The Upper Thames River Conservation Authority Shared Waters Action Plan for the Upper Thames River Watershed

The Thames River (Deshkan Ziibi) Shared Waters Approach to Water Quality and Quantity

The Thames River (Deshkan Ziibi) Shared Waters Approach to Water Quality and Quantity (2019) is a report completed by a long-term, collaborative initiative of First Nations, federal and provincial governments, conservation authorities, and the local community called the Thames River Clear Water Revival. The Shared Waters Approach (SWA) describes the state of the environment in the Thames River watershed, with a focus on water quality and quantity.

Water Quantity and Water Quality Technical Subcommittees each developed a mission statement and four goals for the Thames River watershed (comprised of both the upper and lower portions of the watershed):

Water Quantity: Encourage a flow regime that provides sustainable environmental flow (eflow) while reducing flood risk, by:

1. Understanding environmental flow (eflow) needs in the Thames River watershed,
2. Improving understanding and mitigation of hazards associated with flooding and extreme flows in the Thames River watershed,
3. Expanding water quantity monitoring to improve understanding of eflow needs, flood and drought risk, and climate change,
4. Researching and recommending mechanisms to sustainably meet acceptable eflow needs of flora, fauna, and humans while reducing flood and drought risks.

Water Quality: Protect and improve water quality in the Thames River watershed to improve stream health and potential impact of the Thames River on Lake St Clair and Lake Erie, by:

1. Reducing total and soluble reactive phosphorus loads from the Thames River and reduce overall phosphorus concentrations in the river and its tributaries,
2. Reducing soil erosion from land and maintain geomorphic processes across the watershed,
3. Expanding water quality monitoring to improve understanding of stream health and climate change,
4. Improving water quality to support stream health, including aquatic life.

The SWA partners each developed their own recommendations and activities to meet these water quantity and quality goals.

The Upper Thames River Conservation Authority Shared Waters Action Plan (SWAP)

With the completion of the SWA, the partners are considering developing Shared Waters Action Plans (SWAPs) to implement their recommendations. The Upper Thames River Conservation Authority (UTRCA) has developed a SWAP to achieve its recommendations for the Upper Thames River watershed. The UTRCA worked in partnership with First Nations, federal and provincial governments, the Lower Thames Valley Conservation Authority, and the City of London to ensure the UTRCA SWAP is integrated into the work and action plans of the other partners, where applicable, to achieve their recommendations in the SWA.

The UTRCA SWAP is organized around the five components of sustainable environmental flow (eflow). Sustainable eflow refers to the amount and timing of flow needed to keep aspects of the environment healthy:

1. **Biology:** Suitable habitat for vulnerable life-stages of aquatic and semi-aquatic species such as fish, turtles, snakes, amphibians, plants, etc. depend on flow regimes.

2. **Connectivity:** Healthy rivers are continuous and naturally connect to their floodplains without obstructions.
3. **Fluvial Geomorphology:** How the shape of the river changes over time based on the interaction between sediment, water, and vegetation.
4. **Water Quality:** Aquatic species depend on habitat characteristics (e.g., river temperatures) and concentrations of nutrients, metals, pollutants, and elements (e.g., dissolved oxygen).
5. **Water Quantity:** The volume and timing of flow impacts all the other components of eflow.

Based on these five eflow components, the UTRCA has developed seven key outcomes that it needs to achieve to meet the recommendations and activities it identified in the SWA. The UTRCA SWAP also identified deliverables and supporting actions for each outcome to ensure the health of aquatic ecosystems is protected and a reliable supply of water is available for a sustainable economy in the Upper Thames River watershed. For each action, the UTRCA has determined the organizational priority, unit leads, progress, and staff positions. A spreadsheet of the UTRCA SWAP is included in Appendix A. A governance model for reporting, updating, and continuously improving the UTRCA SWAP is included in Appendix B.

The UTRCA incorporated climate change in many of the deliverables and actions to achieve the seven key outcomes. Climate change in the Thames River watershed is affecting the river's water levels and quality, in terms of both extreme high and extreme low flows, but the full impact is uncertain. This uncertainty makes implementation of the SWAP even more relevant to enable wise stewardship of the watershed in a changing climate. It is anticipated that aquatic ecosystems will be altered as a result of increases in air and water temperature, decreases in ice and snow cover, and changes in the timing and amount of precipitation (*Dove-Thompson, D., C. Lewis, P. Gray, C. Chu, and W. Dunlop. 2011. A Summary of the Effects of Climate Change on Ontario's Aquatic Ecosystems*). These changes will alter the flow of water and water chemistry. Threats to freshwater fauna include nutrient enrichment, hydrological modifications, habitat degradation, habitat loss, pollution, and the spread of invasive species. A changing climate and increasing levels of ultraviolet light pose additional risks. The combination of changes in land use, habitat, and climate presents a serious challenge to the long-term integrity and health of aquatic ecosystems.

Modifications in water availability and quality over time and space, especially in the context of climate change, require intimate knowledge of the changing and growing water needs and the usability of water resources. This includes knowledge of physical fluvial systems and their driving hydromorphological processes (i.e., eflow), and the availability of hydrological data in real time (precipitation, temperature, stream discharge, and groundwater levels), together with data on water quality and water use (by aquatic and semi-aquatic species, as well as humans).

Climate change uncertainty can present severe risks to environmental flows. To address this risk, the approach of the UTRCA SWAP is based on the principle of adaptive management of water resources *(M. Bussettini, 2018. Environmental Flows in Sustainable Integrated Water Resources Management. World Meteorological Organization. Bulletin Volume 67(1)).* Adaptive management promotes flexible decision making that can be adjusted in the face of uncertainty as new outcomes from management actions and other events develop. In the context of climate change and the uncertainty associated with climate models and projections, documenting and monitoring environmental objectives under a range of uncertain but plausible climate futures will be undertaken. This iterative process advances the scientific understanding of climate change and the adaptation actions needed to reduce the vulnerability of environmental systems to the impacts of climate change. Adaptive management has long been a component of the integrated watershed management approach utilized by Ontario's conservation authorities, which operate in the face of uncertainty using a structured, iterative approach for improving actions through long-term monitoring, modelling, and assessment.

Outcome 1. Determine Priority Species and Human Needs in the Upper Thames River Watershed

As flows in the Thames River diminish, suitable habitat for vulnerable life-stages of aquatic and semi aquatic species, as well as critical flows to meet human needs (e.g., drinking, gathering food, washing, playing, and cultural events), may become threatened. Furthermore, the Thames River has an important spiritual connection to First Nation identity (language, stories, cultural teachings) for the First Nations with traditional territory in the watershed.

Deliverable 1.1: Determine priority flora and faunal species

Actions:

i. Incorporate community outreach and public input.
ii. Incorporate First Nations Knowledge pertaining to the biology and ecology of the Thames River.
iii. Include Species At Risk (SAR).

Deliverable 1.2: Compile life history and habitat data on priority flora and faunal species

Actions:

i. Gather information on priority flora and faunal species from:
   - Land use planning applications (e.g., Environmental Impact Study data mining),
   - UTRCA projects and staff (e.g., forest inventories, fish inventories, benthics, cover crop inventories, survey 123 for turtles, mussels, etc.),
   - Environmental partners (e.g., mussels gathered by Department of Fisheries and Oceans (DFO), DFO drain projects, Dingman Creek fish and benthics),
   - Natural Heritage Information Centre and Species Atlases,
   - The Thames River Watershed: A Background Study for Nomination under the Canadian Heritage Rivers System (1998),
   - Land management plans,
   - Citizen science and community environmental programs such as iNaturalist,
   - 2004 report on aquatic SAR in the Thames River watershed (Cudmore et al. 2004).

Deliverable 1.3: Identify critical eflow habitat of priority flora and fauna species

Actions:

i. Develop and apply criteria for critical areas such as:
   - Contain highly ranked sensitive fish species from the DFO SAR mapping website,
   - Are historical sites of key stone species, biological indicator species and SAR such as Silver Shiner, black Redhorse,
   - Are critical SAR habitats,
   - Are identified in the 2004 report on aquatic SAR in the Thames River watershed (Cudmore et al. 2004),
   - Are identified in the draft Thames River Aquatic Ecosystem Recovery Strategy (Thames River Recovery Team 2007),
   - Are in species specific recovery strategies,
   - Are in management plans for SAR,
   - Are nesting locations for turtle and snake.

Deliverable 1.4: Determine priority human uses and needs of the river

Actions:

i. Incorporate community outreach and public input.
ii. Incorporate First Nations (FN) Knowledge on traditional / cultural practices and spiritual connection to the river.

Deliverable 1.5: Compile priority human uses and needs

Actions:

i. Gather information on priority human uses and needs from:
    - Community outreach and public input,
    - Planning applications,
    - UTRCA projects,
    - SWA partners and staff,
    - Water quantity permits (e.g., Permit to Take Water),
    - The Thames River Watershed, Ontario: A Background Study for Nomination under the Canadian Heritage Rivers System (Thames River Background Study Research Team, 1997), which has harvesting and trapping descriptions (e.g., fish, mussels, flora, etc.).

Outcome 2. Improve Connectivity of Watercourses in the Upper Thames River Watershed

Historically, water resources have been exploited with no consideration of the sustainability of these resources in the long term. For example, rivers have been considered as canals and severely engineered for socioeconomic development. As a result, ecosystems have become disconnected from once-related water bodies and have deteriorated, often irreversibly, with a substantial loss of freshwater biodiversity.

Deliverable 2.1: Develop a standardized definition of a natural heritage system and of hazards throughout the watershed that includes linkages between natural heritage, surface water, and groundwater features

Actions:

i. Review and build on the existing watercourse classification system to develop a comprehensive watercourse layer that includes information to support management and protection such as:
   - Thermal (temperature) regime from HOBO loggers and thermometer readings,
   - Water quality metrics,
   - Metrics of flow,
   - Presence / absence of aquatic species,
   - Presence / absence of watercourse barriers,
   - Natural vs. constructed (or open / channelized vs. buried / straightened),
   - Amount of erosion and sedimentation,
   - Presence / absence of pastures,
   - Amount of buffer (length and width),
   - Presence / absence of headwater features (considering municipal drain impact to these features),
   - Entire stream corridor based on the valley land definition (e.g., Digital Elevation Model and Light Detection and Ranging (LiDAR) can be used to define valleys. In areas with less defined valleys in a fill zone, valley lands can be mapped as riparian vegetation, flooding hazard limit (based on regional events), meander belt, or highest seasonal (annual) inundations),
   - DFO drain classification,
   - Information from the 1952 Upper Thames Valley Conservation Report (Department of Planning and Development, 1952),
   - Channel design,
   - Flow permanency,
   - Geology,
   - Incorporating community outreach and public input,
   - Incorporating First Nations Knowledge.

ii. Review and build on the existing wetland layer to include the maximum extent of wetland boundaries defined by:
   - Capture area,
   - Location of vernal pools during high water levels (e.g., spring season),
   - Marginal agricultural fields in depressions,
   - High water marks during high water levels,
   - Shallow aquifer mapping,
   - Recharge and discharge areas.

iii. Include areas of groundwater and surface water connection / interaction by:

- Incorporating updated municipal watershed studies (given new regulations and knowledge about groundwater interactions since the 1990s),
- Incorporating past research projects,
- Incorporating base flow and surface water information in planning applications,
- Incorporating glacial lake levels that could indicate historical surface water and groundwater connections and groundwater dependent ecosystems,
- Incorporating surficial geology (areas of sand and gravel),
- Incorporating the maximum extent of wetland boundaries,
- Including locations of open water in winter,
- Including cool and cold streams,
- Including locations of shallow aquifers,
- Including municipal drains in headwater areas,
- Including locations of cool water fish species or other groundwater-dependent aquatic species.

iv. Review and build on the existing vegetation system to develop a comprehensive vegetation layer including:
- Past natural heritage studies and data on watercourses, wetlands, woodland, meadow, prairie, and thicket layer,
- County and municipal natural heritage features including watercourses, wetlands, woodland, meadow, prairie, and thicket layers,
- Sub watershed boundaries,
- Linkages between natural heritage and water resource systems (i.e., physical connectivity of streams, wetlands, surface water, groundwater),
- Headwater areas, which may be difficult to determine due to the amount of artificial drainage.

Deliverable 2.2: Develop a watershed wide natural heritage strategy for UTRCA to advocate for natural heritage restoration and protection of stream health

Actions:

i. Identify sensitive areas for protection such as:
- Gaps in natural cover,
- Locations of SAR,
- Locations that meet environmental flow requirements,
- Wetland habitat,
- Significant (priority) stream corridors determined by floodplain and riparian areas.

ii. Develop an invasive species control plan that includes:
- Relationship between clearing drains and invasive species.

iii. Support the development of a fish management plan that considers:
- Eliminating perched culverts through riffle / pool installation,
- Incorporating fish ladders on watercourse barriers.

iv. Identify locations of green infrastructure (vegetation) that protects base flow, attenuates floods, or reduces erosion by:
- Determining locations of recharge areas,
- Understanding groundwater mechanisms that maintain recharge areas,
- Determining locations of discharge areas.

v. Develop a stream corridor enhancement plan that includes:
- Analysis of landscape with landowners to identify enhancement opportunities and Best Management Practices (BMPs),
- Water quality monitoring,

- Improvement to reach the watershed report card riparian cover target of 75%,
- Partnership with university researchers to determine appropriate buffer widths,
- Overlay natural heritage cover with topography, land use, soil loss, etc. along streams,
- Ground truth the models / assessments / buffers with monitoring data,
- Developing separate strategies for cold water, cool water, and warm water stream management to help direct appropriate and effective actions to protect and enhance stream ecology within the Thames River watershed,
- Restoring and protecting priority stream corridor sections with increased riparian buffers and natural channel enhancement to reduce thermal loading,
- Protecting significant groundwater recharge and discharge areas,
- Locations of poor stream health,
- Locations with potential to be restored to cold water stream segments.

Deliverable 2.3: Encourage advancements to urban and rural drain construction and drain maintenance methods to protect aquatic habitat and improve fluvial geomorphic processes

Actions:

i. Restore previously / historically enclosed stream reaches in target urban and rural stream sections.
ii. Create offline wetlands and water and sediment control basins to hold water.
iii. Establish optimal rates of drainage from rural land by:
    - Working with drainage partners to review agricultural municipal drainage coefficients to determine optimal rates of water removed from land over time,
    - Considering peak flows in rural storm water management projects associated with the Drainage Act as part of permit review.
iv. Work with drainage superintendents for more progressive approaches for drain maintenance including:
    - Encourage drain cleanouts to be undertaken on one side only,
    - Encourage adoption of BMPs and natural design principles on municipal drains (floodplain connections, buffers / setbacks, instream restoration, bioengineering),
    - Natural design principles.
v. Provide outreach and education about drain construction and drain maintenance by:
    - Re-starting workshops that target the drainage community,
    - Engaging with ministries, agencies, and municipalities to provide education about impacts from drain construction and drain maintenance on natural heritage with drain cleanouts.
vi. Encourage updates to guidelines and design standard documents of ministry agencies (Ministry of Transportation, Ministry of Agriculture, Food and Rural Affairs) to:
    - Promote natural design principles in drainage projects,
    - Encourage adoption of the standardized definition of natural hazards and heritage features into the Drainage Act.

Deliverable 2.4: Assess impact of dams and watercourse barriers on eflow and stream health

Actions:

i. Compile information on dams and watercourse barriers from:

- Environmental Assessments (EAs) completed for dams such as Stratford, Harrington, and Embro,
- Subwatershed report cards that include locations and information on watercourse barriers and dams in the watershed.

ii. Incorporate information from modelling tools (that need to be developed) to assess flood risk and impacts of climate change.

iii. Conduct pre and post decommissioning monitoring to evaluate of impacts from dams including:
- Impacts on eflow from dams and watercourse barriers,
- Relationship of impoundments and phosphorus processes.

iv. Develop criteria to identify and prioritize watercourse barriers that no longer serve their intended purpose and should be removed / decommissioned to mimic natural hydrological processes and improve sustainability of eflow, while reducing flood and drought risks.

Deliverable 2.5: Develop a position paper on watercourse barriers that optimizes water quality and eflow needs while maintaining critical reservoir functions such as protection from flood risks

Actions:

i. Evaluate impacts (positive and negative) of, and the potential risks and/or liabilities associated with, these structures, including:
- Information from the fish management plan,
- Information from the invasive species control plan,
- Results from two-dimensional (2D) hydraulic models (for locations with private dams or complex hydraulics) to determine impact,
- Monitoring results of impacts from dams,
- Dam safety,
- Information from operation and maintenance plans developed for groups of similar watercourse barrier structures.

ii. Evaluate the ability to mitigate negative impacts rather than remove watercourse barriers including:
- Whether natural hydrological processes can be mimicked,
- Whether eflow needs can be incorporated to inform operation of dams and watercourse barriers.

iii. Develop a communication plan around watercourse barrier position paper that will:
- Educate the public and structure owners on impacts and benefits of water control structures, including potential risks and / or liabilities associated with the structures,
- Provide guidance to help private owners make informed decisions regarding the operation, maintenance, or decommissioning of their structures.

Deliverable 2.6: Develop a decommissioning plan for groups of similar watercourse barrier structures where negative impacts cannot be mitigated

Actions:

i. Work with other ministries/agencies to encourage streamlining of the approval process for removal of dams and watercourse barriers.

ii. Find funding opportunities to remove watercourse barriers.

iii. Support efforts and provide technical assistance to remove or decommission water control structures that should be decommissioned, including:

- Advocating for mitigation or decommissioning of dams and watercourse barriers, as opportunities arise, to improve stream health.

iv. Develop a communication plan around watercourse barrier removal that promotes decommissioning water control structures that no longer serve their intended purpose, if decommissioning will improve sustainability of eflow.

Deliverable 2.7: Develop and / or update operation and maintenance plans, where appropriate, to reflect optimization of water control structures considering eflows, climate change and flood risk

Actions:

i. Support efforts and provide technical assistance for proper operation and maintenance of water control structure to owners by:
   - Employ modelling tools developed to assess flood risk and impacts of climate change.

ii. Develop generalized operation and maintenance plans for groups of similar structures.

Outcome 3. Understand Geomorphological Processes of the Upper Thames River Watershed

River management that fails to consider the dynamic nature of rivers has provoked undesired effects. These include incision processes and bank erosion undermining channel stability, sediment starvation, disconnection with groundwater bodies, and, ultimately, loss of habitat and ecosystem services. On the other hand, high (extreme) flows can also construct new habitat through sediment and erosion processes for continued survival of flora and fauna.

Deliverable 3.1: Identify, evaluate, and map potential erosion hot spots

Actions:

i. Increase our understanding of the seasonal variability of field-scale soil loss that includes:
   - Developing an understanding of erosion and sedimentation processes that occur when it rains,
   - Considering time of year (winter/spring) when more bare soil on the landscape means larger areas of soil loss in increasing extreme events,
   - Looking to other Conservation Authorities that deal with shoreline erosion for guidance.

ii. Identify potential erosion hot spot areas by:
   - Using LiDAR, as well as topographic and soils maps, to identify potential erosion areas,
   - Inputting information about erosion hot spots where we lost structures, or filled in a whole oxbow, into geoportal,
   - Incorporating information from plans of subdivisions and EA reports (e.g., Dingman, Mud Creek) that contain a suite of technical studies,
   - Summarizing and identifying where and when sediment spills have occurred,
   - Incorporating the impact of increasingly large / extreme events in expanding the area of erosion hot spots to much larger areas of the landscape, with more area being vulnerable to erosion and runoff.

iii. Determine if there is a relationship between wetlands and downstream erosion:
   - Investigate whether there are areas with high runoff that have experienced a loss of wetland habitat,
   - Evaluate whether catchments with more wetland habitat have less sedimentation in the water,
   - Investigate whether large bowl-shaped wetlands in headwaters that store a lot of water play a larger role in reducing erosion than wetlands in other areas (e.g., Trout Creek).

iv. Develop and maintain a sediment transport model that considers:
   - Incorporating potential climate change effects (e.g., toe erosion and meander) into erosion hazard mapping.

Deliverable 3.2: Develop catchment level erosion plans for each subwatershed

Actions:

i. Use best available data and local knowledge to develop targets and plans to control sediment and erosion in each sub watershed including:
   - Catchment level targets for natural vegetation cover for each sub watershed to control sediment and erosion,
   - Incorporating potential erosion hotspots,

- Incorporating erosion plans developed through the Stratford-Avon River Environmental Management Project in the early 1980s for Kintore Creek, western basin Upper Medway, and Upper Avon.

Deliverable 3.3: Continue to improve public understanding of erosion risk through education and outreach programs to landowners, developers and construction staff

Actions:

ii. Improve landowner engagement in programs by:
   - Understanding where and why we have little uptake in certain areas (costs, demographics).

iii. Develop community-based watershed strategy with information showing areas most prone to erosion to:
   - encourage people from the community to put erosion projects on their property.

iv. Re-start sediment and erosion control presentations.

v. Conduct a cost analysis of windbreaks and other BMPs using yield monitors on combines / machinery.

vi. Educate partners about unique CA perspective on erosion hazards, as it is often thought of a duplicative effort in planning and regulations.

Deliverable 3.4: Recommend and implement a suite of Best Management Practices (BMPs) and Low Impact Development (LID) for low risk erosion hot spots, where feasible

Actions:

i. Continue to promote routine maintenance of erosion control structures for agricultural runoff.

ii. Expand implementation programs across the Thames River watershed to reduce erosion and soil loss, including:
   - Expand the existing rural Clean Water Program (CWP), forestry services, and urban LID program (e.g., crib walls, bioengineering, buffer planting, etc. as well as in-stream work such as riffles),
   - Developing and promoting a list of bank stabilizing flora and / or bioengineering species,
   - Incorporating site specific sediment and erosion controls,
   - Encouraging more windbreaks.

iii. Continue to work with “Friends of” groups to implement community-based sub watershed strategies that can include BMPs and LIDs for erosion and soil loss.

Deliverable 3.5: Work with member municipalities to implement a more effective program to monitor, inspect, and enforce erosion and sediment control measures at construction sites

Actions:

i. Encourage municipal partners who work in the field (drainage, roads, public roads) to be licensed as a Certified Inspector of Sediment and Erosion Control (or develop CA version given that an American company runs the certification now).

ii. Encourage member municipalities to develop fill alteration bylaws requiring details for sediment and erosion control by:
   - Phasing these in by location over time for large subdivision sites,
   - Incorporating UTRCA draft sediment and erosion guidelines.

iii. Encourage the expansion of monitoring erosion and sediment control measures at construction sites in all municipalities.
iv. Conduct routine construction site inspections proactively (rather than reacting to spills / slope failure).
v. Enforce compliance where erosion and sediment control are deficient.

Outcome 4. Improve Water Quality of Watercourses in the Upper Thames River Watershed

Adequate flows help maintain river quality such as temperature, nutrients, and dissolved oxygen necessary for aquatic and semi-aquatic species and a sustainable economy.

Deliverable 4.1: Encourage research in the Thames watershed to better understand emerging issues for surface water quality, groundwater quality, and stream health

Actions:

i. Improve our understanding of the relationship between water quality and climate (e.g., temperature, salt application, quantity changes, etc.).
ii. Identify information gaps on impoundments and phosphorus processes including:
    - Considerations for changes in the natural heritage system, such as the recent natural wetland formation in the upper area of Fanshawe Lake,
    - Considerations on changing operations at Fanshawe Dam to benefit Fanshawe Reservoir versus Lake Erie in dealing with phosphorus. (Fanshawe Reservoir is an area of interest for phosphorus loading to the Great Lakes. The University of Waterloo and Environment and Climate Change Canada are conducting an assessment and modelling work including more assessment of phosphorus loads in winter runoff and the effect of legacy phosphorus in Thames River reservoirs.),
    - Improve our understanding of the relationship between municipal drains and water quality through academic research.
iii. Improve our understanding of buffers/ setbacks and impacts on water quality.

Deliverable 4.2: Work with partners to advance and / or develop best practices, where needed, for priority actions that will have the most impact in phosphorus load reduction, through continued research, monitoring, and demonstration

Actions:

i. Recognizing the price of land, advocate for funds to expand the existing rural CWP that will deliver an enhanced program targeted at best practices for phosphorus reduction.
ii. Support partner agencies in addressing identified emerging issues (monitoring, implementation, control programs, etc.).

Deliverable 4.3: Expand and target stewardship implementation programs to protect and enhance local water quality and stream health, including fish and aquatic life, and to reduce water pollutants (pathogens, chemicals, nutrients) in subwatersheds across the Thames River watershed

Actions:

i. Promote implementation of the suite of actions recommended in the Watershed Report Cards to improve stream health.
ii. Expand the existing rural CWP and urban LID program.
iii. Prioritize (target) specific properties for BMPs that consider:
    - Natural heritage features (e.g., highly erodible lands, watercourses that host / have the potential to host SAR).

- Properties that demonstrate water quality related concerns.

Deliverable 4.4: Expand education and outreach on benefits (including financial benefits) of BMPs and LIDs on nutrient reduction

Actions:

i. Implement social media efforts (e.g., Twitter, YouTube, Facebook, Instagram, and the UTRCA website) to motivate watershed community action with partners and watershed residents on nutrient reduction by:
   - Sharing information about the value of water quality and stream health protection,
   - Sharing results on stream health conditions,
   - Identifying and removing watercourse barriers,
   - Promoting benefits of nutrient reduction.

ii. Develop communication awareness products, including additions to Watershed Report Cards, which specifically link Thames River environmental information to actions.

iii. Provide information on multiple benefits of BMPs to increase adoption, including financial / economic, social, climate change, etc.

iv. Engage all sectors, including youth and young farmers, on phosphorus and other nutrient issues to ensure change, including:
   - Organizing more “friends of” groups for focused community effort.

v. Encourage proponents, consultants, and property owners to consider LID in planning and pre-planning stage.

Outcome 5. Reduce Flood Damage and Ensure Adequate Flow in the Upper Thames River Watershed

To promote heterogeneous habitats and connectivity and sustain the different biotic communities inside ecosystems, there must be an appropriate level of functionality of fluvial processes, in terms of flow and sediment regime. The establishment and maintenance of such flow and sediment regimes, namely environmental flows, is an essential element in protecting all components of the natural flow regime needed to sustain river ecosystems and the services they provide.

Deliverable 5.1: Improve understanding of groundwater infiltration and recharge areas to map aquifers across the watershed

Actions:

i. Incorporate information on areas of groundwater and surface water connection,
ii. Incorporate groundwater monitoring data such as:
    - Data collected from consultant reports for planning and regulations,
    - Data from Ontario Geological Survey.
iii. Build on aquifer mapping in the Thames Sydenham and Region Source Protection Plan that was completed as part of Drinking Water Source Protection program,
iv. Build on information used to identify significant groundwater recharge areas and highly vulnerable aquifers, including in First Nations, where invited.

Deliverable 5.2: Improve characterization of groundwater and streamflow variation

Actions:

i. Incorporate stream gauge and groundwater monitoring.
ii. Improve characterization of daily, seasonal, and annual streamflow variation, as well as extreme events such as flooding and droughts, by:
    - Incorporating water conservancy software (Indicators of Hydrologic Alteration) to provide seasonal trends in flow for significant steam corridors across the watershed,
    - Incorporating site specific information on flow interruption from EAs and studies undertaken as part of plan review.
iii. Characterize long term trends in groundwater and streamflow variation by:
    - Analyzing climate change models to determine changes to inflow,
    - Developing expertise to determine long term trends from groundwater assessments as they relate to riparian-dependent communities.

Deliverable 5.3: Utilize hydrologic and hydraulic analyses and models to understand and evaluate climate change and mitigation measures

Actions:

i. Continue to incorporate climate and stream flow variation when updating / calibrating and maintaining the event-based hydrologic and hydraulic analyses and watershed models.
ii. Develop and calibrate a continuous hydrological watershed model that includes groundwater processes.
iii. Develop 2D hydraulic models for critical watercourse sections (such as those with complex hydraulics or private dams / watercourse barriers).

Deliverable 5.4: Incorporate potential climate change effects and human impacts to hydrology into flood hazard mapping

Actions:

i. Incorporate the impacts of priority human uses on hydrological eflow needs.
ii. Incorporate updated hydrologic and hydraulic analyses and watershed models into regulatory flood hazard mapping.
iii. Ensure flood mapping methodology is consistent with provincial guidance (e.g., Ontario's Climate Change Impact Assessment).
iv. Incorporate infrastructure such as channels, dams, dykes, roads, railroads, drains, storm water management ponds, etc.

Deliverable 5.5: Undertake a watershed-wide assessment of surface water and groundwater flood risk to the built environment by updating range of flood mapping models

Actions:

i. Incorporate regulatory flood mapping, flood hazard mapping, and groundwater flood mapping.
ii. Evaluate inflow design on channels, dams, and dykes and resilience to flood risks.
iii. Evaluate infrastructure (road, rail) and resilience to flood risks.
iv. Work with First Nation communities, if requested, to undertake flood risk assessments to improve understanding of flooding on First Nation built lands by incorporating climate and hydrological modelling with land use and watercourse information.

Deliverable 5.6: Undertake a watershed-wide flood and low flow risk assessment of the natural environment

Actions:

i. Incorporate information about the water cycle (i.e., finite water supply, where water comes from, where it goes).
ii. Incorporate information about extreme weather events that cause droughts and floods.
iii. Incorporate information about the importance of water-related infrastructure and green infrastructure (e.g., forests, wetlands, etc.) in reducing hazards.
iv. Determine how a change in frequency and magnitude of low flow, high flow pulses and annual stream flow regime will impact the priority flora, fauna, and human needs.
v. Work with First Nation communities, if requested, to undertake flood risk assessments to improve understanding of flooding on First Nation natural lands by incorporating climate and hydrological modelling with land use and watercourse information.

Deliverable 5.7: Reduce flood and low flow risk to the built and natural environment

Actions:

i. Prevent future development in floodplain and in locations where green infrastructure protects base flow, attenuates floods, or reduces erosion by:
    - Updating local planning, policy, and regulatory tools that address flood and drought risks as well as sustaining eflow needs,
    - Ensuring updated policies are communicated to promote compliance with and effectiveness of land use regulations (e.g., presentations to municipal councils about CA regulations),
    - Evaluating planning policies and regulations with respect to flood and low flow risks.

ii. Consider flood resiliency in design, operation, and maintenance of infrastructure.
iii. Support increased infiltration and recharge through LIDs and BMPs where potential groundwater mounding from increased recharge (determined by planning ecologist and water balance studies in development applications) will not impact urban structures.
iv. Enhance CA technical capacity for LIDs and BMPs that considers:
    - Implementing local design standards and policies with partners,
    - Ensuring there are adequate resources, including staff, to continue to provide LID and BMP expertise function and to extend that help to other units,
    - Increasing formalized teaching sessions / symposiums to encourage dialogue, discuss new innovations, and share success stories,
    - Additional training for UTRCA staff (planners, regulations officers, etc.) so that they can communicate about the types of services we can provide to each of our municipalities.
v. Promote widespread adoption of LIDs and BMPs by increasing education and outreach that includes:
    - Expanding educational programs on storm water issues and BMPs that continue to involve local students and neighbourhoods in implementing LID projects to provide hands-on experience,
    - Conducting more outreach tours for community members,
    - Providing more information about our services on the UTRCA website,
    - Developing signage on all LID sites to educate public,
    - Improving internal communication between units in the UTRCA to ensure that potential opportunities for LIDs and BMPs are identified,
    - Continuing to investigate funding / cost share programs that support implementation of LIDs and BMPs,
    - Summarizing the suite of services that LIDs and BMPs provide,
    - Encouraging the implementation of LID and BMP projects (e.g., bioswales, pervious pavement, riparian buffers, etc.),
    - Continuing to use demonstration subwatersheds to engage landowners, increase adoption of BMPs, measure environmental and economic benefits, and educate and motivate the broader watershed community
    - Continuing to demonstrate BMPs at rural landowner workshops and field tours,
    - Continuing to develop videos of landowners implementing BMPs.
vi. Enhance LID maintenance in smaller municipalities by:
    - Partnering with Landscape Ontario to provide LID design and maintenance training to landscape architects in the watershed,
    - Educating urban landscaping companies about LIDs so that they will understand how these features work and work with them to develop appropriate planting materials with the goal of developing a list of certified landscaping companies for LIDs,
    - Providing additional training for UTRCA technical staff in the maintenance of LIDs,
    - Developing written maintenance and monitoring agreements for LIDs including replacement of dead vegetation, cleaning LIDs features, working with homeowners, etc.

Deliverable 5.8: Improve flood forecasting and warning program

Actions:

i. Continue to adapt the flood forecasting and warning system to new technologies and incorporate climate change modelling, as appropriate.
ii. Develop and implement an automated notification system for flood forecasting based on near real-time data from the surface water quantity monitoring stations.
iii. Improve communications with general public and vulnerable populations:
    - Promote longer time frames for individual landowners' emergency response,
    - Ensure the public is prepared to be impacted for a longer period of time (e.g., promote 72 hours emergency kit),
    - Work with First Nations, when requested, to develop flood forecasting and warning processes.
iv. Continue to improve municipal and public understanding of different types of flood risk, flooding impacts, flood messages, and role of natural environment in flood mitigation:
    - Continue public education and outreach about flood resiliency, impacts of climate change, and potential adaptation strategies (e.g., annual communication with municipal flood coordinators, public education programs such as natural disaster mitigation, elementary school programs on flooding, "escape room" lessons, public events).

Deliverable 5.9: Ensure municipal emergency flood plans and Conservation Authority flood contingency plans are compatible and consistent

Actions:

i. Continue with routine training and testing.
ii. Improve communication within and between agencies.
iii. Investigate improvements to equipment and technology.

Outcome 6. Protect and Meet Eflow Needs

With an understanding of hydrological eflow needs for priority floral and faunal species as well as human needs, water budget models can be developed by linking the natural flow regime to related hydromorphological processes and the local ecological objectives for the river to determine the availability of water for these eflow needs.

Deliverable 6.1: Develop an understanding of eflow

Actions:

i. Undertake a literature review of eflow methodology.
ii. Identify information gaps for determining eflow needs in the Thames river watershed.
iii. Record current conditions to serve as baseline of ecosystem health.
iv. Develop and execute a plan for filling in priority information gaps.

Deliverable 6.2: Identify hydrological eflow needs (i.e., low flows, high flow pulses and floods) of priority floral and faunal species

Actions:

i. Determine response and sensitivity of priority floral and faunal species to flow interruptions based on:
    - Site specific EAs,
    - Studies undertaken as part of plan review.
ii. Determine the impact of water levels on invasive species (e.g., Phragmites).
iii. Identify critical eflow habitat locations in relation to water levels.
iv. Understand vegetation responses to removal of dams (e.g., Springbank Dam).

Deliverable 6.3: Identify hydrological eflow needs (i.e., low flows, high flow pulses, and floods) of priority human uses

Actions:

i. Undertake a literature review of sensitivity of priority human needs to hydrological eflow.
ii. Undertake a literature review of impacts to hydrology by human uses.
iii. Ensure eflow supports and encourages Indigenous traditional ways of life.

Deliverable 6.4: Build on conceptual understanding of the water budget developed in the Drinking Water Source Protection Program to go beyond municipal drinking water sources and assess the reliability and sustainability of flow in meeting local ecological (eflow) objectives

Actions:

i. Run water budget models to determine the availability of water for different ecosystem objectives by linking typical seasonal and inter-annual variabilities of the natural flow regime to related hydromorphological processes and the local ecological objectives for the river.
ii. Include components of watershed-wide natural heritage and hazard system.

Deliverable 6.5: Develop a broad-based communication and education plan for public education around the importance of eflow to ecosystem health

Actions:

i. Provide information about what the public can do to help with eflow.

ii. Incorporate First Nations (FN) teachings about the spiritual connection to water.
iii. Develop an official partnership with DFO as they have jurisdiction with fish habitat (used to have formal agreements between DFO and individual CAs that gave CAs the authority to work under the Fisheries Act as part of permitting regulations).
iv. Educate the public about the water cycle including concepts such as:
    - Finite water supply,
    - Source of water,
    - Where water goes,
    - Extreme weather events,
    - Importance of water related structures.
v. Discourage diversion of water from one watershed to another.

Deliverable 6.6: Develop policy and guidance documents to protect eflow

Actions:

i. Include applicable recommendations from species specific recovery strategies and management plans, watershed report cards, FN teachings about spiritual connection to water, studies undertaken as part of plan review, eflow literature reviews, and SWA partners and staff, including:
    - Species specific recovery strategies and management plans such as:
        - Applicable recommendations from the 2004 report on aquatic SAR in the Thames River watershed (Cudmore et al. 2004),
        - Applicable recommendations from the draft Thames River Aquatic Ecosystem Recovery Strategy (Thames River Recovery Team 2007),
        - Applicable recommendations from management plans for Species of Conservation Concern,
    - Applicable FN teachings about spiritual connection to water,
    - Applicable recommendations from regulations and studies undertaken as part of plan review such as:
        - Water quantity permits (e.g., Permit to Take Water),
        - Applicable recommendations from site specific EAs,
    - SWA partners and staff,
    - Literature reviews on eflow,
    - Reference actions from watershed report cards that are applicable.
ii. Include concepts of controlling surface runoff according to catchment area / watersheds.
iii. Strengthen land use policies, guidance documents, and bylaws to preserve natural cover and connectivity by:
    - Encouraging adoption of the standardized definition of natural hazards and heritage features into municipal official plans and bylaws as well as into the UTRCA policy manual,
    - Incorporating county and municipal NH strategies and ensuring natural heritage studies are adopted to assist with our advisory role,
    - Ensuring that restoration and protection is included as part of plan review,
    - Updating and sharing CA policies when commenting on municipal official plans, corridor studies, subwatershed plans, compensation guidelines, environmental guidelines, etc.,
    - Developing regulations or bylaws to reduce tree clearing and to limit degradation near watercourses,
    - Determining relationship between policies and protection, loss, and enhancement of natural feature,

- Relating loss and gains to policies or bylaws to establish these relationships and to see differences where tree cutting is legal verses illegal,
- Ensuring that all sub watershed studies include a commitment to protect and enhance headwater drainage features, which tend to be enclosed since we have no policies,
- Updating policies to protect priority stream corridors,
- Including adaptations for climate change,
- Following watershed report card recommendations,
- Ensuring that a net environmental benefit is incorporated in CA policies and advocating for net gain.

iv. Include the protection of natural water storage features by:
- Developing a watercourse enclosure position that considers groundwater interaction,
- Developing environmental management guidelines for these areas,
- Training staff as to when to engage hydrogeologist to interpret groundwater information and incorporate source water,
- Update UTRCA policies, regulatory mapping, and other regulatory tools that consider not enclosing headwater streams, no wetland removal, and continuous riparian cover along streams and tributaries.

v. Include policy around watercourse barrier removal that incorporates:
- Provincial dam removal regulations,
- Working with other ministries / agencies to encourage streamlining of the approval process for removal of dams and watercourse barriers, where appropriate.

vi. Include reduction of excess phosphorus, sedimentation, and erosion by:
- Finalizing UTRCA draft sediment and erosion guidelines,
- Developing riparian buffer zone policy that includes:
  - Policies to protect riparian vegetation, or vegetation along drains, for its filtering function in addition to its function as a natural heritage feature and hazard,
  - Better understanding of how and where intense storms create gullies along streambank, roads, and drains and soil runoff into river,
  - Literature review and research to support appropriate buffer widths,
  - Employing new Geographical Information System (GIS) information that identifies where overland flow reaches watercourses, and where buffers for filtering would be most beneficial,
  - Better understanding of buffer effects, for example, while buffers can play an important role in reducing erosion and stabilizing streambanks, that they may not be effective in improving quality (i.e., filtering out contaminants) as they can act as a barrier or berm to water flow and cause the water to flow around to a low spot rather than through them.
- Continue to review and comment on sediment and erosion control plans through a collaborative effort with the Ministry of the Environment, Conservation and Parks, municipalities, Ministry of Natural Resources and Forestry, and DFO.
- Consider provincial guidance on LID, storm water management, and erosion and sediment control, as part of CA policies and/or procedures when updating all guidelines and policy documents.

vii. Collaborate on implementation of new policies and design standards for LID infrastructure by:

- Promoting and enhancing LID policies specifically for the Thames River watershed as per local watershed conditions and needs (e.g., Conservation Ontario's Southwest Technical Storm Water Management group that focuses on local issues and universal policies),
- Partnering with LID design engineers,
- Requiring enhanced, rather than basic, levels of water protection in our policies,
- Studying first flush and developing policy regarding hold back of rainwater of a particular depth,
- Expanding the existing LID program to develop new design standards specifically for the Thames River watershed as per local watershed conditions and needs,
- Developing a comprehensive program to prioritize (target) specific properties for LIDs (infiltration, erosion, health, and other parameters identified in water quality, as well as areas of flooding).

viii. Encourage updates to municipal policies and bylaws on drain construction and maintenance to protect aquatic habitat and improve geomorphic processes by:
- Continuing to review municipal drain bylaws,
- Ensuring upgrades are incorporated into policy and bylaws,
- Consulting regulations staff for drain policies and bylaws.

ix. Incorporate eflow needs using technical expertise in hydrology, hydrogeology, and ecology, as well as the available body of research, to develop guidance documents on establishing eflow needs in the Thames River watershed.

Outcome 7. Develop a Process for Managing Information Collected for the Shared Waters Action Plan

The success of the UTRCA SWAP in meeting the eight water quantity and quality goals in the SWA depends on maintaining regular communication to update partners on progress in implementing actions, sharing information about the effectiveness of actions, and promoting the SWAP to external agencies and the public. To achieve this, the partners will identify gaps in information, work together to remove barriers to implementation, and celebrate successes in achieving the goals of the SWA.

Deliverable 7.1: Develop an integrated monitoring strategy (surface water and groundwater quality and quantity, biology, etc.) that builds on the current monitoring program to better support decision making and flood forecasting, as well as understanding eflows, climate change impacts, and water quality / quantity relationships

Actions:

i. Include the rationale, locations, field protocol, data management, etc. of the current monitoring programs and the needs currently being met by this monitoring for the UTRCA including:
   - Water chemistry,
   - Bacteria,
   - Benthic invertebrates,
   - Fish / other aquatics,
   - Formalize and update the UTRCA aquatic monitoring plan.

ii. Ensure methodology is compatible with standardized protocols for monitoring programs.

iii. Develop a process for the maintenance and monitoring of storm water management LIDs or BMPs demonstration sites to:
   - Assess the performance of storm water management LIDs or BMPs in the watershed,
   - Ensure the LID or BMP is working the way it was designed for both water quantity and quality (e.g., reduction in phosphorus),
   - Inspect and observe vegetation, odor, colour, etc.

iv. Monitor drains including:
   - Quality of discharge,
   - Effects of cleanout in terms of water quality and quantity,
   - Downstream impacts, before and after land use practices,
   - Effects of brushing / removal of vegetation along banks but not in the water.

v. Enhance monitoring along the river (including tributaries) to measure progress towards Thames River phosphorus reduction loading targets by:
   - Sampling analysis for phosphorus on the main Thames in London or on North / South branches,
   - Assisting partner agencies (Lower Thames Valley Conservation Authority), as needed, to maintain the Thamesville automated monitoring station for the long term (2025+) to measure phosphorus loads, using standardized load monitoring protocol.

vi. Enhance monitoring in target subwatersheds to measure stream health conditions, better plan for and target implementation, and measure and report on progress, by working with partner agencies to:

- Determine monitoring needs in target subwatersheds with partners to better assess conditions and develop plans for watershed protection or restoration,
- Add and maintain long term stations at additional locations as needed along the Thames,
- Add new, long term stations to key subwatersheds where there is minimal or no monitoring currently,
- Increase level of routine water quality and stream health monitoring at existing long term subwatershed stations to capture data on baseline conditions of stream health by adding new, long term monitoring parameters based on gap analysis from the monitoring plan (e.g., phosphorus loading data, continuous temperature stations) and incorporating all quality parameters that are monitored (e.g., pesticides, plastics, toxins),
- Determining if it is more valuable to UTRCA (and municipalities) to either:
  - Establish a long term water quality / quantity / aquatic life monitoring program that includes fish, mussels, and other aquatics for all subwatersheds (program would be expensive and time consuming), or
  - Undertake less intensive inventories at more sites (UTRCA has index sites for mussels and benthics but no long-term fish index sites).
- Investigating the knowledge gaps identified in the 2004 report on aquatic SAR in the Thames River watershed (Cudmore, MacKinnon and Madzia 2004) and the draft Thames River Aquatic Ecosystem Recovery Strategy by the Thames River Recovery Team (2007).
- Increasing fish sampling (e.g., planning and regulations staff have indicated more fish data would be more useful to them).

vii. Improve stream gauge monitoring program to maintain and enhance sustainable surface water quantity monitoring program and ensure it provides adequate information needed for monitoring and responding to a changing climate, by:
- Consulting with biologists to determine where better water depth information is needed to understand critical habitat,
- Ensuring water quality and flow stations are paired or in close proximity,
- Identifying new locations based on watershed report cards, information gaps, and lack of UTRCA presence or awareness,
- Increasing number of stream gauges in smaller ungauged rural and urban watersheds to assess low flow, climate change, eflow, etc.,
- Incorporating past locations, where appropriate (e.g., local support, relevant information, identified in watershed report cards) to maintain data consistency and save set up costs.

viii. Improve groundwater monitoring program to determine baseline conditions and baseflow by:
- Establishing continuous monitoring of water level in groundwater monitoring wells to inform hydrologic modelling for purposes such as groundwater flood forecasting and describing base flow conditions important to eflow,
- Incorporating historical groundwater information to provide context that will aid in near real time decisions (such as reservoir operations),
- Identifying areas of shallow groundwater or areas of changing water levels that have potential for groundwater flooding,
- Establishing a sustainable shallow groundwater monitoring network to measure recharge in shallow aquifers,
- Establishing new groundwater monitoring wells in areas identified as data gaps in Ontario Low Water Response: Draft Groundwater Indicator Site Selection Criteria (UTRCA 2009),

- Establishing new groundwater monitoring wells in areas identified as data gaps in Table 2-8 of the Lower Thames Valley Assessment Report (Thames Sydenham and Region Source Protection Committee 2015a) and Table 2-5 in the Upper Thames River Assessment Report (Thames Sydenham and Region Source Protection Committee 2015b) for the Thames watershed,
- Incorporating groundwater monitoring information and enhanced groundwater concepts in communication and education materials such as watershed report cards, UTRCA newsletter and blogs, and communications about low flow,
- Establish a monitoring program to support chemically based techniques or water table variation methods of estimating recharge.

ix. Monitor components of the water budget in sufficient temporal and spatial detail to document uses, trends, losses, effects of weather and climate, ecosystem impacts and basic water resources.
x. Ensure monitoring program is sustainable, regularly reviewed, and adjusted.
xi. Influence behavior and improve public understanding and awareness of the importance of monitoring by:
    - Incorporating monitoring information in communication and education materials,
    - Broadcasting and reporting on volunteer-based weather reporting programs.

Deliverable 7.2: Expand the use of a comprehensive data storage and environmental data management system (e.g., Water Information Systems by KISTERS or WISKI) for all water quality, quantity, and ecological data collected for the Thames watershed

Actions:

i. Incorporate all life history and habitat data on priority flora and faunal species.
ii. Incorporate data on all priority human uses and needs.
iii. Develop an automatic import process for parameters that are manually imported, such as:
    - Long term surface water quality stations,
    - Bacterial data collected by health unit,
    - Pesticides,
    - Plastics,
    - Toxins,
    - Reservoir data,
    - On-Farm Applied Research and Monitoring (ONFARM) program water quality and quantity data,
    - Saturated buffer water quality data,
    - Snow data,
    - Community data (e.g., Community Collaborative Rain, Hail and Snow program (CoCoRaHS)).

i. Incorporate all-time series (WISKI) or spatial (GIS) LID data collected from maintenance or monitoring of BMPs (e.g., ONFARM and saturated buffer programs) and LIDs.
ii. Establish an automated system for obtaining, calibrating, storing, and utilizing climate data from Canadian and American sources including:
    - Investigating other climate stations for precipitation and temperature information,
    - Continuing to update precipitation and temperature datasets in WISKI as new information becomes available,

- Utilizing radar rainfall data by setting up and maintaining a hydromaster service,
- Integrating volunteer-based weather reporting programs (such as CoCoRaHS, community science projects, etc.) into centralized data management systems to improve spatial coverage of weather data.

List of Acronyms

2D: Two-dimensional

BMP: Best Management Practice

CA: Conservation Authority

CoCoRaHS: Community Collaborative Rain, Hail and Snow

CWP: Clean Water Program

DFO: Department of Fisheries and Oceans

Eflow: Environmental Flow

FN: First Nation

GIS: Geographical Information System

LID: Low Impact Development

LiDAR: Light Detection and Ranging

NH: Natural Heritage

ONFARM: On-Farm Applied Research and Monitoring

SAR: Species At Risk

SWA: Shared Waters Approach

SWAP: Shared Waters Action Plan

UTRCA: Upper Thames River Conservation Authority

WISKI: Water Information Systems by KISTERS

Appendix A: Spreadsheet of the UTRCA SWAP

Appendix B: Governance Model for UTRCA SWAP

The process for reporting, updating, and continuously improving the UTRCA SWAP will be developed through a governance model consisting of an Implementation Committee, a Project Manager, and a Working Group comprised of UTRCA staff.

Implementation Committee: comprised of UTRCA Managers / Coordinators from the Unit Leads and the Project Manager to oversee the implementation of the SWAP by:

- Prioritizing and incorporating the SWAP into integrated unit work plans and budgets,
- Removing barriers to implementation of the action plans,
- Championing the SWAP,
- Assigning a staff role for project manager and working group members,
- Developing annual progress reports on plan implementation.

Working Group: comprised of the Project Manager and key staff positions from the Unit Leads to implement the SWAP to:

- Enhance communication between units,
- Implement priority actions through work plans to meet deliverables in the SWAP,
- Report on and evaluate the effectiveness of actions for the watershed,
- Meet quarterly to share information on progress toward implementing the SWAP and identify any watershed management issues such as gaps in knowledge or barriers to implementing actions (note: additional meetings may be called at the request of any Unit Lead),
- Develop technical monitoring reports to the Implementation Committee every 5 years to provide updates on the SWAP and ensure accountability, identify setbacks, communicate progress, and celebrate success in implementing the UTRCA SWAP.

Project Manager: liaison between the Working Group and the Implementation Committee, as well as the SWA Steering Committee, to:

- Lead the Working Group in the coordination and management of SWAP implementation, reporting, and review,
- Ensure that regular updates are held with the Implementation Committee and the SWA Steering Committee to review progress and address any watershed issues, gaps in knowledge, or barriers identified by the Working Group in implementing actions.