

Subject: Climate Change Master Plan – Climate Vulnerability and Risk Assessment

File Number: ACS2022-PIE-EDP-0019

Report to Standing Committee on Environmental Protection, Water and Waste Management on 21 June 2022

and Council 6 July 2022

Submitted on June 9, 2022 by Don Herweyer, Director, Economic Development and Long Range Planning, Planning, Real Estate and Economic Development Department

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Ward: Citywide

Objet : Plan directeur sur les changements climatiques – Évaluation de la vulnérabilité et des risques climatiques

Dossier : ACS2022-PIE-EDP-0019

Rapport au Comité permanent de la protection de l'environnement, de l'eau et de la gestion des déchets

le 21 juin 2022

et au Conseil le 6 juillet 2022

Soumis le 9 juin 2022 par Don Herweyer, Directeur, Développement économique et Planification à long terme, Direction générale de la planification, de l'immobilier et du développement économique

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Quartier : À l'échelle de la ville

REPORT RECOMMENDATIONS

That the Standing Committee on Environmental Protection, Water and Waste Management recommend that Council:

- 1. Receive the Climate Vulnerability and Risk Assessment (CVRA) attached as Documents 1 and 2 and summarized in this report.**
- 2. Direct staff to bring forward the Climate Resiliency Strategy by Q4 2023.**
- 3. Direct staff to consider resourcing needs to develop the Climate Resiliency Strategy as part of the 2023 budget process, including resources to support public and stakeholder engagement.**
- 4. Direct staff leading new or updates to City plans, strategies, policies and programs to take the CVRA findings into consideration.**
- 5. Direct staff to consider resourcing needs to further assess or mitigate known climate risks as part of the 2023 budget process to accelerate early action while the Climate Resiliency Strategy is being developed.**
- 6. Direct staff to consider climate resiliency in the 2023 – 2026 Strategic Plan / Term of Council Priorities.**

RECOMMANDATIONS DU RAPPORT

Que le Comité permanent de la protection de l'environnement, de l'eau et de la gestion des déchets recommande au Conseil :

- 1. de prendre connaissance de l'Évaluation de la vulnérabilité et des risques climatiques (EVRC) ci-jointe (documents 1 et 2) et résumée dans le présent rapport;**
- 2. de demander au personnel de présenter la Stratégie de résilience climatique d'ici le quatrième trimestre de 2023;**
- 3. de demander au personnel d'évaluer les ressources nécessaires à l'élaboration de la Stratégie de résilience climatique dans le cadre du processus budgétaire 2023, notamment celles nécessaires à la consultation du public et des parties prenantes;**

4. **de demander au personnel de piloter l'élaboration ou la révision des plans, stratégies, politiques et programmes municipaux pour tenir compte des conclusions de l'EVRC;**
5. **de demander au personnel d'évaluer les ressources nécessaires pour mieux évaluer ou limiter les risques climatiques connus dans le cadre du processus budgétaire 2023 afin d'accélérer l'adoption de mesures en attendant l'élaboration de la Stratégie de résilience climatique;**
6. **de demander au personnel de prendre en considération la résilience climatique dans le Plan stratégique et les priorités pour le mandat du Conseil 2023-2026.**

EXECUTIVE SUMMARY

Summary

This report presents the findings from the Climate Vulnerability and Risk Assessment (CVRA). The CVRA assessed how vulnerable Ottawa is to changing climate conditions and prioritized the highest climate-related vulnerabilities and risks to the City and the community.

The CVRA will be used to inform the development of a Climate Resiliency Strategy and identify strategies to mitigate the greatest climate risks. Close to 150 potential climate impacts on the City and the community were assessed as part of the CVRA process including impacts on health and community well-being, infrastructure, the environment and economy. Through the process, about 40 priority risks were identified that require action within 1-3 years to protect the livability and prosperity of Ottawa.

The City is adopting a multi-pronged approach to building climate resiliency in Ottawa. This requires embedding climate preparedness in every City service and across the community more broadly. It also requires an iterative approach where action is taken in the short term to reduce known risks or further assess gaps while the overarching Climate Resiliency Strategy is being developed over the next 18 months.

It is important to note that building climate resiliency – or preparing for the impacts of climate change – goes hand in hand with continued, ambitious efforts to meet global emission reduction targets. [Energy Evolution](#) is the City's strategy to reach zero greenhouse gas emissions by 2050. Progress in meeting global emission reduction targets directly impact the extent of resiliency work required to address climate change impacts that are not already locked in by past emissions.

Climate Mitigation is how to avoid the unmanageable impacts of climate change

Climate Adaptation is how to manage the unavoidable impacts of climate change


Assumption and Analysis

Council directed staff to undertake a climate risk assessment and develop a Climate Resiliency Strategy when it declared a Climate Emergency in 2019 and approved the Climate Change Master Plan in 2020. In addition to meeting Council direction, preparing for the impacts of climate change helps the City meet legislative and policy requirements, including the Provincial Policy Statement, Ontario Public Health Standards and provincial regulations for Asset Management Planning for Municipal Infrastructure, and better positions the City to apply for external funding.

The impacts of climate change are being felt globally and locally and these impacts are expected to continue to intensify for decades to come. In Canada, catastrophic losses from weather-related events have come close to, or exceeded, \$1 billion in most years since 2009. In recent years, Ottawa has seen higher temperatures and more precipitation, as well as more extreme weather like flooding, tornadoes and heat waves. Climate model projections for the National Capital Region indicate that Ottawa will continue to become warmer, wetter and have more unpredictable extreme weather over the coming decades.

Table 1 summarizes the priority risks that require action within 1-3 years. The full set of climate impacts are described in Documents 1 and 2 and includes supporting information on projected changes in climate variables, vulnerabilities and consequences, current adaptive actions, information gaps and vulnerability and risk ratings.

Table 1. Summary of Priority Risks

Climate Hazard	Priority Risks
Extreme heat, drought and humidity	<ul style="list-style-type: none">• Increased heat-related illnesses• Less outdoor recreation and active transportation• Increased building cooling demands, inadequate air conditioning (especially in schools, low-income housing, community buildings, and long-term care facilities)
	<ul style="list-style-type: none">• Increased demand for shaded areas and indoor and outdoor recreation facilities to offset heat• Increased tree stress, reduced stream baseflow, degraded aquatic habitat, algae blooms• Reduced agricultural yields and increased irrigation

Climate Hazard

Priority Risks

Seasonal Variability and Change



- More invasive species, pests and diseases harming:
 - trees, parks and ecosystems
 - agricultural production and food supply
 - New or intensified disease vectors and illnesses (e.g. Lyme disease or West Nile Virus)
 - Increased winter freeze-thaw damage and reduced asset life of:
 - roads
 - buildings (e.g. foundation cracking and heaving, pipe bursts)
 - surface and shallow stormwater and wastewater infrastructure (e.g. catch basins, driveway culverts, maintenance holes, pump stations)
 - Increased winter roads, sidewalks and pathway maintenance and risks to users due to freeze-thaw cycles and freezing rain
 - Increase emergency work (e.g. unplanned culverts replacement, roads washouts)
 - More park and beach degradation from increased use
 - Decline of winter tourism and recreation
-

**Climate
Hazard****Priority Risks****Increased
volume and
intensity of
precipitation**

- Reduced access to roads, transit and pathways, as well as property and infrastructure due to riverine or inland flooding
 - Riverine flood damage and reduced access to Water Purification Plants
 - Damaged / overwhelmed stormwater, wastewater and flood protection infrastructure in floodplains (e.g. pump stations, culverts, sewers, berms)
 - Increased runoff from overwhelmed stormwater infrastructure causing reduced water quality, erosion, bank destabilization and localized and basement flooding
 - Building damage (inland or riverine flooding) and basement flooding/ sewer backup (overwhelmed wastewater systems)
 - Mental, physical & financial health - injuries, stress, mold, contaminated private wells and septic systems
 - Delayed planting/ harvesting and reduced pasture
-

Climate Hazard	Priority Risks
<p>Extreme weather</p> 	<ul style="list-style-type: none"> • Increased winter slips / falls and isolation • Increased winter maintenance of roads, sidewalks and pathways and risks to users due to freeze-thaw cycles and freezing rain • Reduced ability of City and community services to effectively respond to simultaneous or repeated extreme events • Reduced access to essential services during extreme weather (e.g. electricity, health, education, food banks, transit) • Increased pressures on people experiencing poverty or in precarious economic situations (physical, financial and mental health) • Ditch and culvert blockages from windborne debris causing localized flooding • Business disruptions
<p>Global Climate Change</p> 	<ul style="list-style-type: none"> • Supply chain instability and impacts to the availability and cost of food, energy and other goods and services • Additional pressures on disproportionately impacted populations • Additional pressures on social service providers • Overall inflation cost

While nearly all individuals within Ottawa will be impacted in one way or another, there are specific segments of the population who may be disproportionately affected by climate hazards. These include older adults, persons with disabilities, persons living in poverty, racialized people, Indigenous people, rural residents, immigrants, women and youth. Individuals or groups may experience more than one vulnerability to climate

change at one time, putting them further at risk. Consideration for social identities and inequalities relating to gender, race, socioeconomic class, cultural and ethnic background, age, and disability and how they intersect is critical when addressing climate vulnerabilities and risk. Vulnerable groups were identified in each of the climate hazard themes and Focus Areas. Further assessment to determine why, where and how some individuals and groups are at an increased risk to the impacts of climate change, as well as consideration for holistic actions to address these risks, will be further considered in the development of the Climate Resiliency Strategy.

This CVRA is a high-level assessment of vulnerabilities and risks across all sectors to prioritize where further action is required to build climate resiliency. The project identified additional information needed to further assess vulnerabilities and risks as well as initial opportunities to address these gaps, subject to sufficient resources, while the Climate Resiliency Strategy is being developed. These include, for example, ongoing and planned work to:

- Undertake more specific spatial and/or service analysis through the ongoing development of the Infrastructure, Transportation, Solid Waste, and Greenspace and Urban Forest Master Plans, or the Facility Management Framework.
- Conduct more detailed analyses of risks to assets and services through the continued development and refinement of Asset Management Plans, and integration of funding needs into Long Range Financial Plans.
- Further the Health Climate Vulnerability Assessment and Adaptation Plan and continue to collaborate with community partners to develop strategies to reduce exposure to health hazards and promote healthy built and natural environments.
- Further the Hazard Assessment, Mitigation and Prevention program to support emergency preparedness
- Develop a Poverty Reduction Strategy and Food Security Strategy.
- Launch the High-Performance Development Standard and update the municipal Green Buildings Policy for Construction of Corporate Buildings.
- Review and update operational guidelines and standards (such as the Winter Maintenance Quality standards, Sewer Design Guidelines and others as required).

Additional gaps will be explored through the Climate Resiliency Strategy or accelerated subject to available resources and funding, including:

- Implement long-term flood protection measures to protect Britannia and Lemieux Water Purification Plants.
- Continue to work with the Conservation Authorities to update flood hazard mapping, improve flood forecasting modelling and data for the Rideau River watershed, and assess existing flood control structures (berms, walls, pump stations etc.) along the Ottawa and Rideau Rivers to determine risks to nearby communities.
- Complete a Wildland Fire Risk Assessment and Plan and assess priority populations at risk of wildfires and wildfire smoke.
- More detailed analysis to identify specific communities or populations that may be disproportionately affected and identify actions to address these at-risk populations.
- Undertake community education on climate risks and engage in local-level adaptation planning. Continue to make information publicly available to enable residents, businesses, and organizations to make informed climate risk management decisions.
- Establish systems for monitoring changing climate risks including when “tipping points” are close to being reached.
- Undertake cost-benefit analysis to further inform the benefits of preventative actions. Continue to strengthen tracking and management of climate staffing and financial risks.
- Continue to engage with community and private sector organizations to further assess risks and identify solutions for non-City owned infrastructure and services.

Additional opportunities will be sought to consider the findings of the CVRA in all City service areas and to consider required resourcing when developing 2023 workplans and budgets, and the City Strategic Plan.

Public Consultation/Input

The project used well established climate vulnerability and risk assessment methodologies and drew on knowledge from City staff, subject matter experts and key community stakeholders, as well as public input. More than 120 staff from various City departments participated in 12 inter-departmental Task Teams to examine climate risks to all City service areas. Ottawa-based community subject matter experts and partners were invited to participate through online surveys and workshops. A dedicated Climate Resiliency page on Engage Ottawa provided information and surveys for residents, businesses and organizations.

The project also worked closely to align with more detailed climate risk assessments being led by other City departments including Ottawa Public Health, Infrastructure and Waster Services, and Emergency and Protective Services. Risks from climate change and extreme weather have been included in the Corporate Risk Management initiative.

Next steps

The completion of the CVRA is an important step in Ottawa's climate adaptation planning process as it assessed and prioritized the highest climate-related vulnerabilities and risks to the City and the community. The top risks will be the focus of the next phase of the project. The Climate Resiliency Strategy will identify a series of actions focused on minimizing Ottawa's vulnerability to the effects of climate change and strengthening our ability to respond to and recover from climatic events when they occur. While the Climate Resiliency Strategy is being developed, steps can continue to be taken to address known risks and gaps through ongoing City programs and plans, such as the development of Master Plans and Asset Management Plans. The development of the Climate Resiliency Strategy will commence in 2022 and is expected to be completed by the end of 2023, pending sufficient resources.

The Executive Summary of the Climate Vulnerability and Risk Assessment (CVRA) – Technical Report is attached as Document 3.

RÉSUMÉ

Ce rapport présente les conclusions de l'Évaluation de la vulnérabilité et des risques climatiques (EVRC), dont l'objectif était d'évaluer la vulnérabilité d'Ottawa aux changements climatiques et de cibler les facteurs de vulnérabilité et les risques climatiques les plus importants pour la Ville et la collectivité.

L'EVRC servira à élaborer la Stratégie de résilience climatique et à trouver des stratégies destinées à limiter les risques climatiques les plus importants. Ont été évalués près de 150 types de répercussions climatiques potentielles sur la Ville et la collectivité, comme les répercussions sur la santé et le bien-être de la population, les infrastructures, l'environnement et l'économie. L'évaluation a permis de recenser environ 40 risques prioritaires qui nécessitent des mesures d'ici un à trois ans pour protéger l'habitabilité et la prospérité d'Ottawa.

Pour renforcer la résilience climatique d'Ottawa, la Ville adopte une approche multidimensionnelle qui passe par une préparation aux changements climatiques dans chaque service municipal et dans la collectivité de manière générale. Elle applique également une méthode itérative reposant sur l'adoption de mesures à court terme pour réduire les risques connus ou mieux évaluer les lacunes en attendant l'élaboration de la Stratégie globale de résilience climatique dans les 18 prochains mois.

Il convient de souligner que nous ne pourrions renforcer la résilience climatique – ou nous préparer aux répercussions des changements climatiques – qu'en poursuivant les efforts ambitieux et soutenus mis en œuvre pour atteindre les objectifs globaux de réduction des émissions. La stratégie [Évolution énergétique](#) décrit ce que compte faire la Ville pour éliminer complètement les émissions de gaz à effet de serre d'ici 2050. Les avancées dans ce domaine ont une incidence directe sur l'ampleur du travail de résilience nécessaire pour lutter contre les répercussions des changements climatiques qui peuvent encore être évitées.

L'atténuation des changements climatiques s'entend des mesures prises pour éviter les conséquences ingérables des changements climatiques.

L'adaptation aux changements climatiques s'entend des mesures prises pour gérer les conséquences inévitables des changements climatiques.

Hypothèses et analyse

Après avoir déclaré l'état d'urgence climatique en avril 2019 et approuvé le Plan directeur sur les changements climatiques en 2020, le Conseil municipal a demandé au personnel de réaliser une évaluation des risques climatiques et d'élaborer une Stratégie de résilience climatique. En se préparant aux répercussions des changements climatiques, la Ville se conforme à la directive du Conseil, mais également aux obligations prévues par la Déclaration de principes provinciale, les Normes de santé publique de l'Ontario et le Règlement provincial sur la planification de la gestion des

biens pour l'infrastructure municipale. De plus, elle sera en meilleure position pour présenter des demandes de financement externe.

Les conséquences des changements climatiques se font sentir au niveau mondial et local et devraient s'intensifier dans les décennies à venir. Au Canada, depuis 2009, les pertes catastrophiques dues aux intempéries avoisinent ou dépassent chaque année le milliard de dollars. À Ottawa, on observe depuis quelques années une hausse des températures et des précipitations, ainsi que des épisodes météorologiques extrêmes comme des inondations, des tornades et des vagues de chaleur. Selon les projections des modèles climatiques pour la région de la capitale nationale, dans les prochaines décennies, le climat continuera de se réchauffer, le temps sera plus humide et les épisodes météorologiques extrêmes seront plus imprévisibles.

Le tableau 1 résume les risques prioritaires qui nécessitent des mesures d'ici un à trois ans. Les documents 1 et 2 décrivent l'ensemble des répercussions climatiques et présentent des renseignements complémentaires sur l'évolution prévue des variables climatiques, les vulnérabilités et les conséquences, les mesures adaptatives actuelles, les vulnérabilités et les lacunes en matière d'information et l'évaluation des risques.

Tableau 2. Résumé des risques prioritaires

Danger climatique	Risques prioritaires
<p>Chaleur, sécheresse et humidité extrêmes</p> 	<ul style="list-style-type: none">• Augmentation des maladies liées à la chaleur.• Diminution des activités récréatives de plein air et du transport actif.• Augmentation de la demande de climatisation des immeubles et climatisation insuffisante (surtout dans les écoles, les logements des ménages à faibles revenus, les bâtiments communautaires et les foyers de soins de longue durée).• Augmentation de la demande de zones d'ombre et d'installations récréatives en intérieur et en extérieur pour fuir la chaleur.• Augmentation du stress des arbres, réduction du débit de base des cours d'eau, dégradation de l'habitat aquatique et prolifération d'algues.• Réduction des rendements agricoles et augmentation de l'irrigation.

- Augmentation des espèces envahissantes, des parasites et des dégâts liés aux maladies :
 - arbres, parcs et écosystèmes;
 - production agricole et offre alimentaire.
- Apparition ou intensification de vecteurs de maladie et de maladies (ex. : maladie de Lyme ou virus du Nil occidental).
- Augmentation des dégâts causés par les épisodes de gel-dégel et réduction de la durée utile des infrastructures :
 - routes;
 - immeubles (fissuration et soulèvement des fondations, éclatement de la tuyauterie);
 - infrastructures des eaux pluviales et des eaux usées en surface et en sous-sol peu profond (ex. : puisards, ponceaux d'entrée de cour, regards d'égout et stations de pompage).
- Augmentation de l'entretien hivernal des routes, des trottoirs et des sentiers et des risques pour les utilisateurs en raison des cycles de gel-dégel et du verglas.
- Augmentation des travaux d'urgence (ex. : remplacement imprévu de ponceaux, ravinement de routes).
- Dégradation des parcs et des plages en raison de leur utilisation accrue.
- Baisse du tourisme et des loisirs en hiver.

**Variabilité et
changements
saisonniers**



**Augmentation du
volume et de
l'intensité des
précipitations**



- Réduction de l'accès aux routes, aux transports en commun et aux sentiers, ainsi qu'aux propriétés et aux infrastructures en raison des inondations riveraines ou continentales.
 - Dégâts causés par les inondations riveraines et réduction de l'accès aux usines de purification de l'eau.
 - Endommagement ou débordement des infrastructures d'eaux pluviales, d'eaux usées et de protection contre les inondations dans les plaines inondables (ex. : stations de pompage, ponceaux, égouts et talus).
 - Augmentation du ruissellement causé par le débordement des infrastructures de gestion des eaux pluviales causant une baisse de la qualité de l'eau, de l'érosion, une déstabilisation des berges et des inondations localisées et dans les sous-sols.
 - Endommagement des immeubles (inondations continentales ou riveraines), inondation des sous-sols et refoulement des égouts (débordement des réseaux de gestion des eaux usées).
 - Santé mentale, physique et financière : blessures, stress, moisissures et contamination des puits privés et des fosses septiques.
 - Retards dans la plantation et les récoltes, et réduction du pâturage.
-

Danger climatique

Risques prioritaires

- Augmentation de l'isolement et des risques de glissade et de chute en hiver.
- Augmentation de l'entretien hivernal des routes, des trottoirs et des sentiers et des risques pour les utilisateurs en raison des cycles de gel-dégel et du verglas.

Conditions météorologiques extrêmes



- Réduction de la capacité de la Ville et des services à la collectivité à intervenir efficacement lors d'épisodes extrêmes simultanés ou répétés.
- Réduction de l'accès aux services essentiels pendant les épisodes météorologiques extrêmes (ex. : électricité, santé, éducation, banques alimentaires et transports en commun).
- Augmentation des difficultés pour les personnes vivant dans la pauvreté ou en situation de précarité économique (santé physique, financière et mentale).
- Inondations localisées dues au blocage des fossés et des ponceaux par les débris soufflés par le vent.
- Interruption des activités des entreprises.

Dérèglement du climat mondial



- Instabilité des chaînes d'approvisionnement et répercussions sur l'offre et le coût des produits alimentaires, de l'énergie et des autres biens et services.
- Pressions supplémentaires sur les populations démesurément touchées.
- Pressions supplémentaires sur les fournisseurs de services.
- Coûts de l'inflation générale.

Si la quasi-totalité des résidents d'Ottawa sera touchée d'une manière ou d'une autre par les dangers climatiques, certains segments de la population pourraient être touchés de façon disproportionnée. C'est le cas entre autres des personnes âgées, en situation de handicap, vivant dans la pauvreté ou racisées, des Autochtones, des résidents des zones rurales, des immigrants, des femmes et des jeunes. Les personnes ou les groupes peuvent présenter plusieurs facteurs de vulnérabilité aux changements climatiques, ce qui les expose à davantage de risques. Pour agir sur les vulnérabilités et les risques climatiques, il est essentiel de tenir compte des identités sociales et des inégalités liées au genre, à la race, à la classe socioéconomique, à l'origine culturelle et ethnique, à l'âge et au handicap, et de leurs recouvrements. Des groupes vulnérables ont été recensés pour chaque danger climatique et secteur prioritaire. Dans le cadre de l'élaboration de la Stratégie de résilience climatique, des études plus approfondies seront menées pour déterminer pourquoi, dans quelle mesure et dans quels secteurs certaines personnes et certains groupes sont plus vulnérables aux répercussions des changements climatiques, et des mesures globales seront envisagées pour contrer ces risques.

L'EVRC consiste à examiner de façon approfondie les vulnérabilités et les risques dans chaque secteur de manière à cibler les domaines d'action prioritaires pour renforcer la résilience climatique. En attendant l'élaboration de la Stratégie de résilience climatique, le personnel a dressé une liste des renseignements complémentaires à recueillir pour mener cet examen et a recensé les premiers leviers d'action pour combler les lacunes, sous réserve de ressources suffisantes. Ces leviers incluent notamment les initiatives en cours et à venir suivantes :

- Réaliser plus d'analyses de services ou d'analyses spatiales ciblées dans le cadre de l'élaboration des plans directeurs de l'infrastructure, des transports, de la gestion des déchets solides et des espaces verts, du Plan de gestion de la forêt urbaine ou du Cadre de gestion des installations.
- Effectuer plus d'analyses détaillées des risques pour les actifs et les services dans le cadre de l'élaboration et de l'amélioration continues des plans de gestion des actifs et de la prise en compte des besoins financiers dans les plans financiers à long terme.
- Accélérer l'évaluation de la vulnérabilité et la mise en œuvre du plan d'adaptation de la santé face aux changements climatiques, et continuer de collaborer avec des partenaires communautaires pour élaborer des stratégies visant à limiter

l'exposition aux risques pour la santé et à promouvoir des milieux bâtis et naturels sains.

- Accélérer la mise en œuvre du Programme d'évaluation, d'atténuation et de prévention des dangers pour favoriser la préparation aux situations d'urgence.
- Élaborer une stratégie de réduction de la pauvreté et une stratégie de sécurité alimentaire.
- Instaurer la Norme pour l'aménagement d'immeubles à haut rendement énergétique et mettre à jour la Politique de la Ville sur les bâtiments écologiques régissant la construction des immeubles municipaux.
- Réviser et mettre à jour les lignes directrices et normes municipales (ex. : normes de qualité en matière d'entretien hivernal, Lignes directrices de la Ville d'Ottawa en matière de conception des réseaux d'égout).

D'autres lacunes seront examinées dans le cadre de la Stratégie de résilience climatique ou d'autres initiatives accélérées, sous réserve de ressources et de financement :

- Prendre des mesures à long terme pour protéger les usines de purification de l'eau de Britannia et de l'île Lemieux contre les inondations.
- Continuer de collaborer avec les offices de protection de la nature pour mettre à jour les cartes des zones inondables, améliorer les données et les modèles de prévision des crues pour le bassin hydrographique de la rivière Rideau et évaluer les structures de protection contre les inondations (talus, murs, stations de pompage, etc.) situées le long de la rivière des Outaouais et de la rivière Rideau pour déceler les risques pour les collectivités avoisinantes.
- Réaliser une évaluation des risques d'incendies de broussaille et instaurer un plan de gestion des risques, et identifier les populations les plus vulnérables aux feux incontrôlés et aux fumées dégagées.
- Effectuer plus d'analyses détaillées pour identifier les collectivités ou les populations susceptibles d'être démesurément touchées, et trouver des mesures pour protéger ces populations.
- Sensibiliser la population aux risques climatiques et planifier l'adaptation au niveau local. Continuer d'informer le public pour permettre aux résidents, aux

entreprises et aux organisations de prendre des décisions éclairées en matière de gestion des risques climatiques.

- Mettre sur pied des systèmes de surveillance des risques climatiques, notamment lorsque des points de bascule sont en passe d'être atteints.
- Réaliser des analyses coûts-avantages des mesures préventives. Continuer de renforcer la surveillance et la gestion des risques financiers et des risques liés à la dotation en personnel.
- Continuer de collaborer avec les organismes communautaires et le secteur privé pour mieux évaluer les risques et trouver des solutions pour les services et les infrastructures n'appartenant pas à la Ville.

Le personnel cherchera d'autres leviers d'action pour tenir compte des conclusions de l'EVRC dans tous les secteurs d'activité de la Ville et évaluer les ressources nécessaires lors de l'élaboration des plans de travail, des budgets et du Plan stratégique de la Ville 2023.

Consultation publique/commentaires

Dans le cadre du projet, des méthodes d'évaluation des risques et des vulnérabilités climatiques éprouvées ont été utilisées. Il a également été fait appel aux connaissances du personnel municipal, de spécialistes du domaine, des principales parties prenantes et du public. Plus de 120 employés de diverses directions générales de la Ville ont pris part aux 12 groupes de travail chargés d'évaluer les risques climatiques dans l'ensemble des secteurs d'activité de la Ville. Des spécialistes et des partenaires communautaires d'Ottawa ont été invités à participer à des sondages et à des ateliers en ligne. Une page sur la résilience climatique comprenant des renseignements et des sondages pour les résidents, les entreprises et les organismes a été créée sur le site Participons Ottawa.

Ont également été prises en considération les évaluations des risques climatiques plus détaillées réalisées par d'autres directions générales de la Ville, dont Santé publique Ottawa, la Direction générale des services d'infrastructure et d'eau et la Direction générale des services de protection et d'urgence. Les risques liés aux changements climatiques et aux événements météorologiques extrêmes ont aussi été pris en compte dans l'initiative municipale de gestion des risques.

Prochaines étapes

La réalisation de l'EVRC est une étape importante dans le processus de planification de l'adaptation climatique d'Ottawa, car elle évalue et cible les facteurs de vulnérabilité et les risques climatiques les plus importants pour la Ville et la collectivité. La prochaine phase du projet portera sur les risques prioritaires. La Stratégie de résilience climatique comportera une série de mesures destinées à limiter la vulnérabilité d'Ottawa aux changements climatiques et à renforcer les capacités d'intervention et de rétablissement de la Ville en cas d'événement climatique. En attendant que cette stratégie soit prête, la Ville pourra continuer de prendre des mesures pour gérer les risques connus et pallier les lacunes dans le cadre de ses programmes et plans municipaux, notamment par l'élaboration de plans directeurs et de plans de gestion des actifs. L'élaboration de la Stratégie de résilience climatique commencera en 2022 et devrait prendre fin d'ici la fin de 2023, sous réserve de ressources suffisantes.

Le rapport technique du résumé de l'Évaluation de la vulnérabilité et des risques climatiques (EVRC) est joint au présent rapport (document 3).

BACKGROUND

In April 2019, City Council approved a motion to declare a climate emergency ([ACS2019-CCS-ENV-0005](#)) which included the following directions to Council and staff related to climate resiliency:

1. Direct City staff to identify climate change mitigation and adaptation priorities for the next five years (2019-2024) as part of the update of the Air Quality and Climate Change Management Plan and to embed climate change considerations across all elements of City business.
2. Direct City staff to complete a vulnerability assessment and develop a climate resiliency strategy to reduce the impacts of a changing climate.
3. Recognize climate change as a strategic priority in the City's Strategic Plan and accompanying budget directions for the remaining Term of Council.

In December 2019, Council approved the [2019-2022 Strategic Plan](#) which included having climate change mitigation and resiliency plans in place as an outcome of the Environmental Stewardship priority.

In January 2020, Council approved the Climate Change Master Plan (CCMP) which included undertaking a climate vulnerability assessment and developing a climate

resiliency strategy as a priority action for 2020-2025 ([ACS2019-PIE-EDP-0053](#)). A status update on the Climate Change Master Plan, including the latest community and corporate greenhouse gas emissions inventories and updates on the Climate Change Master Plan eight priority actions, is brought forward to Council on an annual basis. The last update was in October 2021 ([ACS2021-PIE-EDP-0039](#)).

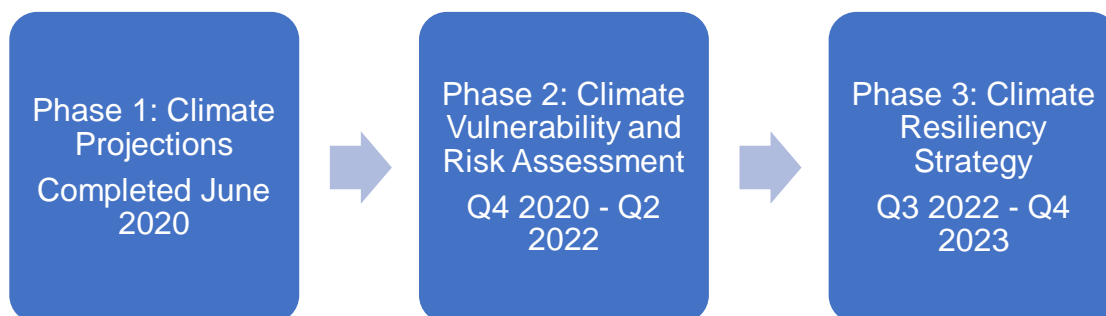
In June 2020, Council received the climate projections for the National Capital Region ([ACS2020-PIE-EDP-0014](#)) which provides a comprehensive analysis of future climate conditions in the National Capital Region to 2100. The report includes projected changes in temperature, rainfall, snow, wind and extreme events such as freezing rain, tornadoes and storms. The climate projections have informed the climate vulnerability and risk assessment as well as the development of the Official Plan, Master Plans, Asset Management Plans and other City plans.

In April 2022, the Ottawa Board of Health received an update on Ottawa Public Health's climate change health vulnerability assessment for extreme heat to improve community resilience ([ACS2021-OPH-HIS-0002-IPD](#)).

DISCUSSION

Overview

The purpose of this report is to share the findings of the Climate Vulnerability and Risk Assessment (CVRA) for Ottawa and outline the next steps in the development of the Climate Resiliency Strategy. The CVRA represents the completion of Phase 2 of a three phase project to develop a Climate Resiliency Strategy:



The aim of the Climate Resiliency Strategy is to assess how Ottawa is vulnerable to climate change and identify strategies to mitigate the greatest risks. The CVRA is a key step of the strategy to prioritize where action is most needed. It uses the best available climate science (developed in Phase 1) to identify potential climate impacts, examine existing adaptive measures and assess remaining risks.

The City is already preparing for climate change. There are currently many measures in place to reduce or respond to climate risks, such as designing infrastructure for greater rainfall, providing back-up power in case of power outages and coordinated emergency response. These existing adaptation measures have been considered when identifying and prioritizing climate risks.

Concrete steps are also being taken now to address known risks while the Climate Resiliency Strategy is being developed. These include protecting the drinking water purification plants from potential riverine floods, ensuring the ROPEC wastewater treatment plant can operate in extended power outages, and adding policies in the Official Plan to ensure Ottawa grows in ways that are liveable in all future climate conditions. The findings of the CVRA will continue to inform City policies, plans and programs as the Climate Resiliency Strategy is being developed.

It is important to note that building climate resiliency – or preparing for the impacts of climate change – goes hand in hand with continued, ambitious efforts to meet global emission reduction targets. [Energy Evolution](#) is the City’s strategy to reach zero greenhouse gas emissions in the corporation by 2040 and the community by 2050.

Climate Mitigation is how to avoid the unmanageable impacts of climate change

Climate Adaptation is how to manage the unavoidable impacts of climate change

Global, National and Local Context

a) Historical climate change

Worldwide, climate scientists agree that fast rising global temperatures have created a climate crisis. The World Health Organization warns that “climate change is the greatest threat of the 21st century”.¹ In 2018, the Intergovernmental Panel on Climate Change (IPCC) released [The Special Report on Global Warming of 1.5°C](#) providing the scientific evidence for the need to limit global warming to 1.5°C to avoid further severe climate change impacts.² In 2022, the IPCC released [Climate Change 2022: Impacts, Adaptation and Vulnerability](#) which assesses global risks and notes that the climate-related costs to cities, communities and supportive infrastructure systems will rise

¹ World Health Organization (WHO) (2016): [WHO Director-General Keynote address at the Human Rights Council panel discussion on climate change and the right to health](#)

² [IPCC \(2018\): Summary for Policymakers. Global Warming of 1.5°C.](#)

rapidly in the mid- and long-term if the current upward GHG emissions trajectory does not stop and reverse course.³

The impacts of climate change are already being felt globally and locally, and these impacts are expected to continue to intensify for decades to come. On a global scale, climate change has already resulted in a warmer atmosphere and oceans, reduced amounts of sea ice and higher sea levels.⁴ On a national scale, Environment and Climate Change Canada released [Canada's Changing Climate Report](#) in 2019 stating that, on average, Canada is warming at twice the rate of the rest of the world and projects that the effects of warming will intensify in the future.⁵ 2021 was noted as a record climate disaster year in Canada. Communities across the country faced devastating heat, extensive wildfires and flooding, drought, tornadoes, hailstorms and hurricanes.⁶ British Columbia was impacted by a record-setting heat dome in early summer of 2021 that resulted in a 440% increase in community deaths (~600 deaths in Vancouver alone) and more than 650 000 farm animal deaths.^{7,8} Several of these events are estimated to have costs billions in damage, with extensive impacts on the economy, including agricultural losses, supply chain disruptions, and the closure of Canada's largest port. In Canada, catastrophic losses from weather-related events have come close to, or exceeded, \$1 billion in most years and in aggregate, have exceeded \$20 billion since 2009.⁹ Natural Resources Canada estimates that the annual costs of climate change could reach \$30-\$62 billion per year by the 2050s and \$74 to \$319 billion by the 2080s in Canada.¹⁰

At the local scale, Ottawa has seen higher temperatures and more precipitation, as well as more variable, unpredictable and extreme weather like flooding, tornadoes and heat waves. Flooding along the Ottawa River in 2017 and 2019 caused extensive property damage and public health concerns, with the 2017 flood alone costing the City \$2.6

³ [IPCC \(2022\): Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change](#)

⁴ Ibid

⁵ Government of Canada (2019). [Canada's Changing Climate Report](#)

⁶ Government of Canada (2021). [Canada's top 10 weather stories of 2021](#)

⁷ Henderson, Sarah B., McLean, Kathleen E.; Lee, Michael J.; Kosatsky, Tom. Analysis of community deaths during the catastrophic 2021 heat dome, Environmental Epidemiology: February 2022 - Volume 6 - Issue 1 - p e189 doi: 10.1097/EE9.0000000000000189

⁸ Government of Canada (2021). [Canada's top 10 weather stories of 2021](#)

⁹ Government of Canada (2021): [Costs and Benefits of Climate Change Impacts and Adaptation](#)

¹⁰ Ibid

million in City resources (staff, supplies and equipment) and more than \$223 million in insured damages in the National Capital Region. The 2018 tornado caused extensive damage to property and trees (roughly 60 buildings were destroyed), extended electricity outages due to significant damage to Hydro Ottawa and Hydro One's assets and caused close to \$1 billion in insured losses in the National Capital Region. [A 2022 report on extreme heat](#) lists Ottawa as one of the top ten municipalities in Canada at risk for future extreme heat. Warming winter temperatures and increasing risks of freezing rain recall the January 1998 ice storm that caused massive damage to trees and electrical infrastructure causing widespread electricity outages and a shutdown of activities across the region for several weeks.

b) Future Climate Projections in Ottawa

Climate model projections for the National Capital Region indicate that Ottawa will continue to become warmer, wetter and have more unpredictable extreme weather (Figure 1). Over the coming decades, average seasonal temperatures will increase, and periods of extreme heat will become more common. Precipitation is projected to increase in all seasons except summer, and the volume and intensity of rainfall events will increase. Annually, less snowfall and a shorter snow season are projected resulting in longer springs and falls. The changes in weather parameters are also expected to create more favorable conditions for extreme events like freezing rain, tornadoes and wildfires. All of these changes are expected to have significant impacts on Ottawa's health and safety¹¹, infrastructure, the economy and the environment.

¹¹ Ontario Ministry of Health and Ministry of Long-Term Care. (2016). [The Ontario Climate Change and Health Toolkit](#).

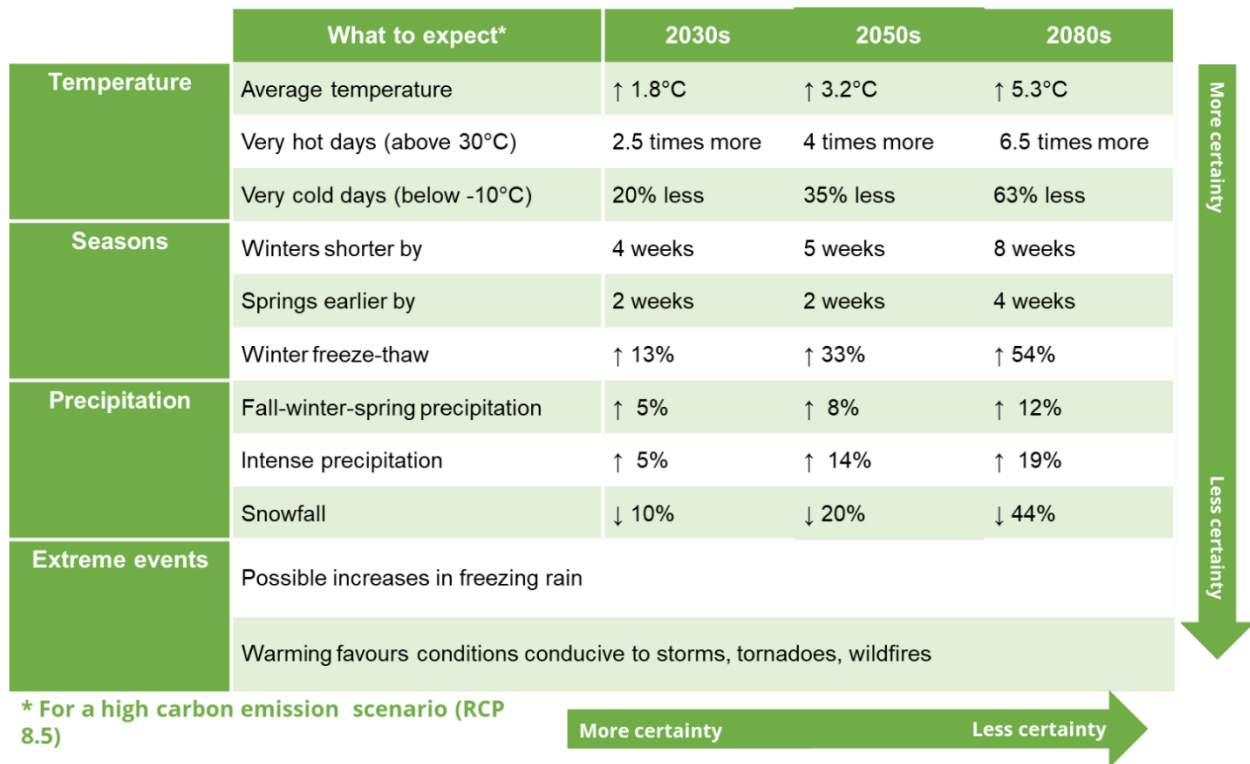


Figure 1. Climate Projections for the National Capital Region (2020)

Approach to Building Climate Resiliency in Ottawa

The City of Ottawa is taking a comprehensive approach to understanding and preparing for the impacts of climate change.

Broadly speaking the approach is based on the following principles:

- Climate change affects all of Ottawa – the Climate Resiliency Strategy should consider ways to reduce risks to public health and safety, infrastructure, natural environment, and local economy.
- Addressing climate change requires action by all City services –capacity must be built across all departments to understand risks to municipal services and embed climate preparedness and adaptation in all City plans, policies, programs and projects. This requires building data, knowledge and expertise in staff, senior leadership and Council.
- The City cannot address or respond to climate risks alone – collaboration with key community partners and stakeholders is necessary to learn from each other, identify shared risks and collaborate on shared solutions.

- Build public understanding – understanding and managing climate risks is a shared responsibility; sharing information is key to help people make informed choices to protect themselves and their communities, businesses, and organizations.
- Act while planning – building climate resiliency is an iterative process. Concrete steps are being taken to address known risks while the overall climate resiliency strategy is being developed, especially for critical services. Examples include:
 - ROPEC co-generation project to provide energy resiliency;
 - Flood protection measures at Britannia and Lemieux water purification plants;
 - The spring freshet team is activated each year to monitor and respond to riverine flooding;
 - The City’s Extreme Heat, Cold and Smog Planning Committee is developing new or enhancing existing adaptation measures as part of Ottawa Public Health’s Climate Change Health Vulnerability Assessment for extreme heat.
 - New policies on extreme heat, flood risk mitigation and sustainable and resilient design have been included in the new Official Plan.
 - Climate impacts are being considered in Master Plans for Infrastructure, Transportation, Parks and Facilities, Greenspace and Urban Forest and Solid Waste, as well as the Asset Management Plans.
 - An interactive map of riverine flood hazards using mapping produced by the Conservation Authorities is available on ottawa.ca/floodplainmaps and shows the extent of flooding for different flood events, including a more severe flood anticipated with climate change.
- Leverage external funds whenever possible – in 2021, the City submitted applications for close to \$30 million in federal funding from the Disaster Mitigation and Adaptation Fund to accelerate climate resiliency projects such as: ROPEC co-generation; erosion protection measures along Ottawa River shoreline to protect City parks and Hwy 174; and road modifications in West Carleton to ensure safe access during flooding. The CVRA and Climate Change Master Plan

better position the City to apply for these funds as these documents are increasingly becoming a condition for funding.

- Align with corporate risk and financial management processes – the City's corporate risk management system brings together departments to coordinate responses to risks that affect multiple City services. The City's Corporate Risk Profile includes updated risks related to climate change and extreme weather events. Long Range Financial Plans identify funding required to take proactive steps to reduce climate risks. Reserves are instrumental in ensuring the City can respond to extreme weather events.
- Meeting regulatory requirements – preparing for the impacts of climate change is increasingly reflected in Provincial policies and regulations, including within the Provincial Policy Statement, Ontario Public Health Standards and O. Reg. 588/17: Asset Management Planning for Municipal Infrastructure

Recommendation #1: Receive the Climate Vulnerability and Risk Assessment (CVRA) attached as Documents 1 and 2, and summarized in this report

a) Scope of the Report

The CVRA assessed climate vulnerabilities and risks across all sectors that affect the liveability and prosperity of Ottawa. The CVRA was structured around 12 Focus Areas pertaining to public health and community well-being, infrastructure, natural environment and the economy (Figure 2).

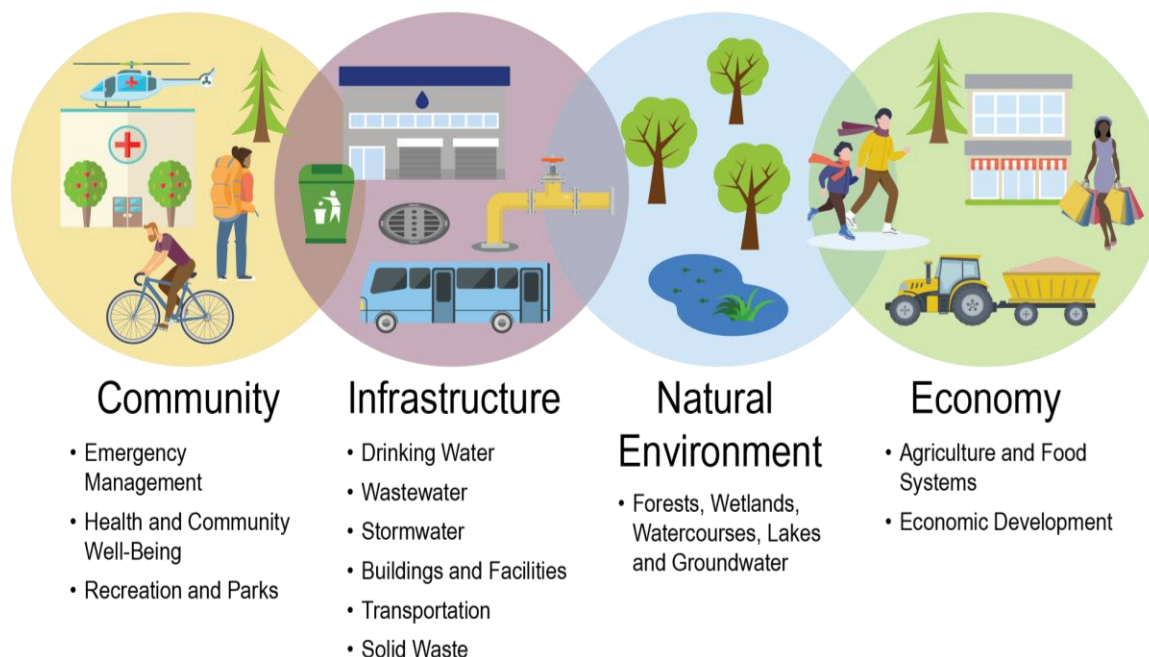


Figure 2. Focus Area Grouping

Within each of the Focus Areas, the CVRA examined the vulnerabilities and risks at two distinct scales:

- **City** – this involved looking at how climate change would impact City operations and programming, infrastructure, levels of service, and staff.
- **Community** – this involved looking at how Ottawa residents (daily activities and lifestyles), businesses and service providers would be impacted by changing climate conditions.

b) Methodology and Approach

The project used well established climate vulnerability and risk assessment methodologies drawing from the Global Covenant of Mayors in Canada program.¹²

The methodology drew on knowledge from City staff, subject matter experts and key community stakeholders, as well as public input. Several surveys were distributed and a series of online workshops were held to help identify and confirm potential climate hazards, identify who or what may be impacted, and gather input on factors that affect

¹² The [Global Covenant of Mayors Canada program](#) is a collaboration between the Federation of Canadian Municipalities, ICLEI Canada, the Global Covenant of Mayors Secretariat and the International Urban Cooperation Project. The City of Ottawa participated in the program's first Showcase Cities project in 2020 to share approaches across municipalities and build capacity in climate change mitigation and adaptation methodologies.

vulnerability and consequences, including adaptive measures that are already in place. The final step in the process prioritized the top climate risks, taking into consideration

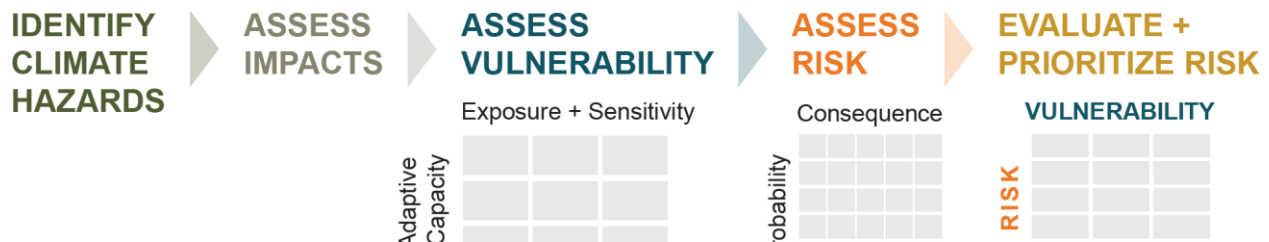


Figure 3. Climate Vulnerability and Risk Assessment Process

vulnerability, probability and consequences (Figure 3).

The project also worked closely to align with more detailed climate risk assessments being led by other City departments including:

- Climate change health vulnerability assessment for extreme heat (led by Ottawa Public Health, see [April report to Ottawa Board of Health](#))
- Climate change vulnerability and risk assessments of water, wastewater and stormwater services to inform the Infrastructure Master Plan and future Asset Management Plans (led by Infrastructure and Waster Services)
- Climate change vulnerability and risk assessments of the Lemieux and Britannia Water Purification Plants and ROPEC wastewater treatment plant to inform the plant Master Plans (led by Infrastructure and Waster Services)
- Hazard Identification and Risk Assessment (led by Emergency and Protective Services)
- Corporate Risk Management (led by Innovative Client Services)

The CVRA assessed a total of 149 potential climate impacts across three time horizons: 2030s, 2050s and 2080s. The impacts are organized by five climate hazard themes drawing on climate indices data in the Climate Projections for the National Capital Region report.



Extreme heat, drought and humidity



Seasonal variability and change



Increased volume and intensity of precipitation



Extreme weather



Global climate change

c) Key Findings

Of the 149 potential climate impacts, the CVRA identified 40 priority risks to the City and the community that require action within 1-3 years. Priority risks are those impacts that have a medium or higher vulnerability and a medium-high or higher risk. The CVRA also identified 37 impacts that require a plan to be developed within 4–7 years and 33 impacts that require possible controls and monitoring. Figure 4 shows the distribution of climate impacts by vulnerability and risk ratings.


	Vulnerability		
Risk	High	Medium	Low
Very High	2	5	0
High	18	4	0
Medium-High	11	17	2
Medium Risk	7	20	0
Low Risk	1	1	2
Immediate action required.			
Develop a plan to address risk.			
Identify possible controls and continue to review for change.			
Continue to manage through existing controls and procedures.			

Figure 4. Distribution of climate impacts by vulnerability and risk ratings

A consolidated summary of the priority risks broken out by climate hazard is presented in Table 3. The full list of climate impacts to the City and community are further described in Document 1, with supporting information on projected changes in climate variables, vulnerabilities and consequences, current adaptive actions, and vulnerability

and risk ratings. The full set of 40 priority risks for all hazards is listed in Appendix C of Document 1. Appendix D (Document 2) presents the full list of climate impacts by each of the 12 Focus Areas, with supporting information on vulnerabilities and consequences, current adaptive actions, and vulnerability and risk ratings for both the City as a corporation and to the community broken out by the four time horizons (baseline (1980-2010), 2030s, 2050s and 2080s).

Table 3. Summary of Priority Risks

Climate Hazard	Priority Risks
<p>Extreme heat, drought and humidity</p>	<ul style="list-style-type: none"> • Increased heat-related illnesses • Less outdoor recreation and active transportation • Increased building cooling demands, inadequate air conditioning (especially in schools, low-income housing, community buildings, and long-term care facilities)
	<ul style="list-style-type: none"> • Increased demand for shaded areas and indoor and outdoor recreation facilities to offset heat • Increased tree stress, reduced stream baseflow, degraded aquatic habitat, algae blooms • Reduced agricultural yields and increased irrigation

**Climate
Hazard**

Priority Risks



**Seasonal
Variability
and Change**



- More invasive species, pests and diseases harming:
 - trees, parks and ecosystems
 - agricultural production and food supply
 - New or intensified disease vectors and illnesses (e.g. Lyme disease or West Nile Virus)
 - Increased winter freeze-thaw damage and reduced asset life of:
 - roads
 - buildings (e.g. foundation cracking and heaving, pipe bursts)
 - surface and shallow stormwater and wastewater infrastructure (e.g. catch basins, driveway culverts, maintenance holes, pump stations)
 - Increased winter maintenance of roads, sidewalks and pathways and risks to users due to freeze-thaw cycles and freezing rain
 - More park degradation from increased use
 - Decline of winter tourism and recreation
-

**Climate
Hazard****Priority Risks****Increased
volume and
intensity of
precipitation**

- Reduced access to roads, transit and pathways, as well as property and infrastructure due to riverine or inland flooding
 - Riverine flood damage and reduced access to Water Purification Plants
 - Damaged / overwhelmed stormwater, wastewater and flood protection infrastructure in floodplains (e.g. pump stations, culverts, sewers, berms)
 - Increased runoff from overwhelmed stormwater infrastructure causing reduced water quality, erosion, bank destabilization and localized and basement flooding
 - Building damage (inland or riverine flooding) and basement flooding/ sewer backup (overwhelmed wastewater systems)
 - Mental, physical & financial health - injuries, stress, mold, contaminated private wells and septic systems
 - Delayed planting/ harvesting and reduced pasture
-

Climate Hazard	Priority Risks
<p>Extreme weather</p> 	<ul style="list-style-type: none"> • Increased winter slips / falls and isolation • Reduced ability of City and community services to effectively respond to simultaneous or repeated extreme events • Reduced access to essential services during extreme weather (e.g. electricity, health, education, food banks, transit) • Increased pressures on people experiencing poverty or in precarious economic situations (physical, financial and mental health) • Ditch and culvert blockages from windborne debris causing localized flooding • Business disruptions
<p>Global Climate Change</p> 	<ul style="list-style-type: none"> • Supply chain instability and impacts to the availability and cost of food, energy and other goods and services • Additional pressures on disproportionately impacted populations • Additional pressures on social service providers

These findings also align with what the City heard back from the public on its climate change survey. Overall, 93% of the 502 respondents identified that they are very concerned about the effects of climate change. When asked about their main impacts of concern, the top concerns were related to extreme heat and drought, flooding, seasonal change and extreme weather events ([As We Heard It Report](#)).

While nearly all individuals within Ottawa will be impacted in one way or another, there are specific segments of the population who may be disproportionately affected by climate hazards. These include older adults, persons with disabilities, persons living in poverty, racialized people, Indigenous people, rural residents, immigrants, women and youth. Individuals or groups may experience more than one vulnerability to climate change at one time, putting already vulnerable populations further at risk. Consideration

for social identities and inequalities relating to gender, race, socioeconomic class, cultural and ethnic background, age, and disability and how they intersect is critical when addressing climate vulnerabilities and risk. For example, women, girls and gender diverse persons face barriers to access adequate, affordable, and suitable services and resources. Women and gender diverse persons coming from intersectional backgrounds face complex and multi-layered forms of discrimination and barriers and are at a higher risk of poverty. The majority of health care workers are women, resulting in women providing more care in their work life during extreme climate events while also juggling responsibilities in their home life. This is on top of women typically experiencing increased domestic responsibility and a decrease in economic stability during a disaster event when women are already at an economic disadvantage.

The CVRA (Document 1) identifies vulnerable or at-risk groups under each climate hazard section, and by Focus Area in Appendix D (Document 2). Further assessment to determine why, where and how some individuals and groups are at an increased risk to the impacts of climate change, as well as consideration for holistic actions to address these risks, will be further studied in the development of the Climate Resiliency Strategy.

d) Gaps and Initial Opportunities

Table 4 summarizes information gaps that were identified in the CVRA. In some cases, work is already underway or planned to address these gaps, for example through the ongoing development of the Infrastructure, Transportation, and Greenspace and Urban Forest Master Plans. Gaps will be further explored in the development of the Climate Resiliency Strategy, or through dedicated departmental projects, subject to available resources.

Table 4. Information Gaps identified in the CVRA

Information Gap	Proposed Response
<p>The CVRA provides direction on the services and types of assets most at risk to climate hazards. Further analysis is needed to identify specific assets that are most vulnerable or require mitigative action, as well as any changes to maintenance.</p>	<p>Additional analysis should be undertaken through the ongoing development of the Infrastructure, Transportation, Solid Waste, and Greenspace and Urban Forest Master Plans as well as Asset Management Plans, or through dedicated assessments of specific assets.</p> <p>More detailed analyses are required to assess climate risks to specific maintenance levels of impacted assets in all City services and identify activities and funding to support the future levels of service.</p>
<p>Initial steps have been taken to identify climate risks in the City's asset management plans for water, wastewater, stormwater, and transportation services as per provincial regulations. More detailed analyses are required to assess climate risks to specific assets in all City services and identify activities and funding to support future levels of service.</p>	<p>Continue to develop and update Asset Management Plans as per provincial regulations. The Province of Ontario requires that by 2025 all local governments approve asset management plans for all municipal infrastructure assets that identify proposed levels of service, activities required to meet proposed levels of service, and a strategy to fund these activities.</p> <p>As climate hazards are likely to influence and impact level of service metrics and targets, climate change considerations should be integrated into both asset and risk management frameworks and reflected in Long Range Financial Plans.</p>

Information Gap	Proposed Response
<p>The new Official Plan includes policies to build resilience to known climate risks such as extreme heat and more severe flooding. The OP Implementation Plan will identify key steps to implement these policies through policy and planning tools.</p>	<p>Continue to review and revise relevant statutory and non-statutory policy and planning tools and procedures (e.g. Zoning By-law, Secondary Plans, Special District Plan, High Performance Development Standard, Master Plans, design guidelines and standards etc.) to identify where and how climate risk and resilience measures could be integrated into planning and development.</p>
<p>While flood forecasting of the Ottawa River is well understood and response plans are in place, flood forecasting, and response plans are less well developed for the Rideau River and other smaller watercourses. There has also not been an assessment of existing flood control structures (berms, walls, pump stations etc.) along Rideau and Ottawa Rivers to determine their performance in more severe riverine flooding events.</p>	<p>Continue to work in partnership with the Conservation Authorities to:</p> <ul style="list-style-type: none"> • Improve flood forecasting modelling and data for the Rideau River watershed. • Assess existing flood control structures (berms, walls, pump stations etc.) along the Ottawa and Rideau Rivers to determine risks to nearby communities (e.g. Kingsview, Windsor Park etc.). • Continue to improve site-specific flood response plans for flood vulnerable areas along the Ottawa and Rideau Rivers. • Continue to update flood hazard mapping of watercourses through the flood mapping project with the Conservation Authorities and make the updated information publicly available.

Information Gap	Proposed Response
<p>There is a risk of wildfires occurring within Ottawa, but there was limited information to identify what areas would be most at risk. Fires beyond the City can also influence air quality and human health.</p>	<p>Complete a Wildland Fire Risk Assessment and Plan (a requirement of the <i>Planning Act</i>). This would involve mapping and ground truthing forested and grassland areas adjacent to urban areas to identify areas at risk and develop a plan to reduce the risk of wildfires occurring and spreading.</p> <p>Assess priority populations at risk of wildfires and wildfire smoke.</p>
<p>The CVRA process highlighted how climate change can disproportionately impact certain populations. More detailed analysis at the community scale is needed to identify specific communities or populations that may be at greater risk.</p>	<p>Continue to examine impacts on priority populations as part of OPH's climate change health vulnerability assessment and risk mitigation and adaptation plan.</p> <p>Continue to engage Indigenous Peoples and equity-seeking groups, as well as organizations and service agencies that work with them.</p> <p>Identify which communities are more at risk to the priority climate impacts identified in CVRA. This would involve assessing specific physical infrastructure, social programs as well as socioeconomic indicators. This would enable the City to compare risks across Ottawa to prioritize which communities require immediate action.</p>

Information Gap	Proposed Response
<p>Public engagement in the CVRA focused on online information and surveys and a series of discussions with subject matter experts and key community stakeholders. More effort will be required to raise awareness of residents, businesses, and organizations on climate risks and solutions, and encourage action to build community resilience.</p>	<p>Undertake community education on climate risks and engage in local-level adaptation planning.</p> <p>Continue to make information publicly available to enable residents, businesses, and organizations to make informed climate risk management decisions.</p>
<p>This CVRA reflects an analysis of risks based on currently available information. A climate risk tolerance threshold or a monitoring system is needed to report when risks are changing.</p>	<p>Establish systems for monitoring, reporting, and evaluating climate risks and adaptation actions to better enable identification of when “tipping points” are close to being reached, or have been reached, and there is a need for transformational adaptation.</p> <p>Continue to collaborate with universities and research agencies to determine the most suitable climate thresholds (e.g. collaborations with University of Waterloo and University of Ottawa on heat-related stress).</p>

Information Gap	Proposed Response
<p>The City gathers information on additional costs incurred during extreme weather events but does not assess opportunity costs incurred due to re-deployment of staff or identify financial risks from future extreme weather events in long-term financial planning.</p>	<p>Continue to strengthen tracking and management of climate staffing and financial risks, including assessing opportunity costs incurred due to re-deployment of staff for extreme weather events and identifying financial risks for future extreme weather events in long-term financial planning.</p> <p>Undertake cost-benefit analysis during the development and/or implementation of the Climate Resiliency Strategy and other City Plans to further inform the benefits of preventative actions.</p> <p>Research market standards for climate change related insurance policies.</p>
<p>More information is needed on impacts to privately owned infrastructure and services (such as private waste collection and management, community buildings etc.).</p>	<p>Continue to engage with community and private sector organizations to collect information, further assess risks and identify solutions.</p>

Recommendations #2 and #3: Develop a Climate Resiliency Strategy

- 2. Direct staff to bring forward the Climate Resiliency Strategy by Q4 2023.**
- 3. Direct staff to consider resourcing needs to develop the Climate Resiliency Strategy as part of the 2023 budget process, including resources to support public and stakeholder engagement.**

This report marks the completion of Phase 2 in Ottawa’s climate adaptation planning process. The next phase of the project involves the development of a Climate Resiliency Strategy.

The Climate Resiliency Strategy will identify a series of strategies and actions to minimize Ottawa’s vulnerability to the effects of climate change and strengthen the ability to respond to and recover from climatic events when they occur. It will focus on the priority risks identified in the CVRA.

The development of the Climate Resiliency Strategy will commence in Q3 2022 and is expected to be brought to Council by the end of 2023. The scope and timing of the strategy will be subject to available resources, to be confirmed as part of the 2023 budget.

The strategy will be informed by:

- A review of climate adaptation strategies and best practices used in similar climates.
- Input from City departments through working groups established to support the project, or where feasible, working groups or projects already in place (such as the Extreme Heat, Cold and Smog Planning Committee).
- More detailed climate analysis being undertaken through the Infrastructure, Transportation, Solid Waste and Greenspace and Urban Forest Master Plans, Asset Management Plans, or other City projects.
- Detailed planning, costing and cost-benefit analysis of proposed adaptation actions will depend on the level of engagement by City departments. The extent of public and stakeholder engagement will depend on resources.
- Community-led or supported actions can be identified through continued discussions with key community partners such as Conservation Authorities, utilities, federal and regional governments, education and health institutions, economic development partners to identify shared risks and develop adaptation strategies.
- Public education and engagement will occur through Engage Ottawa, and potentially include more detailed community-based engagement through a climate adaptation planning toolkit, or discussions with specific communities

Staff will finalize the scope and timing of the Climate Resiliency Strategy based on resources in the 2023 budget.

Recommendations #4, 5 and 6: Embed Climate Resiliency across all City services

- 4. Direct staff leading new or updates to City plans, strategies, policies and programs to take the CVRA findings into consideration.**

5. **Direct staff to consider resourcing needs to further assess or mitigate known climate risks as part of the 2023 budget process to accelerate early action while the Climate Resiliency Strategy is being developed.**
6. **Direct staff to consider climate resiliency in the 2023 – 2026 Strategic Plan / Term of Council Priorities.**

Building climate resiliency in Ottawa will require on-going commitment to embed climate preparedness in every City service and across the community more broadly. It will also require an iterative approach where action is taken to reduce known risks or assess gaps based on the best available information, while continuing to learn from existing measures and developing the Climate Resiliency Strategy. Staff leading new or updates to City plans, strategies, policies and programs will use the climate projections data and climate vulnerability and risk assessment findings to inform ongoing and planned work such as:

- Develop Master Plans and Asset Management Plans
- Integrate into Secondary Plans, Special District Plans, future Master planning and community planning initiatives including the re-write of the New Zoning By-law land use regulations
- Further the Climate Change and Health Vulnerability Assessment and Adaptation Plan and continue to collaborate with community partners to develop effective strategies to reduce exposure to health hazards and promote healthy built and natural environments.
- Further develop the Hazard Assessment, Mitigation and Prevention program to support emergency preparedness
- Develop the municipal Poverty Reduction Strategy and Food Security Strategy.
- Launch the High-Performance Development Standard and update of the municipal Green Buildings Policy for Construction of Corporate Buildings; and
- Review and update operational guidelines and standards (such as the Winter Maintenance Quality standards or the Sewer Design Guidelines).

Additional opportunities should be sought to consider the findings of the CVRA including the information gaps noted in Table 4, into all City service areas and consider required

resourcing when developing 2023 workplans, budgets and the City's Strategic Plan and Term of Council priorities.

The ability to accelerate early actions will depend on resourcing (staffing and budgets). External funding opportunities such as the Disaster Mitigation and Adaptation Fund will continue to be leveraged where possible to accelerate capital projects and other programs. The Climate Projections study and CVRA better position the City to apply for such funding.

Conclusion and Next Steps

The completion of the CVRA is an important step in Ottawa's climate adaptation planning process as it assessed and prioritized the highest climate-related vulnerabilities and risks to the City and the community. The top risks will be the focus of the next phase of the project – the development of the Climate Resiliency Strategy. While the strategy is being developed, steps can continue to be taken to address known risks and gaps through ongoing City programs and plans. The development of the Climate Resiliency Strategy will commence in 2022 and is expected to be completed in 2023, pending sufficient resources.

FINANCIAL IMPLICATIONS

Recommendations 1 and 6:

There are no direct financial implications.

Recommendation 2:

Funding to complete the strategy is contingent upon Council approval of the AQCCMP Implementation (906381) budget adjustment within the Capital Adjustments and Closing of Projects ([ACS2022-FSD-FSP-0009](#)) report.

Recommendations 3 and 5:

Budget requests may be brought forward through the 2023 budget process to address resourcing requirements, subject to the outcome of staff's consideration and subject to funding.

Recommendation 4

Inclusion of the CVRA findings into City plans, strategies, policies, and programs may result in future incremental costs to be incorporated into initiatives/projects, subject to funding.

LEGAL IMPLICATIONS

There are no legal impediments to Committee and Council's approval of the recommendations of this report.

COMMENTS BY THE WARD COUNCILLORS

This is a City-wide report – not applicable.

ADVISORY COMMITTEE(S) COMMENTS

In 2019, staff presented an overview of the proposed eight priorities for the Climate Change Master Plan to the Environmental Stewardship Advisory Committee, one of which was undertaking a climate vulnerability assessment and developing a climate resiliency strategy. In October 2020, staff presented the results of the climate projections and approach for the Climate Vulnerability and Risk Assessment to the Environmental Stewardship Advisory Committee and are scheduled to present the CVRA findings on June 16, 2022.

CONSULTATION

The CVRA was developed with the involvement of City staff and external stakeholders and with input from residents and local businesses and organizations. The purpose of engagement was to:

- Generate broad interest and awareness of the development of the City's Climate Resiliency Strategy.
- Educate the public and stakeholders on the climate projections, impacts, and solutions.
- Seek input from the public and stakeholders on key issues, vulnerabilities, risks, and solutions to inform the CVRA and the upcoming Climate Resiliency Strategy.
- Collaborate with key stakeholders to identify shared risks and opportunities to develop shared solutions.

More than 120 staff from various City departments participated in 12 inter-departmental Task Teams established to examine climate risks to all City service areas. The project also worked closely to align with more detailed climate risk assessments being led by other City departments.

External engagement during the development of the CVRA consisted of 3 streams:

1. Dedicated [Engage Ottawa page](#) with information about climate trends, potential impacts and current adaptive actions, as well as social media.
2. Online surveys to residents, businesses, organizations and institutions on how climate change is affecting them, top concerns and ideas on adaptive measures.
3. Targeted stakeholder engagement with partners and subject matter experts.

The Climate Resiliency page was one of the City's top visited Engage Ottawa pages in 2020 and 2021 receiving more than 8,000 visits. 8.9% of site visitors completed a survey or poll.

Overall, 93% of the 502 respondents identified that they are very concerned about the effects of climate change. The top climate issues of concern relate to extreme heat, seasonal change, flooding and extreme weather. The survey findings are summarized in Section 5.1 of the CVRA (Document 1) and presented in the [As We Heard It Report](#) on Engage Ottawa.

Respondents from all wards completed the survey. The survey was promoted to equity-seeking groups through targeted social media ads and through organizations that work with these populations. Of the 492 respondents who self-identified as equity and inclusion lens groups, 50% identified as women, followed by 17% as older adults, 11% LGBTQ and 11% as Francophone. Other equity and inclusion lens groups represented less than 10% of respondents (see As We Heard it report for a full breakdown).

Ottawa-based subject matter experts and partners were invited to participate through online surveys and workshops to provide input on key areas where there were notable knowledge gaps. Surveys and workshops were organized around five themes: Agriculture and Food Systems; Health and Social Systems; Infrastructure and Built Environment, Local Economic Development; and Natural Environment, Parks and Land Use.

Approximately 50 representatives were invited from a range of government, non-government and private sectors for the following service areas:

- Agricultural producers and processors
- Business and economic development
- Community and social service organizations
- Community associations
- Conservation authorities
- Emergency preparedness and response
- Environmental organizations
- Equity-seeking groups
- Federal and other local governments
- Property management and development
- Public health and hospitals
- School Boards, Colleges and Universities
- Utilities

Representatives from Indigenous communities were provided information and invited to participate through the Business and Technical Support Services team of Planning, Real Estate and Economic Development Department, as part of engagement on departmental issues. Further information on the internal, public and stakeholder engagement can be found in Section 3 of the CVRA (Document 1). City and community stakeholders will continue to be engaged throughout the next phase of the project to develop of the Climate Resiliency Strategy

ACCESSIBILITY IMPACTS

This report is compliant with the Integrated Accessibility Standards Regulation (IASR) of the Accessibility for Ontarians with Disabilities Act, 2005, (AODA).

People with disabilities may be disproportionately impacted by climate change. For example, people with mobility challenges may become isolated during freezing rain or ice storms if sidewalks are icy or Para-Transpo services are reduced. Accessibility impacts will be further assessed as part of the development of the Climate Resiliency Strategy.

ASSET MANAGEMENT IMPLICATIONS

The report identifies risks to City infrastructure and the possible consequences of climate impacts, including reduced service levels, interruptions to service, and

increased costs for operations, maintenance, construction, repair, and replacement. As noted, the City is already taking steps to address known risks while the overall climate resiliency strategy is being developed. Many adaptive responses are already in place.

The City's Comprehensive Asset Management program enables the effective management of existing and new infrastructure in a way that responds to evolving needs, such as adaptation to a changing climate. The guiding principles for the City's Comprehensive Asset Management Policy describe how the City will manage its assets in a way that is "affordable and sustainable" and "progressive and adaptive", noting how both of these guiding principles are directly linked to climate change.

Also, climate resiliency is a critical consideration in the development of the City's Asset Management Plans. Changing climate conditions are anticipated to impact City infrastructure through direct damage, reduced asset life, new specifications and changing maintenance practices. In accordance with the requirements of Ontario Regulation 588/17:

- The Asset Management Plans for core services (drinking water, stormwater, transportation, and wastewater) have been completed and were approved by Council in April 2022. These plans are based on current service levels and the City's current funding model (Long-Range Financial Plan). They include consideration of climate risks to the various assets that support core services. The financial analyses in these Asset Management Plans highlights the need to explore non-infrastructure solutions to climate adaptation in addition to more traditional approaches (i.e., upgrading infrastructure).
- In some cases, climate mitigation measures are a shared responsibility between public and private owners where a combination of solutions is required to provide immediate and targeted risk reduction as part of an infrastructure management program.
- The Asset Management Plans for other infrastructure supporting all other City services requires formal adoption by July 1, 2024. Similar to the core services, these plans will be based on current service levels and the City's current funding models. They will include consideration of climate risks and will identify in what ways future service levels are vulnerable to risks posed by climate change.
- By July 1, 2025, Council will consider revised Asset Management Plans with target levels of service, along with an updated financial strategy. A climate lens will be applied to these plans to incorporate the implications of climate change

and the actions required to address climate risks onto projected service levels and financial forecasts. This could also include a revision of service provision or service levels in response to climate change.

CLIMATE IMPLICATIONS

Council directed staff to undertake a CVRA and develop a Climate Resiliency Strategy as part of the 2019 climate emergency declaration and as one of the eight priorities under the Climate Change Master Plan. Staff have met the requirement to undertake a CVRA through the completion of Document 1 and Document 2.

The CVRA will be used to inform the development of a Climate Resiliency Strategy and identify actions to mitigate the greatest climate risks. The development of the strategy will begin in 2022 and is expected to be completed by Q4 2023, pending sufficient resources. While the strategy is being developed, steps can be taken to address known risks and gaps through ongoing City programs and plans, and consideration can be given to embedding climate preparedness in City services and across the community more broadly.

It is important to note that building climate resiliency – or preparing for the impacts of climate change – goes hand in hand with continued, ambitious efforts to meet global emission reduction targets

ECONOMIC IMPLICATIONS

Changing climate conditions are anticipated to have significant impacts on Ottawa's economy. These include, for example, decline in winter tourism and recreation due to changing seasons, business closures due to extreme weather, and increased costs and disrupted supply chains due to global climate change.

ENVIRONMENTAL IMPLICATIONS

Changing climate conditions are anticipated to have significant impacts on Ottawa's natural environment. This includes increased tree mortality, ecosystem instability and habitat loss due to:

- Extreme heat and drought resulting in lower stream baseflow, degraded aquatic habitat, algae blooms, and increased tree stress
- Seasonal changes and variability leading to an increase in invasive species and disease

- Precipitation variability resulting in erosion, bank destabilization, nutrient run-off, and reduced water quality

Additionally, local parks and recreation areas will be impacted due to:

- Increased demand for shaded areas and indoor and outdoor recreation facilities to offset heat
- Increased environmental damage and degradation from increased park use and invasive species
- Intensification of existing disease vectors, and the migration of new disease vectors and illnesses

Actions to address these impacts will be considered as part of the Climate Resiliency Strategy.

INDIGENOUS GENDER AND EQUITY IMPLICATIONS

During the impact identification and vulnerability assessment stages, the CVRA considered which aspects of the City and community are most vulnerable to the anticipated effects of climate change including people, buildings and infrastructure, ecosystems and natural resources, services, and economic drivers. Representatives from organizations that work with equity-seeking groups were invited to participate in the external targeted stakeholder discussions and asked to send the project surveys to their networks to seek direct input.

During the surveys and workshops, participants were asked to provide information on which segments of the population would be impacted and how. While nearly all individuals within Ottawa will be impacted in one way or another, there are specific segments of the population more vulnerable to specific climate hazards and who have less adaptive capacity to respond. These include, but are not limited to, older adults, persons with disabilities, persons living in poverty, racialized people, Indigenous people, rural residents, immigrants, women, and youth.

Individuals or groups may experience more than one vulnerability to climate change at one time, putting already vulnerable populations further at risk. Consideration for social identities and inequalities relating to gender, race, socioeconomic class, cultural and ethnic background, age, and disability and how they intersect is critical when addressing climate vulnerabilities and risk. A preliminary summary was included in Documents 1 and 2. Further assessment to examine the gender, race and intersectional lens, as well

as consideration for holistic action to address these risks, will be further considered in the development of the Climate Resiliency Strategy. Resources such as the Ottawa Neighbourhood Study and the Neighbourhood Equity Index will factor into this research.

RISK MANAGEMENT IMPLICATIONS

There are risk implications as described in this report.

The report identifies and assesses climate risks to City services and to the community more broadly. It was developed using recognized risk assessment methodologies and with extensive internal engagement and input from external stakeholders.

Steps are being taken to mitigate known climate risks, especially for critical water and wastewater services. Solutions to mitigate other priority risks will be identified in the development of the Climate Resiliency Strategy.

The City's Corporate Risk Profile includes updated risks related to climate change and extreme weather events.

The scope and timing of the strategy will be subject to available resources, to be confirmed as part of the 2023 budget.

RURAL IMPLICATIONS

This is a City-wide report.

All regions of Ottawa, including the city's rural areas, will be affected by changing climate conditions. Climate impacts of particular concern for rural areas include, for example: reduced agricultural production from higher temperatures and variable rainfall; more invasive species, pests and vector-borne diseases; dry shallow wells; riverine and inland flooding; heat risks to outdoor workers, increased risks of wildland fires; prolonged power outages, isolation and reduced services during freezing rain and other extreme weather.

Rural stakeholders were engaged in the development of the report, including the City's Rural Affairs team and external stakeholders such as the Rural Issues Collective. Residents from all wards completed the survey on climate impacts.

TERM OF COUNCIL PRIORITIES

This report contributes to the Environmental Stewardship priority of the 2019-2022 City Strategic Plan and Term of Council Priorities.

The outcome to have climate change mitigation and resiliency plans in place supports several actions including:

- Review the Air Quality and Climate Change Management Plan to see how Ottawa will mitigate and adapt to climate change in the coming years.
- Implement the City of Ottawa - Declaration of Climate Emergency report recommendations as adopted by Council

SUPPORTING DOCUMENTATION

Document 1 Climate Vulnerability and Risk Assessment (CVRA) – Technical Report

Document 2 Summary of Climate Vulnerabilities and Risks for Each Focus Area
(Appendix D to the CVRA Technical Report)

Document 3 Synthèse administrative de l'évaluation de la vulnérabilité et des risques climatiques (EVRC)

DISPOSITION

The Planning, Real Estate and Economic Development department will coordinate the development of the Climate Resiliency Strategy with input from various departments.

All departments will consider the findings from this report in the development of their policies, plans and programs, and participate in the development of the Climate Resiliency Strategy.