

TABLE OF CONTENTS

| | |
|--|-----------|
| EXECUTIVE SUMMARY | i |
| 1.0 INTRODUCTION..... | 12 |
| 1.1 Background..... | 12 |
| 1.2 Project Scope..... | 12 |
| 1.2.1 Task 1: Assessment of Existing Waste Recovery Technologies | 12 |
| 1.2.2 Task 2: Case Studies of Implemented Technologies | 13 |
| 1.2.3 Task 3: Review of New and Emerging Technologies | 13 |
| 1.2.4 Task 4: Relationship of EPR and Resource Recovery with Current Waste Stream | 13 |
| 1.2.5 Task 5: Economic Potential of Full Resource Recovery..... | 13 |
| 1.3 Document Objectives and Organization | 13 |
| 1.4 Glossary | 14 |
| 2.0 TASK 1: ASSESSMENT OF EXISTING WASTE RECOVERY TECHNOLOGIES..... | 17 |
| 2.1 Task 1 - Stage 1: Setting the Scene..... | 17 |
| 2.1.1 Baseline Waste Generation..... | 17 |
| 2.1.2 Forecasting Methodology | 18 |
| 2.1.3 Forecasted Recycling and Residual Waste | 20 |
| 2.1.4 Additional Comments..... | 21 |
| 2.1.5 Initial Technology Considerations..... | 22 |
| 2.2 Task 1 - Stage 2: Technology Options | 22 |
| 2.2.1 Materials Recovery Facility (MRF)..... | 23 |
| 2.2.2 Mechanical Biological Treatment (MBT) | 24 |
| 2.2.3 Biological Treatment | 24 |
| 2.2.3.1 Composting | 24 |
| 2.2.3.2 Anaerobic Digestion (AD)..... | 25 |
| 2.2.4 Thermal Treatment Technologies..... | 26 |
| 2.2.4.1 Combustion | 26 |
| 2.2.4.2 Advanced Thermal Treatment – Pyrolysis and Gasification | 26 |
| 2.3 Task 1 - Stage 3: Multi-Criteria Assessment..... | 27 |
| 2.3.1 Developing the MCA Tool | 28 |
| 2.3.2 Defining the Criteria | 28 |
| 2.3.2.1 Community | 28 |
| 2.3.2.2 Economy | 28 |
| 2.3.2.2.1 Q1. Improving Vibrancy of Green Economy | 28 |
| 2.3.2.2.2 Q2. Enhancing Entrepreneurship Opportunities..... | 28 |
| 2.3.2.2.3 Q3. Advancing Local Food Production..... | 29 |
| 2.3.2.2.4 Q4. Advancement of Green Economy..... | 29 |
| 2.3.2.3 Environment | 33 |
| 2.3.2.3.1 Q1. Improve Oxford's Ecological Systems | 33 |
| 2.3.2.3.2 Q2. Reduce Fossil Fuel Use | 33 |
| 2.3.2.3.3 Q3. Reduction of Solid Waste Disposal | 34 |
| 2.3.2.3.4 Q4. Protection of Water..... | 34 |

| | | |
|------------|---|-----------|
| 2.3.2.4 | <i>Implementation</i> | 34 |
| 2.3.2.4.1 | Q1. Capital Costs | 35 |
| 2.3.2.4.2 | Q2. Operating Costs | 35 |
| 2.3.2.4.3 | Q3. Timeframe to Plan & Implement | 35 |
| 2.3.2.4.4 | Q4. Technology Readiness | 35 |
| 2.3.2.4.5 | Q5. Capability of Modular Implementation | 35 |
| 2.3.2.4.6 | Q6. Extent of Amenity Impacts..... | 36 |
| | 2.3.3 Weightings | 36 |
| | 2.3.4 Scoring | 37 |
| | 2.3.5 Results | 37 |
| | 2.3.6 Discussion | 39 |
| | 2.3.6.1 <i>Interpretation of Results</i> | 39 |
| | 2.3.6.2 <i>Limitations of the Evaluation</i> | 39 |
| | 2.3.6.3 <i>Influence of Weightings</i> | 40 |
| 3.0 | TASK 2: CASE STUDIES OF IMPLEMENTED TECHNOLOGIES | 41 |
| 3.1 | MCA Scenario 2: MRF Producing Recyclables and RDF for Thermal Treatment Outside OC | 41 |
| | 3.1.1 Case Study: FCC Environment, Wrexham, UK | 41 |
| | 3.1.1.1 <i>Process Description</i> | 41 |
| | 80 to 300mm stream | 41 |
| | 0 to 80 mm stream | 42 |
| | Bio-dried fraction | 42 |
| | 3.1.1.2 <i>Operational Comment</i> | 42 |
| | 3.1.2 Case Study: Neath Port Talbot Recycling Ltd, Swansea, UK | 43 |
| | 3.1.2.1 <i>Process Description</i> | 43 |
| | 3.1.2.2 <i>Operational Comment</i> | 44 |
| 3.2 | MCA Scenario 3: MBT Comprising MRF Producing Recyclables and Organics plus Wet AD Organic Processing Stage in OC | 46 |
| | 3.2.1 Case Study: Biffa, W Sussex, UK | 46 |
| | 3.2.1.1 <i>Process Description</i> | 46 |
| | 3.2.1.2 <i>Operational Comment</i> | 47 |
| | 3.2.2 Case Study: Sant Antrnin, Malta | 48 |
| | 3.2.2.1 <i>Process Description</i> | 48 |
| | 3.2.2.2 <i>Operational Comment</i> | 50 |
| 3.3 | MCA Scenario 4: MBT Comprising MRF Producing Recyclables and Organics plus Dry AD Organic Processing Stage in OC | 50 |
| | 3.3.1 Case Study: Western Isles Council, Scotland, UK | 50 |
| | 3.3.1.1 <i>Process Description</i> | 51 |
| | 3.3.1.1.1 Source-segregated Recyclables | 51 |
| | 3.3.1.1.2 Source-segregated Bio-waste..... | 51 |
| | 3.3.1.1.3 Residual waste..... | 52 |
| | 3.3.1.2 <i>Operational Comment</i> | 52 |
| | 3.3.2 Case Study: Tri-Municipal Region, Alberta, Canada | 53 |
| | 3.3.2.1 <i>Process Description</i> | 53 |
| | 3.3.2.2 <i>Operational Comment</i> | 54 |

| | | |
|---------|--|------------|
| 3.4 | Lessons Learned | 55 |
| 4.0 | TASK 3: REVIEW OF NEW AND EMERGING TECHNOLOGIES | 56 |
| 4.1 | Advances in Current Technologies | 56 |
| 4.1.1 | <i>Material Recycling Facilities</i> | <i>56</i> |
| 4.1.2 | <i>Combustion based Energy from Waste</i> | <i>56</i> |
| 4.1.3 | <i>Anaerobic Digestion (AD)</i> | <i>56</i> |
| 4.1.3.1 | <i>Liquefaction</i> | <i>56</i> |
| 4.1.3.2 | <i>Gas to Liquids</i> | <i>57</i> |
| 4.1.4 | <i>Advanced Thermal Treatment (ATT)</i> | <i>57</i> |
| 4.1.5 | <i>Summary</i> | <i>58</i> |
| 4.2 | Upgrading and Use of Existing WWTP Infrastructure..... | 58 |
| 4.2.1 | <i>Case Study 1 – Avonmouth (Bristol), UK.....</i> | <i>58</i> |
| 4.2.2 | <i>Case Study 2 – Fielding WWTP, Manawatu District Council, New Zealand</i> | <i>59</i> |
| 4.2.3 | <i>Considerations for Utilization of Digestate.....</i> | <i>59</i> |
| 5.0 | TASK 4: RELATIONSHIP OF EPR AND RESOURCE RECOVERY TO OXFORD COUNTY | 63 |
| 5.1 | WASTE-FREE ONTARIO ACT, 2016..... | 63 |
| 5.1.1 | <i>Background to the Waste-Free Ontario Act (Bill 151)</i> | <i>63</i> |
| 5.1.2 | <i>Key Elements for Municipalities of the Resource Recovery and Circular Economy Act and the Waste Diversion Transition Act.....</i> | <i>64</i> |
| 5.2 | THE STRATEGY FOR A WASTE-FREE ONTARIO: BUILDING THE CIRCULAR ECONOMY | 66 |
| 5.2.1 | <i>The Vision – What is a Circular Economy?.....</i> | <i>66</i> |
| 5.2.2 | <i>Objectives and Actions Designed to Achieve Ontario’s Vision</i> | <i>68</i> |
| 5.2.3 | <i>Key Actions to meet Ontario’s Waste-Free Goal and Strategy.....</i> | <i>72</i> |
| 5.2.3.1 | <i>Transitioning Existing Waste Diversion Programs (Strategy Action Item #4).....</i> | <i>72</i> |
| 5.2.3.2 | <i>Amend the 3 Rs Regulations to Increase Resource Recovery Across All Sectors (Strategy Action Item # 5).....</i> | <i>73</i> |
| 5.2.3.3 | <i>Designate New Materials (Strategy Action Item #9)</i> | <i>74</i> |
| 5.2.3.4 | <i>Food and Organics Waste Action Plan (Strategy Action Item #10)</i> | <i>75</i> |
| 5.2.3.5 | <i>Disposal Bans (Strategy Action Item #15)</i> | <i>76</i> |
| 5.3 | ONTARIO’S CLIMATE CHANGE ACTION PLAN AND WASTE DIVERSION | 77 |
| 5.3.1 | <i>Ontario’s Climate Change Action Plan.....</i> | <i>77</i> |
| 5.3.2 | <i>Ontario’s Cap and Trade System.....</i> | <i>79</i> |
| 5.4 | RECOMMENDED ACTIONS IN SUPPORT OF OXFORD COUNTY’S GOAL OF ZERO WASTE..... | 80 |
| 5.4.1 | <i>Priority Actions Recommended.....</i> | <i>80</i> |
| 5.4.2 | <i>Future Action Considerations for Oxford County</i> | <i>90</i> |
| 6.0 | TASK 5: ECONOMIC POTENTIAL OF FULL RESOURCE RECOVERY | 92 |
| 6.1 | Scope of Economic Analysis and Assumptions..... | 92 |
| 6.1.1 | <i>Analysis Methodology.....</i> | <i>92</i> |
| 6.1.2 | <i>Specific Assumptions</i> | <i>93</i> |
| 6.2 | MCA Scenario 2 | 94 |
| 6.3 | MCA Scenario 3 | 95 |
| 6.4 | Discussion | 96 |
| 6.5 | Facility Development Considerations | 97 |
| 7.0 | CONCLUSIONS..... | 99 |
| 8.0 | RECOMMENDATIONS | 104 |
| 9.0 | STATEMENT OF LIMITATIONS..... | 106 |

TABLES

| | |
|---|----|
| Table 2-1: Waste Collected and Processed in 2010..... | 17 |
| Table 2-2: Assumed Capture Rates | 20 |
| Table 2-3: Residential Waste Generation Summary | 20 |
| Table 2-4: MRF Technology Providers | 24 |
| Table 2-5: MBT Technology Providers | 24 |
| Table 2-6: Composting Technology Providers | 25 |
| Table 2-7: Anaerobic Digestion Technology Providers..... | 25 |
| Table 2-8: Combustion Technology Providers | 26 |
| Table 2-9: ATT Technology Providers | 26 |
| Table 2-10: Greenhouse Gas Assessment Summary | 32 |
| Table 2-11: Summary of Recycling Performance | 33 |
| Table 2-12: Summary of Multi-Criteria Assessment Scores | 38 |
| Table 4-1: Maximum Concentration for Metals in Compost..... | 61 |
| Table 5-1: Objectives and Actions in the Strategy for a Waste Free Ontario..... | 69 |
| Table 5-2: Milestones to 2023..... | 70 |
| Table 6-1: Potential Revenues Scenario 2..... | 95 |
| Table 6-2: Potential Revenues Scenario 3..... | 96 |

FIGURES

| | |
|--|----|
| Figure 2—1: Indicative Waste Composition (excluding Blue Box)..... | 19 |
| Figure 2—2: Waste Treatment Technology Schematic | 23 |
| Figure 2—3: Life Cycle Assessment Concept..... | 30 |
| Figure 3—1: Picking Station at Neath Port Talbot | 44 |
| Figure 3—2: Bio-drying IVC Tunnels at Neath Port Talbot..... | 45 |
| Figure 3—3 Sorting Lines at Brookhurst Wood | 47 |
| Figure 3—4 Wet Anaerobic Digester at Brookhurst Wood..... | 48 |
| Figure 3—5 AD Plant at Sant Antnin (WasteServ Malta Ltd.)..... | 49 |
| Figure 3—6 Reception Hall at the Western Isles Council Waste Management Facility..... | 52 |
| Figure 3—7: Conceptual design of Combined MRF and High-solids AD plant, Tri-Municipal Region, AB | 55 |
| Figure 5—1 Waste Free Ontario Strategy Interim Goals | 68 |

APPENDICES

| | |
|------------|--|
| Appendix A | Waste Treatment Technology Descriptions |
| Appendix B | Waste Composition and Energy Mix Assumptions |
| Appendix C | Pages 12-13 from Waste Free Ontario Act |