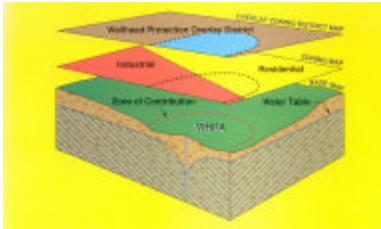




# GUIDING SOURCE WATER PROTECTION



# WATER RESOURCES PROTECTION MASTER PLAN

JANUARY 2008

## **Acknowledgements**

This report was funded by the Ontario Ministry of Environment's Municipal Groundwater Study Initiatives and the Regional Municipality of Waterloo. The completion of the Water Resources Protection Master Plan required the work of many persons over a number of years. Specific mention is provided to: Ian MacDonald and Tiffany Svensson of Water and Earth Science Associates Limited, the Region's consultants on the project; Eric Hodgins and Tammy Middleton, the Region's project managers for the project; and the members of the Water Resources Protection Liaison Committee that reviewed, provided input, and helped develop this Master Plan.

# WATER RESOURCES PROTECTION MASTER PLAN

## EXECUTIVE SUMMARY

Since 1993, the Region has been implementing a Water Resources Protection Strategy (WRPS) to minimize the risk of historic, existing and future land uses on municipal water supplies. In 2003, the Region was awarded funding from the Ontario Ministry of Environment (MOE) Municipal Groundwater Study Initiative which provided funds for a number of tasks including an update of the Water Resources Protection Master Plan (the "Master Plan"). The purpose of the Master Plan update was to develop a municipal water protection implementation plan that build on previous initiatives undertaken by the Region as well as to incorporate new initiatives and policies developed by the Province of Ontario in the wake of the Walkerton Inquiry, including the *Clean Water Act* and related regulations.

This report presents the Master Plan that will guide source protection activities for the Region from 2007 through 2016. The Master Plan will be implemented in two phases: activities and programs in the interim period up to 2012 and prior to completion of the watershed-based Source Protection Plan (SPP) required under the Clean Water Act; and those following integration of this Master Plan with the SPP. For the latter phase, the risk-mitigation programs identified in the Master Plan will be used as the primary basis for risk reduction anticipated to be required in the SPP. The intent of this report is to provide in a single document, an overview of both the status and the proposed technical and policy or program initiatives needed to protect municipal drinking-water supplies.

## Background and Context

The Region has successfully implemented a number of programs to implement source water protection for its water supply system. These include: the Rural Water Quality Program which provides financial incentives to farmers to improve water quality; an amendment to the official plan to designate well head protection areas and implement limited restrictions on non-residential development; the Business Water Quality Program (2001 to 2005) that provided financial incentives to businesses to prevent spills; and development of a Winter Road Maintenance Policy that among other things committed the Region and local municipalities to reducing salt use on roads. These programs together with on-going, water-quality and water-level monitoring programs, and review of development applications and contaminated sites comprise the Region's existing protection activities.

Over the past few years, the MOE has undertaken a number of initiatives on source water protection including development of the *Clean Water Act*. Under the *Clean Water Act*, the MOE will institute new processes, technical standards, and guidance to develop watershed-based source protection plans for municipal drinking-water supplies across Ontario. The Grand River Conservation Authority will be involved in coordinating an independent Source Protection Committee to develop a Technical Assessment Report and Source Protection Plan for Lake Erie Source Protection Region. The *Clean Water Act* will require that municipalities assess their water supplies from both water quantity (water budget and water quantity risk assessment) and water quality (vulnerable area delineation, threat identification and water quality risk assessment) perspectives. Accordingly, the Master Plan will need to merge and integrate with watershed-based source protection over the next several years and steps are identified to ensure this occurs.

## Water Quantity

As the original WRPS focused primarily on quality, the Region's approach to managing water quantity at the source was less well defined and has been developed iteratively through various watershed studies, project environmental assessments, assessments of water pumping and groundwater modeling. The outcome of various water budgets are provided as follows:

- The MOE performed percent water-use calculations for all tertiary watersheds in southern and central Ontario identifying the Upper Grand watershed, which includes the Region as a medium-use watershed with between 25% and 30% of the water resources allocated.
- Based on groundwater monitoring conducted by the Region since 1994, the long continuous pumping of deep aquifers has resulted in stable water levels throughout the Region with the possible exception of recent decreases in water levels around the Parkway wells in Kitchener due to higher pumping in 2004/2005, and declines in water levels during the late 1990s in north east Cambridge where several new wells were commissioned.
- The Long Term Water Supply strategy identified that more than 100,000 m<sup>3</sup>/day of water was available from local water resources, which suggests there is more than adequate available water to meet the 23,000 m<sup>3</sup>/day of new groundwater supplies that were identified to be needed in the strategy.

Recently, a preliminary watershed-scale or "Tier 2" water budget assessment undertaken by the GRCA, in accordance with MOE guidance modules under the *Clean Water Act*, has indicated that much of the central portion of the Grand River Watershed will be identified as potentially moderate to high stress. This area includes most of the Region's water supply wells for the integrated urban system supplying Cambridge, Elmira, Kitchener, New Hamburg and Waterloo. Notwithstanding that the Region's on-going monitoring indicates that stable water levels exist in most areas, it is likely that the Region will be required under the CWA to undertake Tier 3 (Local Area) assessments for each of these wells to ensure they are sustainable.

## Vulnerable Area Delineation

Watershed-based source protection will require the Region to delineate a number of vulnerable areas, many of which have already been completed as follows:

- Well Head Protection Areas (WHPAs) were delineated in 2000, as part of the amendment to the Regional Official Policies Plan, using a multiple-component process including: undertaking three-dimension computer modeling for specific geographic areas, delineating well capture zones (land area contributing water supplies to the wells), creating capture zone envelopes or WHPAs, and developing a semi-quantitative indexing method to classify these areas into sensitivity categories. Notwithstanding the above, additional work will be needed to meet the anticipated standards for source protection including: delineation of additional time of travel capture zones and new risk management zones; delineation of protection zones for new wells; collection of additional hydrogeologic data; and undertaking advanced modeling techniques.

- In 2007, protection zones for the Region's Hidden Valley intake in Kitchener was delineated following MOE guidance procedures. Some additional investigation is needed improve delineation of these protection areas.
- Areas where the groundwater is intrinsically vulnerability to contamination (e.g. sandy soils and shallow water table) were delineated in 2006 based on MOE guidance modules. This mapping will be updated following improvements to groundwater models.
- The recharge area of the Waterloo Moraine was delineated in the early 2000s due to its important role in contributing to the Region's drinking-water system. Other significant recharge areas may be delineated through the watershed-based source protection process.

Delineation of the vulnerable areas in the Region is presented in Figure E1. As required under the *Clean Water Act* and related regulations, the protection zones will be ranked and/or scored and will be used in conjunction with an assessment of threats to identify and rank risks to municipal drinking-water supplies.

## **Threats**

The initial WRPS implementation plan included undertaking a reconnaissance survey of sites that pose a potential threat to water supplies. Over the implementation of the WRPS, the survey has been built into an inventory and has been continually improved by adding additional data and refining the relative ranking of the threats. Using this database, the number of different threats within each WHPA was compiled to assist in understanding the scope of threats near supply wells, to help prioritize which threats pose the greatest concern at individual well fields, and to guide development of risk-mitigation options. This assessment is similar to what is expected to be conducted as part of a watershed-based source protection Tier 1 Assessment, i.e. using existing information. MOE guidance modules require that more detailed information be collected for some properties, i.e. a Tier 2 assessment, where there is uncertainty in the Tier 1 information.

The results of the assessment undertaken as part of the Master Plan confirmed staff's opinion that a Tier 1 assessment will not accurately reflect the number of businesses in the protection areas where chemical, fuel, and waste storage activities occur and that considerable additional effort will be needed to gather specific information for these threats to be able to conduct the water-quality risk assessment. The MOE is currently devising additional guidance materials to link land uses to chemicals which is critical to understanding the scope of additional work and potential threats to municipal water supplies.

A threat assessment has not been undertaken for the Hidden Valley surface water intake and will be undertaken as part of a MOE-funded study to be undertaken in 2007 and 2008.

## **Identification and Prioritization of Risk-Reduction Measures**

The initial objectives of the WRPS were developed primarily to protect the water quality of the municipal supplies. And while these objectives have provided appropriate guidance, they did not explicitly recognize the importance of protecting the quantity of water resources. To ensure that the

Master Plan includes both water quality and quantity, the objectives of the WRPS were modified to the following:

- limit water quality risks to water resources from historic or existing land-use practices;
- minimize water quality and quantity risks to water resources from future land uses and activities;
- and minimize the impact of the Region's water taking on the environment and private supplies.

Several principles upon which risk-mitigation activities would be selected were also similarly modified from the original WRPS.

Detailed threat-evaluation and risk-mitigation approaches for a number of threat categories were developed to provide input into the development of the Master Plan. All the steps taken through this process were documented in a series of background reports that were discussed with members of the Water Resources Protection Liaison Committee. Development of the Master Plan focused primarily on municipal well head protection and was coordinated to the extent possible with the MOE's ongoing development of watershed-based source protection legislation. For surface water intakes, the MOE guidance identifying the purpose of the intake protection zones is relatively recent and steps needed to protect this intake are still evolving. Additional direction is needed from the MOE to guide evaluation of risk and risk reduction measures for recharge areas and naturally vulnerable areas.

Detailed risk-reduction options were developed and ranked for 20 threat groups that ranked as moderate or high threat to municipal wells. Risk reduction options for each category included: use of the Planning Act; use of federal, provincial or municipal regulations; land acquisition; upgrades to municipal infrastructure; implementing beneficial management practices; undertaking monitoring and studies; and undertaking education programs. Based on the risk-reduction ranking, risk reduction measures were proposed for each WHPA, including where additional information on well vulnerability or threats might be needed prior to implementing the risk-reduction program or policy. Tables E2 and E3 present summaries of proposed risk-mitigation measures for each threat category to address existing and future threats to groundwater. Table E4 presents proposed measures for protection of the surface water intake. As areas closest to the supply wells have higher vulnerability scores, these areas have a greater number of proposed risk-management options and tend to include more regulatory tools than for areas further from the wells.

The large number of programs identified through the Master Plan indicates that priorities must be set to ensure implementation. However, identifying which will take priority is challenging in part because the province will require the Region to prioritize risk-mitigation of threats and/or threat categories on a parcel basis following provincial regulations and rules, many of which have not been fully developed. Ultimately the setting of priorities will be influenced by the regulations and the staff /financial resources to meet the combined work load of the regulations and existing programs. Based on this direction, the following principles for setting priorities are proposed for the Plan:

- As an interim measure, undertake tasks to ensure compliance with the *Clean Water Act* and for continuation of current programs and new initiatives developed through the current Master Plan update; and

- Following approval of the SPP by the Minister, implement the plan addressing both future and existing threats focusing first on threats that pose the highest risk to municipal drinking water supplies followed by programs for lower-risk threats

Table E4 presents a list of tasks and interim schedule to guide source water protection activities in the Region over the next five to ten years and until the Master Plan is fully integrated with watershed-based source protection. The tasks identified in Table E5 include both technical and risk-reduction or “implementation” components. And while there is still some uncertainty on how priorities will be established through the *Clean Water Act*, several priorities for implementation can be set based on staff’s current understanding of the *Clean Water Act* and existing water supply issues. These priorities are as follows.

- Implement risk-reduction measures for significant risks identified in the Assessment Report as required by the *Clean Water Act*. This will include determining whether to use the *Clean Water Act* Part IV provisions for Significant Risks and/or to develop additional spill prevention requirements as part of the Region’s Sewer-Use By Law.
- Continue implementing current initiatives including: the Rural Water Quality Program; salt reduction programs; microbial contamination control programs for wells under the influence of surface water; and commenting on development applications and contaminated sites.
- Implement new priority initiatives including: nitrate reduction strategies for well K26 in Wilmot; policies in the current ROP update for microbial contamination control programs, salt assessment guidelines, and aggregate extraction study guidelines; and land acquisition and easement policies for the 100 m zone around wells, the 200 m zone for the Hidden Valley intake, and within Well Head Protection Sensitivity Area 1.



FIGURE E1: Vulnerable Areas

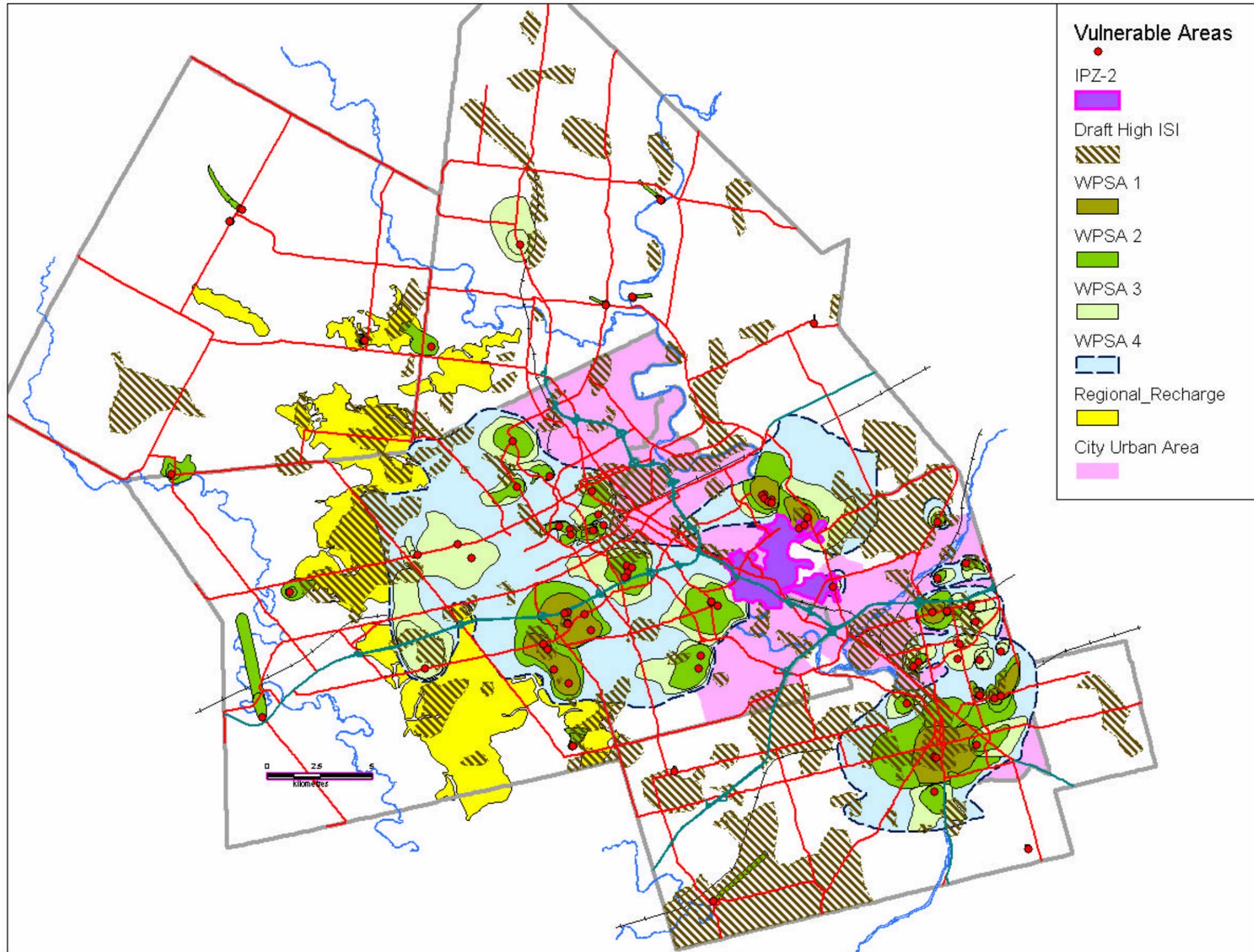




Table E2: Proposed Risk-Mitigation Measures for Existing Threats to Municipal Wells

Threat Category	Protection Area	GUDI/ 100 m	WPSA 1	WPSA2		WPSA3		WPSA 4	Region Wide
				2yr	10yr	2yr	10yr		
Contaminated Sites	Brownfield redevelopment incentives program	-	-	-	-	-	-	-	✓
	Provide comments on site reports	-	✓	✓	✓	☑	☑	×	×
	Installation of sentry wells or off-site monitoring wells <sup>(1)</sup>	-	✓	✓	☑	☑	☑	×	×
	Education – response to site information requests	-	-	-	-	-	-	-	✓
Septic Systems	Faulty system inspection (I)/education (E)	✓I	☑I	✓E	✓E	×	×	×	×
	Strategic mitigation	☑	☑	×	×	×	×	×	×
Sewers and Pipes	Municipal maintenance and upgrade program	✓	✓	☑	×	☑	×	×	×
	Incentives for private maintenance and upgrades	✓	☑	×	×	×	×	×	×
Winter Maintenance	Municipal/Regional road agency reduction programs	-	-	-	-	-	-	-	✓
	Municipal/Regional road agency Sensitive Area management plans	-	✓	✓	✓	✓	✓	×	×
	Education/awareness program	-	-	-	-	-	-	-	✓
	Develop pilot sites and encourage private property salt reduction plans	-	-	-	-	-	-	-	✓
	Regional/ municipal property salt management BMPs	-	-	-	-	-	-	-	✓
Agriculture Nutrient Application	Strategic land purchase and/or easement <sup>(1)</sup>	✓	☑	☑	×	×	×	×	×
	Incentive Program (existing RWQP)	-	-	-	-	-	-	-	✓
	Enhanced incentives/education for nutrient management planning	✓	☑	☑	×	×	×	×	×
	Sentry Well monitoring program	✓	✓	✓	×	✓	×	×	×
Biosolids Application	Strategic land purchase and/or easement <sup>(1)</sup>	✓	☑	☑	×	×	×	×	×
	Require sites have Nutrient Management Plans prior to application by Region contractor	✓	✓	✓	☑	✓	☑	×	×
	Prohibit application	✓	✓	☑	×	☑	×	×	×
Agriculture Chemical application:	Strategic land purchase and/or easement <sup>(1)</sup>	-	☑	☑	×	×	×	×	×
	Incentive program (existing RWQP)	-	-	-	-	-	-	-	✓
	Sentry Well monitoring program	-	✓	✓	×	✓	×	×	×
Impervious cover increase	Develop monitoring and/or research program to clarify problem	-	✓	✓	✓	✓	✓	×	×
Fuel Storage and Handling	Inspection/licensing (I)/education (E) program <sup>(2)</sup>	-	✓I	☑I	✓E	☑I	✓E	×	×

	Education program for provincial agency for upgrades , monitoring and inspection	-	✓	✓	✗	✓	✗	✗	✗
	Incentives for non-targeted training program	-	-	-	-	-	-	-	✓
Chemical Storage and Handling	Inspection/licensing (I)/education (E) program <sup>(2)</sup>	-	✓ <b>I</b>	☑ <b>I</b>	✓ <b>E</b>	☑ <b>I</b>	✓ <b>E</b>	✗	✗
	Incentives for training program	-	-	-	-	-	-	-	✓
	Apply BMPs to Region contracts/facilities	-	-	-	-	-	-	-	✓
Waste Storage and Handling	Inspection/licensing (I)/education (E) program <sup>(2)</sup>	✓ <sup>(3)</sup>	✓ <b>I</b>	☑ <b>I</b>	✓ <b>E</b>	☑ <b>I</b>	✓ <b>E</b>	✗	✗
	Review/Provide Comments on new CofA applications	✓	✓	☑	☑	☑	☑	✗	✗
	Incentives for training program	-	-	-	-	-	-	-	✓
Lawn Chemicals	Municipal by-law restricting chemicals <sup>(4)</sup>	-	-	-	-	-	-	-	✓
	Apply BMPs to Region contracts/facilities	-	-	-	-	-	-	-	✓
	Targeting monitoring	-	☑	☑	✗	✗	✗	✗	✗
	Contractor storage BMPS (refer to chemical handling and storage)	-	-	-	-	-	-	-	-
Golf Course Turf Care	Incentives for training program	-	-	-	-	-	-	-	✓
Airport Deicing and Refueling	Apply BMPs to Region contracts/facilities	-	-	☑	✓ <b>E</b>	☑	✓ <b>E</b>	✗	✗
	Incentives for training program	-	-	-	-	-	-	-	✓
	Assessment and/or improvement of de-icing facilities	-	-	✓	✓	✓	✓	✗	✗
Livestock Management	Strategic land purchase and/or easement <sup>(1)</sup>	✓	☑	☑	✗	✗	✗	✗	✗
	Incentive program (existing RWQP)	-	-	-	-	-	-	-	✓
	Enhanced incentives/education for nutrient management planning	✓	✓	☑	✗	✗	✗	✗	✗
Aggregate Extraction	Education: encourage adoption of guidelines for existing sites	-	-	-	-	-	-	-	✓
	Incentives for training program	-	-	-	-	-	-	-	✓
Well Decommissioning	Implement protocol for monitoring well surveying	✓	✓	✓	✓	✓	✓	✗	✗
	Incentive program Farmers – existing RWQP and federal programs	-	-	-	-	-	-	-	✓
	Non-farm incentive program	✓	✓	✓	✓	✓	✓	✗	✗

Notes:

Table nomenclature: - not applicable ; ✓ part of program; ✗ not part of program, ☑ for vulnerable areas defined by new groundwater modeling technique

1. Specifics of program would be based on outcome of more detailed assessments.
2. Program dependant on provincial licensing program and availability of new authority from the province.
3. Program in this area focuses on pathogenic wastes.
4. Scope of program would be limited to program proposed by Public Health.

**Table E3: Proposed Risk-Mitigation Measures for Future Threats to Municipal Wells**

Threat Category	Details	GUDI/ 100 m	WPSA1	WPSA2		WPSA3		WPSA 4	Region Wide
				2yr	10yr	2yr	10yr		
Contaminated sites	Update development application review protocol	-	-	-	-	-	-	-	✓
Septic systems	Prevent new construction and require additional study prior to installation	✓	✓	☑	☑	☑	✗	✗	✗
	Require monitoring of communal systems	✓	✓	✗	✗	✗	✗	✗	✗
Pipelines and sewers	Prohibit new	✓	☑	☑	✗	✗	✗	✗	✗
	Develop servicing policies to require upgraded materials to reduce leakage	✓	✓	☑	✗	☑	✗	✗	✗
Deicing Salt	Additional study requirements and BMPs	-	✓	✓	✓	✓	✓	✗	✗
Water quantity	Prohibit increased reduction in infiltration for wells identified with high water quantity risk	-	✓	✓	✓	✓	✓	✗	✗
	Require studies to prevent reductions infiltration for other wells	-	✓	✓	✓	✓	✓	✗	✗
Gasoline storage	Prohibition for regulated bulk fuel, retail and accessory use of gasoline	-	✓	☑	☑	☑	✗	✗	✗
	Additional study requirements, BMPs, and monitoring	-	✓	✓	✓	✓	☑	✗	✗
Chemical storage	Prohibition of “worst” land uses especially those using chlorinated solvents	-	✓	✓	✓	✓	☑	✗	✗
	Additional study requirements, BMPs, and monitoring		✓	✓	✓	✓	☑	✗	✗
Waste storage	Prohibitions on worst land uses <sup>(1)</sup>	✓	✓	✓	✓	☑	✗	✗	✗
	Additional study requirements, BMPs, and monitoring	✓	✓	✓	✓	☑	✗	✗	✗
Lawn fertilizers	BMPs for lawn fertilizers near sensitive features		☑	☑	✗	✗	✗	✗	✗
Golf courses	Prohibitions		✓	☑	✗	☑	✗	✗	✗
	Additional study requirements, BMPs and monitoring		✓	✓	✓	✓	☑	✗	✗
Aggregate extraction	Prohibitions		✓	✓	☑	✗	✗	✗	✗
	New Region study guidelines		-	-	-	-	-	-	✓
Private and monitoring wells	Require survey and proper decommissioning	-	-	-	-	-	-	-	✓
	Prohibition in serviced areas	-	-	-	-	-	-	-	✓

## Notes:

Table nomenclature: - not applicable ; ✓ part of program ; ✗ not part of program; ☑ for vulnerable areas defined by new groundwater modeling technique

1. Program in this area focuses on pathogenic wastes.

**Table E4: Proposed Risk-Mitigation Measures for the Mannheim Surface Water Intake**

<b>Policies/Programs To Address Threat</b>	<b>IPZ-1</b>	<b>IPZ-2</b>	<b>TWCA</b>
Continue to invest in improvements to GRCA's surface water model (GAWSER)	-	-	✓
Amend the ROP to include measures to control urban runoff quality including retrofitting of existing controls	-	-	✓
Storm water quality control measures for Highway 8 bridge and other crossings	-	✓	-
Require BMPs under Sewer-Use by law for selected industries with high potential for spills	✓	✓	-
Spill forecasting model and/or early-warning monitoring system	✓	✓	✗

**Notes:**

TWCA – Total Water Contribution Area of the intake

Program components: ✓ - part of program; ✗ - not part of program; - - not applicable

**Table E5: Schedule of Water Resources Protection Master Plan Tasks**

<b>Initiative/Task</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
<b><i>Clean Water Act</i></b>											
Finalized Clean Water Act	x										
CWA Regulation Review											
Source Protection Committee Terms of Reference											
Characterization Report											
Assessment Report											
Plan Development											
Plan Reporting											
Plan Review											
<b><i>Technical - Water Quantity</i></b>											
Groundwater Monitoring Program Review											
New Supply Well Investigation											
Tier 2 Watershed Scale Water Budget											
Tier 3 Local Area Assessment											
<b><i>Technical - Vulnerability</i></b>											
Revise Groundwater Flow Model											
Well Surveys and Abandonment											
Intake Protection Area Delineation											
Raw Water Characterization											
Develop Intake Monitoring Program											
Monitoring Program Assessment											
<b><i>Technical - Threat Assessment</i></b>											
Tier 1 Assessment (Groundwater)											
Tier 1 Assessment (Surface Water)											
Tier 2 Pilot Program											
Tier 2 Threat Assessment											
Well Field "Issues" Assessments											
Middleton (TCE/1,4-dioxane)											

Executive Summary

Initiative/Task	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
p St Agatha (Nitrate)											
H4 (Nitrate)											
K50s (Nitrate)											
Medium Priority Salt-Impacted Wells											
G5 (VOCs and Salt Assessment)											
<b>Risk Mitigation Programs and Policies</b>											
Finalize WRPS Update Plan		x									
Interim Significant-Risk Threats Actions											
<b>WRPS Current Programs</b>											
RWQP											
Road Salt Reduction											
Private Salt Education											
Microbial Contamination Control Plans											
<b>WRPS Update Issues</b>											
Initial Update of Regional Official Plan											
Aggregate Extraction Policies											
Well-Specific Nitrate Strategy											
Salt Impact Assessment Guidelines											
<b>Clean Water Act Implementation</b>											
Regional Official Plan											
Existing Significant-Risk Threats											
Existing Medium-Risk Threats											
Existing Low-Risk Threats											
Monitoring/Enforcement											

Notes:  
 X – indicates completion of a report