in the delta of the Fraser River, with the majority of the land mass located on Lulu Island. Early settlers built dikes and drained the land to farm. Today, agriculture remains an important part of Richmond’s economy and character. While West Richmond is predominantly urban, East Richmond is considered to be rural and agricultural.

Lulu Island is characterized by a relatively flat topography with an average elevation of one meter above sea level. Since much of the island is below the elevation of high tide, the perimeter of the island has been diked to prevent flooding. Stormwater runoff is either drained by gravity during low tides, or pumped out of the City during high tides.

The island forms a single watershed with carefully engineered drainage catchments that include channelized watercourses, sloughs and ditches that serve drainage, irrigation and habitat functions. The peat bog substrate, high water table and limited gradient typical of flood plain ecosystems result in slow flowing watershed drainage and water that has elevated temperatures, low dissolved oxygen, and high dissolved iron and other metals when compared to traditional watersheds. The City’s inland watercourses are generally considered to be not hospitable to anadromous fish species, but do however, flow into and support an abundance of fish life in the receiving waters of the Fraser River Estuary.



Richmond's Needs for Stormwater Management

Growth: The City of Richmond's population is projected to grow substantially in the next 30 years, as described in the City's *2041 Official Community Plan Update*. Significant development activities anticipated within Richmond result in the following consequences that are addressed through rainwater management in the City:

- Additional **demands on the City's drainage infrastructure** due to increased stormwater runoff from increases in impervious land area.
- **Reduced storage capacity** due to the replacement of roadside ditches and watercourses with pipes or culverts.
- **Increased maintenance demands** for the City's stormwater system due to increased sediment from construction sites and increased road runoff.
- **Impacts to the ecological health** of receiving water bodies due to a proportional increase in pollutant load.

Topographic and Water Quality Challenges: Richmond's distinct topography creates the following unique challenges and opportunities that guide the development of our *Integrated Rainwater Resource Management Strategy*:

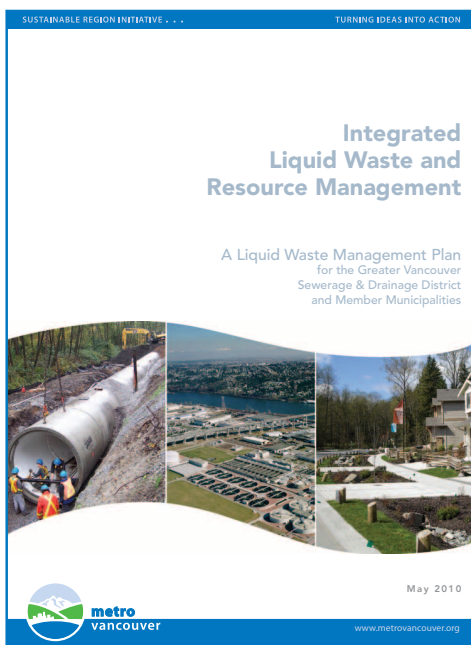
- Low gradients in Richmond's gravity drainage system results in slow conveyance, increased temperatures, and lower levels of dissolved oxygen when compared to traditional watersheds.
- A naturally high water table limits the capacity to infiltrate rainwater.
- Richmond's peat bog substrates contribute to naturally occurring dissolved iron and other metals to water and the inland watercourses are generally considered to be inhospitable to anadromous fish species.

Richmond's *Integrated Rainwater Resource Management Strategy* provides a strategic approach to address Richmond's unique stormwater management issues and needs. This results in an approach that differs from many other municipalities. The strategy aims to protect and enhance the City's stormwater conveyance infrastructure and ecological assets under more frequent rainfall events, and considers rainwater as a resource to be utilized.

Regulatory Context

As a member of the Greater Vancouver Sewerage and Drainage District, the City of Richmond is committed to the stormwater management requirements set out in the *2010 Metro Vancouver Integrated Liquid Waste Resource Management Plan* and the terms of the *Minister of Environment's Letter of Acceptance (2011)*. Specifically, the plan commits member municipalities to:

- Develop and implement integrated stormwater management plans that integrate with land use to manage rainwater runoff.



- Update municipal bylaws and utility design standards to meet the criteria set out in the integrated stormwater management plan and enable and encourage on-site rainwater management.
- Develop a program to monitor stormwater, assess and report the implementation and the effectiveness of the integrated stormwater management plan.

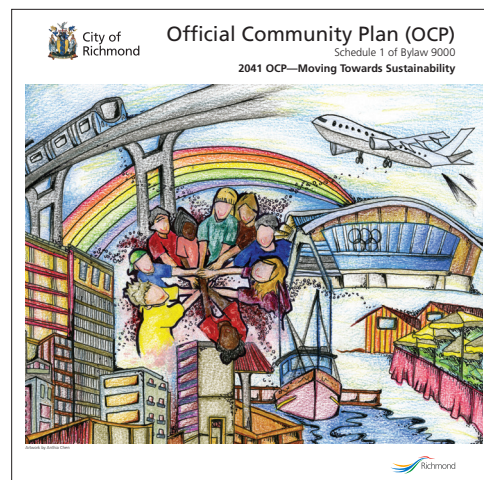
Richmond's *Integrated Rainwater Resource Management Strategy* aims to fulfill requirements of the *Integrated Liquid Waste Resource Management Plan* for stormwater management.

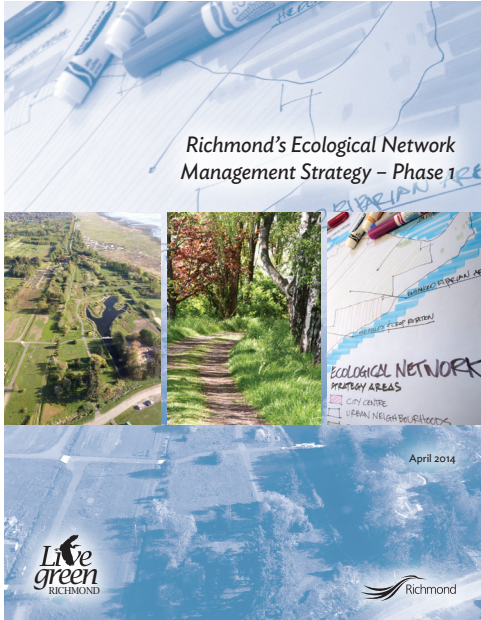
In addition, 119 km of Richmond's 223 km of open waterways are designated Riparian Management Area protected under the provincial *Riparian Area Regulation* and the *Federal Fisheries Act* as they flow into and support fish life in the Fraser River. The new provincial *Water Sustainability Act* also applies to the City's drainage infrastructure. This *Integrated Rainwater Resource Management Strategy* will work to address requirements of these provincial regulations.

Municipal Strategic Context

The *Integrated Rainwater Resource Management Strategy* supports and is congruent with the mandates of several Richmond policies, plans and objectives, including the:

- **2041 Official Community Plan (OCP)**, updated in 2012 forms the City's framework in establishing the City's social, economic, land use, urban design, servicing, transportation and environmental future. The Plan anticipates the City's population to grow by 80,000 people by 2041 and mandates that the City's infrastructure be maintained and improved upon to meet growing needs. The *Integrated Rainwater Resource Management Strategy* aims to address these needs.
- **2008-2031 Flood Protection Strategy**, adopted by Council in 2008, provides an integrated flood protection framework to minimize flooding and its impacts. While the objectives of the strategies differ, recommendations in the Flood Protection Strategy overlap with those of the *Integrated Rainwater Resource Management Strategy*. Overlapping strategies include the utilization of stormwater retention and detention, strategic raising of land levels through development, and establishment of a Floodplain Bylaw.
- **East Richmond Agricultural Water Supply Study (2006) and East Richmond Agricultural Water Supply Update (2013)**, provides a strategy for improving the drainage system in East Richmond to address flood protection and irrigation needs for agricultural lands. As rainwater management strategies within East Richmond's agricultural lands are addressed in the *East Richmond Agricultural Water Supply Study* and its update, the *Integrated Rainwater Resource Management Strategy* will aim to complement that, with a greater focus placed on land uses within West Richmond.





- **Ecological Network Management Strategy (ENMS)**, adopted by Council in 2015, identifies and describes Richmond's Ecological Network and recommends goals, strategies, and actions for protecting, enhancing and connecting natural lands within the City. The strategy addresses similar issues to the *Integrated Rainwater Resource Strategy* including water and habitat quality, impervious surfaces, riparian habitat issues such as bank erosion and green infrastructure enhancement opportunities to increase ecosystem services.
- **Riparian Response Strategy (RRS)** protects Riparian Management Areas that form part of the City's Ecological Network. The strategy, adopted by Council in 2006 identifies 5 m and 15 m riparian setbacks on minor and major watercourses that flow into and support fish life in the Fraser River. The RRS is the City's response to the *Provincial Riparian Area Regulation (RAR)* to protect habitat from industrial, commercial and residential development. Following a Provincial Ombudsperson review of local government's RAR implementation methods in 2012, the City is working with the Province to implement new legislated protection and enhancement measures that is compliant with the directive. The Provincial RAR applies to the City's inland watercourses, but not the foreshore of the Fraser River. The Fraser River foreshore is also part of the City's Ecological Network and is designated Environmentally Sensitive Area in the City's OCP protected under development permit.

Goals

The development of Richmond's *Integrated Rainwater Resource Management Strategy* is guided by four primary goals:

1. To **minimize impacts of future development and redevelopment** on drainage infrastructure and ecological health of receiving water bodies;
2. To **reduce potable water use** consistent with Richmond's sustainability goals;
3. To **address existing and future sedimentation issues** and the associated impacts on the conveyance system; and
4. To **support the City's Ecological Network** through enhancement of green infrastructure.

Strategies

A series of key strategies have been developed to address Richmond's stormwater management needs:

1. Strategic detention of stormwater.
2. Water quality treatment and sediment control.
3. Rainwater harvesting and re-use.
4. Protect, enhance and build green infrastructure.

Management Strategies

Strategy #1: Strategic Detention of Stormwater

IRRMS Goal:

#1: Minimize impacts of future development and redevelopment

As a result of Richmond's growth and ongoing development activities, impervious area in West Richmond is projected to increase. This leads to an escalation in water runoff volumes during major storm events and capacity demands on the City's drainage infrastructure.

The strategy proposes to utilize stormwater detention as a means to reduce excess runoff and consequently minimize or eliminate the need for potential drainage capacity upgrades.

Select Initiatives and Outcomes:

- Strategic implementation of water detention measures.** Because of the City's low hydraulic grade line, stormwater detention is most effective for developments located near the central areas of the island. The City will pursue opportunities for detention in conjunction with other strategic benefits such as rainwater re-use and ecological and aesthetic enhancements. Applications of detention facilities in the Fantasy Gardens Development and Garden City Community Park set precedence for ongoing collaboration between the City, developers and community groups to incorporate rainwater detention to create innovative and mutually beneficial rainwater management schemes.
- Increase storage capacity in the City's drainage conveyance system.** Open watercourse and ditches provide greater storage capacity than an enclosed pipe system. The City will continue to preserve open watercourses and is considering daylighting strategies to convert existing drainage pipes to open watercourses as a means to provide detention as well as ecological values.
- Encourage stormwater detention on private properties** through development and provide guidance and support for voluntary implementation. Examples of potential detention measures include green roofs and rain gardens.



Implementation of rain gardens and rock trenches for detention on private properties.

Application Examples



Fantasy Gardens Development: The multi-family development constructed at Fantasy Gardens located at the corner of Steveston Highway and No. 5 Road successfully utilizes a pond to service as a stormwater detention facility as well as a means for rainwater re-use. The pond, located within a City park, was incorporated with the goal of reducing runoff volume to eliminate the need for downstream infrastructure upgrades. Water in the pond is then treated and pumped into an adjacent community garden area for use to water vegetation in the garden plots.



Garden City Community Park: The Garden City Community Park incorporates a central pond, wetland and swale network that serves as a stormwater detention area during heavy rainfall events. The central pond, together with surrounding trails and a pedestrian bridge, forms a main feature in the park and provides users with a highly liveable and beautiful environment.

Strategy #2: Water Quality Treatment and Sediment Control

IRRMS Goals:

- #1: Minimize impacts of future development and redevelopment
- #3: Address existing and future sedimentation issues

Sediment Control

Ongoing development activities place additional sediment demands on the City's stormwater infrastructure. Primary sources of sediment demands include construction activities such as sand preloading, the filling of sites to meet flood protection levels and vehicular runoff from additional impervious areas introduced through development.

Sediments are introduced to watercourse and storm sewers during significant rain events, leading to increased maintenance demands for Richmond's watercourses and sewers, and impacts downstream ecology, including the Fraser River.

Sediment and erosion management is important as it allows for future development and redevelopment while protecting environmental values and existing infrastructure.

Select Initiatives and Outcomes:

- **Strengthen and enforce erosion and sediment control requirements** for construction activities. Consider the development of a specific Erosion and Sediment Control Program that includes a bylaw with regulatory requirements. The program should address erosion and sediment control expectations, acceptable Best Management Practices, sampling and reporting requirements for construction sites and specific controls for preload activities.
- **Enhance riparian vegetation and implement bank protection works** for areas of watercourses vulnerable to sloughing.
- **Encourage water quality improvement** for runoff from impervious areas to mitigate the migration of pollutants into the drainage network. Strategies for improving water quality for specific land uses include:
 - **Single-family residential:** Pollutant removal through absorbent landscaping or rain gardens.
 - **Multi-family residential, Industrial, Commercial and Institutional:** Pollutant removal through absorbent landscaping, rain gardens or manufactured oil-grit separators.
 - **Parks and Conservation Lands:** Pollutant removal through absorbent landscaping or rain gardens.



Additional sediment demands are introduced construction activities and increasing impervious areas.



Water Quality Treatment and Monitoring

The BC Minister of Environment's approval of Metro Vancouver's *Integrated Liquid Waste Resource Management Plan* requires that municipalities monitor stormwater to assess and report on the effectiveness of the stormwater management plan implementation. To fulfill this provincial requirement, Metro Vancouver developed a *Monitoring and Adaptive Management Framework* (MAMF) with recommended parameters to monitor watershed health and assess the effectiveness of stormwater management throughout the region.

Due to Richmond's unique water quality conditions, the recommended MAMF parameters do not adequately reflect the effectiveness of Richmond's stormwater management plan. Under pre-development conditions, naturally occurring water quality parameters may exceed the water quality guidelines due to slow conveyance and natural soil conditions, and it is not the intent of the *Integrated Rainwater Resource Management Strategy* to alter naturally occurring conditions. As such, Richmond **will pursue a modified MAMF to guide water quality monitoring** for development activities within Richmond. Monitoring and reporting may include the following parameters:

- **Physical:** pH, dissolved oxygen.
- **Sediment:** Total suspended sediment, turbidity.
- **Nutrients:** Nitrate.
- **Microbiological indicators:** E. coli, fecal coliforms.
- **Metals:** Total copper, total lead, total zinc, total cadmium, total dissolved iron.
- **Flow monitoring:** MAD, TQ Mean, Low Pulse Count, Low Pulse Duration, Summer Baseflow, Winter Baseflow, High Pulse Count, and High Pulse Duration.

Monitoring should be undertaken on Richmond's larger watercourses, near pump station or other locations that capture the majority of catchment flow.

Strategy #3: Rainwater Harvesting and Re-use

IRRMS Goals:

- #1: Minimize impacts of future development and redevelopment
- #2: Reduce potable water use

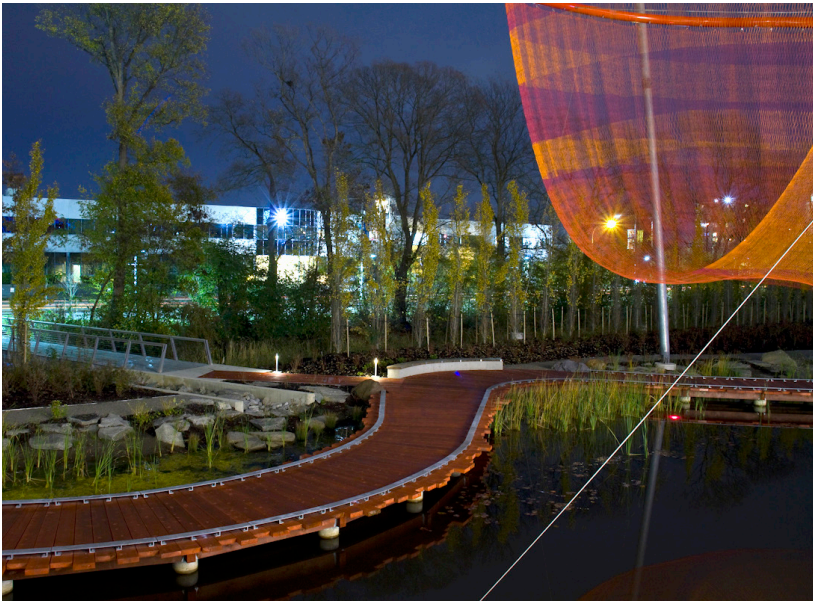
Rainwater harvesting and re-use strategies utilizes water as a resource and offer the two-fold benefit of reducing stormwater runoff volumes as well as potable water consumption. It is a key aspect in addressing the “resource” component of the *Integrated Rainwater Resource Management Strategy*.

Rainwater, primarily from building roofs, can be collected, stored, and treated as required depending on its intended application. Primary applications for rainwater re-use include indoor use for toilet flushing and outdoor use for irrigation and vehicle washing. Richmond currently utilizes potable water for these applications.

Select Initiatives and Outcomes:

- **Address barriers to implementation** for the utilization of harvested rainwater for indoor, non-potable uses such as toilet flushing. The City will review internal and external guidelines and work to enable rainwater re-use for a wider range of applications.
- **Explore further opportunities to incorporate rainwater re-use strategies in parks and conservation lands** through continued ongoing collaborations between the City of Richmond Engineering, Parks and Sustainability departments, as well as developers and community groups.
- **Provide education and support** to improve public knowledge and acceptance of rainwater re-use practices.
- **Monitor the prevalence of re-use technologies inside and outside Richmond.** The price of potable water is currently \$1.26/m³. Potable water-use thresholds for economical benefits of rainwater re-use strategy applications in residential, industrial and commercial applications are as follows:
 - Single-family residential: \$4/m³
 - Multi-family residential (medium- to high-density developments): \$3/m³
 - Office (medium- to high-density developments): \$2/m³

Application Examples



Water Sky Garden at the Richmond Olympic Oval: The Water Sky Garden at the Richmond Olympic Oval contains a wetland treatment pond which serves as a component of a public art piece and provides runoff detention as well as stormwater re-use. Rainwater from the Olympic Oval's two-hectare roof is drained into the pond, where it is treated by vegetation and aerated through a fountain. The harvested and treated water is used for toilet flushing in the Oval and irrigation of plants in the surrounding space.



Fantasy Gardens Development: The multi-family development constructed at Fantasy Gardens located at the corner of Steveston Highway and No. 5 Road utilizes a stormwater detention pond for the re-use of stormwater. Water in the pond is collected, treated, and pumped into an adjacent community garden area for use to water vegetation in the garden plots.



Rain Barrel Program: In 2005, the City of Richmond implemented the rain barrel program aimed at encouraging residential water conservation. The program invites Richmond residents to purchase rain barrels from the City at a subsidized rate. Rain barrels are used by residents to collect and store water for outdoor usage such as watering gardens and washing vehicles. As of January 1, 2016, the City has sold 1,247 barrels to Richmond's residents.

Strategy #4: Protect, Enhance and Build Green Infrastructure

IRRMS Goal:

#4: Support the City's Ecological Network

Green infrastructure encompasses the components of the natural and built environment that provide ecosystem services such as drainage, water filtration, green space and wildlife habitat. The development of these green infrastructures for stormwater management purposes opens opportunities to enhance watercourse habitat and provide other ecosystem services.

This strategy aims to support Richmond's *Ecological Network Management Strategy* through the protection and enhancement of green infrastructure including watercourses, riparian areas and wetlands.

Select Initiatives and Outcomes:

- Improvement of watercourse health through restoration and enhancement of riparian areas.
- Creation of wildlife habitat values and temperature mitigation services (ecosystem services) through the creation or restoration of wetlands for the retention, detention and treatment of runoff.
- Improvement of ecosystem services through green infrastructure projects such as rain gardens and green roofs.
- Enhancement of the Ecological Network's connectivity and maximization of ecosystem services through the protection, enhancement and connectivity of natural lands including the daylighting of watercourses.

Daylighting Strategy

A key component of the strategy involves the daylighting, or exposing, of previously covered waterways or stormwater drains. Daylighting of watercourses re-introduces ecosystem services to a catchment, which serve to improve water and habitat quality, flood mitigation and conveyance, provide community amenities and connecting existing isolated ecological lands.

Daylighting opportunities will be identified through assessment of daylighting benefits and triggers.



Typical watercourse conditions in Richmond's RMAs.

Implementation Plan

The implementation plan outlines recommended actions and corresponding target implementation timeframes for each strategy. Timeframes for the implementation plan are defined as follows:

- Short-term: 1-2 years
- Medium-term: 3-5 years
- Long-term: 5+ years
- Ongoing: Initiatives the City is currently undertaking and will continue to undertake

The implementation plan will be subject to annual review to measure progress towards achieving the strategy's outcomes. The plan will be updated as required to address and incorporate emerging needs and priorities, new science, information, techniques and best practices.

Strategy	Action	Timeframe
Strategy #1 Strategic Detention of Stormwater	1. Update the City of Richmond's Engineering and Design Specifications Manual to include recommendations on the design of rock trenches and rain gardens.	Short-term
	2. Update policies to provide more clarity regarding requirements for rainwater management and lot coverage for landscaping.	Short-term
	3. Work with external agencies such as Metro Vancouver and other municipalities in developing and promoting the implementation of stormwater detention facilities.	Ongoing
	4. Continue to collaborate with Parks, Sustainability and other City departments in implementing stormwater detention facilities in parks and other special projects.	Ongoing
Strategy #2 Water Quality Treatment and Sediment Control	Undertake an internal review to develop an effective and comprehensive Erosion and Sediment Control program.	Short-term
	Update the City of Richmond's Pollution Prevention and Clean-up Bylaw No. 8475 and Engineering and Design Specification Manual to include the following: <ul style="list-style-type: none"> • Details on erosion and sediment control measures that should be implemented for construction projects, including site monitoring and reporting requirements. • Inspection and enforcement for sediment control and erosion management in non-ALR areas. 	Short-term
	Collaborate with Metro Vancouver to establish a modified MAMF specific for Richmond to guide water quality monitoring.	Short-term
	Collaborate between the City of Richmond's Engineering, Sustainability and Operations departments to identify areas of watercourses vulnerable to sloughing for implementation of bank protection works.	Short-term
	Evaluate the need to establish Total Suspended Solids (TSS) removal criteria to address road runoff.	Medium-term

Strategy	Action	Timeframe
Strategy #2 Water Quality Treatment and Sediment Control (con't)	Evaluate the effectiveness of this strategy through periodic monitoring according to modified MAMF guidelines specific for Richmond.	Long-term
	Monitor annual sediment removal volumes by municipal maintenance crews. Review and evaluate the effectiveness of existing Erosion and Sediment Control policies on a 5-year basis.	Long-term
	Monitor contractor compliance with Erosion and Sediment Control requirements and consider the implementation of additional measures to improve compliance.	Long-term
Strategy #3 Rainwater Harvesting and Re-use	Monitor the implementation and success of water re-use technologies inside and outside Richmond.	Ongoing
	Education to eliminate public unfamiliarity with rainwater re-use practices, with a target towards homeowners, regulatory staff, contractors, designers and trades.	Ongoing
	Complete pilot studies to obtain information on actual costs and potable water use reductions for residential and ICI applications.	Short-term
	Implement rainwater re-use for medium- and high-density office developments for toilet fixture applications.	Medium-term
	Update the Drainage, Dyke and Sanitary Sewer System Bylaw No. 7551 to allow rainwater re-use as an alternative to collection and conveyance of all surface drainage to the municipal stormwater sewer system.	Medium-term
	Work with external agencies to: <ul style="list-style-type: none"> Remove regulatory barriers that limit re-use applications. Establish water quality treatment and local Health Authority approval requirements to address various re-use applications. Develop regulations, guidelines and established practices for rainwater harvesting. 	Medium-term
	Monitor changes in the price of water.	Long-term

Strategy	Action	Timeframe
<p>Strategy #4 Protect, Enhance and Build Green Infrastructure</p>	<p>Update the City's Riparian Response Strategy to meet Provincial requirements for compliance with the Riparian Area Regulation.</p>	<p>Short-term</p>
	<p>Incorporate projects and opportunities identified through the Daylighting Strategy in the City's drainage capital planning process and through collaboration with the development community.</p>	<p>Short-term</p>
	<p>Update the criteria for the City of Richmond's Protection of Environmentally Sensitive Areas document to include best management practices for managing and enhancing habitat as part of rainwater management.</p>	<p>Short-term</p>
	<p>Identify and map opportunities for wetland creation in parks and other public land and develop guidelines for the use of parks and other public lands for rainwater management, habitat enhancement, and other green infrastructure projects to be incorporated into the Parks and Open Space Strategy.</p>	<p>Medium-term</p>
	<p>Collaborate on the development of an Erosion and Sediment Control program to address water quality in watercourses.</p>	<p>Medium-term</p>
	<p>Support invasive species management activities under the direction of the Invasive Species Action Plan to improve watercourse health and reduce long-term maintenance cost.</p>	<p>Ongoing</p>



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CNCL - 476