Erosion of Anchor Estates

This presentation is to demonstrate how, I believe, North Cowichan's Stormwater Management is causing stream bank erosion of Anchor Estates Greenspace and a number of strata properties bordering that Greenspace

The following is an email I received in response to my concerns about erosion of Properties and Anchor Estates Greenspace. In the following presentation I hope to challenge the statements in paras one and two. As for para three, the disclosure statement filed by the developer advises that North Cowichan had stated that there is no flooding issues with the Anchor Estates development.

Good evening Mr. Sjolie:

This email is in regards to the matter of the erosion along Hayhurst Creek near to your property and your request for the District to take steps to arrest the said erosion.

Staff have looked into the matter and have concluded the following:

1. The section of creek where the erosion is happening resides within the strata, within common property. The District is not responsible for addressing issues on private property.
2. Upland development has not appreciably increased flows in the Creek.
3. The November 2021 event was a significant rainfall event. Hayhurst Creek is the floodway for major rainfall events and would be expected to see high flows such as those that occurred during the November 2021 event. Creek banks can erode over time. The ravine your property backs onto would have formed over time as the creek eroded. As such, the erosion is naturally occurring and it is assumed that from time to time it may be necessary for property owners backing onto such creeks to address erosion should it become a concern.

For the reasons discussed above, the District will not be taking any action to address the said erosion. Rather, it is the decision of the strata to take what steps it deems necessary to address the erosion.

Also, it is my understanding that you have advised staff that you may take legal action against the District if the District does not address your concerns. It is the District's policy to deny requests to appear as a delegation before Council when there is the threat of litigation.

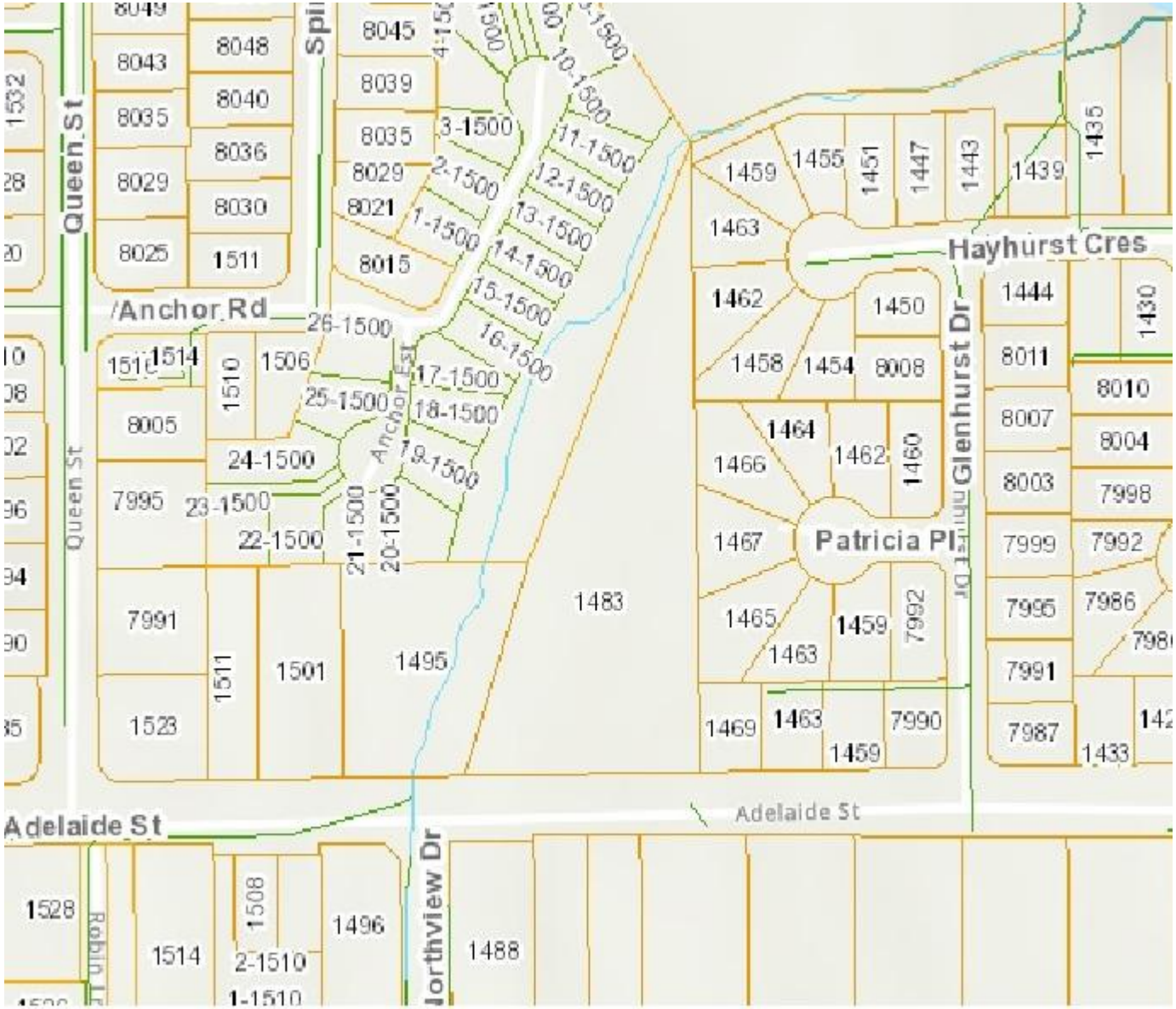
Regards.

Clay Reitsma, MEng, PEng

Director of Engineering

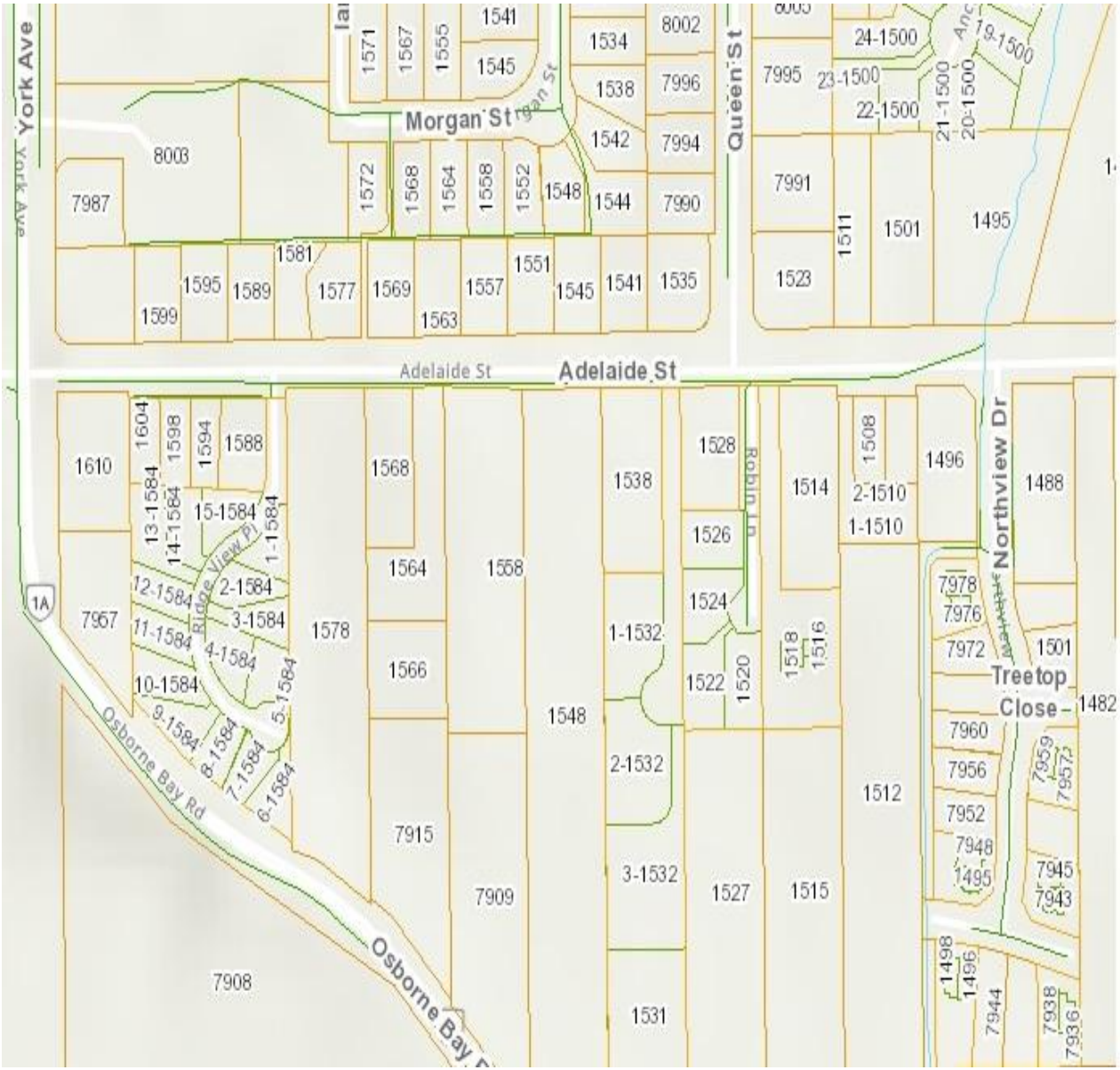
District of North Cowichan

Map of Stream thru Anchor Estates



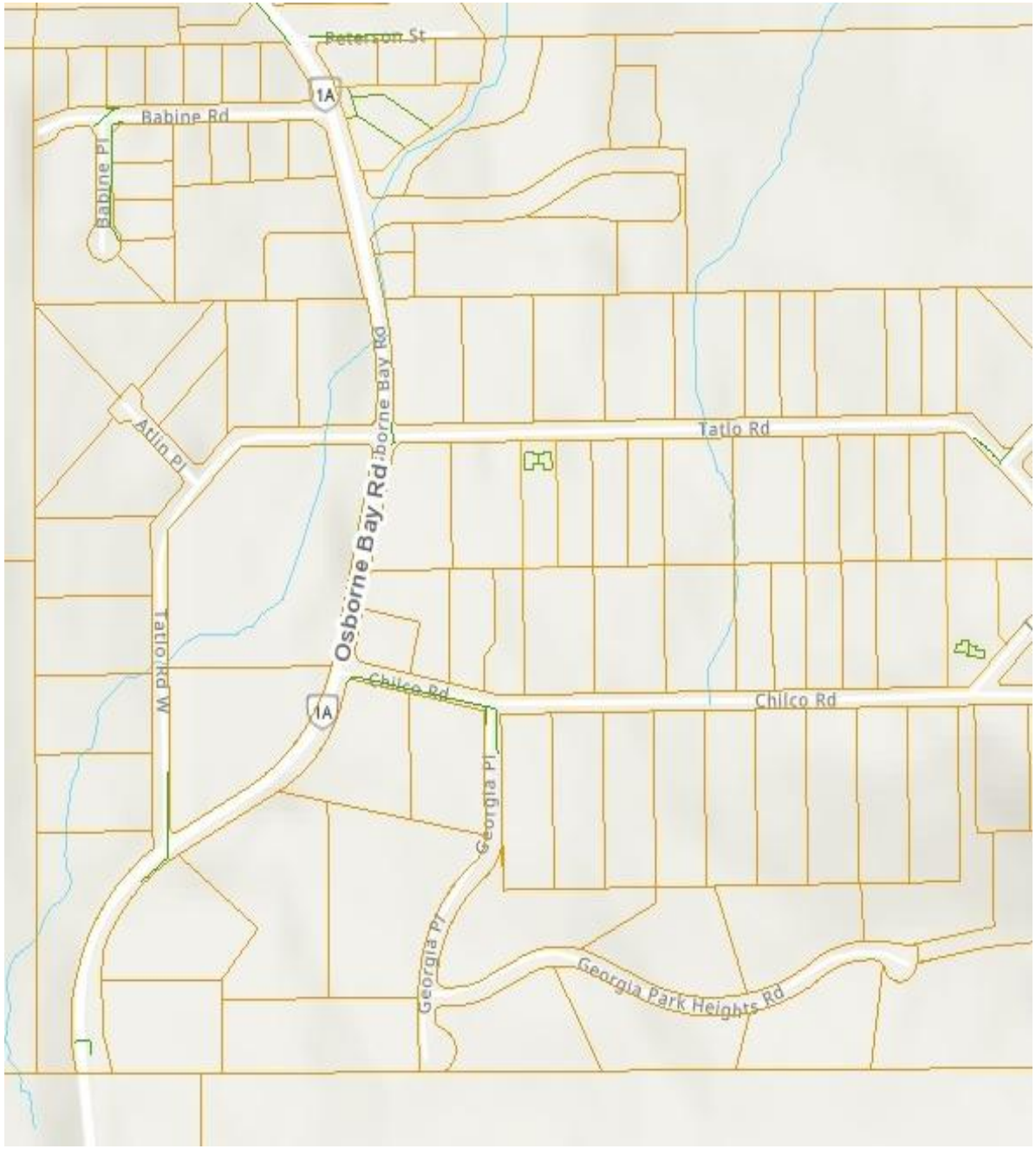
This slide shows the approximate location of the stream (Marked in light blue) flowing from a 1200mm culvert under Adelaide street thru Private Property lot #1495, then thru Anchor Estates (Strata) greenspace alongside lots #20-1500 thru Lot #10-1500 inclusive. The area that borders the above stata lots is classified as “Common Property which is owned by all 26 strata property owners and which BC Assessment considers in property assessment values

Drainage Sewer System Adelaide



This shows the drainage pipe system (light green lines) on Adelaide along with the properties that feed into that system. As you can see the stream that use to flow through the Northview Dr area (Pre Development) has been straightened and has two 1200mm concrete culverts at the top and bottom of the left side of the subdivision and shows as part of the stormwater drainage system.. There are approximately 70+ properties using this drainage system. 45+ have been built and added to the system since Anchor Estates development was approved in 1992.

Drainage Area Above Adelaide



This shows the drainage area for the stream (left side light blue line) as it flows from just below the old Crofton dump thru Tatlo Way area, crossing under Osborne Bay Rd (2 smaller galvanized steel culverts), thru another 1200mm Concrete culvert past 3 newer properties just south of Peterson St, then down a ravine and entering the culvert at the top of Northview Dr. Here I believe that parts of both Maple and Richards mountain along with parts of Osborne Bay Rd., Tatlo Rd., Chilco Rd, Georgia Place, Georgia Park Heights Rd, all of Tatlo Way and Peterson St. drain into this stream. Again about 75+ properties. The area is relatively flat and most drainage is thru Ditches. Here there are less than dozen houses that have been built since 1992.

Erosion

- The following are a series of slides taken on Jan 13, 2022 demonstrating the level of erosion to both the stream banks, trees roots and vegetation and to the Anchor Estate properties bordering the Greenspace.
- Note Again: the Greenspace is classified as “Common Property” and is therefore the property of all 26 Anchor Estate owners and is included in the property tax assessments.

You can see bank erosion and bank slumpage. Over the past few years a number of trees in the Greenspace close to the creek have been undermined. Several have fallen, at least 4 have struck strata lots. You will see more of the same in the following pics.

This is my property where I have had to sandbag in an attempt to stop the bank erosion and slumpage. You can see the tree roots exposed and the severity of the erosion.

The Cause(s)

I believe the primary cause of the erosion is that development since 1992 along with increased storm events due to climate change has increased the flow and volume of stormwater that is fed into the storm system along Adelaide St. to the point that rainfall amounts exceeding 24 mm in a 24 hr period is causing the steam to top its normal banks resulting in the erosion to our Greenspace and properties, as demonstrated in the following slides and video.

This Slide shows the average rainfall for the Crofton area during the winter months of Nov, Dec & Jan. Between 1980 to 2010 an average winter rainfall was 178 mm per Month. As you can see the last 11 years with the exception of 2013-2014 & 2016-2017 have increases of up to 70%. The last five years have averaged a 58% increase. Will this continue? Most Climate Reports state rainfall for our area will increase in intsensity and increase in amounts by at least 20 % going forward

Winter Rainfall for Crofton Area	November	December	January	Average	Percent Increase
Year(s)					
1980 – 2010	186	167	180	178	
2011-2012	239	121	229	196	110%
2012-2013	225	234	112	190	107%
2013-2014	102	31	137	90	51%
2014-2015	166	225	152	181	102%
2015-2016	204	352	271	276	155%
2016-2017	268	123	100	164	92%
2017-2018	325	141	417	294	165%
2018-2019	187	376	276	280	157%
2019-2020	79	194	493	255	143%
2020-2021	296	308	310	305	171%
2021-2022	482	172	178	277	156%

Rainfall this Winter for the Crofton Area

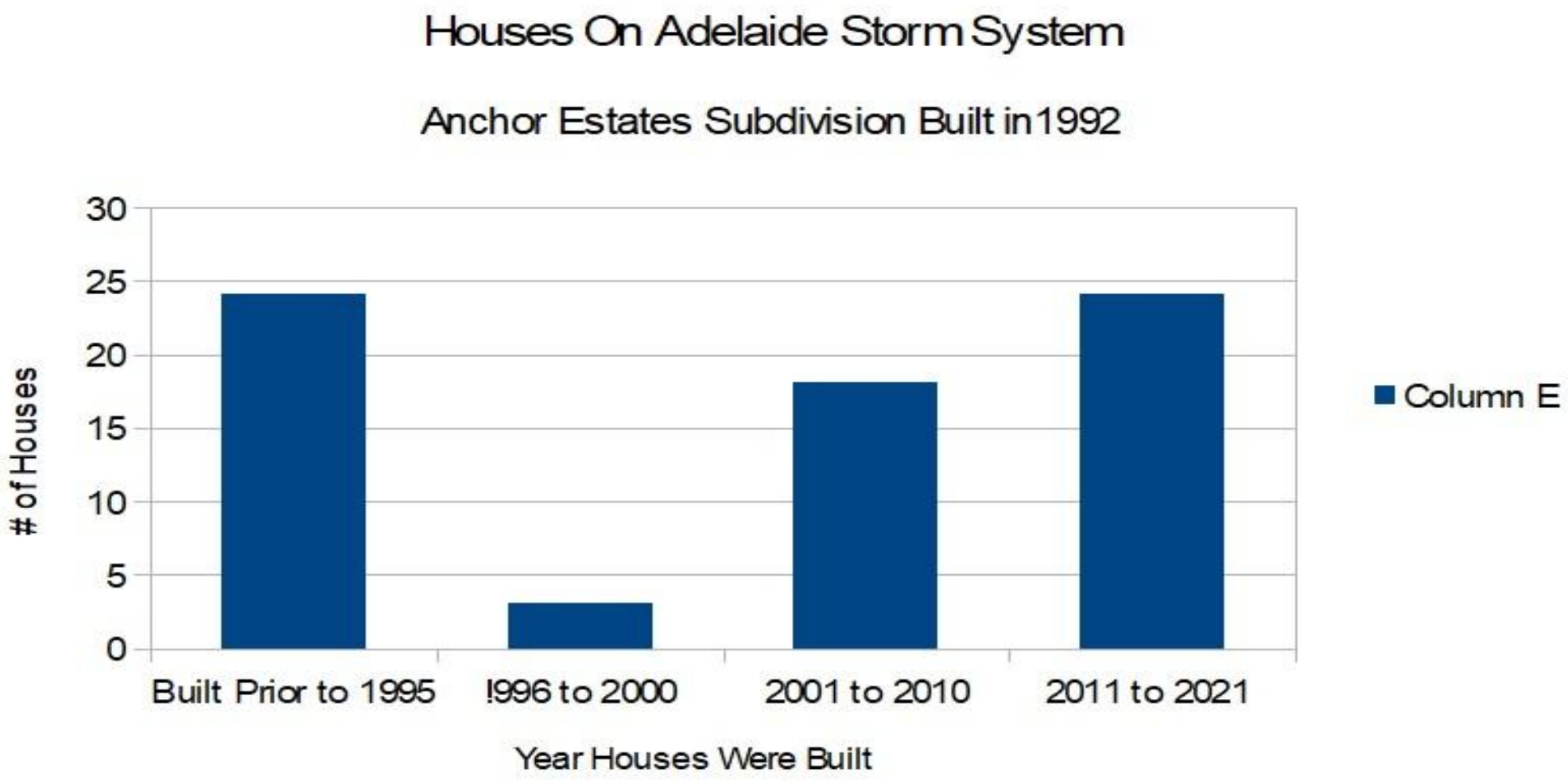
Crofton does not have a weather reporting station. The following data is from the Chemainus weather reporting station and two weather stations located near the District o North Cowichan Offices. This data shows dates this winter where rainfall events are near or have exceeded 24 mm of rain in a 24 hr period from at least one of the reporting stations.

Event Date	Rainfall Totals		
	Chemainus	North Cowichan 1	North Cowichan 2
Nov 2, 2021	48.6	34.2	32.3
Nov 3, 2021	37.5	30.2	34.6
Nov 13, 2021	53.4	43.8	30.4
Nov 14, 2021	90	109	71.1
Nov 15, 2021	33.8	1.2	48.4
Nov 24, 2021	8.3	19.4	0
Nov 25, 2021	37.1	21.4	38.5
Nov 27, 2021	41.8	37.4	41.1
Dec 10, 2021	48.9	27.2	27.4
Dec 11, 2021	15.2	14.6	10.4
Dec 17, 2021	29	33.6	43.2
Jan 11, 2022	20.4	24.8	18.7
Jan 12, 2022	26.8	15	19.8

Chemainus is operated by Climate Canada Network and reports Daily
North Cowichan 1 is operated by Climate Canada Network and reports Daily
North Cowichan 2 is operated by Environment and Climate Change Canada – Meteorological Services Canada

As you can see we have had at least 11 days this winter where one or all of the stations have reported rainfall totals Exceeding 24 mm. The short movie I have attached to this presentation was taken on Jan 13, 2022 representing what the creek looks like for an approximate 24 mm rainfall event over 24 hrs.

Obviously the main culprit was the Nov 13/14/15 storm. Is this a once in a lifetime storm? It was only 12 years ago, Nov 15/16/18/19, 2009 where rainfall exceeded 50 mm on each of those days. Only difference between then and now is the new extensive dyking protecting Duncan.



An average lot has about 200 sq meters of impervious surface (Roofs, Driveways, etc), therefor 50 lots would have about 10,000 sq meters of impervious surface producing 10,000 litres of stormwater for every millimeter of rainfall. This does not include roads and sidewalks that service these lots. That is 10 cubic meters of water every hour for 1 millimeter of rain. Over 40 times this winter hourly rainfall totals exceed 4 mm per hour. I believe that this is a significant increase in water flow, especially as you can see the water flow increase in the creek almost as fast as the rain event intensifies.

Looking Just past new culvert built above Peterson St before and after Jan 12 Rainfall

These slides show (left) the artificial straightening of the stream along Northview Dr. and on the right is a pic of the stream just before entering the culvert at the top of Northview. Most studies on straightening of stream state the following.

1. Flooding may happen downstream of the straightened channel as water is carried there faster.
2. There is more erosion downstream because the water is flowing faster.

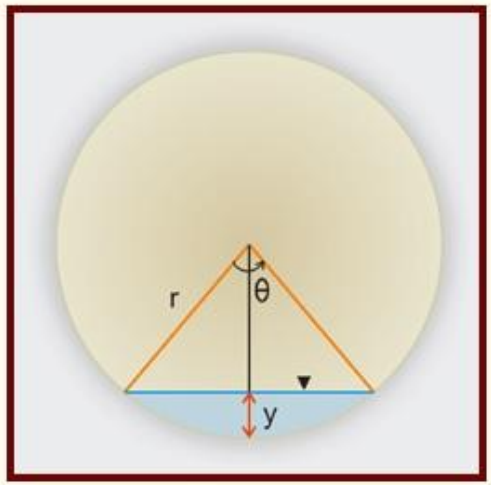
The bottom Culvert outlet on Northview Dr before and after Jan 12, 2022 Rainfall

Adelaide St. Culvert outfall Image before and after Jan 12, 2022 Rainfall. You can see the significant difference between the Northview Dr. outfall and this one which includes the Adelaide Stormwater System.

Adelaide Outfall expanded View before and After the Jan 12 rain event

Below is an online program that I used the calculate the amount and speed of the water flowing from the Adelaide culvert using the preceding pictures. You can see that the discharge Q is almost 2 cubic meters per second and the flow rate is almost 6 meters per second. That is enough water to fill an olympic size swimming pool every 20 minutes.The flow rate is enough to move gravel and small boulders along the stream bed.

onlinechannel03.php: Discharge in a partially full circular culvert



Formulas

$\theta = 2 \cos^{-1}[1 - 2(y/D)]$

$A = (D^2/8)\ (\theta - \sin\theta)$

$P = r\theta$

$R = A/P$

$Q = (k/n)\ AR^{2/3}S^{1/2}$

$V = Q/A$

INPUT DATA:

Select: SI units (metric) / U.S. Customary units

Pipe diameter D: 1.22 m

Flow depth y: .4 m

Bottom slope S: .125 m/m

Manning's n: .022

INTERMEDIATE CALCS:

Constant k: 1

Flow area A: 0.333 m^2

Wetted perimeter P: 1.487 m

Hydraulic radius R: 0.224 m

Relative depth y/D: 0.327

Froude number [based on y]: 2.994

OUTPUT:

Discharge Q: 1.9774 $m^3\ s^{-1}$

Flow velocity V: 5.9302 $m\ s^{-1}$

Excerpts From Bylaw 3450 Official Community Plan

1.3.5 Community engagement

Adopting the principle of community engagement means ensuring that **Council, staff and citizens keep talking to each other in an open and transparent way to ensure that decision-making is in line with the policies, goals and principles of the plan**. It also means committing to regular and meaningful plan monitoring and reporting. The OCP is based on community values and depends on the continued support of the citizens it serves.

Manage rainwater effectively 2.5.7.6

The Municipality will manage storm water in an environmentally conscious way while continuing to protect the community. [See also Goal 2: Environmental Protection, and 2.3.1.6]

a) The Municipality will discourage or avoid culvert installation in open drainage courses except when safety considerations make it unavoidable to do so. Where possible, the Municipality will encourage the daylighting of streams that have previously been culverted.

b) The Municipality will cooperate with watershed management groups to ensure that local expertise, concerns and issues are recognized in policy development.

c) The Municipality will encourage neighbourhoods and residents to take a greater role as stewards of local drainage and watercourses, including conservation measures designed to increase ground infiltration. North Cowichan Official Community Plan 2011 Build Strong Communities:Infrastructure

2.5.7.7 The Municipality will reduce the volume of rainwater run-off by encouraging the use of means to ensure it infiltrates where it falls.

a) Development projects are encouraged to foster rainwater infiltration through the use of absorbent landscaping, swales, rain gardens, pervious paving, green roofs, infiltration trenches, and other appropriate methods.

b) The Municipality will assess development projects in light of drainage implications, with the goal of maximizing on-site rainwater retention. Development projects are expected to comply with the standards in the provincial Water Quality Guidelines (2006) and Stormwater Management Guidelines (2005). [see also 2.3.1 Climate Change]

Note that the common law right of a municipality to drain into a stream has been modified in BC by the enactment of the Water Sustainability Act SBC 2014, c15. Section 11 of that Act prohibits a person from making “changes in and about a stream” without an authorization. “Changes in and about a stream” is defined to include “any modification to the nature of a stream… or to the flow of water in a stream”. Although there is an exemption from the requirement to obtain an authorization for storm sewer outfalls, the exemption only applies if the outfall is designed by a professional engineer and the outfall does not obstruct or cause erosion of the stream channel.

Recent work done (Mar 2022) to Adelaide Street as the pic on the right shows that the bank where the culvert exits has become quite unstable.

Conclusions and Proposals for Consideration

1. I still believe that the water flow coming out of the Adelaide culvert has increased significantly in recent years and as the climate changes into wetter more intense winter storms and development continues in the areas feeding stormwater into this culvert the erosion caused by the stream flowing through the Strata's Greenspace will only continue to exacerbate.

2. My preference would be that the Adelaide portion of the system be disconnected and routed elsewhere, either down Queen St or Hayhurst. I appreciate that this is probably cost prohibitive.

3. North Cowichan does have the authority to appropriate water courses on private land to become part of the municipal drainage system, especially as all the water now flowing through the creek comes from North Cowichan drainage systems.

4. Ensure that all new developments, no matter how small (even single lots) meet the stormwater management design guidelines with the emphasis on stormwater retention.

5. If you still believe that North Cowichan bears no responsibility for this situation, and that it is up to the individual land owner or strata to address this erosion problem, could you provide us with a report outlining the current and future expected water volumes and flows that we would be dealing with so as to allow us to take the appropriate works for containing and controlling the erosion.

Note: Please take time to watch the short movie of the streams water flow past my property taken shortly after the Jan11/12 rain event which produce about 25mm of rain in 24 hrs.