



Office of the Auditor General / Bureau du vérificateur général

**FOLLOW-UP TO THE 2010 AUDIT OF THE WEST END FLOODING
EVENT AND THE DEVELOPMENT REVIEW PROCESSES WITHIN
THE CARP RIVER WATERSHED**

2012

**SUIVI DE LA VÉRIFICATION PORTANT SUR L'INONDATION DU
SECTEUR OUEST ET SUR LES PROCESSUS D'EXAMEN DES
PROJETS D'AMÉNAGEMENT DANS LE BASSIN
HYDROGRAPHIQUE DE LA RIVIÈRE CARP DE 2010**

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EXECUTIVE SUMMARY

Introduction

The follow-up to the 2010 Audit of the West End Flooding Event and the Development Review Processes within the Carp River Watershed was included in the Auditor General’s Audit Plan.

The key findings of the original 2010 audit included:

- Changes to the drainage area, developed area, and volume of runoff tributary to the Glen Cairn stormwater management pond, and the resulting higher water level in the pond have had a serious adverse effect.
- City needs to consider options to increase the storage and reduce water levels in the Glen Cairn stormwater management pond.
- Lack of inlet control devices and backwater prevention valves appear to have a critical impact on flood resistance.
- Westwood subdivision, the application of the Home Rules standards resulted in a lower level of protection to the second phase of the development than was required in Phase 1, which was approved prior to amalgamation.
- City should on a go-forward basis, ensure the wording in the subdivision agreement clearly indicate that where engineering design standards have changed, since the time of registration of the subdivision agreement, that the developer shall be responsible at their expense, to update their design and construction to meet the current engineering standards.

Summary of the Level of Completion

1. The table below outlines our assessment of the level of completion of each recommendation as of December 2012. It also outlines management’s assessment of the level of completion of each recommendation as of February 2013.

CATEGORY	% COMPLETE	RECOMMENDATIONS	NUMBER OF RECOMMENDATIONS	PERCENTAGE OF TOTAL RECOMMENDATIONS
LITTLE OR NO ACTION	0 – 24	5	1	12.5%
ACTION INITIATED	25 – 49	-	-	-
PARTIALLY COMPLETE	50 – 74	2	1	12.5%
SUBSTANTIALLY COMPLETE	75 – 99		-	-
COMPLETE	100	1, 3, 4, 6, 7, 8	6	75%
TOTAL			8	100%

Conclusion

The City has made progress on the recommendations regarding the investigations of the causes of, and remedial measures for, the West End Flooding.

The City has started on the development of an Integrated Infrastructure Management System that will enable the City to access and manipulate the data that currently reside in the Infrastructure Management System (ITX).

Acknowledgement

We wish to express our appreciation for the cooperation and assistance afforded the audit team by management.

RÉSUMÉ

Introduction

Le Suivi de la vérification portant sur l'inondation du secteur Ouest et sur les processus d'examen des projets d'aménagement dans le bassin hydrographique de la rivière Carp de 2010 était prévu dans le Plan de vérification du vérificateur général.

Les principales constatations de la vérification de 2010 sont les suivantes :

- Des changements dans la zone de drainage, la zone aménagée et le volume du ruissellement tributaire du bassin de rétention des eaux pluviales de Glen Cairn, de même que l'augmentation du niveau d'eau du bassin résultant de ces changements ont eu un important effet négatif.
- La Ville doit étudier les options pour augmenter la capacité d'emmagasiner et réduire le niveau de l'eau du bassin de rétention des eaux pluviales de Glen Cairn.
- Si les dispositifs de contrôle du débit et les clapets anti-retour semblent avoir un effet considérable sur la résistance aux inondations.
- Le lotissement de Westwood, l'application des normes des anciennes municipalités a donné lieu à une protection inférieure dans la seconde phase de l'aménagement par rapport à la première, approuvée avant la fusion.
- La Ville doit aller de l'avant et s'assurer que le libellé de l'accord de lotissement indiquera que lorsque les normes de conception technique auront changé depuis la date d'enregistrement de l'accord de lotissement, le promoteur sera responsable, à ses frais, des modifications qu'il devra apporter à la conception et à la construction de son projet afin de satisfaire aux normes techniques en vigueur.

Sommaire du degré d'achèvement

1. Le tableau ci-dessous présente notre évaluation du degré d'achèvement de chaque recommandation. Celui-ci présente également l'évaluation de la direction concernant le degré de réalisation de chaque recommandation au mois de février 2013 :

CATÉGORIE	POURCENTAGE COMPLÉTÉ	RECOMMANDATIONS	NOMBRE DE RECOMMANDATIONS	POURCENTAGE DU TOTAL DES RECOMMANDATIONS
PEU OU PAS DE MESURES PRISES	0 – 24	5	1	12,5 %
ACTION AMORCÉE	25 – 49			
COMPLÉTÉE EN PARTIE	50 – 74	2	1	12,5 %
PRATIQUEMENT COMPLÉTÉE	75 – 99		-	-
COMPLÉTÉE	100	1, 3, 4, 6, 7, 8	6	75 %

	8	100 %
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Conclusion

La Ville a fait des progrès en ce qui a trait aux recommandations portant sur l'examen des causes de l'inondation dans le secteur ouest et sur les mesures d'atténuation.

La Ville a commencé à instaurer un système intégré de gestion des infrastructures qui lui permettra d'avoir accès aux données qui se trouvent présentement dans le système de gestion des infrastructures (ITX) et de les traiter.

Remerciements

Nous tenons à remercier la direction pour la coopération et l'assistance accordées à l'équipe de vérification.

1 INTRODUCTION

The Follow-up to the 2010 Audit of the West End Flooding Event and the Development Review Processes within the Carp River Watershed was included in the Auditor General's Audit Plan.

The key findings of the original 2010 audit included:

- Changes to the drainage area, developed area, and volume of runoff tributary to the Glen Cairn stormwater management pond, and the resulting higher water level in the pond have had a serious adverse effect.
- City needs to consider options to increase the storage and reduce water levels in the Glen Cairn stormwater management pond.
- Lack of inlet control devices and backwater prevention valves appear to have a critical impact on flood resistance.
- Westwood subdivision, the application of the Home Rules standards resulted in a lower level of protection to the second phase of the development than was required in Phase 1, which was approved prior to amalgamation.

2 KEY FINDINGS OF THE ORIGINAL 2010 AUDIT

1. The new City of Ottawa was formed on January 1, 2001, with the amalgamation of the Regional Municipality of Ottawa-Carleton (RMOC) and the local municipalities of Cumberland, Gloucester, Goulbourn, Kanata, Nepean, Osgoode, Ottawa, Rideau, Rockcliffe Park, Vanier, and West Carleton. In the discussion that follows, four periods are noted, namely, Approvals Prior to 1995, the period from 1995 to 2000 is labelled Recent Pre-amalgamation Approvals; the period from January 1, 2001 to 2004, is labelled Home Rules; and, the period after the current Ottawa Sewer Design Guidelines came into force in November 2004 is labelled Harmonized Engineering Standards or Post-amalgamation City-wide Design Standards.

Table 1 - Approval Periods

Approvals Prior to 1995 (1960-1994)	Recent (1995-2000)	Post-Amalgamation Home Rules (2001-2004)	Post-Amalgamation City-wide Design Standards (2004-current)
975 flooded homes	34 flooded homes	144 flooded homes	11 homes
84% of Total	3% of Total	12% of Total	1% of Total

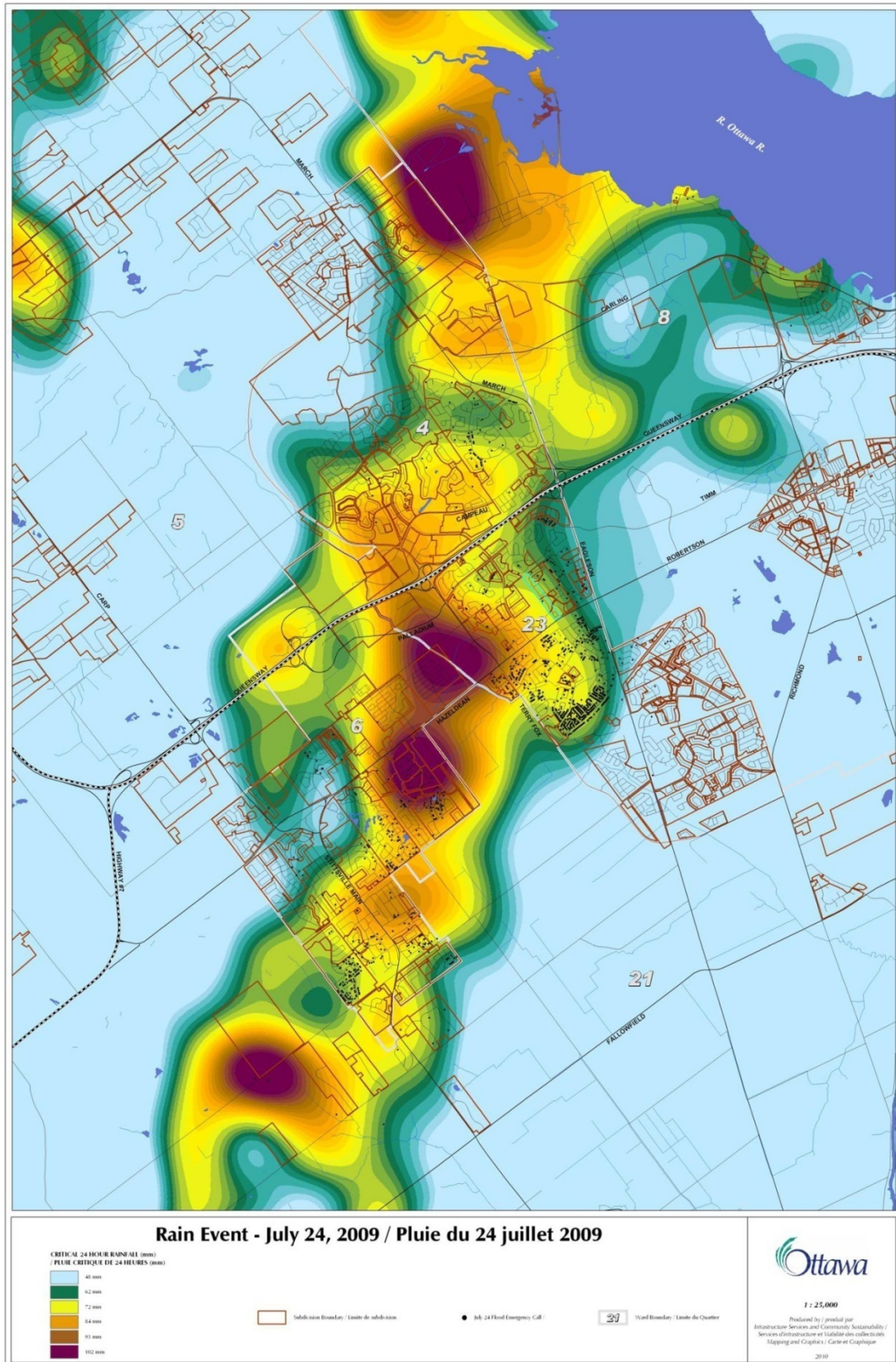
It should be noted that the 11 homes that were flooded in subdivisions approved using the Post-amalgamation City-wide Design Standards are located in a subdivision that was under construction, and therefore did not have all the required stormwater management devices installed at the time of the storm.

2. The radar derived 24 hour average rainfall map prepared by the City after the July 24, 2009 rainstorm (see Figure 1) is not completely instructive in understanding the storm event’s propensity to cause flooding. At various times in various Carp River watershed locations, the storm event reached 100 year levels of precipitation intensity for a 24 hour period. However, it appears that peak precipitation intensity from the July 24th storm event (i.e., represented by the dark purple rainfall areas) did not directly impact the residential development areas that experienced flooding. The purple precipitation areas, which have 24-hour cumulative rainfalls exceeding the 100 year return period precipitation, were in fact centred over undeveloped parcels of land and non-residential developments without basements. Therefore, some uncertainty exists whether this acknowledged 100 year storm event was in fact a 100 year potential flooding event – when viewed from a residential development location perspective. It is critical to gauge the extent of flooding, and engineering solution performance, against an accurate measure of storm event intensity. It is our understanding that the City’s Phase 3 investigation is addressing this issue.

Examination of the radar rainfall data provided by the City for 1-hour and 3-hour accumulation indicates that the rainfall intensities reached the 50 year level for 1-hour duration in the Fringewood Subdivision and Old Stittsville areas, and 5 year return period intensities everywhere else. The 3-hour rainfall accumulations were less than the 2 year return period rainfall intensities.

After reviewing available precipitation intensity data across a number of timeframes, the July 24, 2009 storm event that occurred over west-end residential development does not appear to have been a 100 year flood event. Subsequent residential flooding clusters cannot be solely, or even primarily, attributed to a storm event that failed to exceed City stormwater engineering design capacity. It should be noted that the City’s investigations are addressing this finding in the Phase 3 study.

Figure 1 - Rain Event July 24, 2009

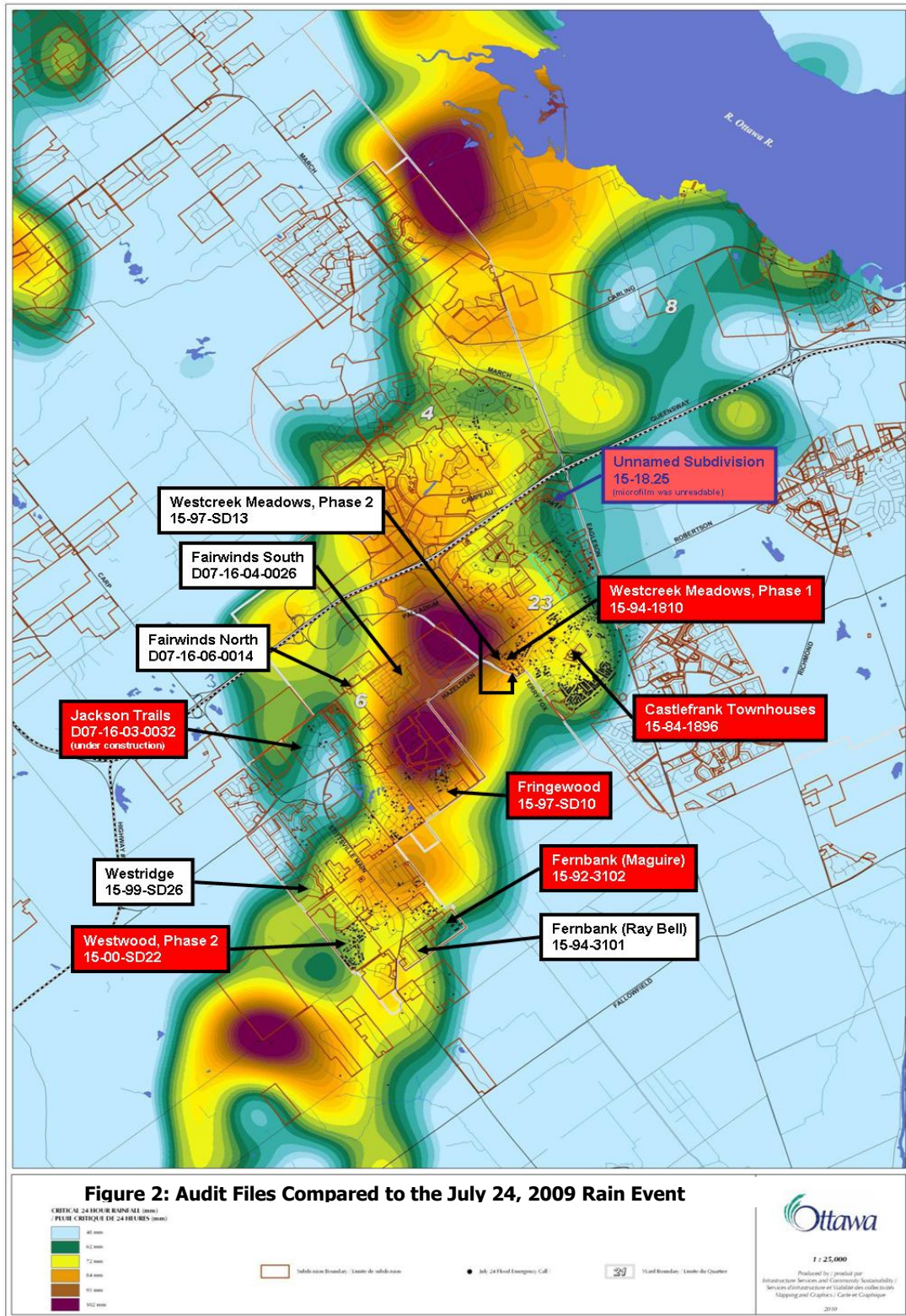


3. Data overlay mapping prepared for this audit documents the fact that residential subdivision developments approved under the City's current Post-amalgamation City-wide Design Standards did not experience flooding during the July 24th, 2009 storm event. The flood resistance correlation with Kanata and Goulbourn pre-amalgamation and City Home Rules design standards is less clear, since similar sub-division developments facing similar precipitation intensity levels demonstrated vastly different flood resistance outcomes. While the presence or absence of inlet control devices¹ or backwater prevention valves² seems to be a critical flood resistance factor, there also appear to be other potential causation factors beyond approval era of origin. This aspect is discussed further in subsequent points of this Executive Summary and in the report.
4. The following conclusions can be made as a result of the observations from the "due diligence" process execution audit of the files:
 - The development review process and risk management linkages were maintained by staff for all the audited subdivisions where there was no flooding;
 - The development review process and risk management linkages were maintained by staff for all the audited subdivisions where there was flooding;
 - When the development review processes are compared between the subdivisions that flooded versus those that did not, staff managed risk appropriately in the process since we found no substantive anomalies;
 - In the case of the Fringewood and the Westwood Phase 2 subdivisions, staff demonstrated an ability to adaptively manage risk, by requiring these subdivisions to comply with the Upper Poole Creek Subwatershed Study which had come into effect while the subdivisions were still being processed; and,
 - We did not carry out a detailed review of the engineering studies.
5. In the case of the Westwood Subdivision, Phase 1 - approved before amalgamation - had inlet control devices specified and the houses were required to have their foundation levels above the 100 year hydraulic grade line, similar to the current engineering requirements. However, Phase 2 - approved during the Home Rules period - was not designed to the same standards as Phase 1. In this case, the Home Rules were applied during review of Phase 2 of the subdivision and resulted in a lower flood protection for the newer phase of the subdivision than was provided for in the phase approved before amalgamation.

¹ Inlet Control Devices are catch basin inserts that control the maximum flowrate that is allowed into the storm sewers. For more information, please refer to Appendix B.

² Backwater Prevention Valves are devices designed to permit flow in one direction, from the house foundations to the sewer and to block flow from the sewer to the house; please refer to Appendix B.

Figure 2 documents the selected files.



6. The transition period between the Stittsville Master Drainage Plan (1994) and the Upper Poole Creek Subwatershed Study (2000) provides an opportunity to examine the potential for adaptive management across multi-year development review process timeframes. Adaptive management requires the City to amend its processes and review criteria across a changing regulatory landscape for any given application.

From 1994, the Stittsville Master Drainage Plan addressed the stormwater management design requirements for the village of Stittsville since no previous subwatershed study was in effect. In 2000, the Upper Poole Creek Subwatershed Study was approved, and effectively superseded the Stittsville Master Drainage Plan where the two overlapped. If there was a culture of adaptive management present, then any subdivisions being originally considered under the Stittsville Master Plan should have been made subject to the Upper Poole Creek Subwatershed Study before final approval. The Westwood Phase 2 Subdivision and the Fringewood Subdivision both had the potential to demonstrate adaptive management since both developments were applied for while the Stittsville Master Drainage Plan was in effect with the Upper Poole Creek Subwatershed Study coming into effect while the developments were being processed. In both cases, the development agreements required the subdivision's stormwater management system to conform to the Upper Poole Creek Subwatershed Plan, which demonstrates that staff acted with diligence in attempting to manage risk during the development review process by ensuring a linkage to the new subwatershed study.

As noted in item 5, the engineering design review component of the planning and development review did not demonstrate the same level of adaptive management. This is problematic given that both Goulbourn and Kanata had similar stormwater management design criteria, based on the Urban Drainage Design Guidelines (1987) and that inlet control devices were used in some subdivisions in both municipalities. We note that the design standards did not require the use of the inlet control devices, but they were applied by some pre-amalgamation municipalities in certain new developments.

7. Although the focus of the audit is on the development review process of the City of Ottawa and former municipalities, the Mississippi Valley Conservation Authority and Rideau Valley Conservation Authority are important agencies in the subdivision approval process. The role that the Conservation Authority takes is a role that has been devolved from the Province of Ontario and all subdivision applications must be circulated to the appropriate Conservation Authority for review and comment.

If the Conservation Authority had identified a stormwater management issue with a subdivision during the development review process but the municipality went ahead with approval of the subdivision, there would be concern about the

viability of the subdivision's stormwater management system. However, through a review of all the correspondence in the audit files, we observed no discord between either the Mississippi Valley Conservation Authority or Rideau Valley Conservation Authority and the local municipality. There appears to have been solidarity among the Conservation Authorities and municipality when an issue arose. In one situation, the concerns shared by the Conservation Authority and municipality regarding stormwater management and the depth of basements ultimately resulted in the developer revising the proposed development to housing units without basements.

8. Following amalgamation in January 1, 2001, the Home Rules design standards used by the City varied significantly across the amalgamated local municipalities. For instance, in Gloucester, City staff report that the requirement for installed inlet control devices was considered "standard operating procedure" and became a requirement in practice although not written in the design standards. However, in Kanata and Goulbourn Township, inlet control devices to protect basements were not required by their design standards, and were not part of the "standard operating procedure".

While City staff were working between 2001 and 2004 on new City-wide stormwater and servicing design standards, it is not clear why the design practices were not amended to mirror those in place in Gloucester, where inlet control devices were generally used (although not a requirement of the Gloucester standards, staff informed us that it was standard practice to require them). This is more so, given that inlet control devices and other stormwater management requirements had already been implemented pre-amalgamation in some developments in both Goulbourn Township and the City of Kanata.

9. In our opinion, draft plan conditions can be amended if necessary and this is specifically permitted by the Planning Act. A subdivision agreement includes the draft plan conditions as a schedule, which allows the ability to ensure that engineering drawings and standards are updated. Therefore, for practical purposes, it is our opinion that the City can modify the requirements of the subdivision agreement up to the point where it gives final approval of the works as constructed. As further discussed below, management does not agree with our opinion.

Our Office obtained a legal opinion, from an outside firm, indicating that the existing conditions of subdivision agreements are broadly defined such that "the City can modify the requirements of a subdivision agreement up to the point where it gives final approval of the works as constructed". The legal opinion indicates that this is possible because the subdivision agreement conditions stipulate that everything must be done "to the satisfaction of" an identifiable individual representing the City. Clearly the individual should not be satisfied unless the current standards are met.

City staff provided a confidential legal opinion in which they were not able to fully endorse the external opinion. The City should on a go-forward basis, ensure the wording in the subdivision agreement clearly indicates that where engineering design standards have changed, since the time of registration of the subdivision agreement, that the developer shall be responsible at its expense, to update its design and construction to meet the current engineering standards, to the satisfaction of the City.

10. Stormwater management to account for the minor and major drainage systems, including measures to prevent surcharging of foundation drains and prevention of downstream flooding have been used in Ontario since circa 1976. As in any field of engineering, the scope and approaches to stormwater management have changed since then and continue to change. Nevertheless, the main objective of managing urban runoff to prevent flooding by overland runoff and basement flooding is a constant.
11. Provision of detention storage of large rainfall events to prevent downstream flooding as a result of development dates to the same time. In this respect, the current standards reflect the methodology used for stormwater management in Ontario since circa 1976. City staff have informed us that these standards were not applied in the City (including the former municipalities) until the 1980s. The review of the files indicate that, with the exception of the use of inlet control devices, the standards used since pre-amalgamation provided for the minor and major systems, detention storage, and for protection of basements up to and including the 100 year storm level.
12. Engineering Reviews of the Subdivision Engineering Drawings carried out by Planning and Growth Management (PGM) met the required standards. However, as noted in item 5, the application of the Home Rules standards for Goulbourn in Phase 2 of the Westwood subdivision actually applied a lower standard of protection than was used in Phase 1, approved prior to amalgamation.
13. Since amalgamation, construction reviews are carried out by the City to oversee that construction of municipal services is completed in accordance with the approved engineering drawings. The developer's engineer is responsible to provide full-time site inspection. With the exception of watermain installation, the City staff provides oversight to confirm general compliance. For watermain installations, the City provides full-time site inspection.
14. The City does not have a procedure in place to capture the as-built elevation of the basement slabs and foundation elevations in the field. This is an exception to a process that comprises reviews and checks of the engineering drawings, the stormwater management report and drainage design, field review of road and lot grades, field review of sanitary and storm sewer systems, and inspection of watermain construction. Although the City inspectors do a qualitative review of

conformance of the lot grades and house general elevations in relation to the design elevations, the City does not have any field documentation to confirm that the houses were actually placed at or above the elevation required by the stormwater management design.

15. Responsibility for checking that house foundations are constructed at the grades required by the engineering drawings now falls under PGM's inspectors since 2009. Since 2001 basement elevations have been captured through the approval of lot grading plans and as part of the As-Built certification by the developer's engineer of record; however, there is no formal method to confirm that the footings and the basements have been constructed in accordance with the engineering drawings.
16. The City's Operation and Maintenance procedures for sanitary and storm sewer systems are carried out according to a schedule that meets industry accepted practices. The Operation and Maintenance procedures are not condensed in an Operations and Maintenance Manual.
17. The information regarding the sanitary and storm system existing assets and their maintenance reside currently in the Infrastructure Management System (ITX) database. Because ITX does not have GIS capabilities, the Asset Management group manages a GIS database, which it shares with Wastewater and Drainage. The Integrated Infrastructure Management System (IIMS) project, which has been underway since 2007, is intended to replace these systems.
18. The Glen Cairn flood remedial measures completed after the 2002 flood event examined an appropriate range of alternative remedial measures for control of flooding from the Carp River, including improvements to the southwest quadrant of the Glamorgan area to reduce flooding from overland runoff originating in the subdivision (i.e., not in the river). The City narrowed the scope of the remedial measures to focus on the river channel and culvert improvements.
19. The Glen Cairn flood remedial measures recommended solution, as implemented, provided an effective solution to the flood risk from the Carp River. However, known problems with overland storm runoff and the storm sewer systems in the Glamorgan Drive, Uxbridge Crescent, Dundegan Drive area were not resolved.
20. Remedial measures recommended by a consultant to reduce the risk of flooding from overland runoff in the Glamorgan Drive, Uxbridge Crescent, Dundegan Drive area were postponed by the City for further investigation, as part of a Needs Study, but were later discarded without further investigation because they appeared not feasible. We confirmed that these recommended remedial measures would not have been feasible under the constraints existing at the time.

21. The City realized that further studies were required to determine the necessary improvements to the Glamorgan Drive, Uxbridge Crescent, Dundegan Drive area, but postponed the studies.
22. The City subsequently made improvements to the sanitary sewer to reduce potential inflow from stormwater ponded on top of sanitary manholes, and to improve the hydraulic conditions of the sewers in the area. In the course of designing these improvements, the City realized that there were segments of the sanitary sewer that might be undersized, and decided to include any further analysis with a Needs Study for storm and sanitary sewers in the area.
23. During the preparation of the Terry Fox Drive Master Drainage Study, the consultant found that the storage in the Glen Cairn pond was less than the storage volumes in the 1978 pond design drawings, which were less than those reported in the 1978 design report. This information was conveyed to the City, and the consultant offered to undertake further analyses. However, the City informed the consultant that the analysis of the detention pond would be carried out after completion of the Carp River Watershed/Subwatershed Study. Although there were communications, including meetings, between City departments in this regard, the Carp River study did not address the Glen Cairn Pond.
24. None of the reports completed to date have addressed the issue of the effect of the Glen Cairn pond on the hydraulic performance of the storm and sanitary sewers in the Glamorgan area. It is recognized that the storm sewers were designed based on the design standards that were valid at the time, namely a 2 or 5 year design storm. However, examination of the area shows that when the water level in the pond reaches the 100 year water level determined in the 2003 Performance Review report and the Terry Fox Drive Extension stormwater management report (95.5 m), storm water will surcharge the Glamorgan area storm sewer system by more than 1 metre. This is a serious impact on the performance of these sewers. We understand that the current study being done as Phase 3 is addressing this issue.
25. Information in reports prepared for the design of the Glen Cairn pond in 1978 indicates that the design high water level in the pond, under the 100 year flood, is 94.72 m. This is consistent with the grades and storm sewer inverts in the Glamorgan subdivision and Castlefrank Road area, as it would not result in backwater into the sewers and the road drainage would be able to flow into the pond.
26. The currently accepted 100 year water level (determined by the Mississippi River Conservation Authority) is substantially higher than the corresponding value used in the design of the pond in 1978. However, no adjustment has been made to address the effects of this higher water level and storage requirements,

in particular with respect to surcharging of the sewers discharging into the pond.

27. Review of the Terms of Reference for the West End Flooding Investigation – Phase 3, currently in progress, indicates that the issues noted above have been identified as matters to be addressed in the Phase 3 investigation.
28. It is our opinion that some clarification may be required regarding information that was provided to Council during the September 2, 2009 meeting and in the Phases 1 and 2 Report, particularly pertaining to design criteria and stormwater management practices:
 - Management indicated that the “communities affected by basement flooding were built to former standards that do not include engineered provisions to deal with large, infrequent rainstorm events”. Based on our findings, this assertion applies to a large percentage of the homes affected, although a number of the affected homes were built since the 1980s, when the Urban Drainage Design Guidelines (1987) were published and generally in place. The dual drainage concept using minor and major systems has been used in some parts of the City since at least 1989.
 - Management indicated that the dual drainage principle is a relatively new policy. As discussed in this audit report, the minor and major system dual drainage system philosophy of the current City sewer design standards is not new, and has been used in North America since at least 1976, formalized by APWA in 1981, and in Ontario, including some Ottawa municipalities, since at least 1987.
 - Management indicated that inlet control devices were not a requirement prior to the current City guidelines being issued. Although factually correct, it should be noted that inlet control devices were used in some parts of the City since before amalgamation. In some Home Rules they were practices, albeit unwritten, operating procedure.
 - Management indicated that the 2003 Glen Cairn investigation made suggestions for solving the overland runoff problems in the Castlefrank Road and Glamorgan Drive area. We found that the 2003 Glen Cairn investigation confirmed that flooding by storm overland runoff in this area would remain a concern after the Carp River improvements; the investigation made recommendations for improvements to the area of Castlefrank Road and Glamorgan Drive.
 - Management indicated that one of the areas flooded was designed based on the 5 year storm. We found that in many of the areas flooded the sewers were designed to convey the 5 year storm but also were designed so that the basements would be located at least 0.3 m higher than the 100 year hydraulic grade line in the sewer.

- Management indicated that the Westwood subdivision was designed using practices in use before the current City standards. We found that the Westwood subdivision Phase 1, which had not flooded on July 24th, was designed using similar standards to those in effect at present, including inlet control devices, but Phase 2, which had flooded dwellings, was designed based on the local municipality design standard, providing a lower level of flood protection.
29. Management indicated that the Westwood subdivision design could not be changed since the subdivision agreement had been registered. As we discussed in point 9 above, it is our opinion that management could have required changes to the design standards.

3 STATUS OF IMPLEMENTATION OF 2010 AUDIT RECOMMENDATIONS

2010 Recommendation 1

That the City ensure that the work plan of the investigation of the July 24th flood includes an in-depth analysis of the storm’s mapped precipitation intensity colour coded “contours” on an hourly basis. Such an analysis may explain why the mapped 24 hour average precipitation intensity colour coded contours seem relatively benign over top of development that experienced intense basement flood clusters.

2010 Management Response

Management agrees with this recommendation. The analysis of the contours was included as part of management’s investigation of the flooding events of July 24th, 2009.

Management Representation of the Status of Implementation of Recommendation 1 as of July 3, 2012

Implementation of this recommendation is complete as per the management response.

Management: % complete 100%

OAG’s Follow-up Audit Findings regarding Recommendation 1

Review of the Glen Cairn Flood Investigation Environmental Study Report, February 23, 2011, shows that the study investigated the pattern of rainfall during the storm, using the data collected at the Maple Grove Road rainfall gauge.

OAG: % complete 100%

2010 Recommendation 2

That the City require staff to document and report on the number and location of residential dwelling units approved after the 2002 flood event under Kanata and Goulbourn Home Rules. City staff should also report on any projected future Carp watershed residential dwelling units to be approved in subsequent phases of development applications originally approved under these Home Rules.

2010 Management Response

Management agrees with this recommendation. The number and location of residential dwelling units draft approved after the 2002 flood event in Stittsville under Kanata and Goulbourn Home Rules will be the subject of an information report to Planning and Environment Committee by the Planning and Growth Management department in Q1 2011. Management will also confirm in this same report, that there are no further future phases of development originally approved under Home Rules that will be developed under Home Rules.

Management Representation of the Status of Implementation of Recommendation 2 as of July 3, 2012

No further development will proceed under Home Rules as per the Council Motion approved on September 23, 2009:

“Where a draft approved plan of subdivision, which has yet to proceed to registration, would permit development on stormwater standards in place prior to November 2004, staff are directed to amend the conditions of approval to require that the new standards be utilized;

Where a registered but undeveloped plan of subdivision, would permit development on stormwater standards in place prior to November 2004, staff shall advise Council in writing prior to the issuance of a Commence Work Notice;”

Staff will report on the number and location of residential dwelling units approved after the 2002 flood event under Kanata and Goulbourn Home Rules to Planning Committee in Q4 2012.

Management: % complete

50%

OAG's Follow-up Audit Findings regarding Recommendation 2

Council Motion approved on September 23, 2009 required that any subdivision that was in draft plan of subdivision could not proceed based on Home Rules. The same motion required that staff advise Council if there were any registered but not developed plans of subdivision that would implement Home Rules.

The same Motion required that staff report to Council on the number and location of residential dwelling units approved after the 2002 flood event using Kanata and Goulbourn Home Rules.

The City has not completed yet the reports to Council.

OAG: % complete 50%

Management Representation of Status of Implementation of Recommendation 2 as of February 27, 2013

Management agrees with the OAG's follow-up audit finding, however further progress has been made.

Staff have completed research and confirmed that there have been no situations where there have been registered but undeveloped plans built on old Home Rules post September 23, 2009.

Research is underway to report on the number and location of residential dwelling units approved after the 2002 flooding event using Kanata and Goulbourn Home Rules. Our initial review indicates that no subsequent phases will be approved under Home Rules, but this will be confirmed and summarized in a report to Council in Q3 2013.

Management: % complete 70%

2010 Recommendation 3

That the City seek legal advice concerning the potential liability associated with the City using design practices that were lower than the practices of some pre-amalgamated municipalities regarding inlet control devices (ICD).

2010 Management Response

Management agrees with this recommendation. Legal Services has confirmed that in the event that legal claims are filed with the City, this would be a standard step followed in all litigation in assessing the City's response to such claims.

Management Representation of the Status of Implementation of Recommendation 3 as of July 3, 2012

Implementation of this recommendation is complete as per the management response.

Management: % complete *100%*

OAG's Follow-up Audit Findings regarding Recommendation 3

Legal Services have indicated that legal actions have been initiated against the City to recover damages arising from the West End Flooding Event and the defence of those claims has been referred to outside legal counsel by the City's insurer. The City Legal Services has indicated that the legal implications of the inconsistent design practices applied by the City with respect to the installation of Inlet Control Devices (ICDs) will be fully considered and addressed in the context of those actions.

OAG: % complete *100%*

2010 Recommendation 4

That the City should on a go forward basis, ensure the wording in the subdivision agreement clearly indicate that where engineering design standards have changed, since the time of registration of the subdivision agreement, that the developer shall be responsible at their expense, to update their design and construction to meet the current engineering standards, to the satisfaction of the City.

2010 Management Response

Management agrees with this recommendation. Standard subdivision agreement wording will be revised by Planning and Growth Management under delegated authority in Q1 2011.

Management Representation of the Status of Implementation of Recommendation 4 as of July 3, 2012

Standard subdivision agreement wording was revised in the "Amendment to the Standard Subdivision Agreement - Schedule of Works" report (Ref N^o: ACS2011-ICS-PGM-0062) approved by Council on March 10, 2011 as follows:

"The General Manager, Planning and Growth Management may apply the most current City Specifications or Standards to all Works not completed within five years of the date of registration of this Agreement."

All such works are completed at the expense of the developer.

Management: % complete *100%*

OAG's Follow-up Audit Findings regarding Recommendation 4

The amended terms of the Subdivision Agreement were approved by Council on March 10, 2011 and indicate that the General Manager may apply the current City specifications or standards to all works not completed within five years of the date of registration ["Schedule of Works" Section 4.2(s)]. Five years represents a reasonable outer limit for building out a registered plan of subdivision, particularly where there are phases. It is reasonable that development beyond such a five-year period after registration should be subject to the possibility of having to construct infrastructure in accordance with any revisions to standards that have occurred during that five-year period.

Section 2.2 "Scope of Works" in the Standard Subdivision Agreement states that all works are to be completed at the expense of the developer and in accordance with City specifications or standards and by-laws.

OAG: % complete *100%*

2010 Recommendation 5

That the City document the operation and maintenance requirements for sewers in an Operations and Maintenance Manual.

2010 Management Response

Management agrees with this recommendation. Operation and maintenance requirements are defined and documented, but in a number of files, formats and locations. Staff are currently working to develop a system-wide comprehensive operations manual. This will be complete in Q4 2011 as a part of the ongoing development of the environmental management system (EQMS - ISO 14001).

Management Representation of the Status of Implementation of Recommendation 5 as of July 3, 2012

A system-wide comprehensive operations manual, which will include operation and maintenance requirements for sewers, will be completed in Q4 2013, as a part of the ongoing development of the environmental management system.

Management: % complete *10%*

OAG's Follow-up Audit Findings regarding Recommendation 5

The City has made little progress on this recommendation.

OAG: % complete *10%*

Management Representation of Status of Implementation of Recommendation 5 as of February 27, 2013

Management agrees with the OAG's follow-up audit finding.

Wastewater Services are currently on schedule to meet the revised timeline to complete a system-wide comprehensive operations manual (completion in Q4 2013). Staff resources are now in place such that progress can be made to meet the target.

Management: % complete 10%

2010 Recommendation 6

That the City ensure that the proposed Asset Management System, currently in the procurement stage, enables the City to combine the information currently available in two separate management systems.

2010 Management Response

Management agrees with this recommendation. The City currently uses two separate stand-alone information management systems. Information is duplicated into a tabular information system (ITX) and a mapping system (GIS), with staff able to access both systems, depending on the information required.

A Request for Proposal is currently on the market to select a leading edge information and work management system that will combine the two ways to access the available information. Until such time as a review of the submitted proposals has been completed, management is not in a position to state whether or not this single data source has been achieved, but it is certainly the intent of staff to meet this objective. The tendering process will be complete by Q1 2011 and the successful proponent should be selected by management in Q2 2011.

It should be noted that the availability of information, currently available in two different systems, had absolutely no role to play in the flooding events of July 24th, 2009 or the application review system.

Management Representation of the Status of Implementation of Recommendation 6 as of July 3, 2012

The tendering process for the proposed Asset Management System was completed in Q2 2011 and EMA Canada was selected. The contract with this firm includes the delivery of a system that uses a single data source.

Management: % complete 100%

OAG's Follow-up Audit Findings regarding Recommendation 6

The Contract Award Reports for Q2-2011 show that the City awarded the contracts for the supply and installation of software and software licenses for the Enterprise Asset Management System (EAMS), and for the professional services required to conduct Phase 1 of the EAMS. In Q4 2011, the City awarded the contracts for the services required to integrate the EAMS with the Client Relationship Management system and to conduct a Scope and Approach to confirm the business requirements, the technology to be used, resources, and timeframes to replace the SIM application (for road and bridge assets) with the EAMS. In Q1 2012 the City awarded the contract for professional services to conduct Phase 4 of the implementation of the EAMS.

The City provided the EAM-IIMS Project Scope and Approach Overview prepared for the Enterprise Asset Management System. The Core Functional Requirements of the EAMS include specifically the requirement for integration of the Work Management and GIS special requirements, water billing, water meter database, work orders, and other requirements.

The implementation of this recommendation is complete.

OAG: % complete

100%

2010 Recommendation 7

That the City consider during the investigation of flood remedial measures, currently underway, options to increase the storage and reduce the water levels in the Glen Cairn stormwater management pond.

2010 Management Response

Management agrees with this recommendation. This is being considered as part of a variety of options under consideration as part of management's investigation. The ultimate recommended solutions will be the subject of a report to Council by Infrastructure Services Department in Q2 2011.

Management Representation of the Status of Implementation of Recommendation 7 as of July 3, 2012

Options to increase storage and reduce water levels in the Glen Cairn stormwater management pond were considered as part of a variety of options assessed during the west end flooding investigation. Upon completion of the investigation, a comprehensive report entitled: "*July 24, 2009 West End Flooding Investigation Action Plan*" was presented and approved at Environment Committee (May 17, 2011) and Council (May 25, 2011).

The report detailed a comprehensive \$32 million Action Plan consisting of a number of projects aimed at reducing the risk of flooding in the City's West End. Such measures include improvements to the Glen Cairn Storm Water Pond (including a new pumping station for the wet pond and pond cleaning as required), installation of backwater valves and sump pumps in zones of influence, Glen Cairn storm drainage improvements and improvements to overflow at the Hazeldean Sanitary Pumping Station.

Management: % complete *100%*

OAG's Follow-up Audit Findings regarding Recommendation 7

Review of the Glen Cairn Flood Investigation Environmental Study Report, February 23, 2011, shows that the study investigated options to increase the storage and reduce the water levels in the Glen Cairn stormwater management pond.

The City provided a copy of the Planning and Environment Committee report and the Council approval of the action plan.

OAG: % complete *100%*

2010 Recommendation 8

That the City consider in the investigation of flood remedial measures, currently underway, all issues that have been raised in this report, including:

- a) **Checking of the basement elevations vs. those required by the engineering drawings;**
- b) **Glen Cairn stormwater management pond capacity and water levels;**
- c) **Effect of the Glen Cairn pond on surcharging of the Glen Cairn sewers;**
- d) **Calculation of the 100-year hydraulic grade line and verification of the design values; and,**
- e) **Remedial measures to prevent basement flooding in the Glamorgan Drive, Uxbridge Crescent and Dundegan Drive areas specifically and Glen Cairn vicinity generally.**

2010 Management Response

Management agrees with this recommendation. The issues raised in this report, including the list above, have been included in management's investigation undertaken throughout 2010. With respect to the first statement, management have undertaken a targeted sampling of basement elevations at critical locations through fieldwork to understand their elevation compared to projected hydraulic grade lines. A field review of approximately 1,000 homes would be exhaustive from a resource perspective.

Infrastructure Services will bring forward a report on the recommended solutions to Planning and Environment Committee in Q1 2011.

Management Representation of the Status of Implementation of Recommendation 8 as of July 3, 2012

As part of the west end flood investigation, all issues raised in the West End Flooding Audit report, as noted by items a) through e) in Recommendation 8, were considered in the analysis of flood causation and the determination of remedial measures. This was one of the most comprehensive infrastructure investigations conducted to date at the City. The investigation process led to the “July 24, 2009 West End Flooding Investigation Action Plan Report” presented and approved at Environment Committee (May 17, 2011) and Council (May 25, 2011).

The report details a comprehensive \$32M Action Plan consisting of a number of projects aimed at reducing the risk of flooding in the City’s west end.

Management: % complete ***100%***

OAG’s Follow-up Audit Findings regarding Recommendation 8

The various investigations carried out by the City addressed this recommendation.

OAG: % complete ***100%***

4 SUMMARY OF THE LEVEL OF COMPLETION

1. The table below outlines our assessment of the level of completion of each recommendation as of December 2012. It also outlines management’s assessment of the level of completion of each recommendation as of February 2013.

CATEGORY	% COMPLETE	RECOMMENDATIONS	NUMBER OF RECOMMENDATIONS	PERCENTAGE OF TOTAL RECOMMENDATIONS
LITTLE OR NO ACTION	0 – 24	5	1	12.5%
ACTION INITIATED	25 – 49	-	-	-
PARTIALLY COMPLETE	50 – 74	2	1	12.5%
SUBSTANTIALLY COMPLETE	75 – 99	-	-	-%
COMPLETE	100	1, 3, 4, 6, 7, 8	6	75%
TOTAL			8	100%

5 CONCLUSION

The City has made progress on the recommendations regarding the investigations of the causes of, and remedial measures for, the West End Flooding.

The City has started on the development of an Integrated Infrastructure Management System that will enable the City to access and manipulate the data that currently reside in the Infrastructure Management System (ITX).

6 ACKNOWLEDGEMENT

We wish to express our appreciation for the cooperation and assistance afforded the audit team by management.