AGENDA ITEM NO: 7.4

MEETING DATE: February 11, 2025

STAFF REPORT – COVER SHEET

SUBJECT:	Strategy to Daylight Watercourses	DATE:	January 31, 2025
DEPARTMENT:	Engineering	PREPARED BY:	Doug Mossey

1. SUMMARY OF ISSUE:

The City of Chilliwack's drainage conveyance network consists of both open watercourses and underground piped storm sewer. Throughout the City's development, many natural watercourses have been relocated into ditches in rural areas and have occasionally been enclosed and covered by installing a storm pipe or culvert to convey the drainage. An increasing number of culverts are experiencing failure due to elapsed service life, requiring intervention by the City to restore drainage. The current practice has been to restore the channel to a natural watercourse ("daylighting") where practical, which has many financial, flood protection and environmental advantages compared to replacing the culvert Open ditches can store and convey greater volumes of water and in addition to the environmental benefits, the City can often receive habitat improvement credit for restoring the open watercourse.

A decision to endorse the daylighting strategy and authorize staff to create a daylighting policy is required.

2. RECOMMENDATION:

Recommendation that Council endorse the strategy to daylight watercourses where conditions allow, and to authorize staff to create a policy in support of the strategy.

Kara Jefford, Director of Engineering

3. FINANCE COMMENTS:

The City's culvert replacement program budget is currently not sufficient to address the replacement of these specific culverts and storm drainage networks in addition to culvert replacement program plan. Should Council wish to replace the culverts and storm pipes as opposed to daylighting, the culvert replacement program budget will need to be increased for future years, which will have financial implications to the overall financial plan.

Glen Savard, Director of Finance

4. CHIEF ADMINISTRATIVE OFFICER'S RECOMMENDATION/COMMENTS:

Supports recommendation.

David Blain, CAO

STAFF REPORT ON
Strategy to Daylight Watercourses

PREPARED BY:	Kristian Biela	DATE:	January 31st, 2025
POSITION:	Senior Engineering Technologist	DEPARTMENT:	Engineering

1. DEFINITION OF ISSUE

The City of Chilliwack's drainage conveyance network consists of both open watercourses and underground storm sewers. A watercourse is any natural, artificial, or man-made channel through which water flows and includes channels that flow continuously or intermittently. Throughout the City's development, many natural watercourses have been relocated into roadside ditches, and occasionally enclosed and covered by installing a storm pipe or culvert to convey the drainage. In many cases, watercourses have been piped for aesthetic improvements or for convenience of property owners.

Like all infrastructure, culverts and storm pipes have a limited lifespan and require maintenance throughout their service life and eventually require replacement to continue serving their purpose. The lifespan depends primarily on the material of the pipe, the soil and water conditions, and the care taken during the original installation. Storm pipe lifespans can range anywhere from 20 to 75 years. Unfortunately, in many instances, it is not known when a pipe was installed and what materials were used. Since many watercourses were enclosed throughout the mid to late 20th century, an increasing number of culverts are experiencing failure due to elapsed service life, requiring intervention by the City to restore drainage.

Depending on the site conditions, staff replace the failed pipe, or remove the pipe to restore an open watercourse, a term called daylighting. Daylighting has many benefits both for drainage and the environment and typically results in significant cost reductions compared to pipe replacement. Daylighting is possible when the following conditions align:

- The culvert or pipe is not used for a public road crossing or private driveway access
- The watercourse can be re-established with stable side slopes
- The re-established watercourse would not be creating a risk to a building or persons

A watercourse daylighting policy would aim to restore watercourses that have been enclosed within pipes or culverts where conditions allow, restoring them to a natural state for benefits described in this report.

2. FACTORS:

2.1 Daylighting is a process in which a watercourse that has been enclosed by a physical pipe is restored to natural open channel.

2.2 City Bylaw No. 168 Watercourse Protection Bylaw prohibits the filling or piping of watercourses without permits from the City and the Province authorizing the work. Currently there is no bylaw or policy requiring or encouraging the daylighting of watercourses.

2.3 There is more than eight kilometers of culverted watercourses with the opportunity to be daylighted within the City.

2.4 Staff estimates indicate the cost to remove a pipe and restore an open channel is roughly $300 per meter by City forces, and the cost to replace storm pipe is typically in the range of $3000 per meter, at current contracted rates. Costs can vary due to factors such as depth, watercourse class, pipe size and other factors.

2.5 Daylighting costs are significantly less than pipe replacement due to cost savings in pipe materials, imported gravels, equipment and labour. In many instances, some storm pipe or culvert will be required to maintain driveway or field access points.

2.6 Piped storm systems are more difficult and expensive to maintain. The condition of a pipe or an obstruction can only be observed from a CCTV camera. A high-pressure flush truck is needed to remove any blockages or deposited sediments. If the condition of a pipe is poor, high pressure flushing can exacerbate failure and pull materials through pipe openings which results in sinkholes.

2.7 Condition data for pipes is not readily available, creating inherent unknown risk associated with asset planning. Most rehabilitation candidates are found through sinkholes, surface displacement, or drainage backups, which are often reported by residents. Council has approved a budget for doing CCTV camera inspections of storm pipes, starting in 2026.

2.8 In addition to cost savings, there are significant flood mitigation and environmental benefits:

a. Flood Mitigation Benefits:

i. Open watercourses have a much higher hydraulic conveyance capacity than pipes, meaning they can transport water at a higher rate during storms. Capacity increases of 100% to 400% can be expected.

ii. Drainage conveyance is especially important in low lying areas with long, winding routes nearly everywhere on the Chilliwack valley floor. Conveyance is dependent on gradient and cross-sectional flow area. Where the gradient of a landscape cannot be altered, an increase in cross sectional area is the easiest method of increasing conveyance, such as increasing a pipe size or daylighting to open drainage.

iii. Pipe cross-sectional area reduces significantly with deposited sediments, while the same amount of sediment in an open watercourse is has less of a conveyance impact due to the larger cross-sectional area.

iv. Watercourses provide more flood storage than pipes due to the open space available for floodwater to occupy. Increased storage volume decreases the risk of overland flooding and leads to improved flood resilience, since floodwater that would typically overwhelm a drainage system can be attenuated within available storage. Storage volume increases of 100% to 1000% can be expected depending on the size of the original pipe and the geometry of the consequent daylighted watercourse.

v. Storage is especially important in areas of the City that are controlled by drainage pump stations such as Greendale, Yarrow, and East Chilliwack. This is because flows generated during storms can exceed the pumping capacity of a drainage pump stations. When capacity of the pump station is reached, water begins to back up within the drainage network and is stored within watercourses and other low-lying areas. Daylighting watercourses provides additional flood attenuation during significant storms, as well as small storms if the system is pre-saturated.

vi. Watercourses promote groundwater infiltration, evaporation, plant uptake, and transpiration. When these factors are combined, the conveyance demand can be significantly reduced.

vii. The combination of improved conveyance and expanded storage can significantly reduce flood risk and hazard, building resilience against severe weather events.

b. Environmental and Ecological Benefits:

i. Open watercourses provide habitat and food for amphibians, fish, birds and other wildlife, leading to healthier ecosystems.

ii. Watercourses support valuable riparian vegetation that provides food and shelter for fish and wildlife, helps keep air and water temperatures cool in the summer, and naturally treats and filters runoff to remove pollutants, improving water quality in the stream. Riparian trees and shrubs also increase carbon sequestration.

iii. In recent years the City has observed an increased demand from federal and provincial regulatory agencies for habitat enhancement and riparian restoration. Daylighting watercourses is an eligible activity for compensation or environmental offsetting on other City projects which has a significant financial benefit.

iv. Root systems in riparian strips reduce stream bank erosion and prevent migration of soils from neighbouring land and farms. This reduces the need for watercourse cleaning, sediment removals, and maintenance.

v. Aquifers are replenished through groundwater infiltration, supporting the natural water cycle and improving drinking water supply security.

2.9 Many cities in the province have adopted the strategy to restore natural streams in their stormwater management planning. Examples include:

a. The City of Abbotsford has adopted multiple policies through its OCP and bylaws (Policy No. 275, 276, 277, 299) in support of daylighting of streams.
b. The City of Prince George OCP Policy 6.2.25 in support of maintaining open channels and removing inappropriate culverts
c. The City of Nanaimo OCP Policy C1.5.10 supports maintaining open watercourses and daylighting where practical.

2.10 A watercourse daylighting policy would reinforce the strategic goals of the City by formalizing the existing practice and laying out criteria to be taken into consideration when determining whether to daylight a watercourse or replace an existing culvert or storm pipe.

3. RECOMMENDATION:

Recommendation:

Recommendation that Council endorse the strategy to daylight watercourses where conditions allow, and to authorize staff to create a policy in support of the strategy.