

1. This document includes a progression in logic and methodology for the development of the preliminary alternative Resource Plans.
2. The High Level Plan (sheets 2 and 3) outlines the strategic components (drivers, goals, objectives) and the tactical components (programs, projects, metrics).
3. The Objectives - Details (sheets 4, 5, and 6) further defines the objectives by providing a description of the objective, expected qualitative benefits, and variations to the objective.
4. The Resource Plans - Summary (sheet 7) illustrates the objectives, the variations and provides an initial look at possible alternative Resource Plans for consideration.
5. P1 to P7 (sheets 8 through 14) show the various preliminary alternative Resource Plans and the variations associated with the "theme". This provides a different way of illustrating the various plans.
6. With 8 objectives having variations, there are a vast number of plan combinations (> 50) that can be considered. The intention is to identify the most meaningful alternative Resource Plans and bring those forward for detailed economic analysis.
7. As well, there are some variations in technology that may be applicable to certain objectives such as the overflow abatement program. For example, we may consider at source controls, end of pipe controls, or a combination of both to manage the overflow abatement program. This will allow for further refinement of alternative Resource Plans such that if we choose Plan 4, the technology variations for one of the objectives may result in Plan 4.1, Plan 4.2, Plan 4.3 for future analysis. Given the time available to complete the Integrated Resource Plan, we need to keep the total number of alternative Resource Plans to a practical limit.

Strategic			Tactical		
Driver	Goal	Objective	Programs	Projects	Program Metrics / LOS
Regulatory Compliance	Achieve compliance with all regulatory requirements	1 Meet current Nova Scotia Environment (NSE) WWTF permit to operate requirements	Continue program for meeting current WWTF compliance requirements	Continue implementation of specific WWTF compliance projects based on study area watershed priorities	Current permit to operate effluent requirements
		2 Meet current NSE WSP permit to operate requirements	Continue program needed for meeting WSP compliance requirements	Continue implementation of specific WSP compliance projects	Current permit to operate treated water requirements
		3 Meet current overflow compliance requirements	Expand overflow monitoring	Implement monitoring at additional sites	Number of monitored active overflows
			Provide floatables management for overflows	Implement screening at specific sites	Number of active overflows with screening
			Ensure no dry weather overflows	Eliminate all dry weather overflows (e.g. Lyle Street weir)	Number of sites with dry weather overflows
			Ensure no increase in overflows due to growth without an approved management plan	Develop and implement an overflow management plan based on study area watershed priorities	Number of overflows at active overflow sites compared to baseline overflow values
			Balance wastewater flows among facilities to accommodate optimal use of available capacity	Implement specific flow diversion projects	Overall facility capacity utilization
		4 Meet future WWTF effluent requirements	Provide secondary level wastewater treatment for harbour facilities	Upgrade Halifax WWTF to secondary treatment	Future effluent requirements consistent with secondary treatment
				Upgrade Dartmouth WWTF to secondary treatment	Future effluent requirements consistent with secondary treatment
				Upgrade Herring Cove WWTF to secondary treatment	Future effluent requirements consistent with secondary treatment
			Provide enhanced nutrient removal for WWTFs discharging to sensitive or limited receiving waters	Implement specific nitrogen (N) & phosphorus (P) reduction projects based on study area watershed priorities	Future effluent requirements consistent with enhanced nutrient removal
		Provide effluent requirements for "toxics"	Implement specific "toxics" management projects	Future effluent requirements consistent with removal of "toxics"	
		5 Meet future NSE/Health Canada drinking water quality requirements	Meet expected drinking water quality requirements	Upgrade WSPs and well systems to meet expected drinking water quality requirements	Enhanced drinking water quality requirements
6 Meet future regulations for overflow volume and frequency	Develop wet weather flow management program including CSO, SSO, and WWTF by-pass reduction based on study area watershed priorities	Implement specific capacity increase/storage/flow reduction (I/I and sewer separation) projects	<ul style="list-style-type: none"> <li>- CSO frequency e.g. events per year or season</li> <li>- WWTF bypass frequency in wet weather</li> <li>- SSO frequency e.g. frequency of occurrence based on 1:5 year design storm</li> </ul>		
		Implement specific deep storm installation projects to facilitate I/I reduction program			
		Implement real time controls to allow for flow optimization			
7 Meet future stormwater quality compliance requirements	Develop stormwater quality management program	Implement specific retrofit and new development stormwater quality projects	Stormwater treatment requirements based on technology (e.g. BMPs and/or water quality)		

Strategic			Tactical			
Driver	Goal	Objective	Programs	Projects	Program Metrics / LOS	
Asset Renewal	Maintain infrastructure serviceability	8 Implement optimal level of asset reinvestment (all asset classes)	Develop asset class renewal program for each asset class	Annual renewal projects for each asset class	Asset renewal rate based on asset risk profile	
	Maintain adequate system security	9 Enhance reliability of critical assets	Develop the water transmission security program	Implement the specific transmission main security projects	Reduction in transmission main failure risk	
			Enhance system reliability including needs for enhancements to firm capacity for treatment and pumping systems, back-up for critical water and wastewater facilities and alarm systems	Implement back up power at specific overflow locations as well as redundancy/protection projects	Reduction in system failure risk	
		10 Ensure existing storm system is adequately sized for minor storm conveyance	Identify possible storm capacity constraints and locations	Conduct storm system capacity assessments	Number storm system capacity upgrade projects identified	
	Assess and implement energy efficiency initiatives	12 Reduce energy consumption, operating costs, and reduce greenhouse gas (GHG) contributions	11 Adapt to future climate change	Adapt to changes in storm flooding particularly with respect to climate change	Implement specific storm system renewal or upgrade projects	System resilience measured by ability to mitigate future flood risk
			Develop pumping station elimination program	Implement specific pumping station elimination/consolidation projects	Number of stations eliminated or consolidated	
			Develop pumping station optimization program (looking at energy optimization, optimizing the number of pumping stations, and right-sizing forcemains for optimal performance)	Implement pumping station optimization projects including variable frequency drive (VFD) implementation	Energy savings realized by pumping station optimization	
			Identify feasible heat/energy recovery programs	Implement feasible specific heat/energy recovery projects	Return on investment	
			Identify feasibility for wind generation program	Implement feasible specific wind generation sites/projects	Return on investment	
			Develop water and wastewater treatment facility energy optimization program	Implement treatment facility energy optimization projects including optimization of aeration systems	Return on investment	
			Identify potential biogas implementations	Implement feasible specific biogas projects	Return on investment	
			Develop energy efficiency design elements for use in pumping station, wastewater treatment facility, pressure reducing valve, and water supply plant designs that consider whole life cost analysis	Implement enhanced pumping station design standards including application of variable frequency drives (VFDs)	Return on investment based on energy savings	
Growth	Support planned growth within the HRM communities	13 Provide regional water, wastewater, and stormwater infrastructure needed to support planned growth	Determine regional water, wastewater and stormwater infrastructure expansion	Implement the specific growth related projects	Timely expansion to permit continued growth.	
			Secure long term water supply for the airport lands	Implement water supply project for airport lands	Adequate supply to meet future needs	
	14 Manage flow capacity allocations	Divert wastewater flows to accommodate optimal management of capacity	Implement specific flow diversion projects	Timely flow management to permit continued approved growth		
		Continue water and wastewater demand reduction practices	Implement enhanced water conservation and I/I reduction programs	Reduction in required infrastructure capacity due to water conservation and I/I reduction programs		

Strategic					Tactical				
Driver	Goal	Objective	Description	Benefits	Variables	Programs	Projects	Program Metrics / LOS	
Regulatory Compliance	Achieve compliance with all regulatory requirements	1	Meet current Nova Scotia Environment (NSE) WWTF permit to operate requirements	A number of HW's WWTF are out of compliance with current NSE permits to operate. These represent an immediate priority for HW and is anticipated in HW's Wastewater Treatment Facility (WWTF) Compliance Plan.	WWTFs operating within required permits. Additional benefits include: reduced environmental impacts, reduced public health risks, greater confidence in HW performance (public image).	The time frame to implement the current compliance requirements may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (3 years); medium (5 years); long (7 years) - these variables will influence the alternative Resource Plans (i.e. 1A, 1B, 1C).	Continue program for meeting current WWTF compliance requirements	Continue implementation of specific WWTF compliance projects based on study area watershed priorities	Current permit to operate effluent requirements
		2	Meet current NSE WSP permit to operate requirements	Presently, HW has no compliance concerns with the WSPs. As a level of service, HW will continue to meet the current NSE WSP permit to operate requirements.	Ongoing drinking water compliance.	None. This will be a requirement of any alternative Resource Plan.	Continue program needed for meeting WSP compliance requirements	Continue implementation of specific WSP compliance projects	Current permit to operate treated water requirements
		3	Meet current overflow compliance requirements	HW will develop programs based on current requirements for overflow compliance. HW will prioritize overflow abatement needs using a risk-based approach that recognizes risk to public health and sensitivity of the receiving water.	Reduced environmental impacts, reduced public health risks, increased enjoyment of recreational areas, fewer beach closures, greater confidence in HW performance (public image).	The time frame to implement the current compliance requirements may vary due to specific requirements once the federal regulations are released, feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (20 years); long (30 years) - these variables will influence the alternative Resource Plans (i.e. 3A, 3B, 3C).	Expand overflow monitoring	Implement monitoring at additional sites	Number of monitored active overflows
							Provide floatables management for overflows	Implement screening at specific sites	Number of active overflows with screening
							Ensure no dry weather overflows	Eliminate all dry weather overflows (e.g. Lyle Street weir)	Number of sites with dry weather overflows
							Ensure no increase in overflows due to growth without an approved management plan	Develop and implement an overflow management plan based on study area watershed priorities	Number of overflows at active overflow sites compared to baseline overflow values
							Balance wastewater flows among facilities to accommodate optimal use of available capacity	Implement specific flow diversion projects	Overall facility capacity utilization
		4	Meet future WWTF effluent requirements	HW will need to respond to future WWTF effluent requirements as these are made known. Presently, HW is aware of impending CCME regulatory changes that will require minimum secondary level treatment for all WWTFs. As well, there is a requirement forthcoming to improve nutrient management of wastewater effluents, particularly for sensitive receiving water environments. An emerging trend in the US is for enhanced effluent requirements related to "toxics".  Variations in technology will be considered once the alternate resource plans are identified.	Reduced environmental impacts, reduced public health risks, increased enjoyment of recreational areas, fewer beach closures, greater confidence in HW performance (public image). These identified benefits related to CCME secondary treatment for WWTF effluent need to be balanced with the greater benefits to be achieved from overflow compliance programs.	There is some minor variation in the time frame for implementing the CCME requirements depending on the class of facility and whether the works are coordinated with CSO management. For the IRP, two time horizons are considered related to CCME compliance: medium (20 years) and long (30 years). Nutrient management will likely be required earlier than the CCME requirements. For the IRP, three time horizons are considered: short (10 years), medium (20 years); and long (30 years). "Toxics" management as an emerging trend not yet seen in Canada is not likely to be prominent until later in the planning horizon of the IRP. For the IRP, one time horizon is considered: long (30 years). These variable time lines will influence the alternative Resource Plans (i.e. 4A, 4B, 4C).	Provide secondary level wastewater treatment for harbour facilities	Upgrade Halifax WWTF to secondary treatment	Future effluent requirements consistent with secondary treatment
								Upgrade Dartmouth WWTF to secondary treatment	Future effluent requirements consistent with secondary treatment
								Upgrade Herring Cove WWTF to secondary treatment	Future effluent requirements consistent with secondary treatment
Provide enhanced nutrient removal for WWTFs discharging to sensitive or limited receiving waters	Implement specific nitrogen (N) & phosphorus (P) reduction projects based on study area watershed priorities						Future effluent requirements consistent with enhanced nutrient removal		
	Provide effluent requirements for "toxics"	Implement specific "toxics" management projects	Future effluent requirements consistent with removal of "toxics"						
5	Meet future NSE/Health Canada drinking water quality requirements	HW has been monitoring and reporting through the Corporate Balanced Scorecard (CBS) the emerging drinking water quality parameters for residual disinfectant (chlorine), trihalomethanes (THM), haloacetic acid (HAA), particle removal, corrosion control (lead). Most of the future requirements are already being met. HW has a Water Quality Master Plan in progress intended to meet these emerging water quality requirements.	Improved drinking water quality in accordance with emerging requirements.	This is a time variable objective. Implementing the Water Quality Master Plan may be achieved under three time horizons: short (3 years), medium (5 years), or long (7 years). These variable time lines will influence the alternative Resource Plans (i.e. 5A, 5B, 5C).	Meet expected drinking water quality requirements	Upgrade WSPs and well systems to meet expected drinking water quality requirements	Enhanced drinking water quality requirements		

Strategic						Tactical			
Driver	Goal	Objective	Description	Benefits	Variables	Programs	Projects	Program Metrics / LOS	
		6	Meet future regulations for overflow volume and frequency	HW currently is required to monitor and report on combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs). HW anticipates there will be a requirement to improve the overflow situation. Early indications are that HW will need to reduce the volume and frequency of CSOs and "virtually" eliminate SSOs (i.e. eliminate SSOs for a 1:5 year event). Operational tasks such as back up power implementation may help to mitigate overflows. Disinfection of CSOs may also be a future requirement.  Variations in technology will be considered once the alternate resource plans are identified.	Reduced environmental impacts, reduced public health risks, increased enjoyment of recreational areas, fewer beach closures, greater confidence in HW performance (public image).	This is a time variable objective. Implementing an I/I reduction program and eliminating SSOs is expected to have a short (10 years), medium (20 years) or long (30 years) implementation horizon. Reducing CSOs, particularly through sewer separation, is expected to have a long (30 years) implementation horizon. Eliminating the WWTF by-passes would likely be implemented over the short (10 years) or medium (20 years) time frame. These variable time lines will influence the alternative Resource Plans (i.e. 6A, 6B, 6C).	Develop wet weather flow management program including CSO, SSO, and WWTF by-pass reduction based on study area watershed priorities	Implement specific capacity increase/storage/flow reduction (I/I and sewer separation) projects  Implement specific deep storm installation projects to facilitate I/I reduction program  Implement real time controls to allow for flow optimization	- CSO frequency e.g. events per year or season - WWTF bypass frequency in wet weather - SSO frequency e.g. frequency of occurrence based on 1:5 year design storm
		7	Meet future stormwater quality compliance requirements	HW anticipates new regulations will be forthcoming for stormwater quality. There remains some question regarding HW's responsibility for stormwater quality	Reduced environmental impacts, reduced fisheries impacts, greater confidence in HW	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 30 years.	Develop stormwater quality management program	Implement specific retrofit and new development stormwater quality projects	Stormwater treatment requirements based on technology (e.g. BMPs and/or water quality)
Asset Renewal	Maintain infrastructure serviceability	8	Implement optimal level of asset reinvestment (all asset classes)	HW has a history of underfunding for wastewater and stormwater assets. Linear water assets have seen reinvestment rates around 0.6% per year on average. In order to ensure sustainable management of HW's assets, an optimal level of reinvestment must be established. As well, an additional allocation for reinvestment will be required to compensate for the historical underfunding of previous decades.  Level of investment will differ depending on the asset class - not all assets have the same asset life.	Preserve the existing asset base and improve the reinvestment of historical assets to ensure asset sustainability and future serviceability.	This is a level of reinvestment-variable objective. As a minimum, HW needs to establish a sustainable (optimal) level of reinvestment to compensate for historical underfunding and to account for future reinvestment needs. The level of investment can be accelerated to provide a more rapid catch up for the historical underfunding. For the IRP, three levels of asset reinvestment per year (using a correlation with asset life) are contemplated: For point assets - minimum (assuming 20% extension of asset life and defined by 1 / 1.2 x asset life); moderate (assuming the asset life and defined by 1 / asset life); aggressive (assuming accelerated replacement by 20% and defined by 1 / 0.8 x asset life); For network/linear assets - minimum (age of assets will increase somewhat over time); moderate (age of assets will remain constant over time); aggressive (age of assets will decrease over time). These variable levels of reinvestment will influence the alternative Resource Plans (i.e. 8A, 8B, 8C).	Develop asset class renewal program for each asset class	Annual renewal projects for each asset class	Asset renewal rate based on asset risk profile
	Maintain adequate system security	9	Enhance reliability of critical assets	HW has critical assets that provide services either to critical industries or to mass population. The impact of not having these assets in service can be catastrophic to HW's performance and the needs of the community as well as causing environmental spills.	Ensures a reliable level of service for critical assets and for key industries (i.e. hospitals). Also provides greater redundancy to protect the environment.	The time frame to implement the system security programs and projects may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (15 years); and long (20 years). These variable time lines will influence the alternative Resource Plans (i.e. 9A, 9B, 9C).	Develop the water transmission security program  Enhance system reliability including needs for enhancements to firm capacity for treatment and pumping systems, back-up for critical water and wastewater facilities and alarm systems	Implement the specific transmission main security projects  Implement back up power at specific overflow locations as well as redundancy/protection projects	Reduction in transmission main failure risk  Reduction in system failure risk
		10	Ensure existing storm system is adequately sized for minor storm conveyance	HW has inherited storm systems with unknown design parameters and there is the potential that stormwater in previous decades was not adequately controlled. Consequently, there may be segments of the storm system that are not properly sized for their intended function.	Greater confidence in the existing storm infrastructure, protection from flooding related to infrastructure.	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 10 years. Note this is for the identification of future capital projects for storm system capacity upgrades - these would be phased over the longer term and can be considered as a variable in future IRPs.	Identify possible storm capacity constraints and locations	Conduct storm system capacity assessments	Number storm system capacity upgrade projects identified

Strategic					Tactical			
Driver	Goal	Objective	Description	Benefits	Variables	Programs	Projects	Program Metrics / LOS
		11 Adapt to future climate change	Climate changes will likely have an impact on HW infrastructure primarily related to storm related flooding. This can impact the combined sewer systems that are subject to tidal influences and where increases in storm flows cannot be managed in the existing combined sewer systems. Currently, HW does not anticipate significant climate change impacts on water supply.	Preparedness related to climate change impacts on flood prone/sensitive areas.	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 20 years.  Subject to identification of storm system capacity constraints in objective 10, there may be a future phasing requirement for projects and these variations can be considered in future IRPs.	Adapt to changes in storm flooding particularly with respect to climate change	Implement specific storm system renewal or upgrade projects	System resilience measured by ability to mitigate future flood risk
	Assess and implement energy efficiency initiatives	12 Reduce energy consumption, operating costs, and reduce greenhouse gas (GHG) contributions	HW is facing significant increases in power costs due to continuing Nova Scotia Power rate increases, increasing costs of fuel sources, and more intensive treatment processes (i.e. need for membrane facilities). Opportunities to reduce and offset energy consumption need to be explored to help manage operating costs. Consideration for energy efficiency requirements must be made early in the design process such that whole life cycle costs are factored into the design decisions for method and technologies of treatment (need to go beyond the initial capital cost and consider ongoing operating costs in the evaluation). HW also needs to consider energy efficiency related to the fleet program.	Demonstrates HW's commitment to investing in demand reduction practices that support optimized operating costs. Also provides a positive message to the NSUARB and stakeholders about HW's willingness to explore cost savings to offset the needs for increased rates.	This is a time variable objective. Implementing the energy efficiency initiatives will reasonably take a number of years however, early implementation of some programs will help illustrate the payback potential for future programs. For the IRP, the energy efficiency implementation is planned under three time horizons: short (5 years), medium (7 years), or long (10 years). These variable time lines will influence the alternative Resource Plans (i.e. 12A, 12B, 12C).	Develop pumping station elimination program	Implement specific pumping station elimination/consolidation projects	Number of stations eliminated or consolidated
						Develop pumping station optimization program (looking at energy optimization, optimizing the number of pumping stations, and right-sizing forcemains for optimal performance)	Implement pumping station optimization projects including variable frequency drive (VFD) implementation	Energy savings realized by pumping station optimization
						Identify feasible heat/energy recovery programs	Implement feasible specific heat/energy recovery projects	Return on investment
						Identify feasibility for wind generation program	Implement feasible specific wind generation sites/projects	Return on investment
						Develop water and wastewater treatment facility energy optimization program	Implement treatment facility energy optimization projects including optimization of aeration systems	Return on investment
						Identify potential biogas implementations	Implement feasible specific biogas projects	Return on investment
						Develop energy efficiency design elements for use in pumping station, wastewater treatment facility, pressure reducing valve, and water supply plant designs that consider whole life cost analysis	Implement enhanced pumping station design standards including application of variable frequency drives (VFDs)	Return on investment based on energy savings
							Implement enhanced pressure reducing valve (PRV) design standards	Return on investment based on energy savings
							Implement enhanced wastewater treatment facility design standards including high efficiency aeration systems	Return on investment based on energy savings
							Implement enhanced water supply plant design standards	Return on investment based on energy savings
Growth	Support planned growth within the HRM communities	13 Provide regional water, wastewater, and stormwater infrastructure needed to support planned growth	Generally, growth will pay for itself. HW will respond to growth through the Regional Plan and in commenting on development applications. Where Regional infrastructure is needed to support	Ensures the timely, and coordinated development of infrastructure to support planned growth.	None. This will be a requirement of any alternative Resource Plan.	Determine regional water, wastewater and stormwater infrastructure expansion	Implement the specific growth related projects	Timely expansion to permit continued growth.
						Secure long term water supply for the airport lands	Implement water supply project for airport lands	Adequate supply to meet future needs
		14 Manage flow capacity allocations	HW will monitor and manage system flows to identify capacity constraint areas and required works to mitigate the constraints.	Ensures the timely, and coordinated development of infrastructure to support planned growth. Also allows HW to optimize flows.	None. This will be a requirement of any alternative Resource Plan.	Divert wastewater flows to accommodate optimal management of capacity	Implement specific flow diversion projects	Timely flow management to permit continued approved growth
						Continue water and wastewater demand reduction practices	Implement enhanced water conservation and I/I reduction programs	Reduction in required infrastructure capacity due to water conservation and I/I reduction programs

## Resource Plans

(elements and variations)

light shaded cells remain as defined for the Reference Plan

		Variations			1	2	3	4	5	6	7	
		A	B	C	INITIAL PLAN	AGGRESSIVE COMPLIANCE FOCUS	AGGRESSIVE ASSET RENEWAL	AGGRESSIVE COMPLIANCE & AGGRESSIVE ASSET RENEWAL	AGGRESSIVE CURRENT COMPL. MODERATE FUTURE COMPLIANCE MODERATE ASSET RENEWAL	MODERATE CURRENT COMPL. MINIMUM FUTURE COMPLIANCE MINIMUM ASSET RENEWAL	MOD. CURRENT WWTF COMPL. AGG. CURRENT O/F COMPL. MODERATE FUTURE WW COMPL. AGG FUTURE WATER COMPL. MODERATE ASSET RENEWAL AGGRESSIVE ENERGY MGMT	
Objective	Variables											
REGULATORY COMPLIANCE	1 Meet current Nova Scotia Environment (NSE) WWTF permit to operate requirements	The time frame to implement the current compliance requirements may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (3 years); medium (5 years); long (7 years) - these variables will influence the alternative Resource Plans (i.e. 1A, 1B, 1C).	3 years	5 years	7 years	1C	1A	1C	1A	1A	1B	1B
	2 Meet current NSE WSP permit to operate requirements	None. This will be a requirement of any alternative Resource Plan.	ongoing			X	X	X	X	X	X	X
	3 Meet current overflow compliance requirements	The time frame to implement the current compliance requirements may vary due to specific requirements once the federal regulations are released, feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (20 years); long (30 years) - these variables will influence the alternative Resource Plans (i.e. 3A, 3B, 3C).	10 years	20 years	30 years	3C	3A	3C	3A	3A	3B	3A
	4 Meet future WWTF effluent requirements	There is some minor variation in the time frame for implementing the CCME requirements depending on the class of facility and whether the works are coordinated with CSO management. For the IRP, two time horizons are considered related to CCME compliance: medium (20 years) and long (30 years). Nutrient management will likely be required earlier than the CCME requirements. For the IRP, three time horizons are considered: short (10 years), medium (20 years); and long (30 years). "Toxics" management as an emerging trend not yet seen in Canada is not likely to be prominent until later in the planning horizon of the IRP. For the IRP, one time horizon is considered: long (30 years). These variable time lines will influence the alternative Resource Plans (i.e. 4A, 4B, 4C).	- nutrient management (10 years) - CCME WWTF effluent rqrmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (20 years) - CCME WWTF effluent rqrmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (30 years) - CCME WWTF effluent rqrmts (30 years) - "toxics" mgmt (30 years)	4C	4A	4C	4A	4B	4C	4B
	5 Meet future NSE/Health Canada drinking water quality requirements	This is a time variable objective. Implementing the Water Quality Master Plan may be achieved under three time horizons: short (3 years), medium (5 years), or long (7 years). These variable time lines will influence the alternative Resource Plans (i.e. 5A, 5B, 5C).	3 years	5 years	7 years	5C	5A	5C	5A	5B	5C	5A
	6 Meet future regulations for overflow volume and frequency	This is a time variable objective. Implementing an I/I reduction program and eliminating SSOs is expected to have a short (10 years), medium (20 years) or long (30 years) implementation horizon. Reducing CSOs, particularly through sewer separation, is expected to have a long (30 years) implementation horizon. Eliminating the WWTF by-passes would likely be implemented over the short (10 years) or medium (20 years) time frame. These variable time lines will influence the alternative Resource Plans (i.e. 6A, 6B, 6C).	- eliminate WWTF by-passes (10 years) - I/I reduction & SSO elimination (10 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (20 years) - I/I reduction & SSO elimination (20 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (30 years) - I/I reduction & SSO elimination (30 years) - CSO reduction (30 years)	6C	6A	6C	6A	6B	6C	6B
	7 Meet future stormwater quality compliance requirements	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 30 years.	30 years			X	X	X	X	X	X	X
ASSET RENEWAL	8 Implement optimal level of asset reinvestment (all asset classes)	This is a level of reinvestment-variable objective. As a minimum, HW needs to establish a sustainable (optimal) level of reinvestment to compensate for historical underfunding and to account for future reinvestment needs. The level of investment can be accelerated to provide a more rapid catch up for the historical underfunding. For the IRP, three levels of asset reinvestment per year (using a correlation with asset life) are contemplated: For point assets - minimum (assuming 20% extension of asset life and defined by 1 / 1.2 x asset life); moderate (assuming the asset life and defined by 1 / asset life); aggressive (assuming accelerated replacement by 20% and defined by 1 / 0.8 x asset life); For network/linear assets - minimum (age of assets will increase somewhat over time); moderate (age of assets will remain constant over time); aggressive (age of assets will decrease over time). These variable levels of reinvestment will influence the alternative Resource Plans (i.e. 8A, 8B, 8C).	Aggressive point assets: 1 / 0.8 x asset life network assets: % investment per year (decreasing asset age over time)	Moderate point assets: 1 / 1 x asset life network assets: % investment per year (asset age constant over time)	Minimum point assets: 1 / 1.2 x asset life network assets: % investment per year (increasing asset age over time)	8C	8C	8A	8A	8B	8C	8B
	9 Enhance reliability of critical assets	The time frame to implement the system security programs and projects may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (15 years); and long (20 years). These variable time lines will influence the alternative Resource Plans (i.e. 9A, 9B, 9C).	10 years	15 years	20 years	9C	9C	9A	9A	9B	9C	9B
	10 Ensure existing storm system is adequately sized for minor storm conveyance	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 10 years. Note this is for the identification of future capital projects for storm system capacity upgrades - these would be phased over the longer term and can be considered as a variable in future IRPs.	10 years			X	X	X	X	X	X	X
	11 Adapt to future climate change	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 20 years.	20 years			X	X	X	X	X	X	X
GROWTH	12 Reduce energy consumption, operating costs, and reduce greenhouse gas (GHG) contributions	This is a time variable objective. Implementing the energy efficiency initiatives will reasonably take a number of years however, early implementation of some programs will help illustrate the payback potential for future programs. For the IRP, the energy efficiency implementation is planned under three time horizons: short (5 years), medium (7 years), or long (10 years). These variable time lines will influence the alternative Resource Plans (i.e. 12A, 12B, 12C).	5 years	7 years	10 years	12C	12C	12A	12A	12B	12C	12A
	13 Provide regional water, wastewater, and stormwater infrastructure needed to support planned growth	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement			X	X	X	X	X	X	X
	14 Manage flow capacity allocations	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement			X	X	X	X	X	X	X

## PLAN 1 - INITIAL PLAN

	Objective	Variables	Variations		
			A	B	C
REGULATORY COMPLIANCE	1 Meet current Nova Scotia Environment (NSE) WWTF permit to operate requirements	The time frame to implement the current compliance requirements may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (3 years); medium (5 years); long (7 years) - these variables will influence the alternative Resource Plans (i.e. 1A, 1B, 1C).	3 years	5 years	7 years
	2 Meet current NSE WSP permit to operate requirements	None. This will be a requirement of any alternative Resource Plan.	ongoing		
	3 Meet current overflow compliance requirements	The time frame to implement the current compliance requirements may vary due to specific requirements once the federal regulations are released, feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (20 years); long (30 years) - these variables will influence the alternative Resource Plans (i.e. 3A, 3B, 3C).	10 years	20 years	30 years
	4 Meet future WWTF effluent requirements	There is some minor variation in the time frame for implementing the CCME requirements depending on the class of facility and whether the works are coordinated with CSO management. For the IRP, two time horizons are considered related to CCME compliance: medium (20 years) and long (30 years). Nutrient management will likely be required earlier than the CCME requirements. For the IRP, three time horizons are considered: short (10 years), medium (20 years); and long (30 years). "Toxics" management as an emerging trend not yet seen in Canada is not likely to be prominent until later in the planning horizon of the IRP. For the IRP, one time horizon is considered: long (30 years). These variable time lines will influence the alternative Resource Plans (i.e. 4A, 4B, 4C).	- nutrient management (10 years) - CCME WWTF effluent rqrmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (20 years) - CCME WWTF effluent rqrmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (30 years) - CCME WWTF effluent rqrmts (30 years) - "toxics" mgmt (30 years)
	5 Meet future NSE/Health Canada drinking water quality requirements	This is a time variable objective. Implementing the Water Quality Master Plan may be achieved under three time horizons: short (3 years), medium (5 years), or long (7 years). These variable time lines will influence the alternative Resource Plans (i.e. 5A, 5B, 5C).	3 years	5 years	7 years
	6 Meet future regulations for overflow volume and frequency	This is a time variable objective. Implementing an I/I reduction program and eliminating SSOs is expected to have a short (10 years), medium (20 years) or long (30 years) implementation horizon. Reducing CSOs, particularly through sewer separation, is expected to have a long (30 years) implementation horizon. Eliminating the WWTF by-passes would likely be implemented over the short (10 years) or medium (20 years) time frame. These variable time lines will influence the alternative Resource Plans (i.e. 6A, 6B, 6C).	- eliminate WWTF by-passes (10 years) - I/I reduction & SSO elimination (10 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (20 years) - I/I reduction & SSO elimination (20 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (30 years) - I/I reduction & SSO elimination (30 years) - CSO reduction (30 years)
	7 Meet future stormwater quality compliance requirements	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 30 years.	30 years		
ASSET RENEWAL	8 Implement optimal level of asset reinvestment (all asset classes)	This is a level of reinvestment-variable objective. As a minimum, HW needs to establish a sustainable (optimal) level of reinvestment to compensate for historical underfunding and to account for future reinvestment needs. The level of investment can be accelerated to provide a more rapid catch up for the historical underfunding. For the IRP, three levels of asset reinvestment per year (using a correlation with asset life) are contemplated: For point assets - minimum (assuming 20% extension of asset life and defined by 1 / 1.2 x asset life); moderate (assuming the asset life and defined by 1 / asset life); aggressive (assuming accelerated replacement by 20% and defined by 1 / 0.8 x asset life); For network/linear assets - minimum (age of assets will increase somewhat over time); moderate (age of assets will remain constant over time); aggressive (age of assets will decrease over time). These variable levels of reinvestment will influence the alternative Resource Plans (i.e. 8A, 8B, 8C).	Aggressive  1 / 0.8 x asset life  network assets: % investment per year (decreasing asset age over time)	Moderate  1 / 1 x asset life  network assets: % investment per year (asset age constant over time)	Minimum  1 / 1.2 x asset life  network assets: % investment per year (increasing asset age over time)
	9 Enhance reliability of critical assets	The time frame to implement the system security programs and projects may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (15 years); and long (20 years). These variable time lines will influence the alternative Resource Plans (i.e. 9A, 9B, 9C).	10 years	15 years	20 years
	10 Ensure existing storm system is adequately sized for minor storm conveyance	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 10 years. Note this is for the identification of future capital projects for storm system capacity upgrades - these would be phased over the longer term and can be considered as a variable in future IRPs.	10 years		
	11 Adapt to future climate change	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 20 years.	20 years		
	12 Reduce energy consumption, operating costs, and reduce greenhouse gas (GHG) contributions	This is a time variable objective. Implementing the energy efficiency initiatives will reasonably take a number of years however, early implementation of some programs will help illustrate the payback potential for future programs. For the IRP, the energy efficiency implementation is planned under three time horizons: short (5 years), medium (7 years), or long (10 years). These variable time lines will influence the alternative Resource Plans (i.e. 12A, 12B, 12C).	5 years	7 years	10 years
GROWTH	13 Provide regional water, wastewater, and stormwater infrastructure needed to support planned growth	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement		
	14 Manage flow capacity allocations	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement		

## PLAN 2- AGGRESSIVE COMPLIANCE FOCUS

	Objective	Variables	Variations		
			A	B	C
REGULATORY COMPLIANCE	1 Meet current Nova Scotia Environment (NSE) WWTF permit to operate requirements	The time frame to implement the current compliance requirements may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (3 years); medium (5 years); long (7 years) - these variables will influence the alternative Resource Plans (i.e. 1A, 1B, 1C).	3 years	5 years	7 years
	2 Meet current NSE WSP permit to operate requirements	None. This will be a requirement of any alternative Resource Plan.	ongoing		
	3 Meet current overflow compliance requirements	The time frame to implement the current compliance requirements may vary due to specific requirements once the federal regulations are released, feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (20 years); long (30 years) - these variables will influence the alternative Resource Plans (i.e. 3A, 3B, 3C).	10 years	20 years	30 years
	4 Meet future WWTF effluent requirements	There is some minor variation in the time frame for implementing the CCME requirements depending on the class of facility and whether the works are coordinated with CSO management. For the IRP, two time horizons are considered related to CCME compliance: medium (20 years) and long (30 years). Nutrient management will likely be required earlier than the CCME requirements. For the IRP, three time horizons are considered: short (10 years), medium (20 years); and long (30 years). "Toxics" management as an emerging trend not yet seen in Canada is not likely to be prominent until later in the planning horizon of the IRP. For the IRP, one time horizon is considered: long (30 years). These variable time lines will influence the alternative Resource Plans (i.e. 4A, 4B, 4C).	- nutrient management (10 years) - CCME WWTF effluent rqrmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (20 years) - CCME WWTF effluent rqrmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (30 years) - CCME WWTF effluent rqrmts (30 years) - "toxics" mgmt (30 years)
	5 Meet future NSE/Health Canada drinking water quality requirements	This is a time variable objective. Implementing the Water Quality Master Plan may be achieved under three time horizons: short (3 years), medium (5 years), or long (7 years). These variable time lines will influence the alternative Resource Plans (i.e. 5A, 5B, 5C).	3 years	5 years	7 years
	6 Meet future regulations for overflow volume and frequency	This is a time variable objective. Implementing an I/I reduction program and eliminating SSOs is expected to have a short (10 years), medium (20 years) or long (30 years) implementation horizon. Reducing CSOs, particularly through sewer separation, is expected to have a long (30 years) implementation horizon. Eliminating the WWTF by-passes would likely be implemented over the short (10 years) or medium (20 years) time frame. These variable time lines will influence the alternative Resource Plans (i.e. 6A, 6B, 6C).	- eliminate WWTF by-passes (10 years) - I/I reduction & SSO elimination (10 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (20 years) - I/I reduction & SSO elimination (20 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (30 years) - I/I reduction & SSO elimination (30 years) - CSO reduction (30 years)
	7 Meet future stormwater quality compliance requirements	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 30 years.	30 years		
ASSET RENEWAL	8 Implement optimal level of asset reinvestment (all asset classes)	This is a level of reinvestment-variable objective. As a minimum, HW needs to establish a sustainable (optimal) level of reinvestment to compensate for historical underfunding and to account for future reinvestment needs. The level of investment can be accelerated to provide a more rapid catch up for the historical underfunding. For the IRP, three levels of asset reinvestment per year (using a correlation with asset life) are contemplated: For point assets - minimum (assuming 20% extension of asset life and defined by 1 / 1.2 x asset life); moderate (assuming the asset life and defined by 1 / asset life); aggressive (assuming accelerated replacement by 20% and defined by 1 / 0.8 x asset life); For network/linear assets - minimum (age of assets will increase somewhat over time); moderate (age of assets will remain constant over time); aggressive (age of assets will decrease over time). These variable levels of reinvestment will influence the alternative Resource Plans (i.e. 8A, 8B, 8C).	Aggressive  point assets: 1 / 0.8 x asset life  network assets: % investment per year (decreasing asset age over time)	Moderate  point assets: 1 / 1 x asset life  network assets: % investment per year (asset age constant over time)	Minimum  point assets: 1 / 1.2 x asset life  network assets: % investment per year (increasing asset age over time)
	9 Enhance reliability of critical assets	The time frame to implement the system security programs and projects may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (15 years); and long (20 years). These variable time lines will influence the alternative Resource Plans (i.e. 9A, 9B, 9C).	10 years	15 years	20 years
	10 Ensure existing storm system is adequately sized for minor storm conveyance	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 10 years. Note this is for the identification of future capital projects for storm system capacity upgrades - these would be phased over the longer term and can be considered as a variable in future IRPs.	10 years		
	11 Adapt to future climate change	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 20 years.	20 years		
	12 Reduce energy consumption, operating costs, and reduce greenhouse gas (GHG) contributions	This is a time variable objective. Implementing the energy efficiency initiatives will reasonably take a number of years however, early implementation of some programs will help illustrate the payback potential for future programs. For the IRP, the energy efficiency implementation is planned under three time horizons: short (5 years), medium (7 years), or long (10 years). These variable time lines will influence the alternative Resource Plans (i.e. 12A, 12B, 12C).	5 years	7 years	10 years
GROWTH	13 Provide regional water, wastewater, and stormwater infrastructure needed to support planned growth	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement		
	14 Manage flow capacity allocations	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement		

## PLAN 3- AGGRESSIVE ASSET RENEWAL

		Variations			
Objective		A	B	C	
REGULATORY COMPLIANCE	1 Meet current Nova Scotia Environment (NSE) WWTF permit to operate requirements	The time frame to implement the current compliance requirements may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (3 years); medium (5 years); long (7 years) - these variables will influence the alternative Resource Plans (i.e. 1A, 1B, 1C).	3 years	5 years	7 years
	2 Meet current NSE WSP permit to operate requirements	None. This will be a requirement of any alternative Resource Plan.	ongoing		
	3 Meet current overflow compliance requirements	The time frame to implement the current compliance requirements may vary due to specific requirements once the federal regulations are released, feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (20 years); long (30 years) - these variables will influence the alternative Resource Plans (i.e. 3A, 3B, 3C).	10 years	20 years	30 years
	4 Meet future WWTF effluent requirements	There is some minor variation in the time frame for implementing the CCME requirements depending on the class of facility and whether the works are coordinated with CSO management. For the IRP, two time horizons are considered related to CCME compliance: medium (20 years) and long (30 years). Nutrient management will likely be required earlier than the CCME requirements. For the IRP, three time horizons are considered: short (10 years), medium (20 years); and long (30 years). "Toxics" management as an emerging trend not yet seen in Canada is not likely to be prominent until later in the planning horizon of the IRP. For the IRP, one time horizon is considered: long (30 years). These variable time lines will influence the alternative Resource Plans (i.e. 4A, 4B, 4C).	- nutrient management (10 years) - CCME WWTF effluent rqrmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (20 years) - CCME WWTF effluent rqrmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (30 years) - CCME WWTF effluent rqrmts (30 years) - "toxics" mgmt (30 years)
	5 Meet future NSE/Health Canada drinking water quality requirements	This is a time variable objective. Implementing the Water Quality Master Plan may be achieved under three time horizons: short (3 years), medium (5 years), or long (7 years). These variable time lines will influence the alternative Resource Plans (i.e. 5A, 5B, 5C).	3 years	5 years	7 years
	6 Meet future regulations for overflow volume and frequency	This is a time variable objective. Implementing an I/I reduction program and eliminating SSOs is expected to have a short (10 years), medium (20 years) or long (30 years) implementation horizon. Reducing CSOs, particularly through sewer separation, is expected to have a long (30 years) implementation horizon. Eliminating the WWTF by-passes would likely be implemented over the short (10 years) or medium (20 years) time frame. These variable time lines will influence the alternative Resource Plans (i.e. 6A, 6B, 6C).	- eliminate WWTF by-passes (10 years) - I/I reduction & SSO elimination (10 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (20 years) - I/I reduction & SSO elimination (20 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (30 years) - I/I reduction & SSO elimination (30 years) - CSO reduction (30 years)
	7 Meet future stormwater quality compliance requirements	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 30 years.	30 years		
ASSET RENEWAL	8 Implement optimal level of asset reinvestment (all asset classes)	This is a level of reinvestment-variable objective. As a minimum, HW needs to establish a sustainable (optimal) level of reinvestment to compensate for historical underfunding and to account for future reinvestment needs. The level of investment can be accelerated to provide a more rapid catch up for the historical underfunding. For the IRP, three levels of asset reinvestment per year (using a correlation with asset life) are contemplated: For point assets - minimum (assuming 20% extension of asset life and defined by 1 / 1.2 x asset life); moderate (assuming the asset life and defined by 1 / asset life); aggressive (assuming accelerated replacement by 20% and defined by 1 / 0.8 x asset life); For network/linear assets - minimum (age of assets will increase somewhat over time); moderate (age of assets will remain constant over time); aggressive (age of assets will decrease over time). These variable levels of reinvestment will influence the alternative Resource Plans (i.e. 8A, 8B, 8C).	Aggressive  point assets: 1 / 0.8 x asset life  network assets: % investment per year (decreasing asset age over time)	Moderate  point assets: 1 / 1 x asset life  network assets: % investment per year (asset age constant over time)	Minimum  point assets: 1 / 1.2 x asset life  network assets: % investment per year (increasing asset age over time)
	9 Enhance reliability of critical assets	The time frame to implement the system security programs and projects may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (15 years); and long (20 years). These variable time lines will influence the alternative Resource Plans (i.e. 9A, 9B, 9C).	10 years	15 years	20 years
	10 Ensure existing storm system is adequately sized for minor storm conveyance	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 10 years. Note this is for the identification of future capital projects for storm system capacity upgrades - these would be phased over the longer term and can be considered as a variable in future IRPs.	10 years		
	11 Adapt to future climate change	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 20 years.	20 years		
	12 Reduce energy consumption, operating costs, and reduce greenhouse gas (GHG) contributions	This is a time variable objective. Implementing the energy efficiency initiatives will reasonably take a number of years however, early implementation of some programs will help illustrate the payback potential for future programs. For the IRP, the energy efficiency implementation is planned under three time horizons: short (5 years), medium (7 years), or long (10 years). These variable time lines will influence the alternative Resource Plans (i.e. 12A, 12B, 12C).	5 years	7 years	10 years
GROWTH	13 Provide regional water, wastewater, and stormwater infrastructure needed to support planned growth	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement		
	14 Manage flow capacity allocations	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement		

## PLAN 4 - AGGRESSIVE COMPLIANCE & AGGRESSIVE ASSET RENEWAL

		Variations			
Objective		A	B	C	
REGULATORY COMPLIANCE	1 Meet current Nova Scotia Environment (NSE) WWTF permit to operate requirements	The time frame to implement the current compliance requirements may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (3 years); medium (5 years); long (7 years) - these variables will influence the alternative Resource Plans (i.e. 1A, 1B, 1C).	3 years	5 years	7 years
	2 Meet current NSE WSP permit to operate requirements	None. This will be a requirement of any alternative Resource Plan.	ongoing		
	3 Meet current overflow compliance requirements	The time frame to implement the current compliance requirements may vary due to specific requirements once the federal regulations are released, feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (20 years); long (30 years) - these variables will influence the alternative Resource Plans (i.e. 3A, 3B, 3C).	10 years	20 years	30 years
	4 Meet future WWTF effluent requirements	There is some minor variation in the time frame for implementing the CCME requirements depending on the class of facility and whether the works are coordinated with CSO management. For the IRP, two time horizons are considered related to CCME compliance: medium (20 years) and long (30 years). Nutrient management will likely be required earlier than the CCME requirements. For the IRP, three time horizons are considered: short (10 years), medium (20 years); and long (30 years). "Toxics" management as an emerging trend not yet seen in Canada is not likely to be prominent until later in the planning horizon of the IRP. For the IRP, one time horizon is considered: long (30 years). These variable time lines will influence the alternative Resource Plans (i.e. 4A, 4B, 4C).	- nutrient management (10 years) - CCME WWTF effluent rqmmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (20 years) - CCME WWTF effluent rqmmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (30 years) - CCME WWTF effluent rqmmts (30 years) - "toxics" mgmt (30 years)
	5 Meet future NSE/Health Canada drinking water quality requirements	This is a time variable objective. Implementing the Water Quality Master Plan may be achieved under three time horizons: short (3 years), medium (5 years), or long (7 years). These variable time lines will influence the alternative Resource Plans (i.e. 5A, 5B, 5C).	3 years	5 years	7 years
	6 Meet future regulations for overflow volume and frequency	This is a time variable objective. Implementing an I/I reduction program and eliminating SSOs is expected to have a short (10 years), medium (20 years) or long (30 years) implementation horizon. Reducing CSOs, particularly through sewer separation, is expected to have a long (30 years) implementation horizon. Eliminating the WWTF by-passes would likely be implemented over the short (10 years) or medium (20 years) time frame. These variable time lines will influence the alternative Resource Plans (i.e. 6A, 6B, 6C).	- eliminate WWTF by-passes (10 years) - I/I reduction & SSO elimination (10 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (20 years) - I/I reduction & SSO elimination (20 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (30 years) - I/I reduction & SSO elimination (30 years) - CSO reduction (30 years)
	7 Meet future stormwater quality compliance requirements	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 30 years.	30 years		
ASSET RENEWAL	8 Implement optimal level of asset reinvestment (all asset classes)	This is a level of reinvestment-variable objective. As a minimum, HW needs to establish a sustainable (optimal) level of reinvestment to compensate for historical underfunding and to account for future reinvestment needs. The level of investment can be accelerated to provide a more rapid catch up for the historical underfunding. For the IRP, three levels of asset reinvestment per year (using a correlation with asset life) are contemplated: For point assets - minimum (assuming 20% extension of asset life and defined by 1 / 1.2 x asset life); moderate (assuming the asset life and defined by 1 / asset life); aggressive (assuming accelerated replacement by 20% and defined by 1 / 0.8 x asset life); For network/linear assets - minimum (age of assets will increase somewhat over time); moderate (age of assets will remain constant over time); aggressive (age of assets will decrease over time). These variable levels of reinvestment will influence the alternative Resource Plans (i.e. 8A, 8B, 8C).	Aggressive  1 / 0.8 x asset life  network assets: % investment per year (decreasing asset age over time)	Moderate  1 / 1 x asset life  network assets: % investment per year (asset age constant over time)	Minimum  1 / 1.2 x asset life  network assets: % investment per year (increasing asset age over time)
	9 Enhance reliability of critical assets	The time frame to implement the system security programs and projects may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (15 years); and long (20 years). These variable time lines will influence the alternative Resource Plans (i.e. 9A, 9B, 9C).	10 years	15 years	20 years
	10 Ensure existing storm system is adequately sized for minor storm conveyance	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 10 years. Note this is for the identification of future capital projects for storm system capacity upgrades - these would be phased over the longer term and can be considered as a variable in future IRPs.	10 years		
	11 Adapt to future climate change	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 20 years.	20 years		
	12 Reduce energy consumption, operating costs, and reduce greenhouse gas (GHG) contributions	This is a time variable objective. Implementing the energy efficiency initiatives will reasonably take a number of years however, early implementation of some programs will help illustrate the payback potential for future programs. For the IRP, the energy efficiency implementation is planned under three time horizons: short (5 years), medium (7 years), or long (10 years). These variable time lines will influence the alternative Resource Plans (i.e. 12A, 12B, 12C).	5 years	7 years	10 years
GROWTH	13 Provide regional water, wastewater, and stormwater infrastructure needed to support planned growth	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement		
	14 Manage flow capacity allocations	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement		

**PLAN 5 -  
AGGRESSIVE CURRENT COMPLIANCE  
MODERATE FUTURE COMPLIANCE  
MODERATE ASSET RENEWAL**

	Objective	Variables	Variations		
			A	B	C
REGULATORY COMPLIANCE	1 Meet current Nova Scotia Environment (NSE) WWTF permit to operate requirements	The time frame to implement the current compliance requirements may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (3 years); medium (5 years); long (7 years) - these variables will influence the alternative Resource Plans (i.e. 1A, 1B, 1C).	3 years	5 years	7 years
	2 Meet current NSE WSP permit to operate requirements	None. This will be a requirement of any alternative Resource Plan.	ongoing		
	3 Meet current overflow compliance requirements	The time frame to implement the current compliance requirements may vary due to specific requirements once the federal regulations are released, feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (20 years); long (30 years) - these variables will influence the alternative Resource Plans (i.e. 3A, 3B, 3C).	10 years	20 years	30 years
	4 Meet future WWTF effluent requirements	There is some minor variation in the time frame for implementing the CCME requirements depending on the class of facility and whether the works are coordinated with CSO management. For the IRP, two time horizons are considered related to CCME compliance: medium (20 years) and long (30 years). Nutrient management will likely be required earlier than the CCME requirements. For the IRP, three time horizons are considered: short (10 years), medium (20 years); and long (30 years). "Toxics" management as an emerging trend not yet seen in Canada is not likely to be prominent until later in the planning horizon of the IRP. For the IRP, one time horizon is considered: long (30 years). These variable time lines will influence the alternative Resource Plans (i.e. 4A, 4B, 4C).	- nutrient management (10 years) - CCME WWTF effluent rqmmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (20 years) - CCME WWTF effluent rqmmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (30 years) - CCME WWTF effluent rqmmts (30 years) - "toxics" mgmt (30 years)
	5 Meet future NSE/Health Canada drinking water quality requirements	This is a time variable objective. Implementing the Water Quality Master Plan may be achieved under three time horizons: short (3 years), medium (5 years), or long (7 years). These variable time lines will influence the alternative Resource Plans (i.e. 5A, 5B, 5C).	3 years	5 years	7 years
	6 Meet future regulations for overflow volume and frequency	This is a time variable objective. Implementing an I/I reduction program and eliminating SSOs is expected to have a short (10 years), medium (20 years) or long (30 years) implementation horizon. Reducing CSOs, particularly through sewer separation, is expected to have a long (30 years) implementation horizon. Eliminating the WWTF by-passes would likely be implemented over the short (10 years) or medium (20 years) time frame. These variable time lines will influence the alternative Resource Plans (i.e. 6A, 6B, 6C).	- eliminate WWTF by-passes (10 years) - I/I reduction & SSO elimination (10 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (20 years) - I/I reduction & SSO elimination (20 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (30 years) - I/I reduction & SSO elimination (30 years) - CSO reduction (30 years)
	7 Meet future stormwater quality compliance requirements	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 30 years.	30 years		
ASSET RENEWAL	8 Implement optimal level of asset reinvestment (all asset classes)	This is a level of reinvestment-variable objective. As a minimum, HW needs to establish a sustainable (optimal) level of reinvestment to compensate for historical underfunding and to account for future reinvestment needs. The level of investment can be accelerated to provide a more rapid catch up for the historical underfunding. For the IRP, three levels of asset reinvestment per year (using a correlation with asset life) are contemplated: For point assets - minimum (assuming 20% extension of asset life and defined by 1 / 1.2 x asset life); moderate (assuming the asset life and defined by 1 / asset life); aggressive (assuming accelerated replacement by 20% and defined by 1 / 0.8 x asset life); For network/linear assets - minimum (age of assets will increase somewhat over time); moderate (age of assets will remain constant over time); aggressive (age of assets will decrease over time). These variable levels of reinvestment will influence the alternative Resource Plans (i.e. 8A, 8B, 8C).	Aggressive  point assets: 1 / 0.8 x asset life  network assets: % investment per year (decreasing asset age over time)	Moderate  point assets: 1 / 1 x asset life  network assets: % investment per year (asset age constant over time)	Minimum  point assets: 1 / 1.2 x asset life  network assets: % investment per year (increasing asset age over time)
	9 Enhance reliability of critical assets	The time frame to implement the system security programs and projects may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (15 years); and long (20 years). These variable time lines will influence the alternative Resource Plans (i.e. 9A, 9B, 9C).	10 years	15 years	20 years
	10 Ensure existing storm system is adequately sized for minor storm conveyance	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 10 years. Note this is for the identification of future capital projects for storm system capacity upgrades - these would be phased over the longer term and can be considered as a variable in future IRPs.	10 years		
	11 Adapt to future climate change	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 20 years.	20 years		
	12 Reduce energy consumption, operating costs, and reduce greenhouse gas (GHG) contributions	This is a time variable objective. Implementing the energy efficiency initiatives will reasonably take a number of years however, early implementation of some programs will help illustrate the payback potential for future programs. For the IRP, the energy efficiency implementation is planned under three time horizons: short (5 years), medium (7 years), or long (10 years). These variable time lines will influence the alternative Resource Plans (i.e. 12A, 12B, 12C).	5 years	7 years	10 years
GROWTH	13 Provide regional water, wastewater, and stormwater infrastructure needed to support planned growth	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement		
	14 Manage flow capacity allocations	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement		

**PLAN 6 -  
MODERATE CURRENT COMPLIANCE  
MINIMUM FUTURE COMPLIANCE  
MINIMUM ASSET RENEWAL**

	Objective	Variables	Variations		
			A	B	C
REGULATORY COMPLIANCE	1 Meet current Nova Scotia Environment (NSE) WWTF permit to operate requirements	The time frame to implement the current compliance requirements may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (3 years); medium (5 years); long (7 years) - these variables will influence the alternative Resource Plans (i.e. 1A, 1B, 1C).	3 years	5 years	7 years
	2 Meet current NSE WSP permit to operate requirements	None. This will be a requirement of any alternative Resource Plan.	ongoing		
	3 Meet current overflow compliance requirements	The time frame to implement the current compliance requirements may vary due to specific requirements once the federal regulations are released, feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (20 years); long (30 years) - these variables will influence the alternative Resource Plans (i.e. 3A, 3B, 3C).	10 years	20 years	30 years
	4 Meet future WWTF effluent requirements	There is some minor variation in the time frame for implementing the CCME requirements depending on the class of facility and whether the works are coordinated with CSO management. For the IRP, two time horizons are considered related to CCME compliance: medium (20 years) and long (30 years). Nutrient management will likely be required earlier than the CCME requirements. For the IRP, three time horizons are considered: short (10 years), medium (20 years); and long (30 years). "Toxics" management as an emerging trend not yet seen in Canada is not likely to be prominent until later in the planning horizon of the IRP. For the IRP, one time horizon is considered: long (30 years). These variable time lines will influence the alternative Resource Plans (i.e. 4A, 4B, 4C).	- nutrient management (10 years) - CCME WWTF effluent rqrmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (20 years) - CCME WWTF effluent rqrmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (30 years) - CCME WWTF effluent rqrmts (30 years) - "toxics" mgmt (30 years)
	5 Meet future NSE/Health Canada drinking water quality requirements	This is a time variable objective. Implementing the Water Quality Master Plan may be achieved under three time horizons: short (3 years), medium (5 years), or long (7 years). These variable time lines will influence the alternative Resource Plans (i.e. 5A, 5B, 5C).	3 years	5 years	7 years
	6 Meet future regulations for overflow volume and frequency	This is a time variable objective. Implementing an I/I reduction program and eliminating SSOs is expected to have a short (10 years), medium (20 years) or long (30 years) implementation horizon. Reducing CSOs, particularly through sewer separation, is expected to have a long (30 years) implementation horizon. Eliminating the WWTF by-passes would likely be implemented over the short (10 years) or medium (20 years) time frame. These variable time lines will influence the alternative Resource Plans (i.e. 6A, 6B, 6C).	- eliminate WWTF by-passes (10 years) - I/I reduction & SSO elimination (10 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (20 years) - I/I reduction & SSO elimination (20 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (30 years) - I/I reduction & SSO elimination (30 years) - CSO reduction (30 years)
	7 Meet future stormwater quality compliance requirements	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 30 years.	30 years		
ASSET RENEWAL	8 Implement optimal level of asset reinvestment (all asset classes)	This is a level of reinvestment-variable objective. As a minimum, HW needs to establish a sustainable (optimal) level of reinvestment to compensate for historical underfunding and to account for future reinvestment needs. The level of investment can be accelerated to provide a more rapid catch up for the historical underfunding. For the IRP, three levels of asset reinvestment per year (using a correlation with asset life) are contemplated: For point assets - minimum (assuming 20% extension of asset life and defined by 1 / 1.2 x asset life); moderate (assuming the asset life and defined by 1 / asset life); aggressive (assuming accelerated replacement by 20% and defined by 1 / 0.8 x asset life); For network/linear assets - minimum (age of assets will increase somewhat over time); moderate (age of assets will remain constant over time); aggressive (age of assets will decrease over time). These variable levels of reinvestment will influence the alternative Resource Plans (i.e. 8A, 8B, 8C).	Aggressive  point assets: 1 / 0.8 x asset life  network assets: % investment per year (decreasing asset age over time)	Moderate  point assets: 1 / 1 x asset life  network assets: % investment per year (asset age constant over time)	Minimum  point assets: 1 / 1.2 x asset life  network assets: % investment per year (increasing asset age over time)
	9 Enhance reliability of critical assets	The time frame to implement the system security programs and projects may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (15 years); and long (20 years). These variable time lines will influence the alternative Resource Plans (i.e. 9A, 9B, 9C).	10 years	15 years	20 years
	10 Ensure existing storm system is adequately sized for minor storm conveyance	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 10 years. Note this is for the identification of future capital projects for storm system capacity upgrades - these would be phased over the longer term and can be considered as a variable in future IRPs.	10 years		
	11 Adapt to future climate change	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 20 years.	20 years		
	12 Reduce energy consumption, operating costs, and reduce greenhouse gas (GHG) contributions	This is a time variable objective. Implementing the energy efficiency initiatives will reasonably take a number of years however, early implementation of some programs will help illustrate the payback potential for future programs. For the IRP, the energy efficiency implementation is planned under three time horizons: short (5 years), medium (7 years), or long (10 years). These variable time lines will influence the alternative Resource Plans (i.e. 12A, 12B, 12C).	5 years	7 years	10 years
GROWTH	13 Provide regional water, wastewater, and stormwater infrastructure needed to support planned growth	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement		
	14 Manage flow capacity allocations	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement		

## PLAN 7 -

### MODERATE CURRENT WASTEWATER TREATMENT FACILITY COMPLIANCE, FUTURE WASTEWATER COMPLIANCE, ASSET RENEWAL

### AGGRESSIVE CURRENT OVERFLOW COMPLIANCE, FUTURE WATER COMPLIANCE, ENERGY MANAGEMENT

	Objective	Variables	Variations		
			A	B	C
REGULATORY COMPLIANCE	1 Meet current Nova Scotia Environment (NSE) WWTF permit to operate requirements	The time frame to implement the current compliance requirements may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (3 years); medium (5 years); long (7 years) - these variables will influence the alternative Resource Plans (i.e. 1A, 1B, 1C).	3 years	5 years	7 years
	2 Meet current NSE WSP permit to operate requirements	None. This will be a requirement of any alternative Resource Plan.	ongoing		
	3 Meet current overflow compliance requirements	The time frame to implement the current compliance requirements may vary due to specific requirements once the federal regulations are released, feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (20 years); long (30 years) - these variables will influence the alternative Resource Plans (i.e. 3A, 3B, 3C).	10 years	20 years	30 years
	4 Meet future WWTF effluent requirements	There is some minor variation in the time frame for implementing the CCME requirements depending on the class of facility and whether the works are coordinated with CSO management. For the IRP, two time horizons are considered related to CCME compliance: medium (20 years) and long (30 years). Nutrient management will likely be required earlier than the CCME requirements. For the IRP, three time horizons are considered: short (10 years), medium (20 years); and long (30 years). "Toxics" management as an emerging trend not yet seen in Canada is not likely to be prominent until later in the planning horizon of the IRP. For the IRP, one time horizon is considered: long (30 years). These variable time lines will influence the alternative Resource Plans (i.e. 4A, 4B, 4C).	- nutrient management (10 years) - CCME WWTF effluent rqmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (20 years) - CCME WWTF effluent rqmts (20 years) - "toxics" mgmt (30 years)	- nutrient management (30 years) - CCME WWTF effluent rqmts (30 years) - "toxics" mgmt (30 years)
	5 Meet future NSE/Health Canada drinking water quality requirements	This is a time variable objective. Implementing the Water Quality Master Plan may be achieved under three time horizons: short (3 years), medium (5 years), or long (7 years). These variable time lines will influence the alternative Resource Plans (i.e. 5A, 5B, 5C).	3 years	5 years	7 years
	6 Meet future regulations for overflow volume and frequency	This is a time variable objective. Implementing an I/I reduction program and eliminating SSOs is expected to have a short (10 years), medium (20 years) or long (30 years) implementation horizon. Reducing CSOs, particularly through sewer separation, is expected to have a long (30 years) implementation horizon. Eliminating the WWTF by-passes would likely be implemented over the short (10 years) or medium (20 years) time frame. These variable time lines will influence the alternative Resource Plans (i.e. 6A, 6B, 6C).	- eliminate WWTF by-passes (10 years) - I/I reduction & SSO elimination (10 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (20 years) - I/I reduction & SSO elimination (20 years) - CSO reduction (30 years)	- eliminate WWTF by-passes (30 years) - I/I reduction & SSO elimination (30 years) - CSO reduction (30 years)
	7 Meet future stormwater quality compliance requirements	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 30 years.	30 years		
ASSET RENEWAL	8 Implement optimal level of asset reinvestment (all asset classes)	This is a level of reinvestment-variable objective. As a minimum, HW needs to establish a sustainable (optimal) level of reinvestment to compensate for historical underfunding and to account for future reinvestment needs. The level of investment can be accelerated to provide a more rapid catch up for the historical underfunding. For the IRP, three levels of asset reinvestment per year (using a correlation with asset life) are contemplated: For point assets - minimum (assuming 20% extension of asset life and defined by 1 / 1.2 x asset life); moderate (assuming the asset life and defined by 1 / asset life); aggressive (assuming accelerated replacement by 20% and defined by 1 / 0.8 x asset life); For network/linear assets - minimum (age of assets will increase somewhat over time); moderate (age of assets will remain constant over time); aggressive (age of assets will decrease over time). These variable levels of reinvestment will influence the alternative Resource Plans (i.e. 8A, 8B, 8C).	Aggressive  point assets: 1 / 0.8 x asset life  network assets: % investment per year (decreasing asset age over time)	Moderate  point assets: 1 / 1 x asset life  network assets: % investment per year (asset age constant over time)	Minimum  point assets: 1 / 1.2 x asset life  network assets: % investment per year (increasing asset age over time)
	9 Enhance reliability of critical assets	The time frame to implement the system security programs and projects may vary due to feasibility of implementation, availability of internal resources, and affordability. For purposes of the IRP, three time horizons are under consideration: short (10 years); medium (15 years); and long (20 years). These variable time lines will influence the alternative Resource Plans (i.e. 9A, 9B, 9C).	10 years	15 years	20 years
	10 Ensure existing storm system is adequately sized for minor storm conveyance	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 10 years. Note this is for the identification of future capital projects for storm system capacity upgrades - these would be phased over the longer term and can be considered as a variable in future IRPs.	10 years		
	11 Adapt to future climate change	None. This will be a requirement of any alternative Resource Plan with an assumed implementation time line of 20 years.	20 years		
GROWTH	12 Reduce energy consumption, operating costs, and reduce greenhouse gas (GHG) contributions	This is a time variable objective. Implementing the energy efficiency initiatives will reasonably take a number of years however, early implementation of some programs will help illustrate the payback potential for future programs. For the IRP, the energy efficiency implementation is planned under three time horizons: short (5 years), medium (7 years), or long (10 years). These variable time lines will influence the alternative Resource Plans (i.e. 12A, 12B, 12C).	5 years	7 years	10 years
	13 Provide regional water, wastewater, and stormwater infrastructure needed to support planned growth	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement		
	14 Manage flow capacity allocations	None. This will be a requirement of any alternative Resource Plan.	Meet moderate growth requirement		