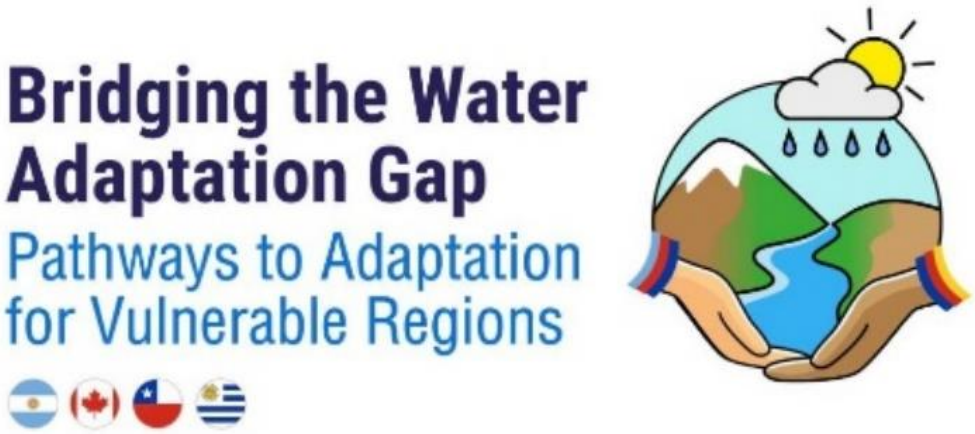
Bridging the Water Adaptation Gap (BWAG) - Pathways to Adaptation for Vulnerable Regions

Infrastructure Sector Focus Group Analysis



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Introduction

Bridging the Water Adaptation Gap (BWAG) - a five-year transdisciplinary Social Sciences and Humanities Research Council of Canada (SSHRC) funded international project investigating how vulnerable agricultural regions may develop sustainable adaptation strategies to address water issues exacerbated by climate change in four countries- Canada, Uruguay, Chile and Argentina has been conducting focus groups for four sectors (Livelihoods, Ecosystems, Primary Economic Activity and Infostructure) as Objective 3 i.e. assess the risks and possible impacts to regional sectors after the completion of Objective 2 (an attempt to identify regional socio-ecological systems risks). This document will aim to describe the analysis of two focus groups conducted by the infrastructure sector in Yorkton (on June 28, 2023) and Saskatoon (on June 29, 2023).

The infrastructure sector of BWAG seeks for a better understanding of Socio-Ecological Systems (including Socio-Economic Systems) around hydro-climactic risks, impacts and adaptations that affect built infrastructure- these infrastructures may include large scale (regional infrastructure), micro-scale (on-farm infrastructure) for e.g. waterways and water control structures, dams, culverts, bridges, drainage works, irrigation systems, constructed green infrastructure, water and wastewater utilities, buildings, landfills, energy systems (oil, gas, electricity, etc.), transportation systems (roads, railways, etc.), telephone/internet communications systems, etc; and Constructed green infrastructure for e.g. constructed wetlands to reduce flood risk and improve water quality, modified land management systems that promote ecologically sustainable economic activities (agriculture or other industry), water management and ecosystem preservation systems to promote biodiversity and water quality /supply; this could include constructed wetlands, designed riparian or landscape modifications to buffer aquatic ecosystems from human activities, enhanced modifications to improve natural wetlands with designed landscape modifications, etc.

The units of analysis for this focus group were: **Water infrastructure that provides BASIC SERVICES:** water supplies for human needs such as drinking water, household water, etc. (Wells, dugouts, farm reservoirs, rural water pipelines, source water intakes, water treatment, and water supply infrastructure, wastewater infrastructure) **– *links to LIVELIHOODS*. Water infrastructure that secures ECONOMIC SECURITY:** including water supplies for agricultural and rural economic needs (wells, dugouts, farm/community/regional dams and reservoirs, rural water pipelines, source water intakes, water and wastewater treatment, and water supply infrastructure for farm and agricultural needs including water for livestock production needs, dairy needs, and value-added agriculture). Infrastructure will include water management for cropland agricultural needs to manage overland flood water to protect agricultural lands and rural landscapes from flood risks (drainage ditches, control works); irrigation infrastructure for agricultural water diversions, water management and field crop irrigation, etc. **- *links to PRIMARY ECONOMIC ACTIVITIES*. Water infrastructure that preserves, safeguards, sustains and enhances the NATURAL ENVIRONMENT –** e.g., green infrastructure for protection of riparian zones, remote livestock watering diversions, constructed wetlands, water management infrastructure and/or green infrastructure that enhances ecosystems (e.g., channel bank and stream protection/restoration improvements with naturalized techniques to restore habitat, protect fisheries, etc.), etc. **– *links to ECOSYSTEMS.***

These focus groups were conducted with a background understanding of water infrastructure related to water use and needs and hydro-climactic risks on built infrastructure with fair

representation from various stakeholders including watershed stewardship associations, water security agencies, non-profit organisations, rural municipality representatives, policy makers and farmers. The focus groups were hybrid in nature i.e., participants were both in person and connected over zoom and were co-moderated by Dr Harry Diaz and Darrell Corkal.

Following were the questions asked during the focus groups:

OBJECTIVE 3 INFRASTRUTURE THEME: CANADA'S INFRASTRUCTURE FOCUS GROUP QUESTION

HYDRO-CLIMATICS RISKS and HAZARDs/IMPACTS will be:

- *Flood Years and EXCESSIVE WET YEARS DURING 2010-2016 (worst years 2011, 2014);*
- *DROUGHTS interspersed during 2000 to 2020; SHIFTS FROM WET TO DRY and DRY TO WET*
- *NON-CLIMATIC RISKS INCLUDED (but note that "governance analysis" is Objective 4)*
- *While the Canadian context differs from Argentina, Chile, Uruguay, the general data collected should be comparable thematically for BWAG analysis*

Interviewer: **Polo Diaz**
Research Assistant: **Bobo Doley (Pradeep Ranjan Doley Barman)**
Observer: **Darrell Corkal**

NOTE: The on-farm, local, regional and provincial infrastructure the questions refer to primarily relate to water management infrastructure. However, hydro-climatic risks affect a much broader scope of built infrastructure, such as roads, bridges, culverts, energy, communications, utilities, buildings, etc.

a. Water storage, supply and delivery, water treatment, wastewater treatment
b. Water management for supply (social, economic, environmental needs)
c. Water management for excess water conditions, drainage and flood protection infrastructure (ditches, canals, control structures, storm water reservoirs) to preserve social, economic, environmental needs

1. **What are some of the impacts caused by flooding in the period of 2010-2016, especially during severe wet years of 2011 and 2014?** For example, What local/regional infrastructure (*water, roads, culverts, bridges, other on-farm homes, barns, buildings, utilities and power lines, local and regional infrastructure, etc.).
    a. Flooding and excess water
    b. Hydro-climatic events including storms, winter icing, summer rains, grassland wildfires, heat waves, droughts, etc.

2. **Are there any risks or impacts to Infrastructure caused by Drought or Water Scarcity?**
    a. E.g. excessive drying of infrastructure foundations?
    b. Other?

3. **What happens in times with dramatic hazard shifts from drought or 'too little water' to floods or 'too much water' (and vice/versa) – do season or yearly hazard shifts strain infrastructure?**
    a. Wet-dry-wet cycles? Or vice versa?
    b. Rapid seasonal shifts? Prolonged (perhaps multi-year) shifts?

4. **Are there examples of other risks, and/or compounding risks that might affect infrastructure?**

a. e.g. Finance, Maintenance, Covid, Economic Supply Chain, Russia's War in Ukraine, etc.?
b. What other climatic risks are impacting infrastructure (e.g. summer/winter storms, wind, tornados, snow, ice, wildfires including grassland/tree fires, excessive heat, etc.)
c. What are some examples of non-climatic risks that might affect infrastructure?

5. **Are there issues, or have there been issues in the past, with water supply, water distribution, and water management infrastructure?** (this includes water infrastructure for storage, flood protection, managing runoff and drainage from communities and agricultural lands; this includes urban, rural and recreational land development; this includes recreational communities water development and management systems; what about irrigation infrastructure?)
    a. What are some-short term, medium-term, longer-term impacts (how do they play out over time?)
    b. Are there other compounding factors/risks affecting infrastructure and how (e.g. other climate or non-climate hazards?, budget/maintenance? Covid, Supply Chain, Russia's War in Ukraine, Other?
    c. Have there been issues of conflicts with water infrastructure (e.g. operational management, competition, flood protection, environmental protection, social/economic/environmental)?
    d. Have different orders of government helped or hindered conflict resolution?
    e. Have equitable solutions been discovered?
    f. What is needed in future to resolve issues or conflicts with water infrastructure?

6. **What other thoughts or contributions would you like to input about how water infrastructure and hydro-climatic risks may need to be improved, particularly into a future that may be experiencing more hydro-climatic variability?**
    a. General contributions to offer wrt Infrastructure Theme?
    b. Final Thoughts?

7. **Ask for:**
    a. their permission to contact them later on
    b. their recommendations of others that the BWAG researchers/partners should talk to
    c. if they may be interested or willing to participate as a Partner?

Both groups were quite informative on the themes discussed and spoke from their expertise and positionality. These conversations were recorded on 4 audio recorders (1 handheld, 2 placed on tables and 1 near the moderator) and transcribed. The transcripts were then analysed on Nvivo using 5 general codes decided upon by the sector leads of all four countries to look for recurrence of themes (presented on Table 2). These general codes for the infrastructure sector are:

Themes	Code	Description
Impacts of drought on infrastructure	**INF_DrouImp_XX** (XX: plus country code)	The diversity of impacts that drought conditions have on different types of infrastructure.
Impacts of excess water (floods) on infrastructure	**INF_ExWImp_XX** (XX: plus country code)	The diversity of impacts that extreme water abundance (i.e. floods) conditions have on different types of infrastructure.

Impacts of other climatic and non-climatic hazards on infrastructure	**INF_OtHImp_XX** (XX: plus country code) Other hazards	The diversity of impacts that climate events (other than droughts and extreme water abundance have on different types of infrastructure, such as ice storms, heat waves, and others.
Impacts of climate shifts on infrastructure	**INF_ClShImp_XX** (XX: plus country code)	The impacts that hydro-climatic shifts (wet-dry, dry-wet, rapid shifts) have on different types of infrastructure.
Impacts of compounded hazards on infrastructure	**INF_ComImp_XX** (XX: plus country code)	The impacts that compounded hazards, where climatic and non-climatic events could be combined, have on different types of infrastructure.

Table 1: Infrastructure general codes for Nvivo

Infrastructure Focus Group Coding

Codes

Name	Description	Files	References
INF_ClShImp_CA	The impacts that hydro-climactic shifts (wet-dry, dry-wet, rapid shits) have on different types of infrastructure.	2	11
INF_ComImp_CA	The impacts that compounded hazards, where climatic and non-climatic events could be combined, have on different types of infrastructure.	2	40
INF_DrouImp_CA	The diversity of impacts that drought conditions have on different types of infrastructure	2	20
INF_ExWImp_CA	The diversity of impacts that extreme water abundance (i.e. floods) conditions have on different types of infrastructure	2	34
INF_OtHImp_CA	The diversity of impacts that climate events (other than droughts and extreme water abundance have on different types of	2	7

Name	Description	Files	References
	infrastructure, such as ice storms, heat waves, and others.		

Table 2: Nvivo Codebook for Infrastructure sector in Canada

The impacts that compounded hazards, where climatic and non-climatic events could be combined, have on different types of infrastructure i.e. INF_ComImp_CA was referenced 40 times during the course of the two focus groups (2 hours each). It was found that Saskatoon focus group referenced it significantly more than Yorkton focus group which may have been due to the particular positionalities of participants. The diversity of impacts that extreme water abundance (i.e. floods) conditions have on different types of infrastructure i.e. INF_ExWImp_CA was referenced a total of 34 times- which happens to be the second most referenced code during this research effort. The diversity of impacts that drought conditions have on different types of infrastructure i.e. INF_DrouImp_CA was referenced 20 times; The impacts that hydro-climactic shifts (wet-dry, dry-wet, rapid shits) have on different types of infrastructure i.e. INF_ClShImp_CA was referenced 11 times and The diversity of impacts that climate events (other than droughts and extreme water abundance have on different types of infrastructure, such as ice storms, heat waves, and others i.e. INF_OtHImp_CA was referenced 7 times. Since this focus group exercise was to limited to assessing risks and possible impacts to regional sectors, a lot of discussion (especially during Saskatoon focus group) around adaptation techniques haven't been coded yet. They have however been marked for the future.

Code	Key findings
INF_ClShImp_CA	• There have been recent extreme shifts in the province • Intersectional impact of such climate shifts- maintenance of infrastructure vs losses sustained (livelihoods) • There is a tendency to be short sighted • Need for more proactive planning to mitigate potential losses
INF_ComImp_CA	• Change in political leadership impacts infrastructure • The political leadership needs to be more reflexive in placement of infrastructure- and use technology such as LiDAR to gain better understanding • People are important resources- especially around region specific knowledges • COVID impacted work culture • War has affected prices

	• The need for education • Need for proactive planning by elected officials and people- keeping in mind potential future risks due to climate change. • Need for collaboration and communication between different departments and industries for the best possible policy outcome
INF_DrouImp_CA	• Dry periods are the time to "do work" to prepare for the wet periods • There is a tendency to be short sighted • Need for more water storage infrastructure • There is immense pressure on the water storage infrastructure • Infrastructure placement is of utmost importance • Extreme heat and draughts have impacted built natural infrastructure in major cities • Major mortality events- ash trees decimated • Water quality inside built infrastructure gets pretty poor during such dry events • It affects agriculture (livelihoods) • There needs to proper planning around managing the water and monitoring it • Infrastructure is affected via shrinkage or expansion depending on the infrastructure • There needs to be better policies for non-farmers impacted by droughts
INF_ExWImp_CA	• Has resulted permanent damage on certain infrastructure such as roads • Rural municipalities affected the worst • Disparity of grants for adaptation between larger municipalities as compared to first nations communities and RMs • Lots of damage to natural infrastructure • Damage to businesses, homes, lanes, etc. • Impact on highways • There is support for responsible? Drainage to mitigate the impacts of floods- excess water
INF_OtHImp_CA	• Forests fires have impacted built infrastructure • Forest fires have also impacted natural infrastructure • Ice storms have caused power- grid issues

Table 3: Key findings (Draft)

NVIVO references

INF_ExWImp_CA reference list:

<Files\\saskatoon meeting transcriptsEdited230824> - § 17 references coded [18.15% Coverage]

Reference 1 - 0.48% Coverage

to commute back and forth from Saskatoon to Humbolt, mainly to watch my son play hockey and I mean the water was over Number 5 highway, and at least in two locations, sometimes three. And I mean, during that time you could see the deterioration of the infrastructure. I mean they did the best to temporarily pack shoulders, but I mean it was, it was futile, and really it needed to, it needed to dry out before the connection with [repairing???] infrastructure?

Reference 2 - 0.18% Coverage

We could still get through. But I don't. That's our we're past to to our late two, and then we're pulling a trailer through the water and worried that it might float.

Reference 3 - 0.91% Coverage

In, in my professional opinion, that period. It's the wettest period of the instrumental record, if you think is, which is over hundred years in Saskatchewan, and especially in the eastern parts of the province, and the extreme example is a Souris river basin, and but the other two aspects of it. First of all, this is largely driven by rain. and Saskatchewan has a long history of severe floods, due to spring snow melt, or rain during the spring snow melt. In the fact that this is driven by rain rather than [snowmelt]. Yeah, it's not [common, and] it's significant. And you know, we've heard a lot of talk about atmospheric rivers. and we, I, I wouldn't care to characterize this as a result of atmospheric rivers. But certainly there's some evidence along that line. And so I ,and then this, the other part of it, of course, is that much of this is overland flooding.

Reference 4 - 0.31% Coverage

And we had, you know, and this is a prairie phenomenon, of course. So Saskatchewan gets some water from the mountains, and it really wasn't a major event on the North or South Saskatchewan rivers. It was simply a prairie event, and it extended into Manitoba, so the spatial scale was significant.

Reference 5 - 0.78% Coverage

Well, one of the one of the interesting things that when you start looking overland flooding is a lot of small communities [occurred] across roads, and for the most part those roads are all the same elevation. and it would be interesting to contemplate the small communities having one road into the community being higher. Just so you can enable emergency vehicle movement and all that sort of thing. So there's probably a something to think about from a small community level. [the point here is that if all roads are at an elevation where they are overtopped, damaged or destroyed by a flood event, then communities are isolated without access in/out, so No. 17 is stating an idea is to build at least one road in/out at a higher elevation]

Reference 6 - 0.84% Coverage

I mapped a few years ago when I was working on green infrastructure strategy. I overlaid the flood prone areas with pre-development aerial air photos because we had air photos going back to 100 years, and they were all wetlands complexes. So there's a very, I think there's some pretty direct relation between which areas flood which is the city flood and which and the development pattern [this is an example of how urban development and human interventions have changed natural wetlands topography to with paved or built urban infrastructure, including houses/neighbourhoods/busineses, etc. in urban areas that are likely prone to flooding with extreme precipitation events today, as there is less "buffer capacity" for the rains to be mitigated by what used to be a natural wetlands topography].

Reference 7 - 0.98% Coverage

What we what we know for sure is that this ??price??? here, obviously, between rural communities, First Nations, for example, their capacity to respond. During disasters like this, maybe flood or a drought and that that is, that is a concern for for us from from our perspective.
And if you have this kind of communities where there's a single entrance, or whether they are not clearly defined roads or well paved roads. And then flooding issues come up and whatnot. And that's that's a big problem whether that fits fits squarely into the infrastructure area, I'm not sure. Maybe it ties with some of the other. Some of the other issues that you're looking at. **But for us that, that would be a major, a major concern - that disparity! I don't, I don't think, we, I don't think we in a position yet in Saskatchewan where we are able to bridge that disparity, and I really don't know what, what the outcome will be if we have a major issue.**

Reference 8 - 2.55% Coverage

I'm based in Yorkton. And so we had a number of events happen. We had the 2010 event. That kind of specifically hit Yorkton. and we had a lot of like localized flooding in the city. And yeah, this, the city's taken a lot of lot of measures to try to improve the flood mitigation within the city. I think they still have a little ways to go, but they're still working on it. And even one of the things that like when I was younger growing up in Yorkton too, we never had rain events like we had in those couple of years, like to get a quarter inch, or, you know, ten ml [millimeters] of rain in one event in the nineties was probably a bigger event. Now, it's not that uncommon to get you know, two or three inches or more [50mm to 75mm or more] in a very short period of time. So that's kind of one of the things that I've ~~no such~~ [seen] changed. One of the other things in, you know, with traveling around, I guess the provinces. You see how the changes in landscapes have a huge impact on the impacts of flooding, where you have closed basins and that water can't go anywhere. It just builds up and up. You start seeing long-term impacts on roads. You basically have to wait for the water to evaporate before you can do anything with it. So that's that, that's going to change across the province. Some areas, you know, you can conduct, you know, construct rain ditches, that sort of thing that will help move the water away, hopefully in a controlled fashion, sometimes not so much. But those, those are some of the the big things that I see. But again, like when you talk about large events and roads washing out. Sometimes those are, or even roads are overtopping and and being temporarily flooded. If it's a if it's a short time scale, it's much less of an issue. So if it's only flooded for, say, six hours or a couple of days, versus being underwater for some roads up - they had to build permanent ?go (drove?) around essentially, that were there for for years. because these

areas were flooded. So, I also remember driving past the house. This is actually on how we (????) and it was built in a very large low area and driving past it. I think it was about 2014, or 15, or something like that. all you could see was the roof, and there was water completely, like it was completely flooded out. So, that house that you and say will likely never be built there again, so that would be have to be a permanent, permanent change there.

Reference 9 - 1.23% Coverage

So like the roads were, you know, if you have a truck ??, they're still possible [to drive over flooded roads]. I don't know if the the road infrastructure themselves were damaged a whole lot. What we saw more for impacts was to the businesses being flooded, homes being flooded and and generally it would be flooded, for, you know, an hour, and then and then the water would go away. So there's this. There was kind of like an outlet capacity issue with the city being able to move the water away. So those are kind of the the main things like, you know when you look at railways in the city. I think they were all pretty much high and dry the whole time, but our water treatment plant and our waste water treatment plant. I think we're okay. they're built on fairly high ground. But the city did actually replace a a section of highway that had a couple of outlet culverts. So it's kind of the one of the main outlets for the city for stormwater, and they replaced with a bridge to improve the capacity. and then, actually, shortly after they get down, I think the next year the next road downstream with a call, when it washed out. They had to do an emergency repair on that.

Reference 10 - 0.55% Coverage

Yeah, there's protection berms built to protect yard sites to protect well sites…. You know, people's lanes were flooded, a lot of, lot of damage to like natural infrastructure like obviously flooding of yard sites, and tree kill, flooding crop land, that sort of thing, you know. Farm yards likely lost like harvested product and grain bags were also likely lost... some of those generalizing [losses]. I don't have a lot of direct experience with with some of that stuff. But those are some of the things that I've heard.

Reference 11 - 3.69% Coverage

So the EFDRP program was was initiated out of the 2011 spring flooding. And at that time there were thousands of applications. So those were from residents. Pardon me, residents, businesses, communities across the province. That was definitely by far the biggest flood year for the EFDRP and since then it really has kind of been on a down slope. Really, those were all across the province, but mainly focus, you know, mainly, or by and large, or the heat map kind of point toward Central East Central, Saskatchewan and and South East Saskatchewan. So that program focusing on really helping protect residents, residences, buildings from from flood damage, 1 or you mentioned a number 1 mentioned, or or you mentioned as well. about the well aspects. So EFDRP also focused how to focus on protecting: water quality and well, so protection of of protection and testing of wells was a priority as well. You know some of the areas that we saw a lot of flooding. Now, ~~we're~~ [Quill Lakes is] a closed Basin. So you know, Little Manitou Lake, or Quill Lakes - places like that really did see a lot of impact. And and there were especially a Little Manitou to a lot of berms were built for the protection of the community. Those berms still exist today, and have become a part of that community now. So what started out as a temporary infrastructure measure turned into essentially a permanent work. So you know, because of even the nature of that, there was, there are still some ongoing challenges. They [the emergency constructed berms or dykes] were not

designed to be permanent structures at the time, but here we are 12 years later, and they're still there. So you know, there's issues with the way those berms were designed initially and issues with maintenance of those berms. And then all the if if you were, have ever seen or been to Little Manitou Lake, for example, you can see even just sort of see the unsightliness of them. I mean, they're they're pretty massive infrastructure. That's you know, basically blocking the shoreline right across that whole community, you know. Since then, too, and and sorry, 17. I I can't remember your number 17 kind of mentioned as well. The idea of the summer storms. You know, in 2011 you talked about Souris [River] Basin and the biggest event, especially in the community of Weyburn, actually came after the spring run off. That was the summer storm that happened in July or in June. Pardon me. So yeah, we're seeing even kind of at these bigger scales, some pretty big impacts from summer storms impacting communities. And at the community level with the, can you like ?waiver? And, for example, they have diking systems. in place. Those dykes needed to be up, you know, in an emergency level, upgraded built up plugged in some locations where there are holes in the dyke, sort of, I designed to to accommodate roads and sidewalks and other things. But it it did have kind of the impact to force an emergency response at the those locations as well. And then, since then, too, we've seen a lot of other summer, you know, spring runoff events, but a lot of summer storms like go on picking in 2020, for example. sort of the excess water storm events that kind of happened in Northwest Saskatchewan and in the Beaver [river] system or the Churchill River system. Those are pretty impactful and and caused an EFDRP response at like Meeting Lake, for example. But it caused a lot of other impact to highways and to first nations communities in in the Beaver River system [near Meadow Lake].

Reference 12 - 0.81% Coverage

It's a lot of these dykes, you know, in the Manitou Lake dykes, you know, dykes built, or levies built around farmyards. Even right as they were, they were done as an emergency response. So you know, in some instances there was an engineer on site, you know, Little Manitou Lake, for example, boulder, I believe, was actually out there (boulder rocks are used to reinforce the dyke slope to stop erosion of the dyke from water and wind scouring the dyke slope]. But in other cases it was, you know - just get as much dirt or material on the ground as possible as quick as possible. And you know what the implications to those are - they're potentially not designed to engineering standards. And and they suffer maintenance issues. They're unsightly. They're eroding their slopes.

Reference 13 - 2.18% Coverage

When I look at agriculture, the effects of you know, excess water flooding in extreme events on agriculture. I think from my perspective, I actually got involved in this because of the high, the excess water years. So 2015, I became an executive director, for the exact reason that we need to do more education around what the agriculture community does to manage water. So in my experience, a lot of landowners work together very efficiently to manage the water coming off their landscapes. And often these, these farms are the reason why these smaller communities exist in the first place, it's the reason why the schools and the hospitals exist. And they don't want to negatively affect their communities. So. looking at many different ways to protect that rural infrastructure through, you know their drainage designs, working together on gated control structures in field dams . All that sort of thing. And when we see those excess moisture events happen in crop, we also see those same farmers holding back, you know, temporary whole ?docs? [water flooding cropland] on their land losing a lot of crop in crop because of that. So we see. you know, we see complete crop loss, we see yield loss due to stress and disease from that that sitting

water. We look at equipment effects. You know, we're looking at more repairs. And we're looking at downtime for managing fields and even roads. What else? There's some areas throughout the province that actually, in these wet, in these wet cycles have required PDAP [Provincial Disaster Assistance Program] assistance. And there's other areas where these drainage networks are working very efficiently to control the water and save those communities. And as a result, they're not applying for that PDAP assistance. [the point being made here is that with responsible drainage, and effective management of that drainage, he is maintaining that there is less flood risk impacts in the region he is referring to, and therefore did not need to apply to PDAP assistance funding because there were less issues with roads, culvers washing out]

Reference 14 - 0.48% Coverage

know from my local community perspective in 2014, our [sewage] lift station went down. And so you have community members pulling together to help each other deal with homes flooding. We talked about loss of upland habitat. And there's areas across this province that you know you. It's kind of like the tree, the tree graveyards. You drive past these kind of more closed basin areas now, and you see all these dead trees because of these high watermark years

Reference 15 - 0.61% Coverage

And so farmers are just trying to get
get their, the water off their field in a responsible manner most of the times. Sometimes it's it's an education thing or training thing. But I mean I do a lot of work with the Manitoba and and Minnesota, and I mean they've been training for significant amount of time here, and a lot of times the drainage [farm drainage systems] actually helps lessen some of that hydrological spikes because you are are draining that saturated [conditions on] some of the saturated Ag lands. Then can you be used as a sponge, or absorb some of that excess water?

Reference 16 - 0.76% Coverage

I grew up in the Outlook area, and we are seeing significant amounts of drainage installs going in, probably right after that wet period, I mean, people saw the benefit in the economics around drainage. The benefit that Outlook had is it had the existing irrigation infrastructure to be used as the drainage conveyance systems [this refers to old irrigation canals replaced by water pipelines, could be changed into drainage canals to address excess water management during extreme wet years]. So, a lot of the old flood irrigation that was going in would have downstream drains to remove the water off the field again, and so we, they were utilizing the irrigation infrastructure to actually manage your, to manage the drainage.

Reference 17 - 0.80% Coverage

People like me who deal with urban flooding tend to, I can at least make a case that the overall economic impacts of urban flooding are neutral or are very, very modest, and some people have damages, but other people benefit by the rebuilding, and the economic activity goes [up] with rebuilding. But when you look at rain-driven overland flooding, that usually leads to crop losses, and those losses are gone forever. So I think when we look at the flood damages, it doesn't hurt to try to make that distinction, that the agricultural crop losses due to overland flooding, are true

losses where you could make an argument in the urban context that there some people lose and some people win. But the overall economy is pretty well unchanged by urban flooding.

<Files\\Yorkton_handheld audio recorder--edited revM230815> - § 17 references coded [11.35% Coverage]

Reference 1 - 2.05% Coverage

You know rain events. I don't know the numbers, but it was millions and millions and millions of dollars of insurance claims and us as a city have started to progress on stormwater management from that event. Excess at the time was a forty million dollar project. I think we're on phase six of fourteen on those improvements. So not even halfway there, essentially in ten years on trying to improve that infrastructure. The other tough thing that I know we've experienced was some background with you know the events and trying to kind of assess it on one and one and one hundred (1:100) events. One and two hundred (1:200) know the Vanguard (Vanguard SK) events and then build that infrastructure and put that money, you know and put that money, I guess, and build it, infrastructure, on the hope that you're protected. But at what level? So you build two a one and one hundred (1:100) and then you have one and two fifty (1:250) event. So you just spent forty million dollars and then it floods again and the residents, or you know of the municipality or the urban center, you know, start to question the experts and that sort of thing on, on what is the right thing and trying to be proactive versus being reactive. I know 19 and I work together on Land and Infrastructure Resiliency Assessment, LIRA Agriculture Canada. We did an assessment within Smith Creek watershed and Yorkton Creek watersheds. I think it was back in 2008-2009 era. Yeah, so you know the same thing that sort of came out of that was the potential to improve infrastructure was estimated at twenty to one benefit. But again for the individuals to create that budget provincially, locally and nationally, you know to start throwing money around at that twenty- Well, it just - the cost is - is horrendous. So that's the decision that we as taxpayers and politicians, I guess, get asked those questions. And how do we proceed is kind of a big question mark, I guess.

Reference 2 - 0.41% Coverage

CMB: But the risks and impacts affected what type of built infrastructure? Homes, streets?

00:18:24

16: Yeah, so mainly businesses, business - lots of businesses, homes, a little bit of street, I guess, and underground. The other thing too is, when we get rain events, you know sump pumps and backup and that's more into the home kind of situations and businesses. Obviously, yeah,

Reference 3 - 0.89% Coverage

I think in large part when it comes to flooding and that it seems like we've traditionally been very reactive approach to dealing with it, to kind of piggy back with what 16 said, it's you know you're always taking that gamble. If you try to be proactive, you put out the money and I guess, hope, or

maybe not hope, that the event never happens and that your dollars actually are going to, you know, be put in play and actually do something. So I think for that very reason, I don't know, it's the society is very much like: “Well, you know we'll fix it if it happens and if it doesn't happen great.” “We, you know, got off scot free and we saved yourself a bunch of money.” I mean. But I think it's slowly transitioning and you know recent memory of it, with, I don't know, climate change, more extreme events, what not? That people are seeing,

Reference 4 - 0.30% Coverage

I think the big flood of events of the fourteen (2014) and eleven (2011) has shown them. We've got major problems here, there, and everywhere. We.ve got to start. You know, throwing some money at these before you know another one happens and then we're just playing clean up again.

Reference 5 - 0.79% Coverage

I mean speaking like from the watersheds that manages road: road washouts, and I mean I remember you couldn't drive anywhere without a four-wheel-drive truck and even at that to get you know one mile as a crow flies was you'd have to go ten miles because this roads cut out, that road cut out, and so I mean the cost in the RMs was probably was quite substantial. And, but then it also showed the value of being proactive. Because where RMs weren't as attuned to keeping up with infrastructure improvements, you know maybe culvert's mis-sized, and they didn't go in sequence. You know from down upstream to downstream whatever. And that - versus more proactively managed RMs: the impacts were severely less, and I think I mean 2 can speak to that more.

Reference 6 - 0.57% Coverage

we didnt lose any roads or anything like that. We have a lot of drainage and the thing is, when you have drainage you can control the water, not that you can stop it, but at least you know where it's going, because one of the biggest things that happens when it's flood, now, when you have water coming across fields, especially, when you drain, you don't know here it's coming from most and it's going this way. It's going that way and you get roads washing out and stuff like that, because water shows up in a place that's never been.

Reference 7 - 0.24% Coverage

We had very minimal damage. It's… it's Smith Creek, is a good news story. Far as I'm concerned. I'm a big advocate and it's a lot, a lot of people running around their half tons stopping water like were excessively wet all the time.

Reference 8 - 1.02% Coverage

Oh yeah, yeah, we have water through the top roads and we were sandbagging. We had graders pushing gravel up to try and hold water back in certain spots. I mean a lot of other people were doing that too. But one thing that does help us to is topography. You know, like you, have areas where it's steep and deep, but where it's flat you can hold the water so steep and deep areas you got to leave them alone, like you can't don't try and control that. That's where you lose the roads and stuff like that, but it flattens out some of those guys. Like an example, my farm. We have one field that's five quarters, that's got seven inches a drop in a mile. So we have a five foot berm on one end. We can block that water back, so there's eight hundred acres on that field and we can hold like four hundred acres of water which slowly goes away. We'll lose crop in those run-off years. But it still slows down the water flows, but we still have farmland that we can farm.

Reference 9 - 0.05% Coverage

I’m pro drainage - doing nothing is not a solution

Reference 10 - 0.40% Coverage

You look at a farm, how much water can move over that area. It's a massive amount right, and just doing that properly and making sure that we have those plans in place to hold that water, to store that water in those massive events. I think we've all seen examples in rural communities where it isn't and you need to [plan and work together a lot??]. You spoke about that RM cost.

Reference 11 - 0.32% Coverage

With roads washed out you know you look at even like Tantallon, Tantallon still doesn't, they'll probably never have their highway back right from those events where that road completely washed out, situations like that. RMs- there are certain situations that just can't recover from [past events];

Reference 12 - 0.40% Coverage

There's there was the highway that ran down into Tantallon and it completely washed out. That was part of the Spy Hill RM and now it's I don't see it ever being replaced. There's an alternate route that you have to go down into Tantallon. Yea, the whole yeah, but that's just a situation where that's cost were just financial. You're never going to be able to recover that.

Reference 13 - 0.25% Coverage

I remember camping out at the local provincial park and being advised that there was only one highway left to get out of the park and that we may have to evacuate because there was not going to be a way to drive out of the park anymore.

Reference 14 - 1.19% Coverage

Two of the two of the three highways were overtopped. Luckily they didn't lose any. During that same time, we had highway sixteen, which is a major highway through Saskatchewan, overtopped and get part of it taken out. So that was major infrastructure damage. We saw at the Quill Lake's threats to rail lines and highways, RM roads completely taken out. We also saw damage to a lot of the green infrastructure that was out there that you mentioned earlier. You know some of our our Ducks Unlimited projects that hold [water] in storage. Some of that floodwater got overtopped. Our water control structures got taken out so that we couldn't hold that water back anymore. So that led to more flooding downstream. When those breeches happened. I think one of the biggest challenges, like people, have sat around the room is trying to manage the water and where the water flows, and part of the issue is some of it is done in a very methodical and controlled fashion and the other challenges, some of it's done without … and sort of, that landscape change that takes place on the landscape, has an effect on how the water runs off

Reference 15 - 1.23% Coverage

We certainly had roads washout, roads that needed to be cut. We had culvert blowouts. It's caused excessive damage to some of our culverts and we're still cleaning up bridges as well, some that were anticipated to last longer. Obviously haven't [damage to roads] that were anticipated to last longer, haven't [damage to] some of our all-weather all-season roads were cut and now, just due to the moisture and and not being able to have the material to properly put that back [to repair damaged roads], they're looking at turning some of our seasonal roads into our all-weather roads. To try and get that by shelterbelts is a big one. It actually it actually kind of caused an unanticipated increase in cost. A lot of the trees ended up dying off a few years later because of the excess water and of course most of them are within, either our right-of-way or shared. So right now we're cleaning them up and trying to plant more trees. We just had a lot of, well, a lot of our agriculture had a lot of loss, right? We had buildings, we had cattle, we had livestock, we had crops. [all losses] It's changed a lot of the ways that we've looked at a lot of things.

Reference 16 - 0.83% Coverage

Now think about a little bit of a different lens as dealing with the storm water utility. You know I'm really worried about. But protection as the management of our storm sewer system, which is about eight hundred kilometers long, if you're stretching linear and so from from a work perspective, it makes me happy, I guess from just from my employment rate. I'm not worried about flooding and flood protection, but other things that we worry about would be more of a positive

would be: know riverbank how long the South Saskatchewan river here in Saskatoon right., in our hot spots or areas of previous instability we're always worried about groundwater conditions, particularly rising ground water conditions right for slope stability. So you know you drought would be somewhat positive.

Reference 17 - 0.42% Coverage

Just again from the rural municipal, what we see is because of the excess. Usually what we see is when they get excess moisture, everybody starts ditching and draining into our ditches, which of course aren't they're not set up or established to hold that kind of water. So then it causes a lot of damage to neighbouring properties, to roads to culverts and all that kind of stuff, and then, of course

INF_DrouImp_CA reference list:

<Files\\saskatoon meeting transcriptsEdited230824> - § 8 references coded [8.73% Coverage]

Reference 1 - 0.57% Coverage

But for us I'll maybe touch on a little bit of a risk is that in the wet years, **we we're actually working on a lot of projects now. So we're we're 10 years on. And we're working on projects now that were initiated 10 years ago because they're saying in the dry periods, that's the time to do the work. So you're prepared for the wet periods. And we tend to be amazingly short-sighted in that regard, I think.** And so that's one of the things. For example, we're talking to the **Lake Roy Watershed Association Board No. 9. It's down by Lampman, SK.**

Reference 2 - 3.77% Coverage

I live in close to the driest part of the province. Southwestern Saskatchewan. So infrastructure-wise, what I'm hearing from the Southwest is more [water] storage is needed in terms of water reservoir capacity, not letting all that water go into Manitoba in terms of the allocation requirement [this refers to the idea that Saskatchewan is sending more than the 50% of its allocated share of water that Saskatchewan could use for Saskatchewan's water needs in the South & North Saskatchewan River System, in a formula established by the Prairie Provinces Water Board]. The other thing is communities that are facing surface water, surface water for their water [supplies]. Not, not potable [water] necessarily. there's a community in the South that actually needs to drill [water wells]. Well now, because there's they have three [water] dugouts [earthen dugouts or ponds are small surface water reservoirs used on farms and in small communities] that service that small community, and they can't service it. They're [too] dry. [Farm and community dugouts are usually designed to store a 2-yr volume of water supply needs; they rely on storing snowmelt runoff; in dry periods, these ponds may not be replenished if there is insufficient snowmelt runoff] So we've got some of that [water storage] infrastructure that needs to be developed, and it's not as easy as you think in terms of getting a permit to get a [water] well done. For a community that is not an easy task. So ourselves, from a personal standpoint, this will be our fifth year of drought. We've had an inch of rain ~~and a lot~~ since April one. This is dry year number five. We're looking to put in

dam development now. Some of our land goes where coulees go through it, and we're looking to look at the three meter down and some some irrigation. So I guess we're willing to take the risk now, because this is the fifth year, and we're pretty sick of it. So then, we've got some of that infrastructure we're going to have to put in ourselves at our own dime, or, you know, quite a bit of our own money, because we're going to have to do some of it. We'll get probably some funding for it. And then the other thing I think that is, it is maybe something to consider, is that communities don't have drought preparedness plans. I and I just, I don't want to back up to question Number one, but in my notes, I think rural municipalities really struggle in strategies in terms of correct culvert replacement where roads should go. We have the highest road density in our province, and we do not, I think there is a struggle with that, because sometimes culverts are put on because the councillor wanted a culvert there, not because it was the best place to put the culvert. So I think that goes back into in 2010. There was a project that was done called land infrastructure resiliency assessment [AAFC's LIRA project] for the town of Radisson, and where that they they lider'd that town [referring to LiDAR - Light Detection and Ranging, a remote sensing method survey used to better understand 3-Dimensional topography and surface conditions]. And then they developed a plan, and if you had a one in one hundred or one in fifty [1:100 yr or 1:150 yr event] , or whatever that looked like, they would be able to know where to cut the road [for more accurate overflow drainage management with better culvert placement], you know, or cut the highway, or what they had to do to make sure people's infrastructure was protected. So I'm not saying "Go back and reinvent the wheel", but I'm saying there might be some information there that would help.

Reference 3 - 0.51% Coverage

I'm hearing you say that during dry years there's pressure on the need for water storage infrastructure at a community level as well as on, on, on-farm or rural level, and similarly, or in wet periods, some of the [water management] infrastructure [like culverts] that exists might not be in the best locations. And with better data like the LiDAR data, you could be more strategic in in managing water runoff from land. Yes, in in terms of infrastructure placement. Yeah. thank you.

Reference 4 - 2.51% Coverage

Extreme heat and drought events are another risk that we're looking at, to help the city adapt. We expect this, this risk to occur at least once a year with major consequences. And oh, a lot of it has, a lot of it impacts our natural infrastructure, so availability of water to plants increases in mortality rate, makes them more susceptible to disease, and pests and invasive species. So [conditions that are too dry] can have an impact on our natural infrastructure as well as the community. Access to water and cooling ability is a pretty big risk for our community, and we're looking at what happened in BC in 2021, with the heat dome. And I believe 600 deaths are attributed to that heat event. So we're looking at how we can, oh, the other, the other thing, extreme heat, or in extreme heat. Our water and the electrical systems get strained. So managing the demand during these extreme events every year is something we're trying to address by water conservation. We've got targets established to reduce water use. So there's an overall reduction in water use by 2026, and then by 2050, we have a thirty percent indoor and twenty percent outdoor, a target to reduce water demand. We are making progress on our overall and our indoor demand. The outdoor demand has gone crazy in the other direction. Our water our summer time. Water use is up. It's increased a lot. So a lot of the work right now is on that outdoor summertime demand. So we can manage our water system and plan for, you know, plan for capital investment in that system, and more strategy in a methodical way, rather than dealing with emergency situations. What else can I, and then

addressing, addressing extreme heat, is what natural infrastructure is the best way to do that. Like planting trees, improving parks, and natural areas, retaining our natural areas as much as possible [as natural areas] can really help with air quality, and that transpiration will be pure air – [evapotranspiration] thing, shade things like that. So giving people places to cool off and cooling off our city itself, because cities tend to be heat islands. And I will also point out we track water, rain, rain events in the city, and we can have, and it's very common to have an extreme flooding event next to a neighbourhood when [the adjoining neighbourhood is] in extreme drought, so both events can be occurring at the same time, something

Reference 5 - 0.12% Coverage

we've we've had some pretty major mortality events for some species in our city that, like our ash trees are decimated.

Reference 6 - 0.28% Coverage

So living in Yorkton, where I can't remember the exact stats, but like we're one of the largest cities in Canada, I think, that is solely reliant on ground water. So there is a concern, I think in long term we're lucky. We haven't had very long-term drought around here,

Reference 7 - 0.59% Coverage

I guess I worked for the City of Weyburn and the City of Weyburn gets their water from Nickle Lake, which in the dry times that lake is relatively shallow. It's a constructed dam [and reservoir], and the water quality in that lake can get pretty poor in in dry conditions. So there was a plan back, I think, probably also in the seventies or eighties, or something like that. The last really dry, extended dry period, to put a water intake all the way down into the Rafferty reservoir [near Estevan] - just to have more available, higher quality water for the city.

Reference 8 - 0.38% Coverage

From our perspective, farming perspective water drives agriculture. So whether you know, and you can't, you can't control what you get. I often refer to it as the 4 Rs of water management. So basically getting the right form of moisture, the right amount at the right time in the right place, which would be excellent if we could do that as producers. But we can't.

<Files\\Yorkton_handheld audio recorder--edited revM230815> - § 12 references coded [7.62% Coverage]

Reference 1 - 1.14% Coverage

I think there's a reactive component, particular operations as they go down, the severity and duration of drought increases, reservoirs, drops, drop when there gets to be more coordination between the respective agencies in terms of monitoring but also **managing the water**, and from perspective that we leave. (.....)?? This is a very significant one, as there has been a portent ??? agreement [???concept is likely about critical water management decisions in drought??]. It passes from upstream to downstream jurisdictions. I think from an infrastructure perspective certainly are

some stresses to existing reservoirs as the water levels really start to fall, supply levels , things can dry out, shrinkage (of sorts) , expansion (of sorts) , certain types of infrastructure can stop operating, wells can run dry , might be demand desires to do more drilling, more water quality and associated reservoirs soon changes and has an impact on agriculture, on plenty of other sectors. It is related to infrastructure, maybe demands for prolonged monitoring, which require more structure.

Reference 2 - 0.61% Coverage

Number 18 mentioned just to clarify the shrinkage and expansion has an impact on water control structures like dams. Is that what you are referring to?

00:39:32
18: Yeah, I don't want to go too far on that one, but you know when, when water tables [drop] drought soils commensurately too can dry out as well, and certainly in the prairie you have an awful lot of clay. Entirely reactive to the water level, so , so in a sort of normal conditions, you know what to expect. they either get saturated or dry out, expand and contract according to pressure on the infrastructure.

Reference 3 - 0.01% Coverage

Reference 4 - 0.83% Coverage

Now think about a little bit of a different lens as dealing with the storm water utility. You know I'm really worried about. But protection as the management of our storm sewer system, which is about eight hundred kilometers long, if you're stretching linear and so from from a work perspective, it makes me happy, I guess from just from my employment rate. I'm not worried about flooding and flood protection, but other things that we worry about would be more of a positive would be: know riverbank how long the South Saskatchewan river here in Saskatoon right., in our hot spots or areas of previous instability we're always worried about groundwater conditions, particularly rising ground water conditions right for slope stability. So you know you drought would be somewhat positive.

Reference 5 - 0.52% Coverage

So providing a water source, the city of Saskatoon levels we draw right from the river if the levels were supposedly decreasing you know we'd run into problems with with our plant and providing that that's utility to the citizens of Saskatoon. So I think irrigation popped up in my head too as

well right. We have so many parks and dry ponds and parks next to wet ponds that rely on irrigation. You know drought has a big impact on how much water we're using in those facilities. That's it for me.

Reference 6 - 0.56% Coverage

The only things that I could really comment are, you know, in periods of drought crop failures we see in our area increased insects, you know grasshopper infestations, that sort of thing you know wells [water wells] going dry and then when you know the levels and stuff are down. Farmers don't have access to water and, and you know, get water to their livestock, is sort of you now. I think it would be the main concern scenario. I don't think we've seen too much to roadways, culverts that themselves we have experienced much

Reference 7 - 0.93% Coverage

I'll just add. You guys kind of touched on it, but the same thing from our perspective. Aquifer management. We manage over two hundred meters, were solely groundwater source. We ~~fried~~ [supplied] a lot of water with our utility to ag industry. Ag Industry is huge in our region, in the city, so that infrastructure is critical for wells and the aquifer as a whole. And it also ties into the water quality and the economic side of things. Definitely, with ag and ag industry and with drought I mean go on to extreme and with ag practices sort of changing over the years. I mean we've kind of gone away from the sort of the summer fallow type landscape. But then we're talking about our waterways and then maybe some, you know, drifting or silt getting into some of those waterways and then doing maintenance on those waterways after you know kind of drought, that sort of thing.

Reference 8 - 0.42% Coverage

but the drought does have a plus side where you can get in. You can clean out those creeks and those spots where you can't get in normally, and that's one of the things that happens a lot. You have wet, wet wet and then it gets dry and everyone just forgets about it. Never get wet again, but it does, and that's when you got to go like that, when you got to start cleaning stuff out and get going,

Reference 9 - 0.76% Coverage

drought, I think, provides opportunity for infrastructure improvements, water conveyance in terms of like creeks, and that you can start doing a lot of work that obviously in the wet years you can't and then just kind of continue on with what I was saying before, being reactive versus proactive. You know in drought everyone's looking for water. Who's talked about well, we're going dry. Guys start digging dugouts in a drought because they're trying to get more water, whereas you know we really should be, you know, increasing dugout capacity and stuff like that in the wet years and you

know, trying to have that carry over when we actually need the water instead of go looking for water when it's bone dry out.

Reference 10 - 0.66% Coverage

a lot of our infrastructure that's in place is really like people have said for the wet years, so it's to move water. We don't have a lot of infrastructure, green infrastructure in place to store water and having more storage on the landscape, holding some water back would definitely help fight droughts, lessen the severity of the drought. I don't know if it really has that much effect on the infrastructure itself, but again having that green infrastructure present would definitely help and and sort of looking at sort of how we manage water from both perspectives as opposed to just we need to get rid of the water.

Reference 11 - 0.42% Coverage

Good Spirit Lake as an example, holding that water back and then in drought years. You know the loss or the negative effect on that would be tourism and that, industry as well. There could be impacts related. Once we see those drier conditions we definitely saw some less usage because people just weren't coming to that Lake. Water quality as well dropped off in the Qu'Appelle system as well.

Reference 12 - 0.77% Coverage

I guess last year, when it got wet again, was in terms of source water protection, when people's wells are going dry, the ability of non farmers to access funding for digging a new well or something like that became very apparent. And as a source water protection agency you know it really kind of struck home and it's like well, sorry, but we can't help you because unless you're a farmer and can access the programs that they can access, you know you're basically out of luck and wasn't an easy conversation to have with you know people that and you got no water, these dire straits and that sort of thing. So I guess yeah it. It sheds light on the need to revamp programming and policy regarding, you know source, water protection.

INF_ClShImp_CA reference list:

<Files\\saskatoon meeting transcriptsEdited230824> - § 4 references coded [4.45% Coverage]

Reference 1 - 1.21% Coverage

result of these, you know, wet to dry to wet, as a case may be over over a period of time. And particularly when we look at sectors, we are concerned, say for the energies that you know, largely oil and gas power production infrastructure on teams and things like that [buried energy systems like oil, gas lines are “at risk” of shrinking/swelling soils and as a result, breakages can occur if there are serios shrinkage/swelling shifts in the ground]. And most of all, as we look at the future

with renewables, and those set of infrastructure as well [foundations for windmills, solar panels, etc. could be impaired by shrinkage-swelling ground, if not properly designed]. So those would be things that we that we would be, we would be concerned about. And as we think about planning, I know someone talked about community plans and emergency plans and things like that. As we think about planning, we also want to start thinking about how to build some of these issues in, because they are they can be quite significant in terms of the impact.[i.e., these problems need to be proactively engineered for changing foundation conditions wet-dry-wet, etc.]

Reference 2 - 1.20% Coverage

there doesn't seem to be as much of an impetus at the local level to create something that's not really needed until it gets wet again. So it it's interesting how how it shifts when there's a need. All of a sudden there's an impetus. And now that there's not a need.
we made a plan for but It's a little hard to push that in that. That's that's all I'll say. But I mean we still have. There's no doubt about it

[NOTE: CAAs or C&D Areas are formal boards, governed by 1949 Saskatchewan legislation revamped in 2018. CAAs are provincially-supported local government legal arrangements, where CAAs are formed with a mandate under "*An Act to assist Conservation and Development of the Agricultural Resources of Saskatchewan*." *The Conservation and Development Regulations, 1965* provided additional guidance for the administration of the Act, that is established to "protect and preserve agriculture." CAAs, SCDA largely work to preserve economically viable agricultural production in land areas that are susceptible to water logging or flooding by incorporating drainage projects as a kind of water management adaptation to address flooding issues.]

Reference 3 - 0.73% Coverage

So when we're having this shift, extreme shift from wet to dry, I mean 2021 to 2022 is a perfect example of that. In many areas of the province, what we call temporary wetlands disappeared without drainage, let alone being managed through drainage. And I think you know most of the producers looking at setting up successful drainage networks don't want to just plan for the one in 5 event [1:5 events are the standard designs followed by CAAs/C&Ds in their drainage projects] , they're looking at planning for one in twenty five or one and fifty [1:25 or 1:50] the amount of work that goes into that, to begin with, they want to make sure that they're prepared for some of this extreme variability.

Reference 4 - 1.30% Coverage

Yeah, some great points there, and kind of bring it back to the farmer.analogy, like, usually like a year from 2021 to 2022 a lot of the farmers were actually, that was their best year, because they could access some of those lower lying areas that they hadn't before, and that was some of the best land, and they had that water reservoir [during a dry period, previous "wet land" could be farmed]. Of course, after another year or two everything goes the opposite way, and it gets rough [as the dry period extends in time, the soil dries out, and cropping is not sustainable]. So the really successful farmers. They'll always tend to think that long term. And usually we see more the investments tied to crop prices. Right? So I mean, as the farmer makes more money, he knows he needs to, he's not, they're not judging based on what's happening that year. The year before they're

they're seeding. Well, we're not going to go through that cycle again. So I have some extra cash flow right now. So I'm going to reinvest in myself versus that. [this refers to the desire of farmers to more effectively manage water when too much (drainage) or too little (dry) so drainage/water storage investments are considered to reduce economic farm risks]

<Files\\Yorkton_handheld audio recorder--edited revM230815> - § 7 references coded [4.89% Coverage]

Reference 1 - 1.49% Coverage

Just again from the rural municipal, what we see is because of the excess. Usually what we see is when they get excess moisture, everybody starts ditching and draining into our ditches, which of course aren't they're not set up or established to hold that kind of water. So then it causes a lot of damage to neighbouring properties, to roads to culverts and all that kind of stuff, and then, of course, when it shifts to very dry, then we see people trying to drain out of areas where they shouldn't be draining, out of which that causes not only just a safety concern, but I mean those basins that are meant to hold that water are now leaking onto their properties and adjoining properties right and then again, and that's just the shift. So then when we get the torrential rains they have water sitting, so they drain into places where it shouldn't be going and then, of course, when it's dry now they're cutting into creeks, trying to drain it on to their land. Just a whole lack of infrastructure problems right, and it's hard for everybody to stay consistent. I know we were. We try and work with 19, with Yorkton Creek and Assiniboine as well. We have even our culverts that are gated right. If they're gated on private properties, they they close them and open them when they feel like it, and it does cause a lot of problems again. Crop loss, culverts, roads, all of our ditches, that kind of stuff.

Reference 2 - 0.40% Coverage

one observation over the years working here, is there our quick ability to forget the extreme events? I mean we went from extremely wet, you know, from 2010 to 2016, and I remember it vividly because then in 2017, the same area where I was hunting2016, we were under water. It was a swamp… 2017- You lit a match and the whole bush would go under, light it up and under fire.

Reference 3 - 0.94% Coverage

You know, downstream, and then it's like we're coming to the Assiniboine watershed and I got to dig new dug outs and I want you to install pipelines to get water here, because now I don't got access to any water on this area of my pasture and it's like only, you know. Five years ago I ditched all that pasture out and send it willy-nilly downstream. So people are so quick to forget, like you know, what we just went through and that it might happen again. And you know, and the opposite is going to happen again back to keep harping on that reactive versus proactive nature like it's been talked about, like number 12 said it perfectly. It's like we have to plan ahead and not just, you know, deal with what's in front of us. We have to think down the road, what the actions impacts

of our actions. You know getting rid of water one day might be a few years down the road when we need water.

Reference 4 - 0.93% Coverage

Just the extreme variability we're seeing and we're talking about before the meeting started, in the precipitation you know, one area can be getting hammered, the other area can be missing every single rain. So you know, even in small areas, even in a small RM , you could have extreme variability from dry to wet, and I think planning and mitigating those and working together on those is really important, because you look at the weather radar the last three days it's been forty percent chance of rain and depending on where you are, you've got three inches or you don't get anything, right, and those aren't coming in is just general rains. It seems like they're coming in. We're having those high event high impact. You know whether it's hail, whether it's those heavy downpours, and those are important because land isn't really retaining those rains the way it should.

Reference 5 - 0.57% Coverage

we find we're going to have more and more extreme weather events and the run-off like you said, coming down so hard, it's running, it's not soaking in, like when I was a kid you got an inch of rain. That was a big deal in ???train could be a minute. Five minutes like it's crazy like so I mean like RM wise for infrastructure. I know, like our guys have been pretty pretty adamant to get the water off the roads. Like if you want good roads, you got to have dry roads and the thing is storing water along the roads is a very bad decision.

Reference 6 - 0.25% Coverage

And growing up in this area, I mean in the eighties we had some drought conditions, but the extremes are seeing more and more like the 12 said as well. Literally this week we've had three inches, you now five miles away, and zero that area.

Reference 7 - 0.32% Coverage

We are consistently on that edge, being dry, kind of building. Back on that. It actually led to us putting up a hundred and thirty acres of irrigation maybe six or seven years ago. And to me I think there's a lot of potential and there's a lot of possibility in kind of building those relationships.

INF_ComImp_CA reference list:

<Files\\saskatoon meeting transcriptsEdited230824> - § 18 references coded [12.58% Coverage]

Reference 1 - 1.17% Coverage

with some of the program that we do so ?WSA's EFDRP?. we're developing flood maps, would be on that, through implementation. We're trying to have conversations with communities around flood preparedness and mitigation [projects] that they can take on. And and sometimes that's you know, in the dry years, right now, while we're having conversations with these communities. Sometimes it is a bit of a challenge trying to, you know, get the point across, or trying to, you know, help them understand that. You know these flood mitigation measures, for example, are important to be considering right now when they haven't, you know. It's only been 10 years, but they might have already, especially with the elected being out of an election. That's a couple of election cycles away. they're not always seeing the importance of it, you know. Right now, they're more concerned, maybe, about the dry conditions which is valuable. But you know, when we're talking about the vulnerabilities that we're seeing within their communities and how to address those. that's definitely not not coming across this top of mind all the time.

Reference 2 - 1.10% Coverage

I guess. you know, certainly I was working in, and so for me, working in in the public service, and being funded by the public service, our programming being funded that way, we, you know, are kind of "What do you say?" where, you know, the priorities that we're given are kind of the priorities of the day. In a lot of cases. So what is top of mind for those in the elected positions? Potentially – Now. So these long-term cycles where you know for several, you know, maybe several election cycles away from the last worst event, you know. Say, the 2010-2011-23 flooding - those aren't, as is always, as big [an amount of] priorities. I think right now, we're actually doing a pretty good job, at least at WSA by keeping flood mapping and some of this flood mitigation alive. It's been a while since this has been broadly, you know, there's been broad problems across the province. Obviously, every year we have a little bit here and there. Swift Current, for example, this year. But no, it's a program that's still been going on now for for twelve years.

Reference 3 - 1.25% Coverage

so when you're looking at elected officials right? Like it's almost like that corporate memory gets lost when you go through an election cycle, and people forget, especially once. You're, if you're managing a city or something like that, and you lose the elected officials that you had during that event, they, the new elected [officials] don't understand exactly what was happening in the management of that [past] event. So so I would just kind of add that for for the elections like those part. The other thing I would add to for "when you have a dramatic shift, especially from the dry to the wet" is that's when you see your lack of maintenance really show up. So when you start seeing, you know, if you have, we have WSA, a channel [clearing] ~~quick~~ program, and the best time to do channel [repairs is] in the dry, not in the wet. And so, keeping up with that maintenance ahead of ahead of those events, and staying on top of that, is pretty critical when you start having those dramatic shifts, and that, like a dramatic shift, could be even from one month to the next right, like you could go from extreme drought to a flood within a couple of weeks. One event almost around here lately.

Reference 4 - 0.51% Coverage

yeah, just to add the point of you know how elections and that screw things up. I mean, we had a major flood in 2016. So we had some assistance, and whatnot, declared an emergency. And one

of the things that they planned on doing was to replace a bunch of culverts throughout town along the highway to help drain the highway, and then it never got done.
Ran into another election, and in the in the fall and the next summer, we I mean, we still have the culverts sitting in our yard.

Reference 5 - 0.70% Coverage

So you're giving us a concrete example of how you actually purchased materials as a response to that planning. But now were not able to finish the task. Well, that's interesting, anything further to add? Give me, just to clarify number 10, I know it's going back. But that was with the flood damage emergency that occurred, you said, in 2016. So the Town of Carrot River was severely affected [by flooding]?

10: yeah, we declared a state of emergency along with our town south of us the town of Arborfield. I think we got like nine inches of rain in a few hours.

D: And did both towns participate in the provincial disaster assistance program [PDAP]?

10: Yes.

Reference 6 - 0.21% Coverage

people are an important resource, and that knowledge that goes with them. So there's all different levels. I mean, that are a very important part of a project working efficiently and being sustainable.

Reference 7 - 0.89% Coverage

the way the modern election cycle, the way some of our funding programs are structured, might also have some implication to the way they are delivered. So some of the rules, ground rules governing some of this programs, may not necessarily be controlled locally or even provincially. So that takes you very far off from the action, or where things are happening and so that that it creates a little bit of a disconnect. So you're having this disconnect as a result of the election cycle. But you're also having some kind of disconnect as a result of the structure of this funding itself. But these are some of the issues that that that we would, we would find, when we get out working with communities, and talking with people about planning and whatnot. And I think it's interesting that they are coming out this way in in real concrete examples.

Reference 8 - 0.30% Coverage

I know for sure on the road to [?rural?] development is to have landowners get together, to have conversations. Covid, God, right in the middle of that, and I mean Zoom/Teams helped, but it certainly slowed us down in our ability to meet and get land owners together and have conversations.

Reference 9 - 0.35% Coverage

I think economics for small communities to afford water upgrades. like we are dealing with a quite a few communities that have, like, say, a community of forty five or three fifty, and they can't. They need to upgrade their water facility, and they can't because they can't afford it. Affordability and affordability and program funding

Reference 10 - 0.32% Coverage

I guess another way of looking at might be the effective climate effects or the interaction of climate effects with the industrial accidents. One kind or another a repeat of this famous Regina cyclone that derails a bunch of oil tankers in the middle of Regina. It would be a considerable issue to deal with.

Reference 11 - 0.49% Coverage

there are some programs available. sometimes. you know, the minimum buy-in from a community is pretty substantial. They're really not targeting small communities. the timelines imposed are, are kind of based off of budget cycles, so that really makes it makes it challenging as well for particularly the smaller communities that maybe don't have all the internal resources in their community like Regina or Saskatoon would. So yeah, that's definitely a a challenge.

Reference 12 - 0.78% Coverage

I would say like, for factors that would affect infrastructure would be cooperate, cooperation or lack of willingness to cooperate. there's definitely an education piece on that. As to the infrastructure needs in a community looking at some proper policy to support different forms of infrastructure and regulation around that. Looking at finances, access to funding which has been mentioned. Looking at people so knowledge and governance innovation. Looking at communication networks. Often there's silos that exist across this province, lots of great people and lots of great resources. And we're not tying those together effectively enough. And just simply having access to information. So time back again to Transparency of information.

Reference 13 - 1.20% Coverage

I just wanted to add a little bit of about kind of like cost recovery funding. you know that kind of stimulus funding as a result of a major event. Or you know, you start seeing seeing some of that tied to infrastructure, spending lot on roads, and Saskatchewan got paved over the last couple of years to try to increase some of the economic drivers in the province. you know other other worldly events, I guess I can say with changes in like even something like, you know, fertilizer production, in the Ukraine, may cause more impacts to our road infrastructure here, because we have to start hauling more fertilizer or shipping more fertilizer. Just some of those really. Really I don't know if they're strong connections, but And then also, I guess to with climatic risks, you know, when we depending what new source you're looking at. They talk about, you know, thousand year old viruses are stored in the kernel for us as we start seeing melting. We're going to start to see more pandemics. whether that's you have to be seen. But that could also be a potential impact going forward on the economy and, and general funding for infrastructure.

Reference 14 - 1.11% Coverage

Infrastructure [needs] to be more resilient. There's the funding challenges, of course, we're chasing a lot of grant funding. And with that, the staff capacity to do that that planning work available space is a challenge. To fit new infrastructure into this existing the built-up areas, and with that conflicting uses, so finding ways to add new functions to existing space and existing infrastructure is, it can be really challenging with that, and often tied to the funding. Our timelines that are often really quick. And would you wait, really challenging to achieve? And on the, I can relate to the pandemic, engagement we rely on a lot of community organizations, our community serving organizations to do our engagement, and especially during Covid. They just they were serving their communities and could not, could not afford the time to engage with us, so that just having to wait it out, or, you know. be ready to engage when they were in those challenges, especially with our timelines that we're we're trying to meet. So that's definitely a challenge

Reference 15 - 0.50% Coverage

I'm gonna bring some of my educational experience into this because you mentioned you mentioned the war in Ukraine. We're teaching in our schools now about Holodomor. Holodomor was basically Russia starving the Ukrainians, taking their crops. And that's going to the impact of the war on Ukraine. Our province. Our country is going to be dependent upon to produce grain. because how much grain can you produce when there's a war going on. I mean, that's that's a significant issue.

Reference 16 - 0.93% Coverage

environment, Canada or environment climate change, Canada's responsibilities is to produce so-called IDF [Intensity Duration Frequency] curves for use in planning structures and facilities across the country. This is this is high intensity, duration, frequency curves related to rainfall and they're way behind on this, and we all know we've had very significant rain falls over the last decade or two, so I think Saskatoon is still using 20 year old IDF curves for planning infrastructure.

8:They've been looking at their the idea of curves. And yeah, we're not ~~connect~~ [?current?]. They're right

17:, I can guarantee you they're not right. But at any rate, this is just a it's a minor example. But you know we have a responsibility that lies with an agency to produce data to help people. We live a more sustainable life. And yet they are way behind on producing the data to do it.

Reference 17 - 0.20% Coverage

We have the goal of working as one team and stuff. But clearly, there's room. There's room for us to keep working at that and and improving how we how we actually do that one team arrangement.

Reference 18 - 0.57% Coverage

We work with government and regulators on water management policy, and I've seen a positive shift there. I've seen a positive shift to more communication, more trust

relationships, I guess, and it's all kind of centered towards a "Made in Saskatchewan approach". And just speaking to outdated information. I think we have a real opportunity here to come together in a way and really try to work together and develop this "Made in Saskatchewan approach". So it it really benefits all the different industries within our province and the people.

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Reference 1 - 0.70% Coverage

But the power grid system is is, you know, as you get into electric and all these different changes and ideas and discussions we are pretty limited on power and and I know I'm moving forward with the ag industry, some of those expansions and developments. You know you need to supply a lot of power and gas and that infrastructure actually isn't in place. You know for larger expansion, so they're in, you know, sask energy, sask power. They're looking at a lot of expansion as well. Like you said, the risk and we're facing it right now, like some of our simple products, such as like a water meter. You know we're looking at delays of 12 months, you know.

Reference 2 - 0.20% Coverage

the COVID. We're seeing it delays on products and we're still seeing that we've changed suppliers. We've changed suppliers again, we're trying to get different products, switching products.

Reference 3 - 0.22% Coverage

We've gotten laptops and stuff like that where people can a lot of their I pads and stuff like that. Now they can take them home and we do some work from home, whereas before you always had to be in the office.

Reference 4 - 0.91% Coverage

Yeah, just getting parts for for machines, I know we. We bought a third grader. We had bought a brand-new grader for, and it was down for six weeks. In the winter the guys were running one and 24 hours a day to keep roads up and we were getting wind storm like every second day, but just simple little things you can't get in. And even as an ag producer parts like you, we carry such an inventory in our shop now, like there's stuff I have that I shouldn't have, but it's like you have no choice, because you can't afford to have a common line or something, go down and be waiting two or three days for a part. So. People have changed. People don't want to work, but you say you want to get people to work 24 hours to run shift. Well, it used to be 12 hour shifts. Now you're lucky to get a six or eight-hour shift. everyone wants to just look at their phones.

Reference 5 - 0.58% Coverage

I think we're running into the compounding cost of doing those actions. I think it's becoming harder and harder to implement those based on the cost that it is to do business now and to get those supplies, because you know in certain situations you are limited by what you can get. You're also limited by the cost of what it is to do that project, as you talked about earlier. You know, with the fourteen phase plan, wherein, as much as I think you brought it up grade, are we planning for a hundred year are we planning for two hundred and fifty a year?

Reference 6 - 0.39% Coverage

We actually removed snow that we in areas that we haven't particularly done in the past. So that's a fifteen to twenty million dollar swaying right there. Right. So your services, the other services that you provide, are decreasing, with about fifteen to twenty million dollars for every structure you have trucks, graders, excavator, (dozers....????), heavy equipment.

Reference 7 - 0.73% Coverage

So you think of park's perspective now. You know they want good snowdump on their parks. You know it reduces the earliest early season irrigation requirements. I mean it's all tied to fuel costs recently for us right. So our fuel costs have increased significantly and just in our recent budget there was an actual line-item for you know, adjusting for fuel costs for the city just becasue the contractors are (.....??) . So we're getting it both on the capital side and the operational side. So, yes, that was an interesting one for a city of Saskatoon. It depends on how much you get, obviously, and then what services are impacted and and what what services declined. So I'll stop there.

Reference 8 - 0.25% Coverage

As farm sizes have increased, the size of equipment has increased as well, which affects the you know how roads are maintained and less green is moving by rail right. It's moving more on municipal roads, highways instead of rail instead.

Reference 9 - 0.86% Coverage

Nevermind capital improvements were going further and further behind, like we're in probably eighty-year deficit as it is in our municipality. Just on today's replacement cost for the kilometers of underground infrastructure we have that nobody sees. You know, we see the surfaces, obviously with buildings and roads but are underground, are over a hundred years old. Some stuff that's forty years old is failing already. So it's bad quality of either workmanship or bad quality at the time with certain products and some of that infrastructure isn't lasting the eighty years of the hundred years we were hoping to last as well. So again it kind of tied into the question of number one, but

not to be doom and gloom. But there's a major infrastructure crisis in western Canada, globally, in Canada for that matter,

Reference 10 - 1.01% Coverage

like water and sure exactly, and then trying to get the pipe. And the pipe has increased fifteen percent and then getting the contractors, they can't get workers. So to pay the workers that are actually working more hours more pay, their contract goes up. So the municipality has to pay now thirty- forty percent more than we did last year, with a three percent increase. Now our costs, went up forty percent you know we're we're at a negative thirty thirty seven percent and it's like how do you make that up? And I mean nobody wants to pay more for taxes but our infrastructure. You know, compared to the sixties and I know some of the watershed stuff and all of us are involved in watershed. But like Yorkton Creek, you know what we've built-in this whole system for a few million dollars would be like hundreds of millions now, with control structures and ditches and all that stuff. So it's it's the costs are just surpassing what we can actually fund.

Reference 11 - 0.51% Coverage

Some of the stuff that holds things back. Some of it comes down to the red tape just to get approval, to do some of the channel clearing and the channelization. There's different permits that you have to apply for, and I mean some of those things you apply in three months down the road and then the ground is frozen. They expect you to go and do the work then, and repairs are mad because you're doing the work when it's frozen, because it's costing more. But it's the red tape

Reference 12 - 0.64% Coverage

stuff like your cost is going higher and higher. Your ability to get the stuff is going higher and higher through the grant programs. You have to get it done with a certain time-frame so then what we end up finding to do is when we do like a request for proposal or a tender agreement, we have to make it so they can get the stuff in time and the work has to be done. Otherwise we lose that grant funding. But then we're putting in the bigger Infrastructure to be able to try and handle the drought and and the flooding seasons right. So it is. It's just compounding everything and then not being able to get it

Reference 13 - 0.24% Coverage

We did major Culvert installation, not that long ago, you know, and I think that was around a million. So in order to do that we have a secondary site. We're probably looking at almost doubling that and we can't get the material.

Reference 14 - 0.15% Coverage

management tools, but still the the cost to the municipality, the ratepayers, when also government changes regulations, is substantial as well.

Reference 15 - 0.83% Coverage

groundwater. You know it's a relatively unknown resource even to live in for a long time. Certainly as demand for supply increases. That uncertainty is an increasing risk, getting too much better understanding of the water resources going forward to that Federally and , provincial governments, where all stakeholders have an interest in this. Of course, from an infrastructure standpoint, (....????) paper is most prominent, wells and irrigation for agriculture. So I think that's pretty big one. I guess another ~~it is late~~ [relates] to water distribution is the electrical distribution system. Recall hearing that that's pretty important cost and that has to be done, planning for increased irrigation and across the province, in some pretty large future plans for increased irrigation.

Reference 16 - 0.31% Coverage

here within Assiniboine you know, tying into the Quills [Quill Lakes] and up in the Carrot River. Even it's you know, roughly ninety percent of residents rely on groundwater for their source water and we've done extensive work in Yorkton region trying to, you know, maintain our aquifers.

Reference 17 - 0.69% Coverage

One of the risks that we faced a few years ago was potash expansion in this area and talking about more allocation potentially being sort of, I guess, allowed or provided to them versus, you know, our area and municipalities. So again we were large utility, I guess in this, this community, in this sort of area, SaskWater is also a utility out of Melville just down or upstream, I guess. So they provide a lot of water and rural pipeline to area residence here so that groundwater and allocation is critical for again like ag industry within the region and to support, you know, individuals, obviously with with that water and kind of that water, I guess

Reference 18 - 0.75% Coverage

they truly don't understand. I guess you don't know. There's a lot of unknowns. I guess. So for them to then provide allocation. You know this is multi-million pro, billion dollar companies looking for answers and if they don't get the answer one they're not coming. You know the positive. You know that brings to the community a lot of jobs, a lot of economic development. The negative is maybe we're competing with water. So you know that's that spin-off and in the province to provide that answer. I don't think they have that answer. You know, province wide in this region

they can provide some answers through ourselves, through our own information. There is a lack of some data, data, lack data for sure.

Reference 19 - 0.49% Coverage

The only deterrence that that I can actually see from from our perspective is the provincial money and assistance has way less red tape. So we'll do that sooner. I think we have three or four federal projects on the go and the last we're still waiting for complete approval and agreements. The last one took over two years from the time we applied. So then, of course, because of the process and the length of time they're starting to not like the federal programs.

Reference 20 - 0.71% Coverage

You're always work reporting on costs, stuff like that, all engagements for the smaller. I don't want to speak for them, but it's it's a headache challenge for larger city likes to Saskatoon. So for for the smaller cities you have to hire outside help right and that's an extra cost, one cause that I will say well, that is, you know, usually external costs and those applications are you need, probably paid, paid by the government, so any any external help. But we need forty percent of that is usually.... positive or negative. We needed to get these projects going, but I can see they're on the administrative side, they're they're they're troublesome. I can stop there.

Reference 21 - 0.53% Coverage

Then I realize we're a unique situation. But one thing that I had a lot of producers come to me with this year is because around the quill lakes we saw so much putting. Those waters have started to recede, but there isn't any sort of funding available for them to clean up. As with just the amount of garbage and tree trunks, everything great branches that are on their land, there is nothing that they can apply for to clean up their land and get back production. That's all just coming out of pocket

Reference 22 - 0.69% Coverage

You know their yields are, you know, getting close to average, I would say another problem that they have, though I can. You know you get a small flood of ventral??, say you get half an inch, an inch. Unfortunately that crop grounds out. Or if you get those really windy days, sometimes the water will come in and flood them out again, and I didn't get a chance to mention it. But we had a whole study then that evaluates the economic impacts between 2012 and 2018, and that's something that we can definitely share. There's you know all the all the numbers are in there already. I think it's just easiest for for me to share that stuff with the group.

INF_OtHImp_CA

Files\\saskatoon meeting transcriptsEdited230824> - § 1 reference coded [0.32% Coverage]

Reference 1 - 0.32% Coverage

I guess another way of looking at might be the effective climate effects or the interaction of climate effects with the industrial accidents. One kind or another a repeat of this famous Regina cyclone that derails a bunch of oil tankers in the middle of Regina. It would be a considerable issue to deal with.

<Files\\Yorkton_handheld audio recorder--edited revM230815> - § 6 references coded [3.98% Coverage]

Reference 1 - 0.91% Coverage

the last couple of years we're having (firebans ??). I mean wildfires, grass fires in this region. That seems kind of unheard-of but major disaster, you know, around the lake a couple of years ago as well we had a major ice storm tied into the... Our concern with that is the power in the grid system. So I mean we were, we are basically well, screwed is not…. If we have no power, you know, if we're down for three days, I mean we'd come to a pretty devastating halt. As for our infrastructure and supplying water to residents through the water treatment plant process, we're actually installing two backup generators now: natural gas, in case of those power outages stemming from the ice storms we've been. We have updated some of our processs and our our water distribution system or raw water distribution system to bring it to the water treatment plant.

Reference 2 - 0.55% Coverage

So I mean on the park side of things and I mean the landscape. We have a lot of trees, older trees, so that damage. So you're dealing with that infrastructure and we actually chipped a lot of it. The positive side we incorporated into compost rather than just, you know, landfilling or burning or that sort of thing. But the ice storm. We had some power, grid issues, you know some delays, some downtime. So again, when you're dealing with multi-million dollar ag industry, half an hour is a large downtime, I guess for them

Reference 3 - 1.08% Coverage

Supply issues are huge. We've switched. We. We actually just ended up. We built a new building and were renovated building whatever. We built a bigger storage area onto some of it so that we can, we're able to keep more on hand . we've seen a shift from our operators and personally used to always use telephones. They're installing radios because during the ice storm we didn't have anything [i.e. lost cell communications]. Keeping generators on hand so that they are usable, part of our problem, especially with the aggressive snowstorms that we've had in the past. It's left where our equipment hasn't been big enough to even move that and we have people who are essentially stuck in our house and our equipment can move maybe 10 foot-high and these are 16

and 17 feet. So we've had to wait for a contractor to be able to get out there, to be able to move those so those people can actually get out of their homes and get down the road. due to extreme snow. Extreme, yeah, so then it leads council to looking at more.

Reference 4 - 0.36% Coverage

the town of Wadena, for example, was having issues with flooding and the solution was what we'll build a berm around the town. Well, you stop flooding the town, but you have decreased the amount of water coming through town and especially if we get into more extreme events, the amount of water coming through town is only going to increase.

Reference 5 - 0.39% Coverage

We actually removed snow that we in areas that we haven't particularly done in the past. So that's a fifteen to twenty million dollar swaying right there. Right. So your services, the other services that you provide, are decreasing, with about fifteen to twenty million dollars for every structure you have trucks, graders, excavator, (dozers....????), heavy equipment.

Reference 6 - 0.69% Coverage

You know their yields are, you know, getting close to average, I would say another problem that they have, though I can. You know you get a small flood of ventral??, say you get half an inch, an inch. Unfortunately that crop grounds out. Or if you get those really windy days, sometimes the water will come in and flood them out again, and I didn't get a chance to mention it. But we had a whole study then that evaluates the economic impacts between 2012 and 2018, and that's something that we can definitely share. There's you know all the all the numbers are in there already. I think it's just easiest for for me to share that stuff with the group.

Transcripts

BWAG PROJECT
Transcription of the focus group on Infrastructure sector
Held on June 28, 2023 13:00 to 15:30 at Assiniboine Watershed Stewardship Association 29 2nd Ave. North in Yorkton Saskatchewan

CMA: Co-moderator
CMA: Co-moderator
B: Research Assistant
2: Smith Creek Regional Watershed Association Board #8 and Wallace Creek Watershed Association Board #11
6: Ducks Unlimited
7: City of Saskatoon
12: Saskatchewan Association of Watersheds
14: Quill Lakes Watershed Association Board #14
16: City of Yorkton
18: Prairie Provinces Water Board
19: Assiniboine Watershed Stewardship Association
27: Rural Municipality of Orkney No. 244

00:00:05
CMA: This Focus Group is a part of a larger project, It is a project that is taking place in four countries, Uruguay, Argentina, Chile and Canada. In Canada we are focused on the south Saskatchewan Basin. This project is about the impact of climate change on people and their social conditions and for that purpose, when we try, what we are trying to do in this project is to understand what risk situation is all about. We are understanding climate change as a precursor of risk and we want to know the experience of people in dealing with risk in order to be able to develop later on, a regional adaptation study. That is a general context of our project. We are trying to understand the real situation by focusing on several components of a region. So infrastructure is one of them is the economic activities as well as livelihood and finally, we are going to do an assessment of all these sectors in the next two years, but before that, when what we'd like to do, is to understand at least the impact, the role of impact of climate events on local regional component. So the focus of **this** focus group is to understand the impact of climate events on infrastructure. Climate events for us are mainly an excess of water, rain and the related droughts, as well as the impact of little water, okay? the scarcity of water drought on infrastructure. We are also interested in other types of climate events such as extreme heat, wild fire, snow ice, et cetera, but we are going to be mainly focus on drought and floods. We are interested on water infrastructure as well as built infrastructure. And here we are also talking about Built Green infrastructure and we are special interested in the period of 2000 and 2020 and 2022. So we are, we are going to be asking questions to you. We have five large questions or topics. We will presenting them to you and we will like (answers) from you, based on your experience, based on your knowledge, what you think of the topic, Okay?, D anything else, that you would like to add?

00:04:06
DMB: Yeah, just a couple of items. We're actually looking at five basins in Saskatchewan: the South Saskatchewan River basin, the Carrot River watershed, the Upper Qu'Appelle and Lower Qu'Appelle watersheds, the Assiniboine River watershed and Quill Lakes watershed. In this particular meeting, in this room at least we have most of our attendees from the Assiniboine watershed and Quill Lakes, I believe, and online we have people who are in other areas of the province. But if you think about the questions we're asking, we're kind of zeroing in on these watersheds. It's a big study region or study area in Saskatchewan. One of the reasons we're in this location is because, it is in contrast to the South Saskatchewan river, southwest especially where

it is extremely dry. Here [Yorkton area]we have a range of dry and wet conditions. So we know, for example, that floods and excess water, too much water, have been an issue for many in the region. So some of our questions will relate to that and the last point I'll make is- CMA, just to reinforce this. We are looking at hydro-climatic risks, to built infrastructure which could be water infrastructure, as it relates to managing water on the farm scale, at a community scale or a regional scale. And then the built infrastructure could be anything from a farm house to farm building, power lines, roads, highways, that type of thing, it's that development aspect that we've got in society that helps us live where we live, that we use to try to cope with our natural resources and, as CMA pointed out, we're at the beginning of this study. This is objective two. We're trying to identify these hydroclimatic risks that we're asking questions about. Take it away CMA.

00:05:55

CMA: Thank you. Now, anybody have a question?..... Okay we jump into the next topic which is the issue of consent. It is my understanding CMB has been asking all of you to consent to participate in this meeting. Consent is a fundamental issue to us. We are limited by very rigid- if I could use the word- ethics rules in terms of our research - so it is important for us to know that you consent to participate. My understanding is that most of you have already sent your consent, properly signed to CMB, but if still there are people here, who for certain reasons, have been unable to do that? So what I would like to do is for you to agree, by participating in this meeting, to consent to be part of the focus group. Okay? If you stay and participate I will take your consent to participate in the meeting. So by any chance, any reason, you don't want to participate or you don't want to consent then we will have to ask you to leave because as CMA said before, this meeting is confidential. Now you, as part of the consent process, you have the right to withdraw at any moment, any chance if you feel that you have no more interest in the discussion for several other reasons you don't want to continue participating. Please withdraw from the meeting and that will be all right with us. You could also have the right to pass in any one of the questions if you don't want to answer the question just say pass and we will continue with another person. And finally we are going to do a transcription of the recording of this meeting. It would take us maybe two or three weeks to complete the transcriptions and then we will send the transcription back to you so you are able to read your comments during this meeting and then you know, suggest some changes to the transcript and in that way then we will ensure we are being very loyal to your comments. There are some basic rules in focus that I would appreciate if we followed. The favorite point of them is that the co-moderators [CMA and CMB] lead the discussion - so are the dictators in this meeting, basically because it will allow to facilitate, a proper discussion of the issues. So, one of the basic rules here is: please do not interrupt if somebody else is talking, if you want to say something after a person's comments please raise your hand, if you are on Zoom, and also in this case use the mechanism that Zoom provides for this, your yellow hand. If you are online, just raise your hand and we will give you the right to express your opinion. As CMB said before, please use your number that I identify you before you make any comment, please say your number one, number two, and then please say whatever you want to say. Really important point is disagreements are totally allowed, don't be scared if you don't agree with another person, just say so, and that is a part of the logic of focus groups. Those are very much the basic rules. So, before we start asking the questions, CMB would you like to add something?

00:11:08

CMB: Yeah, I mean just to clarify- this rigid ethics rule for consent and the recording is done,

because this is an academic project funded by the Social Sciences and Humanity's Research Council of Canada and all the data that's gathered on this study will be used to help advance and improve the understanding of the focus of the research, which we can provide more background on- if you're interested. In the one graphic I think I sent as a handout, there's eight objectives and ultimately, as CMA pointed out, by year five, in each of these five, 4 countries rather, the project will not only publish peer reviewed academic papers, but hopefully there'll be insights that we gain in each country about possible pathways that improve our ability as a society to manage water. This is a social sciences research project that involves people and this project was heavily funded by the Partnership project. So we have twenty Canadian partners, but we have many, more than 20 stakeholders and if any of you want to be interested in them, maybe closer involvement with the project, our partners may meet maybe twice a year. So we like to consider that our insights on our water challenges come from us as a community, and that's what this whole project is all about trying to work together back to you CMA.

00:12:27
CMA: Thank you. Well, let's begin with the discussion, the first topic that we have for discussion is related to an excess of water- basically relating to torrential rains and associated floods. What we would like to know in the next 15 minutes is your opinion, your experience about how an excess of water, impacts on the infrastructure where, especially in the wet years of 2011 and 2014. But if you feel that you have an experience related to another year, please feel free to say: so. We have interested in this case of infrastructure, provincial, regional or local. So, who would like to be the first one?

00:13:56
CMB: We have number 16,

00:14:00
16: so I guess I'll cover a few things just going off in my head right now. So as for again, in the city of Yorktown Infrastructure, we saw some t torrential rains in 2010, which is still relatively recent. So you know aging infrastructure. You know regionally within, obviously, cities and rural municipalities in the area a lot of our infrastructure was built in the sixties, a lot of that infrastructure is now sixty plus years old. I think a lot of the communities are going to see troubling times ahead in the next twenty and thirty years across western Canada. You know extenuating from that. You know rain events. I don't know the numbers, but it was millions and millions and millions of dollars of insurance claims and us as a city have started to progress on stormwater management from that event. Excess at the time was a forty million dollar project. I think we're on phase six of fourteen on those improvements. So not even halfway there, essentially in ten years on trying to improve that infrastructure. The other tough thing that I know we've experienced was some background with you know the events and trying to kind of assess it on one and one and one hundred (1:100) events. One and two hundred (1:200) know the Vanguard (Vanguard SK) events and then build that infrastructure and put that money, you know and put that money, I guess, and build it, infrastructure, on the hope that you're protected. But at what level? So you build two a one and one hundred (1:100) and then you have one and two fifty (1:250) event. So you just spent forty million dollars and then it floods again and the residents, or you know of the municipality or the urban center, you know, start to question the experts and that sort of thing on, on what is the right thing and trying to be proactive versus being reactive. I know 19 and I work together on Land

and Infrastructure Resiliency Assessment, LIRA Agriculture Canada. We did an assessment within Smith Creek watershed and Yorkton Creek watersheds. I think it was back in 2008-2009 era. Yeah, so you know the same thing that sort of came out of that was the potential to improve infrastructure was estimated at twenty to one benefit. But again for the individuals to create that budget provincially, locally and nationally, you know to start throwing money around at that twenty- Well, it just - the cost is - is horrendous. So that's the decision that we as taxpayers and politicians, I guess, get asked those questions. And how do we proceed is kind of a big question mark, I guess.

00:17:16
CMB: Just to clarify, I'm asking number 16. If you could describe the infrastructure you're referring to, how would you categorize it? Specifically, what specific type of infrastructure are you referring to?

00:17:27
16: So with the LIRA project? Yeah, so that was looking at highways, culverts in the whole region. So that was two regional assessments. The uniqueness of both that study was Smith Creek- We had LiDAR data, so it's very fine-tuned; the other watershed we had more coarse data and trying to do those assessments, creating those events, mapping that out and then meeting with the locals to get their local input in perspectives on [responses or actions]

00:17:58
CMB: and when you were referring to stormwater management. Of the forty million dollars, was that largely stormwater runoff infrastructure?

00:18:03
16: Yeah, so that's specifically just the city of Yorkton, part of our engineering department, and progressing with our engineering consulting firms. We were looking at forty million dollars (of infrastructure???) for those areas that flooded in 2010.

00:18:18
CMB: But the risks and impacts affected what type of built infrastructure? Homes, streets?

00:18:24
16: Yeah, so mainly businesses, business - lots of businesses, homes, a little bit of street, I guess, and underground. The other thing too is, when we get rain events, you know sump pumps and backup and that's more into the home kind of situations and businesses. Obviously, yeah,

00:18:45
CMB: thank you.

00:18:46
19: I can go next. Number 19. I'll speak to some general comments or whatever. I think in large part when it comes to flooding and that it seems like we've traditionally been very reactive approach to dealing with it, to kind of piggy back with what 16 said, it's you know you're always taking that gamble. If you try to be proactive, you put out the money and I guess, hope, or maybe not hope, that the event never happens and that your dollars actually are going to, you know, be put in play and actually do something. So I think for that very reason, I don't know, it's the society is very much like: “Well, you know we'll fix it if it happens and if it doesn't happen great.” “We,

you know, got off scot free and we saved yourself a bunch of money." I mean. But I think it's slowly transitioning and you know recent memory of it, with, I don't know, climate change, more extreme events, what not? That people are seeing, like 16 said, the benefit of being proactive. You know it's just like have an insurance. I guess you know you pay [for insurance] and you might use it, you might not. But when you need it then then you're good to go. And I mean I think there's examples of that in the city of Yorkton and I know in the broader context of the Assiniboine Basin; like, the City of Minot has done tremendous flood proofing and stuff like that, and I mean even the RMs and stuff around or watershed with their infrastructure improvements. Not, I think the big flood of events of the fourteen (2014) and eleven (2011) has shown them. We've got major problems here, there, and everywhere. We.ve got to start. You know, throwing some money at these before you know another one happens and then we're just playing clean up again. So

00:20:58
CMB: so number 19, what were some of the infrastructure elements that were affected by those high flood years? From your experience,

00:21:06
19: well, I mean speaking like from the watersheds that manages road: road washouts, and I mean I remember you couldn't drive anywhere without a four-wheel-drive truck and even at that to get you know one mile as a crow flies was you'd have to go ten miles because this roads cut out, that road cut out, and so I mean the cost in the RMs was probably was quite substantial. And, but then it also showed the value of being proactive. Because where RMs weren't as attuned to keeping up with infrastructure improvements, you know maybe culvert's mis-sized, and they didn't go in sequence. You know from down upstream to downstream whatever. And that - versus more proactively managed RMs: the impacts were severely less, and I think I mean 2 can speak to that more. But so to sum it up, yeah, there's definitely merit being proactive and like 16 says, you might spend the money, you might not see the results for quite some time, but when they happen then you're OK and you can deal with it as opposed to complete disaster.

00:22:27
CMB : Thank you, number two and again, let me just emphasise that we're talking on risks and impacts to infrastructure and that experience that you've had with these high flood events.

00:22:43
2: Number two will just speak on behalf of the Churchbridge and Smith Creek on the eastern side of the province. In the last 15 years I guess there was funding, emergency funding and all that stuff and our RM was the only RM on the eastern side that didn't qualify for assistance. When you look at the Smith Creek, the Smith Creek, there'll be studies done and they'll be the Nile River, the Amazon, and then there's Smith Creek like it's, it's a little creek, and it's judged so high. But anyhow, like through all that events, we have lots of drainage but we still have lots of intact wetlands. But you have councillors before us. We're all proactive and a lot of guys around Council, now we're still proactive and we always looking ahead. We've engineered our creek to look at how we can improve infrastructure, where we can do better from the 2014 floods and tens (floods like the 2010 event) and elevens (floods like the 2011 event) and all that jazz. But it's a continual improvement. It can be done relatively cheap, cheap, actually, as long as you have everyone on the right track and you have to have everyone working together and you still have people that don't agree. You have extremes, you have this end, and you have that end, but the majority of people

are in the middle and you can make most things work; and a lot of one of the main things that actually helped us in our flooding was a lot of the producers themselves. You'd call and say: close the gate, but can you plug these culverts off? Can you do this? And there's land that has no drainage and there's a lot of water on it and guides were going out and plugging off those pipes do, trying to hold water back so that it didn't go down stream.

00:24:24
CMB: Number two: a question. You said that you did not qualify for funding. Are you referring to the Provincial Disaster Assistance Program?

00:24:30
2: Yes

00:24:30
CMB: Does that mean you had no risks of impacts or - ?

00:24:34
2: we didnt lose any roads or anything like that. We have a lot of drainage and the thing is, when you have drainage you can control the water, not that you can stop it, but at least you know where it's going, because one of the biggest things that happens when it's flood, now, when you have water coming across fields, especially, when you drain, you don't know here it's coming from most and it's going this way. It's going that way and you get roads washing out and stuff like that, because water shows up in a place that's never been.

00:24:58
CMB: So in your case, did you have a lot of damage?

00:25:02
2: We had very minimal damage. It's… it's Smith Creek, is a good news story. Far as I'm concerned. I'm a big advocate and it's a lot, a lot of people running around their half tons stopping water like were excessively wet all the time. It don't matter: 2021 was dry, but that was like the first year that I've seen. I started farming in 1990. That was the first time that I actually seen like dry like.

00:25:28
CMB: So when, in 2011 and 2014 [excessive rain events], did that create challenges for your infrastructure?

00:25:34
2: Oh yeah, yeah, we have water through the top roads and we were sandbagging. We had graders pushing gravel up to try and hold water back in certain spots. I mean a lot of other people were doing that too. But one thing that does help us to is topography. You know, like you, have areas where it's steep and deep, but where it's flat you can hold the water so steep and deep areas you got to leave them alone, like you can't don't try and control that. That's where you lose the roads and stuff like that, but it flattens out some of those guys. Like an example, my farm. We have one field that's five quarters, that's got seven inches a drop in a mile. So we have a five foot berm on one end. We can block that water back, so there's eight hundred acres on that field and we can hold like four hundred acres of water which slowly goes away. We'll lose crop in those run-off years.

But it still slows down the water flows, but we still have farmland that we can farm. So I can talk all day, but some other guys can take a turn. You'll get sick of me and I'm pro drainage - doing nothing is not a solution, and in my opinion and like one of the other things, [drainage] is like a creek. Those [drainage systems] are highways, they are water highways. We need to manage them like a road, like they need to be cleaned up. What's going on in the farms? Fields are one thing, but I mean like, even if it's not drained, you get four inches of rain, [it becomes] a wetland. Once it's full, it's running like it's rained hundred percent. I mean at that point it don't matter what's going on in the field. It's your creek. So you got to have that [drainage system] "creek" streamlined and managed so that you can take those [higher wet years] flows like, and yes, it's going to be. It's not perfect, like there's still troubles every. It's continuous improvement, like it's always worse.

00:27:24
CMB: Can we go around the room number 12? We can't hear you, but we're going to keep proceeding around the room number 12. Can you say something? You're unmuted now [Zoom], if you want to say anything.

00:27:54
CMA: Okay, well, you said number 12. Let's go with 12

00:27:58
12: Number 12, yeah, I think you made a great point there on just kind of having the team approach to it. I think that just having those relationships and those communities intact makes a massive difference. I think when you run into trouble is when you have that interpersonal, all those conflicts going on where that water isn't being managed properly. I think a big thing. You look at a farm, how much water can move over that area. It's a massive amount right, and just doing that properly and making sure that we have those plans in place to hold that water, to store that water in those massive events. I think we've all seen examples in rural communities where it isn't and you need to [plan and work together a lot??]. You spoke about that RM cost. With roads washed out you know you look at even like Tantallon, Tantallon still doesn't, they'll probably never have their highway back right from those events where that road completely washed out, situations like that. RMs- there are certain situations that just can't recover from [past events]; and being proactive, like 19 mentioned before, leads to long term gain and I think that's a massive thing, is just [to have] that whole teamwork approach [in being proactive]. Having those relationships in place and the planning to properly deal with those events can lead to a lot of, you know, success in a long term and…

00:29:19
CMB: you mentioned that Tantallon highway was completely washed out. Where are examples where there are some severe impacts like that?

00:29:24
12: . Yeah, the road just completely. It's gone. There's there was the highway that ran down into Tantallon and it completely washed out. That was part of the Spy Hill RM and now it's I don't see it ever being replaced. There's an alternate route that you have to go down into Tantallon. Yea, the whole yeah, but that's just a situation where that's cost were just financial. You're never going to be able to recover that.

00:29:56
CMB: Thank you.

00:29:59
6: Number 6, number 6. Yeah, I guess can hear stories too, as well. As you know some of the impacts we saw, and you're talking earlier about summer holidays and camping. I remember camping out at the local provincial park and being advised that there was only one highway left to get out of the park and that we may have to evacuate because there was not going to be a way to drive out of the park anymore. Two of the two of the three highways were overtopped. Luckily they didn't lose any. During that same time, we had highway sixteen, which is a major highway through Saskatchewan, overtopped and get part of it taken out. So that was major infrastructure damage. We saw at the Quill Lake's threats to rail lines and highways, RM roads completely taken out. We also saw damage to a lot of the green infrastructure that was out there that you mentioned earlier. You know some of our our Ducks Unlimited projects that hold [water] in storage. Some of that floodwater got overtopped. Our water control structures got taken out so that we couldn't hold that water back anymore. So that led to more flooding downstream. When those breeches happened. I think one of the biggest challenges, like people, have sat around the room is trying to manage the water and where the water flows, and part of the issue is some of it is done in a very methodical and controlled fashion and the other challenges, some of it's done without … and sort of, that landscape change that takes place on the landscape, has an effect on how the water runs off. You know I just read an article yesterday about how forage on the landscape can reduce runoff by thirty six percent and so as we see a landscape change, the more cultivated land that increases the amount of runoff, especially in these major flood events. So again, it's it's not anything that any one has control of, like you know, to try to micromanage everything you can, but at least if we can sort of identify some of the threats and try to create a system that can handle these floods and, and not cause the damage that it causes, I think everyone would be better off.

00:32:11
CMB: Thank you. Number six. We're going to go to number 27 and CMA before we go to 27. P You have a question. Well, number 27 is going to speak, but you have your hand up. So can you.

00:32:29
CMA: Well, I was going to say that perhaps after number 27 we could move into the next question and later on if we have some time. Have some of the participants could come back to some of these.

00:32:47
CMB: Yeah, that's okay, and part of the reason CMA is suggesting this is: We're trying to move through this fast. We apologize that we haven't got to the Zoom people, but we'll start with the Zoom people on the next question and we can come back to this if we gain some time here. So number 27.

00:33:02
27: So just on behalf of the rural municipal perspective, I guess part of us, how it's impacted or what infrastructure it's impacted. We certainly had roads washout, roads that needed to be cut. We had culvert blowouts. It's caused excessive damage to some of our culverts and we're still cleaning up bridges as well, some that were anticipated to last longer. Obviously haven't [damage to roads]

that were anticipated to last longer, haven't [damage to] some of our all-weather all-season roads were cut and now, just due to the moisture and and not being able to have the material to properly put that back [to repair damaged roads], they're looking at turning some of our seasonal roads into our all-weather roads. To try and get that by shelterbelts is a big one. It actually it actually kind of caused an unanticipated increase in cost. A lot of the trees ended up dying off a few years later because of the excess water and of course most of them are within, either our right-of-way or shared. So right now we're cleaning them up and trying to plant more trees. We just had a lot of, well, a lot of our agriculture had a lot of loss, right? We had buildings, we had cattle, we had livestock, we had crops. [all losses] It's changed a lot of the ways that we've looked at a lot of things.

00:34:18
CMB: Thank you. In the interest of time, we're going to move into the next question, but I'll ask Zoom people not to lose sight of that first question, because you might want to add.

00:34:29
CMA: Okay, well, we have been discussing about "excess of water" and related phenomena of floods. What we would like to do is go to the opposite situation- drought, when we have water scarcity. As everybody knows, the Canadian [prairies] have been characterised by significant periods [of drought] and in the case of Saskatchewan this is especially the case on the western part of the province. But anyway, when we would like to know again based on your experience and your knowledge, what are the impacts? What are the effects of drought -too little water on all types of infrastructure? Who will? Who would like to be the first one to come to the swimming pool here?

00:35:34
CMB: The empty swimming pool is empty and if I could, maybe we'll toss that question to people on Zoom. First we have 14 and 7 and 18 and before we start talking this room, any of you want to offer any insight into this question? Too little water, what kinds of impacts might have, if any, and maybe there is few. But is there? Is there an issue with too little water affecting structure at all? Number 18.

00:36:16
18: Thanks, I'll start with a few thoughts. Others can build on them. You certainly do see that there are some impacts. Sort of try to answer as much. The opposite might have said excess water, but I think there's a reactive component, particular operations as they go down, the severity and duration of drought increases, reservoirs, drops, drop when there gets to be more coordination between the respective agencies in terms of monitoring but also **managing the water**, and from perspective that we leave. (.....)?? This is a very significant one, as there has been a portent ??? agreement [???concept is likely about critical water management decisions in drought??]. It passes from upstream to downstream jurisdictions. I think from an infrastructure perspective certainly are some stresses to existing reservoirs as the water levels really start to fall, supply levels , things can dry out, shrinkage (of sorts) , expansion (of sorts) , certain types of infrastructure can stop operating, wells can run dry , might be demand desires to do more drilling, more water quality and associated reservoirs soon changes and has an impact on agriculture, on plenty of other sectors. It is related to infrastructure, maybe demands for prolonged monitoring, which require more structure. We put in place to get the necessary information necessary for monitoring level and water quality, and

often referred to as the creeping disaster, as certain as they increase in length, partly human nature, to think more about planning for the next one. So again, there's you're in the response and impacts, and then there's the after, the drought response and softening approach, one of the big ones that comes up with respective infrastructures: (freedom???), more storage and more conveyance of water from one place to another.

00:39:21
CMB: Thank you. Number 18 mentioned just to clarify the shrinkage and expansion has an impact on water control structures like dams. Is that what you are referring to?

00:39:32
18: Yeah, I don't want to go too far on that one, but you know when, when water tables [drop] drought soils commensurately too can dry out as well, and certainly in the prairie you have an awful lot of clay. Entirely reactive to the water level, so , so in a sort of normal conditions, you know what to expect. they either get saturated or dry out, expand and contract according to pressure on the infrastructure.

00:40:12
CMB: Thank you, number 18, number 14 or number seven. You have any items to add?

00:40:18
7: Thank you.

00:40:19
CMB: Thank you number seven.

00:40:21
7: Number seven: with the city of Saskatoon. Now think about a little bit of a different lens as dealing with the storm water utility. You know I'm really worried about. But protection as the management of our storm sewer system, which is about eight hundred kilometers long, if you're stretching linear and so from from a work perspective, it makes me happy, I guess from just from my employment rate. I'm not worried about flooding and flood protection, but other things that we worry about would be more of a positive would be: know riverbank how long the South Saskatchewan river here in Saskatoon right., in our hot spots or areas of previous instability we're always worried about groundwater conditions, particularly rising ground water conditions right for slope stability. So you know you drought would be somewhat positive. Thinking from a different lens in just my role, though. You know we've run into trouble with our, our water treatment plants, right? So providing a water source, the city of Saskatoon levels we draw right from the river if the levels were supposedly decreasing you know we'd run into problems with with our plant and providing that that's utility to the citizens of Saskatoon. So I think irrigation popped up in my head too as well right. We have so many parks and dry ponds and parks next to wet ponds that rely on irrigation. You know drought has a big impact on how much water we're using in those facilities. That's it for me.

00:41:55
CMB: Thank you, number 14. Do you have something to add-on this question?

00:42:00
14: Not so much on the drought. The only things that I could really comment are, you know, in periods of drought crop failures we see in our area increased insects, you know grasshopper infestations, that sort of thing you know wells [water wells] going dry and then when you know the levels and stuff are down. Farmers don't have access to water and, and you know, get water to their livestock, is sort of you now. I think it would be the main concern scenario. I don't think we've seen too much to roadways, culverts that themselves we have experienced much ???alive. We've kind of been on the opposite end of that.

00:42:49
CMB: All right in the room number 16. Thank you.

00:42:53
16: Yeah, I'll just add. You guys kind of touched on it, but the same thing from our perspective. Aquifer management. We manage over two hundred meters, were solely groundwater source. We ~~fried~~ [supplied] a lot of water with our utility to ag industry. Ag Industry is huge in our region, in the city, so that infrastructure is critical for wells and the aquifer as a whole. And it also ties into the water quality and the economic side of things. Definitely, with ag and ag industry and with drought I mean go on to extreme and with ag practices sort of changing over the years. I mean we've kind of gone away from the sort of the summer fallow type landscape. But then we're talking about our waterways and then maybe some, you know, drifting or silt getting into some of those waterways and then doing maintenance on those waterways after you know kind of drought, that sort of thing. But

00:43:55
CMB: go ahead number two.

00:44:01
2: Basically, what everyone else said: the drought. Like we said, our area. It's kind of very rare, the financial damages to a ???jot. I think we've we've experienced more financial losses from two, but the drought does have a plus side where you can get in. You can clean out those creeks and those spots where you can't get in normally, and that's one of the things that happens a lot. You have wet, wet wet and then it gets dry and everyone just forgets about it. Never get wet again, but it does, and that's when you got to go like that, when you got to start cleaning stuff out and get going, I'll stop.

00:44:36
CMB: For that kind of maintenance?

00:44:42
19: 19, just a piggyback on 2: drought, I think, provides opportunity for infrastructure improvements, water conveyance in terms of like creeks, and that you can start doing a lot of work that obviously in the wet years you can't and then just kind of continue on with what I was saying before, being reactive versus proactive. You know in drought everyone's looking for water. Who's talked about well, we're going dry. Guys start digging dugouts in a drought because they're trying to get more water, whereas you know we really should be, you know, increasing dugout capacity and stuff like that in the wet years and you know, trying to have that carry over when we actually

need the water instead of go looking for water when it's bone dry out. There's one other thing that's going to can't remember. That's it for me.

00:45:42
6: number six, I guess piggybacking on what number 19 said, a lot of our infrastructure that's in place is really like people have said for the wet years, so it's to move water. We don't have a lot of infrastructure, green infrastructure in place to store water and having more storage on the landscape, holding some water back would definitely help fight droughts, lessen the severity of the drought. I don't know if it really has that much effect on the infrastructure itself, but again having that green infrastructure present would definitely help and and sort of looking at sort of how we manage water from both perspectives as opposed to just we need to get rid of the water.

00:46:25
CMB: Number 16 right,

00:46:29
16: just to chime in and I remembered one point too, touched on the drought in one of the infrastructure. Just as involved with too is like Good Spirit Lake as an example, holding that water back and then in drought years. You know the loss or the negative effect on that would be tourism and that, industry as well. There could be impacts related. Once we see those drier conditions we definitely saw some less usage because people just weren't coming to that Lake. Water quality as well dropped off in the Qu'Appelle system as well.

00:47:05
19: Number 19 is the point that I remembered here. That it became very apparent in the from 2017 to 2022. I guess last year, when it got wet again, was in terms of source water protection, when people's wells are going dry, the ability of non farmers to access funding for digging a new well or something like that became very apparent. And as a source water protection agency you know it really kind of struck home and it's like well, sorry, but we can't help you because unless you're a farmer and can access the programs that they can access, you know you're basically out of luck and wasn't an easy conversation to have with you know people that and you got no water, these dire straits and that sort of thing. So I guess yeah it. It sheds light on the need to revamp programming and policy regarding, you know source, water protection. [relates to non ag needs for water well development]

00:48:08
2: hey it's Number two: just regarding ag drainage and stuff: helping out the green spots, when you have that drainage you can help fill up some of those dedicated areas for the for the green area to make it better, so you can guarantee that those areas are filled every spring. Versus being shy water at the beginning of a drought, they can get filled regardless.

00:48:33
12: Number 12: I think just building on everyone's kind of ideas. I think there's a lot of potential. You know I'm kind of going back to that teamwork aspect and in creating those projects and where we can create those mitigations and we can create those holding spots to somewhat mitigate those drought impacts. Because you know, as we've all kind of talked about, we've had a lot of years, a lot of springs with excess water, you know, with proper planning and you know, with teamwork

there we can create that where producers are able to hold on to that water somewhat mitigate. You know, say that's a pasture we're constantly going dry. Mitigate through proper planning to get that water to those spots. So in a drought year that producer isn't having a drill, a new well, he isn't having to go searching. We can try and get that water, hold it and keep it in place to try and mitigate some those impacts on the producers and the landscape during a drought year.

00:49:18
CMB: Thank you. I think we should move on. This is the next question.

00:49:29
CMA: Well, the next question is about this. Weather changes that we see- when in weather you are always going to see this shift. One day it will be very cold, the next day it would be very hot now in relation to extreme climate event, which are basically risk even because they produce a lot of damage in relation to extreme climate event. We also have some shift and we have been realizing that this is very often in our recent history. One year we have a very extreme drought that next year we have very high level of torrential rains or vice versa, a lot of torrential rain, a lot of water for a year. Next year is very dry. I wonder again based on your knowledge and based on your experience, if these climate event shifts, these hazard shifts, affects in one way or another that exist in infrastructure.

00:51:04
27: Just again from the rural municipal, what we see is because of the excess. Usually what we see is when they get excess moisture, everybody starts ditching and draining into our ditches, which of course aren't they're not set up or established to hold that kind of water. So then it causes a lot of damage to neighbouring properties, to roads to culverts and all that kind of stuff, and then, of course, when it shifts to very dry, then we see people trying to drain out of areas where they shouldn't be draining, out of which that causes not only just a safety concern, but I mean those basins that are meant to hold that water are now leaking onto their properties and adjoining properties right and then again, and that's just the shift. So then when we get the torrential rains they have water sitting, so they drain into places where it shouldn't be going and then, of course, when it's dry now they're cutting into creeks, trying to drain it on to their land. Just a whole lack of infrastructure problems right, and it's hard for everybody to stay consistent. I know we were. We try and work with 19, with Yorkton Creek and Assinoboine as well. We have even our culverts that are gated right. If they're gated on private properties, they they close them and open them when they feel like it, and it does cause a lot of problems again. Crop loss, culverts, roads, all of our ditches, that kind of stuff.

00:52:20
CMB: Thank you. Any other comments on this question regarding shifts

00:52:28
19: number 19 one observation over the years working here, is there our quick ability to forget the extreme events? I mean we went from extremely wet, you know, from 2010 to 2016, and I remember it vividly because then in 2017, the same area where I was hunting2016, we were under water. It was a swamp… 2017- You lit a match and the whole bush would go under, light it up and under fire. But I think yeah, like even from a landscape perspective. You know, farmer, like livestock perspective, it's yeah, like let's get rid of all this water and everything ???center. You

know, downstream, and then it's like we're coming to the Assinaboine watershed and I got to dig new dug outs and I want you to install pipelines to get water here, because now I don't got access to any water on this area of my pasture and it's like only, you know. Five years ago I ditched all that pasture out and send it willy-nilly downstream. So people are so quick to forget, like you know, what we just went through and that it might happen again. And you know, and the opposite is going to happen again back to keep harping on that reactive versus proactive nature like it's been talked about, like number 12 said it perfectly. It's like we have to plan ahead and not just, you know, deal with what's in front of us. We have to think down the road, what the actions impacts of our actions. You know getting rid of water one day might be a few years down the road when we need water.

00:54:23
12: number 12, I think you know, especially this year it's been really opening in kind of the area that I'm covering. Just the extreme variability we're seeing and we're talking about before the meeting started, in the precipitation you know, one area can be getting hammered, the other area can be missing every single rain. So you know, even in small areas, even in a small RM , you could have extreme variability from dry to wet, and I think planning and mitigating those and working together on those is really important, because you look at the weather radar the last three days it's been forty percent chance of rain and depending on where you are, you've got three inches or you don't get anything, right, and those aren't coming in is just general rains. It seems like they're coming in. We're having those high event high impact. You know whether it's hail, whether it's those heavy downpours, and those are important because land isn't really retaining those rains the way it should. You know if it was that general downpour. When it's coming down like that, that water is going to run. It's important to kind of have those plans in place and you know, like I, keep kind of bringing it back to that. But having those plans in place to maybe store that water so that the next time, when the next four rains don't hit you, that water is, you know, in the right place and you're able to utilize it in some point.

00:55:44
2: Number two: just backing up on number 12 there. But yeah, we find we're going to have more and more extreme weather events and the run-off like you said, coming down so hard, it's running, it's not soaking in, like when I was a kid you got an inch of rain. That was a big deal in ???train could be a minute. Five minutes like it's crazy like so I mean like RM wise for infrastructure. I know, like our guys have been pretty pretty adamant to get the water off the roads. Like if you want good roads, you got to have dry roads and the thing is storing water along the roads is a very bad decision. So I mean that's where it's helped out a lot of the producers in the area and in that way we can also then, in the drought years we can mitigate some of those flows off the farmers fields because we can use our infrastructure. So that's just what we do.

00:56:38
CMB: Anyone care to add ?to add all right 14 number 7?. If not, we'll move onto the next question.

00:56:58
CMA: Thank you. Well, we're going fast here. The next question is, if any chance to have any other example of risk situation that might affect the infrastructure, this could be other forms of of climate risks, such as snow storm, summer storm, too much ice, wildfire too, okay or non climatic risk. For example, issues related to maintenance of financial issues may affect infrastructure.

Perhaps it's very important here. To think in terms of how , for example, government program might affect the viability of certain types of infrastructure is a very general question, is open to everybody.

00:58:13
CMB: If I could add to that, to set the context here, we're looking at compounding risk factors so it could even be things like the COVID situation. Supply chain situation has that had an impact on risks, to how you operate, maintain, build, manage infrastructure. Maybe you think about it in the context of managing water, water treatment, as water treatment, landfill, all types of built infrastructure. And/or Green infrastructure.

00:58:40
16: 16, number two started the last question as well. And growing up in this area, I mean in the eighties we had some drought conditions, but the extremes are seeing more and more like the 12 said as well. Literally this week we've had three inches, you now five miles away, and zero that area. But as for risk same thing here I mean we've kind of been in some wet conditions. But the last couple of years we're having (firebans ??). I mean wildfires, grass fires in this region. That seems kind of unheard-of but major disaster, you know, around the lake a couple of years ago as well we had a major ice storm tied into the... Our concern with that is the power in the grid system. So I mean we were, we are basically well, screwed is not…. If we have no power, you know, if we're down for three days, I mean we'd come to a pretty devastating halt. As for our infrastructure and supplying water to residents through the water treatment plant process, we're actually installing two backup generators now: natural gas, in case of those power outages stemming from the ice storms we've been. We have updated some of our processs and our our water distribution system or raw water distribution system to bring it to the water treatment plant. But the power grid system is is, you know, as you get into electric and all these different changes and ideas and discussions we are pretty limited on power and and I know I'm moving forward with the ag industry, some of those expansions and developments. You know you need to supply a lot of power and gas and that infrastructure actually isn't in place. You know for larger expansion, so they're in, you know, sask energy, sask power. They're looking at a lot of expansion as well. Like you said, the risk and we're facing it right now, like some of our simple products, such as like a water meter. You know we're looking at delays of 12 months, you know.

01:01:19
glitch: Techincal issue in the office

01:01:31
CMB: Thank you, if you don't mind this. Clarify. The ice storm was the origin [infrastrucrture?] affected by the ice storm.

01:01:38
16: Yeah, it was. So I mean on the park side of things and I mean the landscape. We have a lot of trees, older trees, so that damage. So you're dealing with that infrastructure and we actually chipped a lot of it. The positive side we incorporated into compost rather than just, you know, landfilling or burning or that sort of thing. But the ice storm. We had some power, grid issues, you know some delays, some downtime. So again, when you're dealing with multi-million dollar ag industry, half an hour is a large downtime, I guess for them. So the power grid system and and that sort of thing

we faced there, the COVID. We're seeing it delays on products and we're still seeing that we've changed suppliers. We've changed suppliers again, we're trying to get different products, switching products. So yeah, yeah, there, yeah,

01:02:43
27: I agree with number 16. Supply issues are huge. We've switched. We. We actually just ended up. We built a new building and were renovated building whatever. We built a bigger storage area onto some of it so that we can, we're able to keep more on hand . we've seen a shift from our operators and personally used to always use telephones. They're installing radios because during the ice storm we didn't have anything [i.e. lost cell communications]. Keeping generators on hand so that they are usable, part of our problem, especially with the aggressive snowstorms that we've had in the past. It's left where our equipment hasn't been big enough to even move that and we have people who are essentially stuck in our house and our equipment can move maybe 10 foot-high and these are 16 and 17 feet. So we've had to wait for a contractor to be able to get out there, to be able to move those so those people can actually get out of their homes and get down the road. due to extreme snow. Extreme, yeah, so then it leads council to looking at more. What do we need to do? Because it seems to be in more specific areas where it keeps happening. So then, what can we do to help try and prevent some of that right? So it changes the way that they look at budgeting and planning and right, just putting trees up, buying older trees to establish there. So at least it stops some of it. So these people aren't stuck in their homes.

01:04:14
CMB: So the arm has actually changed communications to some degree because of loss of communications, with loss of electricity.

01:04:19
27: Yes, they've also. We've gotten laptops and stuff like that where people can a lot of their I pads and stuff like that. Now they can take them home and we do some work from home, whereas before you always had to be in the office.

01:04:44
2: Yeah, just getting parts for for machines, I know we. We bought a third grader. We had bought a brand-new grader for, and it was down for six weeks. In the winter the guys were running one and 24 hours a day to keep roads up and we were getting wind storm like every second day, but just simple little things you can't get in. And even as an ag producer parts like you, we carry such an inventory in our shop now, like there's stuff I have that I shouldn't have, but it's like you have no choice, because you can't afford to have a common line or something, go down and be waiting two or three days for a part. So. People have changed. People don't want to work, but you say you want to get people to work 24 hours to run shift. Well, it used to be 12 hour shifts. Now you're lucky to get a six or eight-hour shift. everyone wants to just look at their phones.

01:05:44
12: I think, just kind of building on the parts, availability and different things like that. Right number 12. Yeah, even though there is more discussion and more planning now, I think we're running into the compounding cost of doing those actions. I think it's becoming harder and harder to implement those based on the cost that it is to do business now and to get those supplies, because you know in certain situations you are limited by what you can get. You're also limited by the cost

of what it is to do that project, as you talked about earlier. You know, with the fourteen phase plan, wherein, as much as I think you brought it up grade, are we planning for a hundred year are we planning for two hundred and fifty a year? How are we going to do that within the economic budget and Of what we're able to do. I guess one other observation. I've seen is a lot of the programs and solutions that seem to come forward when we have damage to infrastructure are seemed to be focused on the symptoms rather than the cause. And so you know, the road washes out okay. Well, we rebuilt the road and we put in a bigger culvert, but you know why did the road was out in the first place? You know it's easier to fix that than to look at the watershed and say you know where. Why did this happen? Are the things we can do in the watershed that would have prevented that road from failing in the first place, and a lot of the programs are in place sort of. You know your towns, I know the town of Wadena, for example, was having issues with flooding and the solution was what we'll build a berm around the town. Well, you stop flooding the town, but you have decreased the amount of water coming through town and especially if we get into more extreme events, the amount of water coming through town is only going to increase.

01:07:32
CMB: Sorry the the Zoom people, we're we're hearing a lot of conversation in the room and thank you for everyone contributing and not to put you under pressure, but we do want to make sure you feel like you're included. So this question is compounding risks and and we've heard about the supply chain, finance, this could even be things like Russia's war on Ukraine. Are there other factors that are affecting how you're dealing with nonclimatic impacts on infrastructure for you.

01:08:10
7: Number seven, for the discussion was saying about snowfall and how? How unique that is for a city like Saskatoon. It's all obviously how dependent on how much we get and the fact that if we get a lot, do we drain it? Do we remove it like the last two years? We actually removed snow that we in areas that we haven't particularly done in the past. So that's a fifteen to twenty million dollar swaying right there. Right. So your services, the other services that you provide, are decreasing, with about fifteen to twenty million dollars for every structure you have trucks, graders, excavator, (dozers....????), heavy equipment. That is, you know, depreciating in value for use and then, obviously, maintenance you have to do on that from storm sewer perspective. You know you want just enough snow to get that good, first clean flush of your sewer pipes and then you, you obviously want to snow melt. And then, if you have a late-season snowfall altered with, you know, free to climate and the early season rain, you know that's that's an operational and flooding nightmare for us. So you think of park's perspective now. You know they want good snowdump on their parks. You know it reduces the earliest early season irrigation requirements. I mean it's all tied to fuel costs recently for us right. So our fuel costs have increased significantly and just in our recent budget there was an actual line-item for you know, adjusting for fuel costs for the city just becasue the contractors are (.....??) . So we're getting it both on the capital side and the operational side. So, yes, that was an interesting one for a city of Saskatoon. It depends on how much you get, obviously, and then what services are impacted and and what what services declined. So I'll stop there.

01:10:00
CMB: Thank you, number 14. Do you want to add anything?

01:10:03
14: Yeah, kind of steering it in a different direction. You know we talk about the impact of flooding on our roads and stuff too, but another compacting, compounding factor for qualities. As farm sizes have increased, the size of equipment has increased as well, which affects the you know how roads are maintained and less green is moving by rail right. It's moving more on municipal roads, highways instead of rail instead.

01:10:38
CMB: Thank you that

01:10:41
16: number 16. Sorry I want to add one more and I know 7 kind of touched on it a bit. But you know, as we get into projects in the supply chain, you know our contractors like contracted services. So not only in the storm but then like watermain replacement repaving, those contracts have increased in one year, anywhere from twenty to thirty five percent some parts have doubled hundred percent in a couple of years. So when we're looking at, you know, tax increases or even increases to the water utility in the three percent range, to try to just maintain what we have on a kind of an annual basis with just operational costs. Nevermind capital improvements were going further and further behind, like we're in probably eighty-year deficit as it is in our municipality. Just on today's replacement cost for the kilometers of underground infrastructure we have that nobody sees. You know, we see the surfaces, obviously with buildings and roads but are underground, are over a hundred years old. Some stuff that's forty years old is failing already. So it's bad quality of either workmanship or bad quality at the time with certain products and some of that infrastructure isn't lasting the eighty years of the hundred years we were hoping to last as well. So again it kind of tied into the question of number one, but not to be doom and gloom. But there's a major infrastructure crisis in western Canada, globally, in Canada for that matter,

01:12:28
CMB: and specifically on water in structure. This would be waterlines, supply lines exact, but also other buried infrastructure

01:12:36
16: Yeah, like water and sure exactly, and then trying to get the pipe. And the pipe has increased fifteen percent and then getting the contractors, they can't get workers. So to pay the workers that are actually working more hours more pay, their contract goes up. So the municipality has to pay now thirty- forty percent more than we did last year, with a three percent increase. Now our costs, went up forty percent you know we're we're at a negative thirty thirty seven percent and it's like how do you make that up? And I mean nobody wants to pay more for taxes but our infrastructure. You know, compared to the sixties and I know some of the watershed stuff and all of us are involved in watershed. But like Yorkton Creek, you know what we've built-in this whole system for a few million dollars would be like hundreds of millions now, with control structures and ditches and all that stuff. So it's it's the costs are just surpassing what we can actually fund.

01:13:35
CMB: You know, number two was going to.

01:13:43
2: Some of the stuff that holds things back. Some of it comes down to the red tape just to get approval, to do some of the channel clearing and the channelization. There's different permits that you have to apply for, and I mean some of those things you apply in three months down the road and then the ground is frozen. They expect you to go and do the work then, and repairs are mad because you're doing the work when it's frozen, because it's costing more. But it's the red tape and.

01:14:15
27: Just built on what number 16 and 2 are saying even for for us. So we, you know, going back to the wet years. Now we're looking at capacity and trying to build instead of the one and fifty to the one and two hundred. So we're increasing our capacity right. And then when we go to do this, stuff like your cost is going higher and higher. Your ability to get the stuff is going higher and higher through the grant programs. You have to get it done with a certain time-frame so then what we end up finding to do is when we do like a request for proposal or a tender agreement, we have to make it so they can get the stuff in time and the work has to be done. Otherwise we lose that grant funding. But then we're putting in the bigger Infrastructure to be able to try and handle the drought and and the flooding seasons right. So it is. It's just compounding everything and then not being able to get it. What used to what used to cost us? I'm going to pick on our on our culverts. We did major Culvert installation, not that long ago, you know, and I think that was around a million. So in order to do that we have a secondary site. We're probably looking at almost doubling that and we can't get the material.

01:15:22
16: Just keep circling back all these great ideas. So my department also we deal with the waste water and wastewater. Basically, treatment has changed in the last five or six years, so kind of tying in with number 2's comment before. So there's federal regulations that have changed. So we're being held to a higher standard on nutrient management and so we have to look at major upgrades to our facility. So a community of eighteen- twenty thousand we're looking upwards of potentially like a hundred million dollar treatment plant to reduce, x you know, out of the, you know, the wastewater stream. We're looking at some other ideas on, you know, utilizing that water better. So then you know, like the planning side of it, aquifer recharge, you know, instead of dumping it down stream, so to speak. So those management tools, but still the the cost to the municipality, the ratepayers, when also government changes regulations, is substantial as well.

01:16:37
CMB: Thank you, I think we should. This has been excellent information. I appreciate this to everyone. Shall we move to the next question? We're getting near the end and we'll kind of have some open space for people to generally contribute, but this has been valuable.

01:16:53
CMA: Well, we wondered if you have any other issues to discuss, either in the past or in the present in relation to water supply. water distribution and water management infrastructure? And we are talking about other natures that are not directly, related to the part of infrastructure let me give you an example in the case of drought. We usually have problems in relation to water supply. So I wonder if there are any example of conflict around water infrastructure it would be about operational management, it would be about competition, it could be about environmental protection and we went in the same perspective if provincial or federal government have been able

in some way or another to resolve the conflict. In some other cases this is very possible to the conflict. Even worse, we're not even interacted only directed on the nature, the impact of climate, but also in other regions related to infrastructure and water management. That could be relevant in terms of the capacity of people to deal with the impact of climate and water resources.

01:18:54
CMB: I'm going to ask: we have someone who's got a hand here, but I'm going to ask the first: anyone that wants to do something like you see number 18,

01:19:07
18: Okay, thanks to offer up her something around groundwater. You know it's a relatively unknown resource even to live in for a long time. Certainly as demand for supply increases. That uncertainty is an increasing risk, getting too much better understanding of the water resources going forward to that Federally and , provincial governments, where all stakeholders have an interest in this. Of course, from an infrastructure standpoint, (....????) paper is most prominent, wells and irrigation for agriculture. So I think that's pretty big one. I guess another ~~it is late~~ [relates] to water distribution is the electrical distribution system. Recall hearing that that's pretty important cost and that has to be done, planning for increased irrigation and across the province, in some pretty large future plans for increased irrigation.

01:20:43
CMB: Thank you. Any other comments from Zoom?. Well, move back to the room and you can still contribute any time you want. Just show your hand number12.

01:21:01
12: Just kind of coming from this from a bit of a personal standpoint as well. I've kind of mentioned it a bit in what I've said before. As Number 2 said it seems like years they've been wet. It seems like where where our farm is located. We are consistently on that edge, being dry, kind of building. Back on that. It actually led to us putting up a hundred and thirty acres of irrigation maybe six or seven years ago. And to me I think there's a lot of potential and there's a lot of possibility in kind of building those relationships. I know even myself actively in kind of using some of those storage storage location to try maybe expand that irrigation. I think it's something that can mitigate a lot of impact downstream if we can find those relationships between producers who have that interest in possibly adding something like irrigation, possibly adding something in like a storage capacity on on their operation because from a great perspective you don't really want that water if you don't have to have it and if you're if you're working towards that partnership with the irrigation. They want that water. They need that and we can put that in the right spot that it's being utilized and it is being accessed. I think there is a lot of potential moving forward through building those relationships to just kind of store that water and kind of keep that peak flow to a minimum, to that capacity building.

01:22:21
CMB: Thank you number 16 .

01:22:21
16: Yeah, I'm going to kind of touch a little bit more on kind of aquifer management and allocation and working with the provincial organization that oversees the water security and so in Yorkton in

our area here within Assiniboine you know, tying into the Quills [Quill Lakes] and up in the Carrot River. Even it's you know, roughly ninety percent of residents rely on groundwater for their source water and we've done extensive work in Yorkton region trying to, you know, maintain our aquifers. We have twenty years now of of pretty in-depth data from from piezometers over the years and we've really tracked the aquifer movement. You know anywhere from three to five meters. It's moved within that that time-frame kind of ups and downs and and pumping and managing accordingly through different wells. One of the risks that we faced a few years ago was potash expansion in this area and talking about more allocation potentially being sort of, I guess, allowed or provided to them versus, you know, our area and municipalities. So again we were large utility, I guess in this, this community, in this sort of area, SaskWater is also a utility out of Melville just down or upstream, I guess. So they provide a lot of water and rural pipeline to area residence here so that groundwater and allocation is critical for again like ag industry within the region and to support, you know, individuals, obviously with with that water and kind of that water, I guess

01:24:14
CMB: 16. You mentioned risk being potash expansion. It's not because of industrial pollution, is about water sharing and water use availability?

01:24:21
16: Yeah, and I think kind of you know a risk or a question: is the province hasn't put the money or the effort into kind of identifying more of these? They they truly don't understand. I guess you don't know. There's a lot of unknowns. I guess. So for them to then provide allocation. You know this is multi-million pro, billion dollar companies looking for answers and if they don't get the answer one they're not coming. You know the positive. You know that brings to the community a lot of jobs, a lot of economic development. The negative is maybe we're competing with water. So you know that's that spin-off and in the province to provide that answer. I don't think they have that answer. You know, province wide in this region they can provide some answers through ourselves, through our own information. There is a lack of some data, data, lack data for sure.

01:25:19
CMB: Thank you. Number 16, number 18, is your hand up for a new.

01:25:27
18: It is just within the provinces we are very close to signing a new schedule for (.....??) aquifers and it's all about, and I made a point out, is that it's all based on risk management and again just one but doesn't know (....) WBS?? structure, that's federal provincial ?????eminence mechanism that work together cooperatively on specifically transponder matters. Big picture. This is a very big step forward and for today's discussion it is so essentially going to put into affect and implement the transmitter, applies, given risk rating and then commensurate or risk of action, that is to protect, conserve those aquifers commensurate with risk. Again, it's for open piece of prooactive case and hope for the result and it will enhance the management and discussions going forward.

01:27:01
CMB: Thank you. I want to mention, to reiterate, something CMA mentioned, because I heard an actual reaction in the room. I think they may have been on the line too, was about whether there

were programs that helped or maybe did not help with the provincial local Federal. There was a bit of a reaction. I forget how you have said that CMA. I know people were smiling and just curious. You want to rephrase that.

01:27:29
CMA: There is no other way to make it more elegant. You know something that we have learned in many of these projects is that the role of the government will be very a case of running, if you want to put it in that way, and that is related to the way in which government work. In some cases they are able to resolve the problem, but in some other cases they have the capacity to exaggerate the problem because they have policies that are very limited, because they have very poor programs sometimes just because they don't think about it so much that the IPCC the international climate committee that deals with climate change has decided that risky situations, in the case of climate change are not only produced by climate event but they could only produce by government acts. , and that is the reason why we are saying that in some cases the participation of government, it doesn't matter, the level, would help to resolve conflict, but in some other cases it could exaggerate the conflict which you practically cannot resolve. Is that more clear?

01:29:19
CMB: Yes, and I'm curious what people's reactions are or have examples number 27.

01:29:28
27: That's one of the things that I just want to share. I know previously for some councils, engineering and water experts weren't utilized due to the cost, some of the changes that we've seen coming down through the grant application process, especially when you're applying for the federal grants, provincial as well. But you need those engineers in order to get the grant. With the cost of everything increasing, the conversations around the table can go. If we need an engineer, we don't want to do it because we can get it done for half the cost if we don't have the engineer now, the conversation that we're actually switching, so that if you can get that grant money that actually moves that project up higher. So I guess in reality, just at the local level. Those local people can have those conversations where we might be able to get the project done for half the cost, but we also don't get any of the grant money, which means we have less project that we're able to do. So now the conversations are yeah, absolutely, if we can get that grant money in we'll do that project because it might, over the couple of years, allow us to do more projects. So I guess in some ways it's actually help help some of our councils utilize the engineers, the water experts, which gives them a bigger, broader range and a long term effect. Some of the stuff that for us that's come out is of course drainage projects and if we can get the ground money now we're going to do that. The only deterrence that that I can actually see from from our perspective is the provincial money and assistance has way less red tape. So we'll do that sooner. I think we have three or four federal projects on the go and the last we're still waiting for complete approval and agreements. The last one took over two years from the time we applied. So then, of course, because of the process and the length of time they're starting to not like the federal programs.

01:31:35
6: I guess. Building on that, yeah, the province is responsible for water management, but there's still a sort of prevailing attitude out there that you know that isn't the case, that any water on your land is yours to manage as you see fit, and that leads to all kinds of conflicts, of course, and you know our government, well known for not monitoring and enforcing infraction. So that sort of

further leads to more infractions down the road and I know they're trying to address that with education and a new policy coming out here. But again, a policy is only good if it's enforced and there's no enforcement. Nothing will change in that respect so that that is a real challenge. The fact that we tend to be very underpopulated province, you know everyone sort of is sort of their own island and you know the cost of going through a proper approval. If you mention getting you know everything in place takes time and money. You might have to hire an engineer, whereas hey, I got the equipment. I can do it myself. Who needs to know right? And if that's happening across the province, you know the cumulative effects are really where the issues are, not so much at the local level. You know doing whatever might not have that much effect on the guy downstream. It's the guy's two hundred miles down stream where it might cause problems.

01:33:11
CMB: You've been quiet. You want to add anything.

01:33:17
7: Seven from Saskatoon: yeah , yeah in positive and negative we were very successful with those federal government grants there been recently. So the government of Canada has given us a little bit of provincial government: Thirty one million bucks to spend on flood protection, storm water management before the end of 2027 So those those capital projects you know wouldn't be wouldn't be going ahead for our city people without that forty percent rate. So that capital investment is crucial, that the amount of work that goes into doing those applications and it is equipped with many engineers and experts on the storm water side and it's it's a-list for us right. So we have those people on staff. You know you can be developed in one of those applications for you know and all working consistently, but you know working on it for six and twelve months and then then you're waiting. You know, as, as was mentioned now, six to eighteen months to see if you're successful and then it takes another six to twelve months to get that agreement signed right. The time it takes to execute them is always crazy to me and then once you get them once you are improved, you know the work doesn't stop it. You meet quarterly with their chairs and their committees. You have to report on community benefits. You're always work reporting on costs, stuff like that, all engagements for the smaller. I don't want to speak for them, but it's it's a headache challenge for larger city likes to Saskatoon. So for for the smaller cities you have to hire outside help right and that's an extra cost, one cause that I will say well, that is, you know, usually external costs and those applications are you need, probably paid, paid by the government, so any any external help. But we need forty percent of that is usually.... positive or negative. We needed to get these projects going, but I can see they're on the administrative side, they're they're they're troublesome. I can stop there.

01:35:28
CMB: Thank you, number 14.

01:35:31
14: Not too much to add. I agree that it's sometimes just a difficult process to move through a lot of red tape. Unfortunately, it takes a lot of time and sometimes programs are being developed for the right things or their funding isn't available for the right thing. Then I realize we're a unique situation. But one thing that I had a lot of producers come to me with this year is because around the quill lakes we saw so much putting. Those waters have started to recede, but there isn't any sort of funding available for them to clean up. As with just the amount of garbage and tree trunks,

everything great branches that are on their land, there is nothing that they can apply for to clean up their land and get back production. That's all just coming out of pocket .

01:36:25
CMB: Number 14, and bear with me, room here because I know you never had a chance to speak to question one. But risks and impact to the flooding. We're rather severe from 2010 to 2017 for the Quill Lakes. Do you want to just comment about this post flood clean up now? That's only happening and starting to happen in 2023, when you had multiple years of wet conditions. What were the impacts?

01:36:46
14: There have been guys able to farm their land probably from 2020 forward, the ones that are further away from the lake. They're doing quite well. Amazingly enough, the land is productive. You know their yields are, you know, getting close to average, I would say another problem that they have, though I can. You know you get a small flood of ventral??, say you get half an inch, an inch. Unfortunately that crop grounds out. Or if you get those really windy days, sometimes the water will come in and flood them out again, and I didn't get a chance to mention it. But we had a whole study then that evaluates the economic impacts between 2012 and 2018, and that's something that we can definitely share. There's you know all the all the numbers are in there already. I think it's just easiest for for me to share that stuff with the group.

01:37:50
CMB: Thank you too. I think we can move to the last question.

01:37:55
CMA: Yes, it is a very big questions, as everybody knows we are going into a new stage of climate change - towards very extreme vulnerability. Then we're going to have more serious droughts, more serious floods . we now wonder, through knowledge and experience if there is any way in which we could improve infrastructure. In this context, please feel free to share with us your ideas, your dream or nightmares

01:38:58
16: Yeah, I guess my thoughts on that kind of a watershed scale. I mean in the municipality. You know, looking at that bigger picture, I guess, and creating more of those larger storage structures. You know managing those, those floods, holding that water for the drought and then releasing and managing that water accordingly. You know within the municipality, like the city itself, we talked about doing some upgrades on underground and stormwater. It's tough, it's it's it's millions of millions of dollars and you know everything was built. One and ten kind of capacity. Same thing. We built some storm water management ponds to try to alleviate some of those peaks. Looking at some different management stuff within the wastewater treatment plant as well: storage capacity upstream to take on water, to try to curb those large rain events with some infiltration coming down the the system so that you could feed that water in maybe two days, after three days, the next week after just take those peaks out of the system. I guess I guess that's plotting, planning and more planning.

01:40:31
6: I guess in recent times we've seen lots of developments in terms of the technology, in terms of

management. We've got LIDAR now you know we're doing inventory of wetlands for the province, so we're getting all the pieces that we can actually start to plan better, model different things. You know, we've got pure waters and global water futures in Saskatoon that are sort of on the cutting-edge of of developing models to help us understand snowmelt and and run-off and those sorts of things. So we're getting to a point where we should be able to model some of these things and sort of where are infrastructure is lacking and where it needs to be improved. The challenge with that, although, is also you're talking at a very high level landscape, and so how do you translate that to the ground-level where you're dealing with thousands of individual landowners that are making their own individual decisions based on their own operation. You know when you're trying to, you know, manage the whole for everyone. So that's the real challenge I can see going forward is how do you mesh those two? How do you mash the individual operations with sort of the bigger context? scale is crucial, for sure,

01:41:49
27: number 27, just just a compound. On that absolutely we see more of a regional, more of a district being able to work together with your neighbors, with your surroundings as well as your landowners. I think it just became during those flooding years it became very obvious that each individual looking after what they do isn't working right. So being able to to call out and use our expertise and and making it mandatory to deal with those, those kind of groups and looking at it absolutely in a more regional and more district approach, provincial approach instead of this is mine and this is what I'm looking after.

01:42:29
CMB: Thank you. Number 16.

01:42:31
16: Sorry, I'm just going to touch on the regionalization too, because I had some background when I worked with WSA So now with the municipality. Here you know the big discussion was, you know again, and you know, number 6 kind of touched on it is our, our population, we're not, we're not dense [population] and we have all kinds of space and infrastructure Road network is just horrendous really across the province. But you know tying that altogether and working together on that region or network or watershed. You know, you know, I believe that's the process. You know I look at it from a funder. You know if I'm looking at a municipality and I'm paying tens of millions to upgrade whatever they're upgrading a water treatment plant they'll use and three other municipalities they're building millions and millions of dollars of, you know, treatment plants. You know if we look more of a regional system and a pipeline because in those areas they're having trouble getting staff. So the government's putting tens of millions, hundreds of millions of dollars into infrastructure and then you can't even get staff in some of these communities to operate it. And that's that's a real situation. That's happening. And if we can, you know, it's hard because each municipality, when you start talking regionalization, they start to grasp at control right. You don't want to lose control. But how do we offer up, you know, and work with our neighbours? And that's a real difficulty with change and change in Saskatchewan for hundred years it's been tough to tough to accept, but I really do think, in order for us to proceed, being fiscally responsible, also helping the environment and moving down the correct path is looking more at regionalization

01:44:31
CMB: number two.

01:44:36

2: Just going to speak, I guess from the farmer point-of-view and I guess watershed RM. We're fortunate in the area we are. There's been a lot of foresight. What's been happening, lot of how I put it. Try. Be politically correct, I guess in a way, but lot of people like the point fingers that ag drainage and doing nothing is not an answer. And there's certain groups that like to hold water back. That does just as much damage to our infrastructure as draining it. And sometimes they need to do some work in order to help the community out. Also drainage. When people, you have a hundred and sixty acres that's naturally drained, that's okay. Then the road across the road has like a little corner, say two point three cres????, and the guy puts a scraper in there and drains it. Everyone driven by that guy's just a criminal. But yet they develop a whole corner of the city. pave it put up houses, everybody has eve troughs, everybody has weeping tile they have a hundred percent drainage surface and exactly. But if a farmer does it, everyone's pointing the finger and all these individuals need to be controlled. And the thing is what they're trying to do is soil health. Most guys aren't doing it because of a hate of wetland, they're farming land, they're doing it. You're seeding the spot seven out of ten years. You can't afford to lose it nowadays, like back in the old days when it was your grandfather's farm and they go back to inventory from 1957 on your wetlands. Well, guys had a couple of cows, they had a pig, they farm the hilltops, they hayed the slews. Now things have changed. Agriculture equipments changed, everything is getting bigger and it's not not necessarily what the ag producers want, it's what's been pushed on them. You know that's just how society's changed, you know. So the big thing I just have: drainage is a good thing. It is one of the best things that we can use in a drought. You can stop drainage if you have control structures, you can hold water back, but if you're in a drought, when peg???? will be screaming because we're going to want the water, they're going to want to drain water and it's in the wet years. You can mitigate the floods too because just letting it hold up and saving it doesn't do anything. So I'll quit now.

01:47:02

19: I guess just piggyback on mentioned soil health and we're talking. You know what are some of the dreams, number 19, some of maybe dreams or whatever that could, if it came to fruition, would help this whole conversation recently getting into the **regenerative agriculture field**. I think the way we manage our agricultural landscape and our soils has huge potential to either help the problem . The problem, or, you know, hurt the lead to more disaster and that sort of thing, and I know one of the quotes that echoes with me regarding this conversation is: you know, we might not have water quantity problem. We have a water infiltration problem on much of our agricultural landscape and it's the way you know, guys. I mean very rarely do we still see summer fallow unless you're organic. Yes, but even that there's ways to do organic farming topic. On that you know that you don't have to till the snot out of your land and have zero infiltration capacity. So I think I mean the whole region of Ag is very interesting and it's one thing that's coming. You know more and more commonplace. Hopefully, and hopefully one day it will be just like Zero Till [farm practice to conserve soil] was many years ago. Everyone kind of scoffed at it and said it's never going to you know, catch on. Hopefully it will be in my kid's lifetime. They'll they'll look back and say: oh, you used to farm this way. And what the heck are you guys thinking? Because I think the soil has huge potential to mitigate a lot of these issues and if we can infiltrate ninety percent or more of the rain that's falling down rather than sending ninety percent into ditches, into whatever down the road, that sort of thing, I think it's only a positive thing. Another dream of mine, I guess, from the

stewardship and of things, is again natural landscape stuff. This province needs to take a little bit of firmer stance on the natural landscape and protecting natural landscape. I know we're talking. You know infiltration, well, bush and that sort of thing. The amount of bush habitat that has disappeared in my lifetime is it's crazy or whatever has a hunter? You know, I've seen it first-hand and wetlands always get all the attention. You know you can't do this, you can't do that, should be doing this with wetlands. But then meanwhile guys are pushing whole sections of bush down without any thought or you know any repercussions. I mean those areas have substantial ability to infiltrate water and you know we're talking groundwater recharge and aquifers all that sort of thing. So I think I think the province has really turned a blind eye on that. And just in general ecological landscape it it always plays second fiddle to seems like everything else. But in reality, if we don't take care of nature, if we don't take care of that soil, not everything else is for the lack of a better word screwed anyway. So that needs to be at the forefront to take care of our land, or else you know all our efforts to mitigate all this. It's we're just doing a band aid solution,

01:50:45

12: I think, just build on from different points, kind of made from to?2, 19. You know you talk about some of the different things that have happened on the landscape and I think a lot of it just comes back to the simple economics you talked about. You know how farming is changed and it's changed because we have to produce more of less right. That's just the name of the game. That's where, as at right now, and it's a pretty tough spot because even though maybe sometimes that's not what each person necessarily believes in, that's what they're going to do because they're trying to save their seed on the pants on the on the far right like this, trying to survive. So I think they're trying to find a way to make those relationships. **And then 19 kind of bring in the different practices that are being involved, trying to bring those and bridge that gap between the economics, you know, and the environmental sustainability and trying to find that middle ground, because right now producers are doing it because they have to. That's just that's the reality of them. It's just trying to survive and trying to keep their farm together, and so we have to find a way to bridge that gap and bring those together to get those environmental outcomes.** [bolded as a likely quote] To get those, you know, water outcomes we want, you know the storage of water and the wetland and all that in bringing that back together and back into the far number 14. Thank you.

01:52:09

14: Yeah, just to comment on this last comment: if you want to retain wetlands and bush and stuff on the landscape, you have to compensate farmers right? for the service that they're providing. Right, they're providing a service and they should be compensated for it.

01:52:31

CMB: So you're referring to the concept of alternate land use systems and ecological goods and services – Correct? [ALUS and EG&S techniques/programs promoting sustainability by compensating farmers to take land out of production for selected/targeted environmental benefits]

01:52:37

14: And they [i.e. the farmers/producers that take land out of production for ALUS and EG&S] should be compensated for those goods and services that they provide by right: holding water on their landscape, keeping bush on their landscape now, reseeding forages or reseeding native prairie. They should be compensated fairly for those services.

01:52:58
CMB: Thank you, number six.

01:53:02
6: Just adding on to that, I guess number **19 mentioned regenerative ag**. In addition to that we also have millions of acres of marginal lands in this province that really aren't suited to crop annual crop production, but there still being annually cropped, and I know a lot of producers tend to look at the farm as a whole unit. And you know every acre is productive but not necessarily every acre is, and so even just converting some of those problem makers to forages would help their bottom line as well as also help reduce runoff, store water provided biodiversity, pollinator habitat, all that kind of stuff, lots of wind, winds and there are programs out in place, both provincially from the Ministry of Ag and from non-profits like Ducks Unlimited, "Soils" has programs as well. So you know we're seeing, you know, changes within agricultural practices and it wasn't that long ago that Zero Till was new, and so now we have some new programs that are going to start to catch on and and hopefully they do. It is after three.

01:54:22
CMA: It's only two oclock, but anyway. [ha ha ha - time in BC]

01:54:26
CMB: Are you saying you want to go another hour?

01:54:31
CMA: That was quite good, so thank you. Everybody. In the next couple of months, I think in October we are going to set up interviews and this person-to-person interview about again the impact and the vulnerability of the influence that sector. So if this is okay with you, we are going to contact you then and ask you for the possibility of having an interview with one of us and undergoing nations ??? in terms of people that should the interview for this we have a couple of months again, on behalf of my colleagues are above. Thank you. Thank you very much for your contribution, for your ideas, for sharing this bothering ??? with us. We've got a lot of information. We are really looking forward to the analysis of all the information we collected today. As I said before before that you are going to get a copy of the transcription of this meeting . so you could review it and Give us our blessing in terms of what it contained there again sent you very much to everybody.

01:56:27
CMB: So, Polo, in terms the next steps, you lighted the immediate next step. So what about the longer-term will this project solve all these problems?

01:56:37
CMA: I think I found it very is a very complex problem.

01:56:43
CMB: We can still.

01:56:47
CMA: On record and stop recording, but I think she will allow us to remain so.

01:56:56
CMB: Now we can talk, to relax.

BWAG PROJECT
Transcription of the focus group on Infrastructure sector
Held on June 29, 2023 at Saskatchewan Conservation and Development Association
202- 1630 Quebec Avenue in Saskatoon, Saskatchewan

P: Co-moderator
D: Co-moderator
B: Research Assistant
1: Internal Quality Specialist – WSA (Saskatchewan Water Security Agency)
3: Flood Mitigation Specialist – WSA (Saskatchewan Water Security Agency)
5: Senior Planning and Performance Improvement Consultant- SPSA (Saskatchewan Public Safety Agency)
8: Sustainability Specialist (Water Conservation)- City of Saskatoon
10: Public Works & Utilities Foreman-Town of Carrot River
11: Executive Director – SAW - Saskatchewan Association of Watersheds
13: Executive Director- SCDA – Saskatchewan Conservation and Development Association
15: Irrigation and Drainage Engineer AAFC – Agriculture and Agri-Food Canada

17: President, R. Halliday & Associates & Board Chair – Partners FOR the Saskatchewan River Basin (winding down in 2023)
20: Sask FSA Executive Director – Saskatchewan Farm Stewardship Association
29: Program Manager- SCDA- Saskatchewan Conservation and Development Association

[for context/clarification, text in square brackets was added by D]

P: I will be co- leading this meeting with my dear friend D, so whenever you feel that we could begin.

D: We could begin now.

P: Okay let's do that then. well, D sent a document to all of you a document that explains what the project is all about. So I'm not going to go into details. Yeah. As you already know, the main purpose of this project is to develop an adaptation strategy, a regional adaptation strategy in 4 countries- Uruguay, Argentina, Chile, and Canada. and in Canada we are focusing on Saskatchewan. Now, in order to be able to generate this regional adaptation program,
we need to know how different components of the region are being affected by climate events and one of the components is Infrastructure. As D mentioned before, we have other components like ecosystem, primary economic activities, livelihoods, and of course, governance Now, what we will, in this case, we are going to focus on the impact of climate events on the infrastructure. This is very much the sort of a [start] in each of work areas and exploratory work in the area. It will be followed later on in this year by a very large number of interviews to some of you and some other experts in the area [of interest where you] might be able to provide some information about how infrastructure is doing in the context of climate change. So at this moment, it is basically again, an initial discussion, an initial exploration of the issues. And we we hope that this conversation, then, will allow us later on, to develop an interview guide that we could use later in the year where with some of the experts. D, maybe you would like to present what we understand as infrastructure - what we call it in that idea.

D: Yes, I would. Then I need to get my notes. Thank you sorry. basically, we're going to focus a lot on water infrastructure. But we realize that infrastructure is much more than that. So built infrastructure, for example, can be telephone lines, buildings, landfills, water and waste water treatment plants, bridges, roads, culverts, irrigation works, basically all built infrastructure that our developed human environment uses, including ditches and drainage canals, farm buildings, etc. – all infrastructure that might be affected by hydro-climatic events. So when you've got severe events like floods, wildfires, hail, all human built infrastructure can be affected some way or another. So we're using a broad term like that.
We're also trying to capture infrastructure at different scales in Saskatchewan, especially focused on the farm and [off-farm infrastructure] within the watersheds we are studying, [to better] understand what some of these risks are coming to [for infrastructure], the infrastructure [affected by] hydroclimatic events. We're also classifying built infrastructure as natural or green infrastructure; constructed [green infrastructure] could be parks, wetlands, even tourist areas that have been developed (not so much the natural ecosystems because that's covered under another theme [natural ecosystems]. But in in some cases, for example, on a farm scale, you might have riparian grass buffers, or you might have drainage ditches, or you might have something that manages water or works with the landscape in a managed ecosystem perspective, whether it's for a farm or a watershed, to help protect and manage the environment and economics and social

welfare. So green infrastructure like that could even be [riparian zones] or repaired stream banks where it's been re-vegetated, for example. we consider that as part of built infrastructure as well. And what we're going to be asking you questions about today is how hydroclimatic events have affected the infrastructure in this broad definition, based on your experience, your expertise, your knowledge, and we'll tease out some concepts that will help the research project better understand the risks caused by hydroclimatic extreme events.

P: Okay. Thank you D. Now, before we begin with the question, we, we have 6 questions, and of course we have allocated a certain amount of time for you to discuss, or to present your perspective on each one of the questions. But before we do that, a couple of things: number one - this is academic research, and as such, we are very, Ethical issues are very important to us. So a point of clarification about this. In order to participate in this meeting, you have to agree to be part of that. That is a fundamental thing to us. We cannot get information from anybody who hasn't agreed to be a, a, a part of an interview, or part of a survey [focus group?]. No, so in those terms, then, I understand that D has already sent some consent forms to all of you. My understanding is that most of you have already agreed to do this, and send a form back to D. However, there are a couple of people who were unable to do it. So what I am going to do is, I'm going to assume that by participating in this meeting you are consenting to be part of the focus group- Okay? So if by any chance you have changed your mind, by any chance you don't want to be part of this, please leave the meeting, and that will be okay with us. But as long as you will stay I will assume that all of you have consent to be part of the focus group. Now in the same line, all of you have the right to withdraw at any moment from the focus group. If you don't like the way the way in which this meeting is going, please feel free to withdraw. That is part of your right. In the same way, if you don't feel comfortable with any one of our questions. Please, just say "I pass", and then we will continue with other people. Again, you have some rights in this in this meeting. and of course you could use them whenever you want. After the meeting, we will be recording the meeting -Okay? So, after the meeting, we are going to do a transcription of the recording. And we are going to use this transcription in order to know our data analysis. Now, once we have the transcription ready, where we will send it to each one of you, so you could read it, review your comments and let us know if everything is okay. After that, we will start the process of data analysis. And at that moment, then we will make sure that your names are not in the final report, okay, or any means that may identify you. A couple of things about the rules of this meeting. D and I- We are the coordinators. So we will be leading the discussion, and in that way, then we are going to be a sort of a dictators here today. Please do not interrupt when somebody else is talking. You have all the right to agree or to disagree with the opinions of other people. And that's fine. That happens in the focus group all the time. The only thing that we want to ask you is, let's not get into a sort of a hot debate about the issues because if that is the case that we are not going to move into any direction. Please, if you want to talk at any moment, just raise your hand. Okay?And those of you who are online please use to the Zoom device in order to do this. And I think that very much what the introduction is. D will you? Will you like to proceed with the questions?

D: Thank you. Everyone, one last item. Because of this being anonymous in the transcripts. we will be using numbers. So everyone on Zoom has been a assigned a number. Obviously, we know from data input who's speaking. But when the material is used by the academic team, they'll be keeping the statements that are stated as anonymous statements not contributed to individuals. So as we talk, and it's a little awkward, but as we talk, even in this room, we are, we're assigned numbers. I'm going to be saying things like, if someone doesn't contribute, I might say, "Hey, number 8 - Does No. 8 have anything further to add?" And we'll ask you to try to play that game,

too. It didn't work totally for us yesterday, when we did this. People still use names, and don't worry about that. If that happens, we'll just strip those out when the transcripts are done. So in that sense, this is a little awkward and stilted. But we'll relax after this, and we'll get , we'll just enjoy the academic game that we're going through here right now, and it's out of respect and confidentiality. Institutional names, however, will be used, and, but when the material is used, it will be respecting to the extent possible, the [individual's] anonymity as well. Just so you are aware of that.

D: So let's get into our discussions. The reason we've invited all of you here is, because you've got your own personal expertise, and perhaps a number of different hats in what you've seen in your work and personal lives and livelihoods. How hydroclimatic events, extreme events have affected infrastructure, and we're focused on Objective Two out of an eight objective [BWAG] project, on teasing out some of the risks and hazards and impacts on infrastructure at the various scales that we just talked about. So our questions are geared around that. We'll probably touch on some of the other elements, and that's okay, because if they cross-connect to livelihoods or ecosystems or economics, that will all be quoted and correlated with the research team eventually. And the ultimate goal in this project, which goes to the 2028 or December 2028, is to help gather different perspectives, to better understand how we might work towards the society improving adaptation to deal with hydroclimatic risk. So again, our questions are geared in on infrastructure, and the first round or two is a little bit slow to get started. And I might actually go around the room and also on Zoom to make sure everyone contributes. And if you've got something to say when I ask you the question and prompt you, if I ask you to put you on the spot, please forgive me for putting you on the spot you can pass, or you can just say, "Yeah, I've got something", or if the idea comes up later, we can go back to that. Well, as P said, we've got six questions. The first one will take a little bit of time. It's one thirty [PM] right now, so I'm guessing it'll be twenty minutes, maybe thirty minutes for this first question. The others are shorter. **[Question 1] So first question is, What are some of the impacts caused by flooding during our study period is actually going from 2000 year, 2000 to 2020. But we also know that parts of the province experienced very severe flooding, or extremely wet conditions during the period of 2,010 to 2,016. So our first question is directed to all. What are some of the impacts caused by excess water, or excessive flooding, or extreme events dealing with some of these severe years, and in particular in Saskatchewan we had very high wet years in 2011 and 2014.** So that's the basic question. P any way, should that be rephrased. Is that good?

P: It's perfect. I think that everybody understood?????

D: Great and I'll let, I'll give a little bit of time to let people think about that, and wait until someone starts to talk, and then what I will ask is to go through around the numbers to make sure that everyone has the opportunity. But we'll just let it start to flow out, based on people's degree of willingness to participate right now in interest. And again I'll rephrase it. What are some of the impacts caused by flooding, especially during this wet phase, which is rather unique in Saskatchewan, where it was back-to-back wet years, 2010, 2011, 2012, 2013, 2014, 2015 and 2016. For me as a civil engineer I'm not a hydrologist, but when I looked at some of the hydrology, I was looking at some stuff at the Rm of Orkney, and I just could not believe it. the severity of those wet years. So that's the context.

13: Considering those wet years? I I I need you to decide.

D: Okay, pause. Sorry. Sorry. I'm going to say, every time we talk the individual say number 13, or if they don't, I'll say number 13. So number 13, thank you. Sorry. I forgot to make that clear.

13: No, I had to bring them [?], to commute back and forth from Saskatoon to Humbolt, mainly to watch my son play hockey and I mean the water was over Number 5 highway, and at least in two locations, sometimes three. And I mean, during that time you could see the deterioration of the infrastructure. I mean they did the best to temporarily pack shoulders, but I mean it was, it was futile, and really it needed to, it needed to dry out before the connection with [repairing???] infrastructure?

D: Was it severe enough that you were still able to get through to it though?

13: We could still get through. But I don't. That's our we're past to to our late two, and then we're pulling a trailer through the water and worried that it might float.

D: Yeah, it's pretty scary when that happens. So severe flooding highway number five. Number 17?

17: Okay, just, just a little bit of hydrology. In, in my professional opinion, that period. It's the wettest period of the instrumental record, if you think is, which is over hundred years in Saskatchewan, and especially in the eastern parts of the province, and the extreme example is a Souris river basin, and but the other two aspects of it. First of all, this is largely driven by rain. and Saskatchewan has a long history of severe floods, due to spring snow melt, or rain during the spring snow melt. In the fact that this is driven by rain rather than [snowmelt]. Yeah, it's not [common, and] it's significant. And you know, we've heard a lot of talk about atmospheric rivers. and we, I, I wouldn't care to characterize this as a result of atmospheric rivers. But certainly there's some evidence along that line. And so I ,and then this, the other part of it, of course, is that much of this is overland flooding. And so people that don't have offstream storage – flooding [occurs]. So…

D: so number 17, I'm gonna ask you a detail, because it seemed to me, and I'm not a hydrologist either, but it wasn't just the rain and the Peak [flow] event. It was also the volume of water?

17: Yeah. Exactly. And we had, you know, and this is a prairie phenomenon, of course. So Saskatchewan gets some water from the mountains, and it really wasn't a major event on the North or South Saskatchewan rivers. It was simply a prairie event, and it extended into Manitoba, so the spatial scale was significant.

D: Comments on, on how that affected infrastructure?

17: Well, one of the one of the interesting things that when you start looking overland flooding is a lot of small communities [occurred] across roads, and for the most part those roads are all the same elevation. and it would be interesting to contemplate the small communities having one road into the community being higher. Just so you can enable emergency vehicle movement and all that sort of thing. So there's probably a something to think about from a small community level. [the point here is that if all roads are at an elevation where they are overtopped, damaged or destroyed by a flood event, then communities are isolated without access in/out, so No. 17 is stating an idea is to build at least one road in/out at a higher elevation]

D: So the risk being that if a road is washed out, access might be shut off entirely, you know, entirely for some communities.

D: I'm gonna pause for a second. Everyone on Zoom. Are you able to hear us? Okay.

P: yes. I do.

D: Excellent. If for some reason you can't please interrupt us to make sure that our mic. is projecting to you as well. Thank you. Number 17. Anything further down.

8: I can. I can go next.

D: number 8.

8: Yeah. we're funding at the city. A lot of the work on green infrastructure, water conservation, and climate adaptation or converging [??of projects??]. So, a lot of the work we're doing right now is it's focused on adapting our parks and green spaces and our natural infrastructure, to deal with, or to be more resilient to climate change. So I think, ??x?? is the person who oversees the flood control strategy with that yesterday's meeting and implementing flood control measures that, in fact, from areas of the city happens to occur in parks. So it's really it's it's a challenge to accommodate that sort of new infrastructure into our existing park infrastructure. So that's like that that's going to continue to be a challenge because we work on that, and then on the flip side of that which is the part I think is focused on, is the adaptation to extreme Drought. And maybe that's all I could say of that from the next.

D:That's question number [upcoming]. So don't lose sight of it.

8: I will. Yeah, I'll hold on to that. But it's definitely yeah, how are like natural infrastructure is. And if one of the key ways we're going to make our city more resilient in our community is to increase the resilience to climate change, so that that that green infrastructure is really important.

D: I I want to toss this [idea] out [for consideration]. I mean green infrastructure that's built or constructed [green infrastructure], built by humans. But the [natural] ecosystems are also affected by extreme flooding, and we've seen in the Souris River Valley. That Number 17 pointed out, as it went down into the United States. massive amounts of trees that were basically killed because they were waterlogged for long periods of time. Did any of that occur on natural infrastructure? Did the natural ecosystem get damaged by excess water during these wet periods in anyone's experience in this room.

8: I'm not aware of any of this city. I I will add that I'm I mapped a few years ago when I was working on green infrastructure strategy. I overlaid the flood prone areas with pre-development aerial air photos because we had air photos going back to 100 years, and they were all wetlands complexes. So there's a very, I think there's some pretty direct relation between which areas flood which is the city flood and which and the development pattern [this is an example of how urban development and human interventions have changed natural wetlands topography to with paved or built urban infrastructure, including houses/neighbourhoods/busineses, etc. in urban areas that

are likely prone to flooding with extreme precipitation events today, as there is less “buffer capacity” for the rains to be mitigated by what used to be a natural wetlands topography].

D: For clarification are, are you seeing that some of the flood prone areas today in the past, used to be wetlands.

8: Yes yes they were

D:That is an interesting correlation. So thank you. Yeah. I'm gonna shift over to Zoom world - the Zoom world. I'll throw some numbers out. But before I do that. Does anyone want to volunteer some thoughts. and you should be able to see what your number assigned is? So if you want to speak to say, just go ahead. We have a hand up from number 5.

5: Yeah. I just this is number 5. I just wanted to respond to to a comment from Number 17, which I find very interesting for me. Personally, I I did not, sorry my my timer so messed up here. I did not get into Saskatchewan till 2014, so I don't have a great deal of background and context in terms of the history. And the lived experience and whatnot. But when I hear comments about how small communities, for example, might potentially be impacted. That just raises the alarm bells for me, because from from where we see it at the SPSA we really don't have a control over infrastructure directly. But our concern really is how any of these factors affect all of the other, all of the other components that you that you are looking at in this project. And so when I when I speak, I'm going to be speaking more so in that sense about how potentially we could have these kind of impacts on infrastructure, that that that's no ??fall?? into other aspects. What we what we know for sure is that this ??price??? here, obviously, between rural communities, First Nations, for example, their capacity to respond. During disasters like this, maybe flood or a drought and that that is, that is a concern for for us from from our perspective.
And if you have this kind of communities where there's a single entrance, or whether they are not clearly defined roads or well paved roads. And then flooding issues come up and whatnot. And that's that's a big problem whether that fits fits squarely into the infrastructure area, I'm not sure. Maybe it ties with some of the other. Some of the other issues that you're looking at. **But for us that, that would be a major, a major concern - that disparity! I don't, I don't think, we, I don't think we in a position yet in Saskatchewan where we are able to bridge that disparity, and I really don't know what, what the outcome will be if we have a major issue.**

D: So for me to understand this number 5, you're saying there is a a need to bridge the disparity of risk? And the potential hydroclimatic risks that it affects the rural versus larger urban centers?

5: Yeah, absolutely. especially from an emergency response point, perspective. To begin with. a capacity to respond in some of these smaller communities is by itself hampered by lack of resources in this places people to begin with. And I when I say resources, I mean fundamentally people. And then you add the pile on off of a of the flawed [access road?], or any other kind of hazard triggering. Then you have multiple issues to deal with, and so How you coordinate all of that all of that kind of of a challenge. This is definitely going to be difficult, because for us, **at SPSA, that's what we would have to do moving resources from different places into some of these small towns and and you know, locations will be much more challenging. and that if, if we can bridge that disparity from the get go, then it makes it makes the work easier for us.** [this point relates to emergency response teams being able to get in/out of the flooded communities, particularly the rural, and First Nations communities which are more remote and harder to access]

D: Thank you. Number 5. That's an extremely important point, and I am going to put number 1 on the spot. Number 1 this is a segue, because I think you have something to offer about the impact on infrastructure in the rural context especially, but also in the community context. Number one, could you let us know what some of the impacts to infrastructure were, in your experience during especially those wet seasons?

1: yeah. So like, I'm based in Yorkton. And so we had a number of events happen. We had the 2010 event. That kind of specifically hit Yorkton. and we had a lot of like localized flooding in the city. And yeah, this, the city's taken a lot of lot of measures to try to improve the flood mitigation within the city. I think they still have a little ways to go, but they're still working on it. And even one of the things that like when I was younger growing up in Yorkton too, we never had rain events like we had in those couple of years, like to get a quarter inch, or, you know, ten ml [millimeters] of rain in one event in the nineties was probably a bigger event. Now, it's not that uncommon to get you know, two or three inches or more [50mm to 75mm or more] in a very short period of time. So that's kind of one of the things that I've ~~no such~~ [seen] changed. One of the other things in, you know, with traveling around, I guess the provinces. You see how the changes in landscapes have a huge impact on the impacts of flooding, where you have closed basins and that water can't go anywhere. It just builds up and up. You start seeing long-term impacts on roads. You basically have to wait for the water to evaporate before you can do anything with it. So that's that, that's going to change across the province. Some areas, you know, you can conduct, you know, construct rain ditches, that sort of thing that will help move the water away, hopefully in a controlled fashion, sometimes not so much. But those, those are some of the the big things that I see. But again, like when you talk about large events and roads washing out. Sometimes those are, or even roads are overtopping and and being temporarily flooded. If it's a if it's a short time scale, it's much less of an issue. So if it's only flooded for, say, six hours or a couple of days, versus being underwater for some roads up - they had to build permanent ?go (drove?) around essentially, that were there for for years. because these areas were flooded. So, I also remember driving past the house. This is actually on how we (????) and it was built in a very large low area and driving past it. I think it was about 2014, or 15, or something like that. all you could see was the roof, and there was water completely, like it was completely flooded out. So, that house that you and say will likely never be built there again, so that would be have to be a permanent, permanent change there.

D: So so number one in terms of naming the types of infrastructure. You said the city of Yorkton was impacted. Was it houses, roads, water plants, pavement, what examples of specific infrastructure?

1: So like the roads were, you know, if you have a truck ??, they're still possible [to drive over flooded roads]. I don't know if the the road infrastructure themselves were damaged a whole lot. What we saw more for impacts was to the businesses being flooded, homes being flooded and and generally it would be flooded, for, you know, an hour, and then and then the water would go away. So there's this. There was kind of like an outlet capacity issue with the city being able to move the water away. So those are kind of the the main things like, you know when you look at railways in the city. I think they were all pretty much high and dry the whole time, but our water treatment plant and our waste water treatment plant. I think we're okay. they're built on fairly high ground. But the city did actually replace a a section of highway that had a couple of outlet culverts. So it's kind of the one of the main outlets for the city for stormwater, and they replaced with a bridge to

improve the capacity. and then, actually, shortly after they get down, I think the next year the next road downstream with a call, when it washed out. They had to do an emergency repair on that.

D: And with your experience working with WSA, do you have a sense of the infrastructure damage in the rural context on farms or wells, [water supply] dugouts, buildings, farm buildings, that type of thing.

1: yeah. So, I I started with WSA in 2016. So it was kind of near the tail end of a lot of this. But there's a lot of [information in] WSA Emergency Flood Damage Reduction [Program – i.e., the EFDRP] files in the office here where? Yeah, there's protection berms built to protect yard sites to protect well sites…. You know, people's lanes were flooded, a lot of, lot of damage to like natural infrastructure like obviously flooding of yard sites, and tree kill, flooding crop land, that sort of thing, you know. Farm yards likely lost like harvested product and grain bags were also likely lost... some of those generalizing [losses]. I don't have a lot of direct experience with with some of that stuff. But those are some of the things that I've heard.

D: Thank you. and that's the same way to number 3 with WSA, because I'm assuming number 3, you might have something to add.

3: yeah, no, certainly. So the EFDRP program was was initiated out of the 2011 spring flooding. And at that time there were thousands of applications. So those were from residents. Pardon me, residents, businesses, communities across the province. That was definitely by far the biggest flood year for the EFDRP and since then it really has kind of been on a down slope. Really, those were all across the province, but mainly focus, you know, mainly, or by and large, or the heat map kind of point toward Central East Central, Saskatchewan and and South East Saskatchewan. So that program focusing on really helping protect residents, residences, buildings from from flood damage, 1 or you mentioned a number 1 mentioned, or or you mentioned as well. about the well aspects. So EFDRP also focused how to focus on protecting: water quality and well, so protection of of protection and testing of wells was a priority as well. You know some of the areas that we saw a lot of flooding. Now, ~~we're [~~Quill Lakes is] a closed Basin. So you know, Little Manitou Lake, or Quill Lakes - places like that really did see a lot of impact. And and there were especially a Little Manitou to a lot of berms were built for the protection of the community. Those berms still exist today, and have become a part of that community now. So what started out as a temporary infrastructure measure turned into essentially a permanent work. So you know, because of even the nature of that, there was, there are still some ongoing challenges. They [the emergency constructed berms or dykes] were not designed to be permanent structures at the time, but here we are 12 years later, and they're still there. So you know, there's issues with the way those berms were designed initially and issues with maintenance of those berms. And then all the if if you were, have ever seen or been to Little Manitou Lake, for example, you can see even just sort of see the unsightliness of them. I mean, they're they're pretty massive infrastructure. That's you know, basically blocking the shoreline right across that whole community, you know. Since then, too, and and sorry, 17. I I can't remember your number 17 kind of mentioned as well. The idea of the summer storms. You know, in 2011 you talked about Souris [River] Basin and the biggest event, especially in the community of Weyburn, actually came after the spring run off. That was the summer storm that happened in July or in June. Pardon me. So yeah, we're seeing even kind of at these bigger scales, some pretty big impacts from summer storms impacting communities. And at the community level with the, can you like ?waiver? And, for example, they have diking systems. in place. Those dykes needed to be up, you know, in an emergency level, upgraded built up plugged

in some locations where there are holes in the dyke, sort of, I designed to to accommodate roads and sidewalks and other things. But it it did have kind of the impact to force an emergency response at the those locations as well. And then, since then, too, we've seen a lot of other summer, you know, spring runoff events, but a lot of summer storms like go on picking in 2020, for example. sort of the excess water storm events that kind of happened in Northwest Saskatchewan and in the Beaver [river] system or the Churchill River system. Those are pretty impactful and and caused an EFDRP response at like Meeting Lake, for example. But it caused a lot of other impact to highways and to first nations communities in in the Beaver River system [near Meadow Lake]. So yeah.

D: thank you. That's an excellent summary and snapshot of a diverse amount of impact. I just want to ask one question about the clarification, many of the the emergency responses. were done under emergency management. And I think if you stated this - correct me if I'm wrong, the comment was, the emergency response is sometimes still used many years later. But now there's a recognition that the emergency response is not necessarily a permanently-engineered response which raises questions about how to deal and operate and maintain that [emergency response infrastructure like temporary dykes and berms constructed during the emergency].

3: Yeah, correct. And that's something we're kind of discussing a little bit internally right now. It's a lot of these dykes, you know, in the Manitou Lake dykes, you know, dykes built, or levies built around farmyards. Even right as they were, they were done as an emergency response. So
you know, in some instances there was an engineer on site, you know, Little Manitou Lake, for example, boulder, I believe, was actually out there (boulder rocks are used to reinforce the dyke slope to stop erosion of the dyke from water and wind scouring the dyke slope]. But in other cases it was, you know - just get as much dirt or material on the ground as possible as quick as possible. And you know what the implications to those are - they're potentially not designed to engineering standards. And and they suffer maintenance issues. They're unsightly. They're eroding their slopes. You know there are a lot of things

D: you know. There are a lot of things. Thank you. Number 29 had your hand up. We'll come to you. P- coordinator.

P: yes, might be a time to move into the other question.

D: 29 and 19 will go 19, and then 29, quickly, and then we'll switch to second the second question, 19, No. 20. I'm sorry my [Zoom screen] eyes are bad. Sorry 20 go ahead.

20: No, sorry. I thought we were just taking turns. So I was waiting. I you know everyone's comments are super interesting, and I think clearly. when it comes to the farming side of things, we know that no two years is ever the same. And we see that very vividly. We also know that you can't sustain crop production without drainage in most areas of Saskatchewan and just referring back to number 1's comment, we have a diverse geography across this province. So it's always different. Some areas need irrigation, in fact, and a lot. But even irrigation requires drainage in some capacity just to clarify when I speak drainage. I'm I'm talking responsible drainage always. When I look at agriculture, the effects of you know, excess water flooding in extreme events on agriculture. I think from my perspective, I actually got involved in this because of the high, the excess water years. So 2015, I became an executive director, for the exact reason that we need to do more education around what the agriculture community does to manage water. So in my experience, a lot of landowners work together very efficiently to manage the water coming off

their landscapes. And often these, these farms are the reason why these smaller communities exist in the first place, it's the reason why the schools and the hospitals exist. And they don't want to negatively affect their communities. So. looking at many different ways to protect that rural infrastructure through, you know their drainage designs, working together on gated control structures in field dams . All that sort of thing. And when we see those excess moisture events happen in crop, we also see those same farmers holding back, you know, temporary whole ?docs? [water flooding cropland] on their land losing a lot of crop in crop because of that. So we see. you know, we see complete crop loss, we see yield loss due to stress and disease from that that sitting water. We look at equipment effects. You know, we're looking at more repairs. And we're looking at downtime for managing fields and even roads. What else? There's some areas throughout the province that actually, in these wet, in these wet cycles have required PDAP [Provincial Disaster Assistance Program] assistance. And there's other areas where these drainage networks are working very efficiently to control the water and save those communities. And as a result, they're not applying for that PDAP assistance. [the point being made here is that with responsible drainage, and effective management of that drainage, he is maintaining that there is less flood risk impacts in the region he is referring to, and therefore did not need to apply to PDAP assistance funding because there were less issues with roads, culvers washing out]

I know from my local community perspective in 2014, our [sewage] lift station went down. And so you have community members pulling together to help each other deal with homes flooding. We talked about loss of upland habitat. And there's areas across this province that you know you. It's kind of like the tree, the tree graveyards. You drive past these kind of more closed basin areas now, and you see all these dead trees because of these high watermark years. Just going back to some of this water management infrastructure. It's not just having those in place, but it's also requiring that maintenance. And with every year not being the same, you know, every year is an evaluation time to look at what sort of maintenance needs to be done, and what sort of money actually needs to be spent on improvements in those areas?

D: Thank you very much. That's excellent. Number 20. And just for clarification. PDAP is provincial disaster assistance program. Im gonna- we have another hand up some. I do want to go to 29 and 15, but 15. First.

15: yeah, sorry. I just want to add on to number 20 points, and they are very good points. a lot of times. The reason agricultural drainage gets some flack, I always find is, is that no, a lot of the infrastructure off the farm doesn't exist. Usually, I mean lot of these incidents are, are fairly new as a result of some of the more extreme events. And so farmers are just trying to get
get their, the water off their field in a responsible manner most of the times. Sometimes it's it's an education thing or training thing. But I mean I do a lot of work with the Manitoba and and Minnesota, and I mean they've been training for significant amount of time here, and a lot of times the drainage [farm drainage systems] actually helps lessen some of that hydrological spikes because you are are draining that saturated [conditions on] some of the saturated Ag lands. Then can you be used as a sponge, or absorb some of that excess water? And temperate down the stream? [i.e, reduce flow off of the land] Again, there should be a bit more education and training on on ideas such as controlled drainage or conservation drainage practices. But I am, I mean Saskatchewan's fairly relatively new to drainage compared to some of the other areas of Canada. And that's, I mean, as you can see by WSA [which] kKind of had to come up with a provincial change [a new agricultural drainage] strategy update not that long ago. And not that long after that some of the significant amounts of wet years we had, and just as a personal note from like I where

I grew up in the Outlook area, and we are seeing significant amounts of drainage installs going in, probably right after that wet period, I mean, people saw the benefit in the economics around drainage. The benefit that Outlook had is it had the existing irrigation infrastructure to be used as the drainage conveyance systems [this refers to old irrigation canals replaced by water pipelines, could be changed into drainage canals to address excess water management during extreme wet years]. So, a lot of the old flood irrigation that was going in would have downstream drains to remove the water off the field again, and so we, they were utilizing the irrigation infrastructure to actually manage your, to manage the drainage.

D: thank you number 15. we are going to shift into the next question 17 has one more point quick. And the next question, we're gonna talk about drainage. And I'm gonna start with 29. So you're on the spot, if you can. 29. I'm sorry to delay this, but

17: Just to follow on from Number twenty's point. People like me who deal with urban flooding tend to, I can at least make a case that the overall economic impacts of urban flooding are neutral or are very, very modest, and some people have damages, but other people benefit by the rebuilding, and the economic activity goes [up] with rebuilding. But when you look at rain-driven overland flooding, that usually leads to crop losses, and those losses are gone forever. So I think when we look at the flood damages, it doesn't hurt to try to make that distinction, that the agricultural crop losses due to overland flooding, are true losses where you could make an argument in the urban context that there some people lose and some people win. But the overall economy is pretty well unchanged by urban flooding.

D: Thank you. Number 17. So this next question, and you can segue from your previous comment that you might want to make number 29**. [Question 2] The next question is shifting to the dry periods. Are there any risks that impacts the infrastructure caused by drought or water scarcity?**

29: I'll maybe I I appreciate all of the last 5 speakers because I was gonna give specific examples for almost every one of the concepts that they had touched on. But for us I'll maybe touch on a little bit of a risk is that in the wet years, **we we're actually working on a lot of projects now. So we're we're 10 years on. And we're working on projects now that were initiated 10 years ago because they're saying in the dry periods, that's the time to do the work. So you're prepared for the wet periods. And we tend to be amazingly short-sighted in that regard, I think.** And so that's one of the things. For example, we're talking to the **Lake Roy Watershed Association Board No. 9. It's down by Lampman, SK.** [*Note: Saskatchewan has about 19 Watershed Association Boards, 17 are active, all are established under legislation, these WABs are established to own, operate and manage water infrastructure to address water flooding issues, lake level controls, some irrigation, etc. but most address regional, rural, and community flood protection. Lake Roy WAB No. 9 was formed as an emergency response to 2011 flooding. It include 6 rural municipalities and 2 communities and tries to manage 30 km2 of flooded land. The immediate flood response was conducted as an emergency response, by constructing temporary ditches, emergency berms, and water infrastructure to drain the affected area. In subsequent years, when regional conditions were drier, the berms were re-constructed, and the infrastructure was engineered to current standards for drainage ditches, pumping works and water control infrastructure. However, due to a number of planning and operational issues, not all infrastructure works were completed to fully mitigate flooding from similar extensive runoff events*]. And it gets flooded. And so they're saying, Well. it's dry. We'd like to maybe figure this

out. What if it happens again? But then here's the problem with that is, then the next thing is risk. And what are you willing to pay for the amount of risk you are willing to communicate. And that's and that is often the challenge. Are you willing to pay forty million dollars for a small town to mitigate a one and a hundred year [1:100 yr hydrologic] risk. And so that's something that we're trying to to wrestle with. And it you have to resolve that at a local level. So but I'll flip that around and say the same with your irrigation, too, is, in those really dry periods. What are what are we willing to spend in order to mitigate that risk? And my neighbour? 2 years ago he combined [harvesting a crop with combine equipment] a whole section of Canola in 3 hr, and he, the truck, didn't move. I didn't even think that he unloaded his auger once, because the essentially he got nothing. and so I was talking to him. Well, he said, you know what this happens once every 10 years. It's pretty rare. It seems like it might happen again this year. So that's maybe bad timing. But he's willing to take that risk and actually not invest the money because he he realizes that in those really ~~direct like~~ that the dry years will happen, and for him the irrigation wasn't worthwhile in his particular situation. I think there's some demographics that might play into that [this may be related to a common assumption that farmers who are older will not develop irrigation because the rate of return on investment may take many years to see a positive rate of return, i.e., a farmer invests in irrigation if there is economic benefits and if an older farmer is "exiting or selling" the farm, the economic risk may not be worth costly, risky investments in irrigation], and economics, too, on on his personal part. But for me, I'm actually kind of the of the thinking that we planted an orchard, and in those really dry years, and if we didn't have irrigation, we would have just poured $35,000 worth of berry bush money down the drain. And so for us, that's where, having that infrastructure in place, we set it up in the dry years. But I'm not going to get rid of it in the wet years, just because it's wet. **So preparing for both cycles and having a long term view, I think that's something that we need to be working toward.**

D: Thank you 29. Number 11, I'm putting you on the spot. You care to comment on the first and second question?

11: Well, I live in close to the driest part of the province. Southwestern Saskatchewan. So infrastructure-wise, what I'm hearing from the Southwest is more [water] storage is needed in terms of water reservoir capacity, not letting all that water go into Manitoba in terms of the allocation requirement [this refers to the idea that Saskatchewan is sending more than the 50% of its allocated share of water that Saskatchewan could use for Saskatchewan's water needs in the South & North Saskatchewan River System, in a formula established by the Prairie Provinces Water Board]. The other thing is communities that are facing surface water, surface water for their water [supplies]. Not, not potable [water] necessarily. there's a community in the South that actually needs to drill [water wells]. Well now, because there's they have three [water] dugouts [earthen dugouts or ponds are small surface water reservoirs used on farms and in small communities] that service that small community, and they can't service it. They're [too] dry. [Farm and community dugouts are usually designed to store a 2-yr volume of water supply needs; they rely on storing snowmelt runoff; in dry periods, these ponds may not be replenished if there is insufficient snowmelt runoff] So we've got some of that [water storage] infrastructure that needs to be developed, and it's not as easy as you think in terms of getting a permit to get a [water] well done. For a community that is not an easy task. So ourselves, from a personal standpoint, this will be our fifth year of drought. We've had an inch of rain ~~and a lot~~ since April one. This is dry year number five. We're looking to put in dam development now. Some of our land goes where coulees go through it, and we're looking to look at the three meter down and some some irrigation. So I guess we're willing to take the risk now, because this is the fifth year, and we're pretty sick of it. So then, we've got some of that

infrastructure we're going to have to put in ourselves at our own dime, or, you know, quite a bit of our own money, because we're going to have to do some of it. We'll get probably some funding for it. And then the other thing I think that is, it is maybe something to consider, is that communities don't have drought preparedness plans. I and I just, I don't want to back up to question Number one, but in my notes, I think rural municipalities really struggle in strategies in terms of correct culvert replacement where roads should go. We have the highest road density in our province, and we do not, I think there is a struggle with that, because sometimes culverts are put on because the councillor wanted a culvert there, not because it was the best place to put the culvert. So I think that goes back into in 2010. There was a project that was done called land infrastructure resiliency assessment [AAFC's LIRA project] for the town of Radisson, and where that they they lider'd that town [referring to LiDAR - Light Detection and Ranging, a remote sensing method survey used to better understand 3-Dimensional topography and surface conditions]. And then they developed a plan, and if you had a one in one hundred or one in fifty [1:100 yr or 1:150 yr event] , or whatever that looked like, they would be able to know where to cut the road [for more accurate overflow drainage management with better culvert placement], you know, or cut the highway, or what they had to do to make sure people's infrastructure was protected. So I'm not saying "Go back and reinvent the wheel", but I'm saying there might be some information there that would help.

D: So number 11, I'm hearing you say that during dry years there's pressure on the need for water storage infrastructure at a community level as well as on, on, on-farm or rural level, and similarly, or in wet periods, some of the [water management] infrastructure [like culverts] that exists might not be in the best locations. And with better data like the LiDAR data, you could be more strategic in in managing water runoff from land. Yes, in in terms of infrastructure placement. Yeah. thank you.
11: Okay. Number 29 is shaking his head. So maybe there's something right in those

D: Drought and water scarcity. This is, I'm just gonna leave it open. we're getting a good dynamic [conversation] here. I think number 8 has some comments.

8: So what happens to yeah, so it's yeah. Extreme heat and drought events are another risk that we're looking at, to help the city adapt. We expect this, this risk to occur at least once a year with major consequences. And oh, a lot of it has, a lot of it impacts our natural infrastructure, so availability of water to plants increases in mortality rate, makes them more susceptible to disease, and pests and invasive species. So [conditions that are too dry] can have an impact on our natural infrastructure as well as the community. Access to water and cooling ability is a pretty big risk for our community, and we're looking at what happened in BC in 2021, with the heat dome. And I believe 600 deaths are attributed to that heat event. So we're looking at how we can, oh, the other, the other thing, extreme heat, or in extreme heat. Our water and the electrical systems get strained. So managing the demand during these extreme events every year is something we're trying to address by water conservation. We've got targets established to reduce water use. So there's an overall reduction in water use by 2026, and then by 2050, we have a thirty percent indoor and twenty percent outdoor, a target to reduce water demand. We are making progress on our overall and our indoor demand. The outdoor demand has gone crazy in the other direction. Our water our summer time. Water use is up. It's increased a lot. So a lot of the work right now is on that outdoor summertime demand. So we can manage our water system and plan for, you know, plan for capital investment in that system, and more strategy in a methodical way, rather than dealing with emergency situations. What else can I, and then addressing, addressing extreme heat, is what natural infrastructure is the best way to do that. Like planting trees, improving parks, and natural

areas, retaining our natural areas as much as possible [as natural areas] can really help with air quality, and that transpiration will be pure air – [evapotranspiration] thing, shade things like that. So giving people places to cool off and cooling off our city itself, because cities tend to be heat islands. And I will also point out we track water, rain, rain events in the city, and we can have, and it's very common to have an extreme flooding event next to a neighbourhood when [the adjoining neighbourhood is] in extreme drought, so both events can be occurring at the same time, something

D:so so just a clarification. The concern you mentioned about the 600 deaths. That's the [recent past, 2021] heat dome in British Columbia. Yeah. So you're trying to be aware from the city's perspective about risk to people as well.

8: Yes,

D: and from a green infrastructure, a national infrastructure perspective. Have you seen impacts to, I guess, permanent impacts to the infrastructure or stresses, mostly?

8: no, we've we've had some pretty major mortality events for some species in our city that, like our ash trees are decimated.

D: interesting. Yeah. So strategies are needed even in green infrastructure for the design and tolerance

8: providing water when it's needed and optimizing how we irrigate is specific. We're we're looking at a whole revamp of our irrigation in the city, like across all the parks. so three to four hundred sites. Kind of as a network.

D: thank you. Number one has his hand up.

1: Yeah, I just wanted to add, like, So living in Yorkton, where I can't remember the exact stats, but like we're one of the largest cities in Canada, I think, that is solely reliant on ground water. So there is a concern, I think in long term we're lucky. We haven't had very long-term drought around here, but you know the long-term water availability for Yorkton is likely a concern. There was a large, essentially a large surface water drainage water management project built around the south, that was called Yorkton South, and one of the drivers for that, it was built in the late seventies, early eighties, was actually to help support groundwater recharge for the City of Yorkton. And so that was some forethought, I think, was put into that for supporting the City of Yorkton's ground water resources. I also, in my previous life, I guess I worked for the City of Weyburn and the City of Weyburn gets their water from Nickle Lake, which in the dry times that lake is relatively shallow. It's a constructed dam [and reservoir], and the water quality in that lake can get pretty poor in in dry conditions. So there was a plan back, I think, probably also in the seventies or eighties, or something like that. The last really dry, extended dry period, to put a water intake all the way down into the Rafferty reservoir [near Estevan] - just to have more available, higher quality water for the city. [Weyburn's Albert Douglas Dam was an water supply expansion project built by Prairie Farm Rehabilitation Administration to enlarge Nickle Lake, and was completed in 1984]

D: Thank you. number 20

20: So just a couple of points to make, because often in my area, in particular, we're dealing with excess water versus, you know, the drought situation. Full respect and admiration for those dealing with the drought on a more regular basis. **From our perspective, farming perspective water drives agriculture. So whether you know, and you can't, you can't control what you get. I often refer to it as the 4 Rs of water management. So basically getting the right form of moisture, the right amount at the right time in the right place, which would be excellent if we could do that as producers. But we can't**. So, in terms of drought and water shortages. there's different, and this is going back to an education component that Number 15 mentioned earlier.

There's such things as spring back-flood irrigation that producers use to retain some of that water on their landscapes [in spring snowmelt runoff]. Looking at some of these drainage networks, actually consolidating some water for irrigation purposes and projects or livestock watering systems. And in some areas 2021 self around ?Redvers? [a town west of Carlyle, northeast of Estevan, in the Souris River basin] There the only water available for livestock, was actually because of an approved drainage project consolidating some water for that area. So that's pretty pretty neat stuff. And then the next level is actually, there's not a ton of tile drainage in Saskatchewan, but there is some network tiling. There is some grid tiling, and there is differences between those two. But looking at some subsequent surface irrigation, potential. For
in the States they call it controlled drainage. So they're basically using control great control gates to keep water in those tile drainage lines to to feed that crop all season. So super interesting stuff on the conservation drainage. aspect as well. [the participant is referring to using overland drainage systems as a dual-purpose flood irrigation, if properly designed and incorporated for use during dry periods; and, to sub-surface agricultural drainage systems to manage high water tables to enable crop production – sub-surface drainage systems help farmers address issues with water-logged land and in theory, could also serve as a dual purpose to "hold water in the sub-soil" during dry periods, if there is potential to do so by "preventing drainage and/or recharging the sub-soil with water by closing the sub-surface drains from discharging water – these are innovations that depend on good designs, but cannot overcome extensive dry periods where there may not be any water available – when dry conditions are long, intense, there may not be any source of water to store]

D: Thank you. Number 20, I think. Do we have another hand up? No, I think we're going to shift gears to go to the next question, which is**, [Question 3] What happens to dramatic shifts from drought where you have too little water, to too much water, or vice versa?** We've heard that can be geographically spaced, but it can also be spaced in time. We can go through a season that's very dry. or you go to, through geography that's very dry, beside another season that becomes very wet or a year that's very wet. And when you see these shifting from dry to wet, or wet to dry. anything further to add to the discussion today?.. and number 10. I know you've been quiet, but I do want you to contribute some of your experience. If you've got at some point if you're willing to state, for the Carrot River watershed. But I'm asking right now to focus on the dry to wet, wet to dry shifts. Number 5.

5: So one of one of the things that we've heard especially for those that that are heavy in terms of infrastructure, but infrastructure particularly would be ground-shifting events. As a result of these, you know, wet to dry to wet, as a case may be over over a period of time. And particularly when we look at sectors, we are concerned, say for the energies that you know, largely oil and gas power production infrastructure on teams and things like that [buried energy systems like oil, gas lines are "at risk" of shrinking/swelling soils and as a result, breakages can occur if there are serios

shrinkage/swelling shifts in the ground]. And most of all, as we look at the future with renewables, and those set of infrastructure as well [foundations for windmills, solar panels, etc. could be impaired by shrinkage-swelling ground, if not properly designed]. So those would be things that we that we would be, we would be concerned about. And as we think about planning, I know someone talked about community plans and emergency plans and things like that. As we think about planning, we also want to start thinking about how to build some of these issues in, because they are they can be quite significant in terms of the impact.[i.e., these problems need to be proactively engineered for changing foundation conditions wet-dry-wet, etc.]

D: Thank you. So we hear from you number 5 that there is a a suite of proactive funding needed to be ready for this kind of variable, dry and wet periods from the energy sector, oil and gas, power production, renewables community planning and even the risks that might relate to ground expansion and shrinkage.

5: Yes, for those sectors particularly. Yeah.

D: Thank you. I should mention we, some of this might correlate to the economics team at some point, too. So these are really good points for [the BWAG project], and we will be sharing these transcripts with the other themes in our project as well. Everyone's quiet. But I'm going to drill through these other questions. Thank you. Number 13,

13: number 13 comments. I appreciate all of No. 20's, comments, because what SaskFSA says and what the SCDA says are pretty much the same. But this wet to dry cycle - right now it's dry. And we're trying to set up more Conservation and Development Areas which govern water management. And right now there doesn't seem to be as much of an impetus at the local level to create something that's not really needed until it gets wet again. So it it's interesting how how it shifts when there's a need. All of a sudden there's an impetus. And now that there's not a need.
we made a plan for but It's a little hard to push that in that. That's that's all I'll say. But I mean we still have. There's no doubt about it

[NOTE: CAAs or C&D Areas are formal boards, governed by 1949 Saskatchewan legislation revamped in 2018. CAAs are provincially-supported local government legal arrangements, where CAAs are formed with a mandate under "*An Act to assist Conservation and Development of the Agricultural Resources of Saskatchewan*." *The Conservation and Development Regulations, 1965* provided additional guidance for the administration of the Act, that is established to "protect and preserve agriculture." CAAs, SCDA largely work to preserve economically viable agricultural production in land areas that are susceptible to water logging or flooding by incorporating drainage projects as a kind of water management adaptation to address flooding issues.]

D: so knitting this in with Number 20 and Number 5 comments. What I hear you saying is that there's a need to be aware of those shifts in the extremes, even when you're not experiencing the actual experience, you need to be proactive, proactive.

D: Thank you. number 17,

17: **I would go so far as to repeat the statement someone else made that the time to plan for flooding is during a drought, and the time to plan for droughts is during a flood. Making**

emergency decisions on the fly is fraught with problems. And we do need to be better prepared on both fronts.

D: That is a wonderful clarity of thinking. Thank you for that statement number 20

20: Number 17 took the words out of my mouth. again, just all in planning. **So when we're having this shift, extreme shift from wet to dry, I mean 2021 to 2022 is a perfect example of that. In many areas of the province, what we call temporary wetlands disappeared without drainage, let alone being managed through drainage. And I think you know most of the producers looking at setting up successful drainage networks don't want to just plan for the one in 5 event [1:5 events are the standard designs followed by CAAs/C&Ds in their drainage projects] , they're looking at planning for one in twenty five or one and fifty [1:25 or 1:50] the amount of work that goes into that, to begin with, they want to make sure that they're prepared for some of this extreme variability**. And just tying back into this temporary water. We do have some, you know, some…[there is a] lot of conversation around wetlands in Saskatchewan disappearing, and I think temporary water within these agriculture zones or these field landscapes. We're a prairie pothole region. They're never completely gonna disappear. So in this shifting from wet to dry, they are gonna provide some of that recharge within a field. But we also need to manage that temporary water. So it's not creating that permanent crop loss that we talked about earlier. So [this issue of wetland loss it tied to "illegal drainage" and/or over drainage, and is in debate in Saskatchewan, where there is much land being drained without the project being licensed; this is a challenge and a work in progress where WSA is striving to ensure all drainage projects are licensed; SCDA, CAAs, C&Ds and watershed stewardhip groups are all working towards helping achieve "licensed drainage" and "responsible drainage" but the backlog of unlicensed drainage is huge, and at times seems to be more than daunting – refer to WSA's Agricultural Water Management Strategy, and Saskatchewan's Auditor, that describes some of these issues in the references placed on BWAG's Zotero site]

D: thank you. Number 20 number 15.

15: Yeah, some great points there, and kind of bring it back to the farmer.analogy, like, usually like a year from 2021 to 2022 a lot of the farmers were actually, that was their best year, because they could access some of those lower lying areas that they hadn't before, and that was some of the best land, and they had that water reservoir [during a dry period, previous "wet land" could be farmed]. Of course, after another year or two everything goes the opposite way, and it gets rough [as the dry period extends in time, the soil dries out, and cropping is not sustainable]. So the really successful farmers. They'll always tend to think that long term. And usually we see more the investments tied to crop prices. Right? So I mean, as the farmer makes more money, he knows he needs to, he's not, they're not judging based on what's happening that year. The year before they're they're seeding. Well, we're not going to go through that cycle again. So I have some extra cash flow right now. So I'm going to reinvest in myself versus that. [this refers to the desire of farmers to more effectively manage water when too much (drainage) or too little (dry) so drainage/water storage investments are considered to reduce economic farm risks]

D: thank you. 15 number 1. Hold tight. I want to go to number 3 first. I know your hand's down, but you had it up a little while back. So I didn't want to lose your point. Number 3.

3: Oh, yeah, no worries.yeah. I guess I I I was gonna kind of add on to what number 20 and number 17 said. It's about planning and planning for flooding and drier years and drought and in wet years. But with some of the program that we do so ?WSA's EFDRP?. we're developing flood maps, would be on that, through implementation. We're trying to have conversations with communities around flood preparedness and mitigation [projects] that they can take on. And and sometimes that's you know, in the dry years, right now, while we're having conversations with these communities. Sometimes it is a bit of a challenge trying to, you know, get the point across, or trying to, you know, help them understand that. You know these flood mitigation measures, for example, are important to be considering right now when they haven't, you know. It's only been 10 years, but they might have already, especially with the elected being out of an election. That's a couple of election cycles away. they're not always seeing the importance of it, you know. Right now, they're more concerned, maybe, about the dry conditions which is valuable. But you know, when we're talking about the vulnerabilities that we're seeing within their communities and how to address those. that's definitely not not coming across this top of mind all the time. [likely referring to "build water management infrastructure now" even though it may not be needed until the future – people understand immediate problems, and forget about them when time passes…]

D: So number 3, I know we had a reaction in this room to the couple of election cycle statement. Can you explain how that affects priorities of planning?

3: yeah, I guess. you know, certainly I was working in, and so for me, working in in the public service, and being funded by the public service, our programming being funded that way, we, you know, are kind of "What do you say?" where, you know, the priorities that we're given are kind of the priorities of the day. In a lot of cases. So what is top of mind for those in the elected positions? Potentially – Now. So these long-term cycles where you know for several, you know, maybe several election cycles away from the last worst event, you know. Say, the 2010-2011-23 flooding - those aren't, as is always, as big [an amount of] priorities. I think right now, we're actually doing a pretty good job, at least at WSA by keeping flood mapping and some of this flood mitigation alive. It's been a while since this has been broadly, you know, there's been broad problems across the province. Obviously, every year we have a little bit here and there. Swift Current, for example, this year. But no, it's a program that's still been going on now for for twelve years.

D: Thank you very much. Number 1, and then we'll go to number 20. Number one.

1: Yeah, actually, kind of just quickly to add to number 3 first, and then I've got another comment. But like, **so when you're looking at elected officials right? Like it's almost like that corporate memory gets lost when you go through an election cycle, and people forget, especially once. You're, if you're managing a city or something like that, and you lose the elected officials that you had during that event, they, the new elected [officials] don't understand exactly what was happening in the management of that [past] event.** So so I would just kind of add that for for the elections like those part. The other thing I would add to for "when you have a dramatic shift, especially from the dry to the wet" is that's when you see your lack of maintenance really show up. So when you start seeing, you know, if you have, we have WSA, a channel [clearing] ~~quick~~ program, and the best time to do channel [repairs is] in the dry, not in the wet. And so, keeping up with that maintenance ahead of ahead of those events, and staying on top of that, is pretty critical when you start having those dramatic shifts, and that, like a dramatic shift, could be even from one month to the next right, like you could go from extreme drought to a flood within a couple of weeks. One event almost around here lately.

D: That's an excellent point referring to the operations and maintenance is so driven by the conditions. Number 10, and then number 20, if you can just sit tight. Number 20, number 10. First.

10: yeah, just to add the point of you know how elections and that screw things up. I mean, we had a major flood in 2016. So we had some assistance, and whatnot, declared an emergency. And one of the things that they planned on doing was to replace a bunch of culverts throughout town along the highway to help drain the highway, and then it never got done.
Ran into another election, and in the in the fall and the next summer, we I mean, we still have the culverts sitting in our yard.

D: So you're giving us a concrete example of how you actually purchased materials as a response to that planning. But now were not able to finish the task. Well, that's interesting, anything further to add? Give me, just to clarify number 10, I know it's going back. But that was with the flood damage emergency that occurred, you said, in 2016. So the Town of Carrot River was severely affected [by flooding]?

10: yeah, we declared a state of emergency along with our town south of us the town of Arborfield. I think we got like nine inches of rain in a few hours.

D: And did both towns participate in the provincial disaster assistance program [PDAP]?

10: Yes.

D: Thank you. I should mention that our project will go down to more detailed interviews and subsequent to this initial exploratory interview, we may follow up by asking if someone's willing to participate in more detailed interviews. So the project team can gather more data.T hank you. Number 10, anything to add?

10: No, not at this time.

D: thank you. Number 20. Then.

20: I'd just like to kind of build on the last few comments. I guess that **people are an important resource, and that knowledge that goes with them. So there's all different levels. I mean, that are a very important part of a project working efficiently and being sustainable.** I guess. So, looking at you know you're, I'm, looking from the producer level, but also looking to the community level, and we haven't mentioned **rural municipalities yet which are a really important piece of our rural infrastructure. And in my experience, we have some RMs [Rural Municipalities are RMs established as local governments with legislated authorities] that are very proactive and very productive, and willing to dig in and get involved and and spend that money in the maintenance piece and the improvement piece and they have. They have a knowledge base**. So I think that those are the, you know, the highly functional ones versus some RMs that are a little less so.

D: Thank you. Number 20. These are very important comments, and I should mention the study. We'll get into governance at some point so. But that comes a little later in the study. So we're

focusing primarily on infrastructure right now in this meeting. But that will certainly come up at a greater degree of focus later on the [BWAG] studies. These are good points number 5, and then we'll move to the next question.

5: So I just wanted to respond to one of the comments about the response to 2016 events. I don't remember what town it was, but also, maybe this ties in more with the governance side. But I just had to quickly respond. And I mentioned that also **the way the modern election cycle, the way some of our funding programs are structured, might also have some implication to the way they are delivered. So some of the rules, ground rules governing some of this programs, may not necessarily be controlled locally or even provincially. So that takes you very far off from the action, or where things are happening and so that that it creates a little bit of a disconnect. So you're having this disconnect as a result of the election cycle. But you're also having some kind of disconnect as a result of the structure of this funding itself. But these are some of the issues that that that we would, we would find, when we get out working with communities, and talking with people about planning and whatnot. And I think it's interesting that they are coming out this way in in real concrete examples.**

D: thank you. Number 5. And that's actually in a really good segue. I'm gonna keep moving. We've got. We're gonna try to wrap up on these last few questions quickly**. [Question 4] The next few questions are kind of dealing with non-climatic risks. And I'm gonna throw some random stuff out and ask you to start to think about this. And the questions related to how do non-climatic or other, what might be seemingly feel unrelated, but yet factors that might affect you as it relates to infrastructure, and especially water infrastructure. And that could be from finance to maintenance to COVID-19, the economic supply chain, or the issues with Russia's war on Ukraine. Are there other non-climatic impacts, or, for that matter, other climatic impacts that might be, not water related, they might be, say wildfires, or whatever. Just this is a brainstorming question that might be affecting infrastructure in general, and your ability to manage water in in your context. P, do you want to rephrase that at all? What people are thinking.**
P: no, it's fine well, maybe something else. And it is a issue of compounding risk. I mean, what happens when we have it at the same time. Do you have in your memory and your experience, do you have any example of this a compounding risk, and they have potential impacts on the infrastructure?

D: Thank you, P I'm gonna leave the floor open here.

13: I know for sure on the road to [?rural?] development is to have landowners get together, to have conversations. Covid, God, right in the middle of that, and I mean Zoom/Teams helped, but it certainly slowed us down in our ability to meet and get land owners together and have conversations.

D: Very good point and obviously, very probably significant in the rural context, especially because people are so used to meeting face to face.

D: Yes. Number 11,

11: I think economics for small communities to afford water upgrades. like we are dealing with a quite a few communities that have, like, say, a community of forty five or three fifty, and they

can't. They need to upgrade their water facility, and they can't because they can't afford it. Affordability and affordability and program funding

D: number 17.

17: I guess another way of looking at might be the effective climate effects or the interaction of climate effects with the industrial accidents. One kind or another a repeat of this famous Regina cyclone that derails a bunch of oil tankers in the middle of Regina. It would be a considerable issue to deal with.

17: Yes, what was the expression? They have a challenge or space shuttle was brought down by chunk of foam? **You're thinking, thinking beyond the norm, I think, in disaster planning. And this is what we have to be well aware of thinking the unthinkable.**

D:Thank you. Any other comments. We have a couple of hands. So number 3,

3: yeah, I'll I I guess a second to number 11 said there, both the funding availability and small communities. I would definitely see that a lot. And and sometimes there are barriers as well to provincial or federal particularly, I would say Federal funding with the infrastructure. Certainly. there are some programs available. sometimes. you know, the minimum buy-in from a community is pretty substantial. They're really not targeting small communities. the timelines imposed are, are kind of based off of budget cycles, so that really makes it makes it challenging as well for particularly the smaller communities that maybe don't have all the internal resources in their community like Regina or Saskatoon would. So yeah, that's definitely a a challenge.

D: Thank you. Number 20.

20: Well, I have a bit of a list. **I would say like, for factors that would affect infrastructure would be cooperate, cooperation or lack of willingness to cooperate. there's definitely an education piece on that. As to the infrastructure needs in a community looking at some proper policy to support different forms of infrastructure and regulation around that. Looking at finances, access to funding which has been mentioned. Looking at people so knowledge and governance innovation. Looking at communication networks. Often there's silos that exist across this province, lots of great people and lots of great resources. And we're not tying those together effectively enough. And just simply having access to information. So time back again to Transparency of information.**

D: Excellent points. Thank you. Number 1.

1: I just wanted to add a little bit of about kind of like cost recovery funding. you know that kind of stimulus funding as a result of a major event. Or you know, you start seeing seeing some of that tied to infrastructure, spending lot on roads, and Saskatchewan got paved over the last couple of years to try to increase some of the economic drivers in the province. you know other other worldly events, I guess I can say with changes in like even something like, you know, fertilizer production, in the Ukraine, may cause more impacts to our road infrastructure here, because we have to start hauling more fertilizer or shipping more fertilizer. Just some of those really. Really I don't know if they're strong connections, but And then also, I guess to with climatic risks, you know, when we depending what new source you're looking at. They talk about, you know, thousand year old

viruses are stored in the kernel for us as we start seeing melting. We're going to start to see more pandemics. whether that's you have to be seen. But that could also be a potential impact going forward on the economy and, and general funding for infrastructure.

D: Excellent points. It's in broad thinking, too. Okay, we're going to keep running on through any of our comments here.

8: Infrastructure [needs] to be more resilient. There's the funding challenges, of course, we're chasing a lot of grant funding. And with that, the staff capacity to do that that planning work available space is a challenge. To fit new infrastructure into this existing the built-up areas, and with that conflicting uses, so finding ways to add new functions to existing space and existing infrastructure is, it can be really challenging with that, and often tied to the funding. Our timelines that are often really quick. And would you wait, really challenging to achieve? And on the, I can relate to the pandemic, engagement we rely on a lot of community organizations, our community serving organizations to do our engagement, and especially during Covid. They just they were serving their communities and could not, could not afford the time to engage with us, so that just having to wait it out, or, you know. be ready to engage when they were in those challenges, especially with our timelines that we're we're trying to meet. So that's definitely a challenge

D: thank you. And what I find interesting is we're hearing some similarities, even in a city context. With these impacts to the rural context in terms of how non-climatic events are affecting [rural and urban communities].Yes, number 13

13: I'm gonna bring some of my educational experience into this because you mentioned you mentioned the war in Ukraine. We're teaching in our schools now about Holodomor. Holodomor was basically Russia starving the Ukrainians, taking their crops. And that's going to the impact of the war on Ukraine. Our province. Our country is going to be dependent upon to produce grain. because how much grain can you produce when there's a war going on. I mean, that's that's a significant issue.

D: So there's impact on infrastructure and our economy and our practices here in Saskatchewan. Thank you. Number 13. Okay, we're gonna shift into the next last 2 questions we've got with 10 min left, and it's a bit of a rifling brainstorm. [**Question 5] This next question is phrased as, Are there issues, or have there been issues in the past with water supply, water distribution, water management infrastructure? And again, we're looking at this in a broad context. But for P I'll ask you to maybe help phrase this, I'll start it up by saying, and we've kind of touched on it. This last question about government programming. Governments oftentimes will develop policies and programs to help deal with problems. But sometimes those programs are either shortsighted or maybe at times even misdirected. They, they may actually exacerbate a problem. P do you want to comment on this? We're trying to ask in this question on a variety of items that might be touching on, in particular water infrastructure. But how this is getting a little bit of the governance question - can you clarify or phrase it?**

P: I would try my best. Well, we are trying to understand risk situations. And one of the most interesting comments from the IPCC about risk situation is that climate change is not the only source of risk, but it is also government. The absence of certain type of government programs, or the capacity to organize some programs or the responses that they might have

on the impact of climate on communities. I'd be totally wrong. So to a large extent then the IPCC is asking to ~~conceal, (????), and~~ [better understand] as a potential sources of risk that obviously ?deny? compound, the impact of climate event risks. So this is why we are interacted in this in this each. What kind of- What is your evaluation of all programs, programming policies that might resolve some of the problems related to the impact of climate on infrastructure or the opposite. You know some examples of program that in may exacerbate, the problem

D: thank you D, that's helpful. I'm going to leave this open for 5 to 10 min, and then we'll go into the last question. Yes, 17

17: I I've got a rather our keen example. But many of you may or may not know that one of environment, Canada or environment climate change, Canada's responsibilities is to produce so-called IDF [Intensity Duration Frequency] curves for use in planning structures and facilities across the country. This is this is high intensity, duration, frequency curves related to rainfall and they're way behind on this, and we all know we've had very significant rain falls over the last decade or two, so I think Saskatoon is still using 20 year old IDF curves for planning infrastructure.

8:They've been looking at their the idea of curves. And yeah, we're not ~~connect~~ [?current?]. They're right

17:, I can guarantee you they're not right. But at any rate, this is just a it's a minor example. But you know we have a responsibility that lies with an agency to produce data to help people. We live a more sustainable life. And yet they are way behind on producing the data to do it.

8: Data. Yeah, we need lots and lots of data.

D: So what I'm hearing is that there's been these IDF curves that are out of date to the point where, you know, we're operating in a in a less informed way.

17: Well, if you're one in the one in twenty-five rainfall is now probably one in ten. Right? Yeah.

D:And out of curiosity. Do you know why this is falling off the priority list of activities?

17: If you're trying to describe the need for this, to a Federal politician. How would you describe it? No, no one's sensitive to it. I guess. It's a and the people that are doing it don't have the resources to do it quickly.

8:Yeah, it's a hard concept to it. It's it's basically the likely the likeliness of a of a major event occurring so, and the intensity of each of those events being greater and greater, so

[This whole discussion relates to the past Environment Canada programs that previously updated hydro-climatic data. E.g., 1:25 year events have evolved over time and with more instrumental records. There is a theory of non-stationarity in hydrology, and now the 1:25 year event might be a 1:10 year event, but we don't have the data summarized across the country to understand this due to Federal government cut-backs of resources dating back many, many years. Bottom line is that with historical instrumental records, climate and hydrology is changing, and with climate change drivers, we can model scenarios, but the uncertainties in data are affecting our current

infrastructure designs – if a culvert/bridge or building, etc. is designed to cope with a specific probability of an event, we may not be meeting the current hydro-climatic stressors.]

D: so don't. Instead of this, because when we get to queue the last question. **Question six. There might be something you want to offer about that. Other comments or reactions to this? And I'll rephrase the question, What positive and or less than positive roles does government risk or play in these hydroclimatic risks?** Number 5,

5: I think there's a real opportunity for governments to work together. I know this is definitely not a new concept, the whole idea of working in silos and whatnot. and from from a government that's just touch on point of view. we have. **We have the goal of working as one team and stuff. But clearly, there's room. There's room for us to keep working at that and and improving how we how we actually do that one team arrangement.** I see it in this. In this conversation. We have folks from WSA, and I listen to the comments, and I can't help but see, you know, connections between what we want to achieve at SPSA and and what they are saying they are doing at WSA. And I think. there's there's real opportunities there to bring some of these ideas together. Bring some of these to work together. whether we are doing that enough, I'm not able to say, but I think there's a real opportunity for us to to improve in that area.

D: Thank you. Number 5, number 20,

20: Relating to government and source of risk. I think what I've seen over the last 2 years is working with. **We work with government and regulators on water management policy, and I've seen a positive shift there. I've seen a positive shift to more communication, more trust relationships, I guess, and it's all kind of centered towards a "Made in Saskatchewan approach". And just speaking to outdated information. I think we have a real opportunity here to come together in a way and really try to work together and develop this "Made in Saskatchewan approach". So it it really benefits all the different industries within our province and the people.**

D: Thank you. And I'm going to use that as segue for the last question here**. [Question 7] The last question is, it's a general one. What are the thoughts or contributions you would like to offer as input about how water infrastructure and hydroclimatic risks can be reduced or improved? in terms of coping with this especially if we look into the future into twenty thirty, forty, fifty years, where we may be experiencing even greater intensity and variability than what we've had in these last years? If this is a brainstorming question, What is your ideal future? What's your vision for the future to reduce risk?** P rephrase please in English?

P: No, I think the question is very clear. We just want to listen to your dreams or nightmares.

D: Thank you. number13.

13: If we could have. if we could have problems wide LidAR [calling for more LiDAR surveys across Saskatchewan] - that would help us with planning for and managing during wet years. It just makes it a lot easier than having to go out and survey having LiDAR. I realize it picks up a lot of hard drive space. But when you have it I mean you can do modelling readily without having to go up to the field, and I mean it would helpful for any for our organizations. And I'm sure for RMs and other organizations, too.

D: So number 13, reference to LiDAR, which is light, most of the phrase light detection and ranging radar. Yeah, like the text and ranging it's a form of technology that more accurately defines elevation and topography when you know that you can better manage water because you know where it's going to go in the landscape. Thank you.

D: Number 17.

17: Just to add to that point to, if you compare the cost of producing LiDAR for Saskatchewan, or even say the agricultural part of the Saskatchewan of what was great demand for it in forestry as well. and compare that cost the cost of the emergency flood damage reduction program over the last decade. Yeah. yeah, it's not surprising that the the moderate cost is less. So [a proactive LiDAR survey and proactive planning may reduce emergency response programs]

D: thank you. Number 8, do you have some?

8: Okay? Just so I'm finding the more like we have silos of the city, just like everywhere else, and **the more we integrate our work and try to coordinate and collaborate, the outcomes are better. And we achieve. We address more risks that way. I mean. achieve, yeah, more benefits. have greater impact. So that's that's been something I'm trying to work on the modest, to bring a lot of different groups together, to, to achieve, to do projects that are, you know, multidisciplinary and multi- and I guess, address multiple objectives and risks.**
and I will, I'll kind of echo in on it, and LIDAR is good. I think there's data gaps everywhere on all sorts of things and just **having data that's easily accessible. from, you have a federal , government or other levels of government or other sources would be so useful we could again make better decisions. But with more data.** So

D: **So what I find fascinating about your contribution. You're talking with hard data like the natural side stuff like LiDAR. But you also emphasize the multi-disciplinary multi- objective problem solving by bringing groups of people together from different perspectives**.
Yeah, have you had some experiences with that?

8: **Well, the work we are doing right now with regard to heat, or extreme heat tie into things like health impacts. And then actual environmental impacts and our hard infrastructure impacts? And if we are looking at all of those and addressing all of those things together, that I think you'll be better. And we we have data, on some special things like economic or human health, and and the impact of of extreme heat and drought. So we can. We really look to place to where it's half. And and they've had to generate like, like the BC example [heat dome], where there's tangible examples of of that. But it would be nice to have it more prairie specific too so We don't have to kind of interpolate something from Ontario or BC, right? So thank you**.

D: Good comments. Yeah. okay, we're running out of time, everyone, so: speak now or forever hold your peace. This is an opportunity to present some ideas on what you see in the future that could strengthen capacity. By the way, the project won't end at this meeting. You'll still be able to contribute. But I'm just talking for this day's meeting. Number 20.

20: Something that we often talk about, you know, just reiterated through all my comments and all of the different questions. But **looking at more education.** can't remember the number. **But talking about this information, sharing, reducing these silos, working together, but looking at water infrastructure from the agriculture perspective. If we're looking at working towards drainage approvals in Saskatchewan, which we definitely are through kind of a made in Saskatchewan approach to support our, I mean, we're pretty, we're responsible for forty-four percent of Canadian farmland in this province. I call it the agricultural zones or the working landscapes or the fields. However, you want to see it. But when we're looking at this water infrastructure, it's kind of comparable to our road system in a way. We have all these lakes and rivers across our province, which are our point of adequate outlet in many cases for our drainage networks. And I think you know LiDAR mapping is good for some of this stuff, but in more importantly, we need to know where flow capacities of some of these channels and point of adequate outlets and proactively identify them. So people when they're looking at drainage approvals, they actually know where they can start planning and working towards**

D: We're after 3 PM where energy is waining a bit. Any last comments. P Any last statements?

P: No. Well, other than Thanks to everyone of you for participating in this focus group. It was a real pleasure to listen. You're attendance, coming, you're understanding. You provided us with a very rich information. And I am really looking forward to doing the data analysis. Now remember, before that we are going to transcribe the A, this focus group. And at that moment, then we will send you the transcription for your comments. So in behalf of my colleagues D and B, thank you. Thank you very much. Take care, have a wonderful weekend.

D: Thank you, You might be hearing from us. We will invite you to be willing and interested if you are to join us as a partner. There's no real demand on that on the time. Thank You.

* No transcripts were shared as it would jeopardise the ethical obligations of the project and their names were removed. However, their association names and positions are mentioned for deconstruction (if need be) to draw connections in the future.