



Final Report

WASTEWATER SERVICING STUDY FOR NEW GROWTH AREAS BADEN AND NEW HAMBURG

VOLUME 1 - TEXT

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Table of Contents

	Page
Section 1.0 Introduction and Background	1
1.1 General.....	1
1.2 Study Purpose and Objective.....	1
1.2.1 Forecasted Population within the Township of Wilmot	2
1.2.2 Evaluation of Population Forecasts under BNHWWMPU Recommendations	2 2
1.2.3 Development of Baseline 2012 Sanitary Sewer Model.....	2
1.2.3.1 New Development to 2012	3
1.2.3.2 Estimate of New Development Population and Sanitary Flow	3
Section 2.0 Selection of Phased Development Options for Evaluation	4
2.1 Baseline Hydraulic Sanitary SWMM Model	4
2.2 Township Planned Development Intensification.....	6
2.3 Selection of Phased Sanitary Sewer Servicing Alternatives.....	7
2.3.1 Alternative A – Utilization of Existing Sanitary Linear Infrastructure (Do Nothing Alternative)	9 9
2.3.2 Alternative B – Proposed Sanitary Linear Infrastructure and Pump Stations	9 9
2.3.3 Alternative C – Proposed Sanitary Linear Infrastructure and Pump Stations	10 10
2.3.4 Alternative D – Proposed Sanitary Linear Infrastructure and Pump Stations	10 10
2.4 Sanitary Sewer Servicing Evaluation Matrix	10
2.4.1 Delineation of Sub-Catchment Areas.....	11
2.4.2 Matrix Evaluation Criteria	12
2.4.2.1 Hydraulic Compatibility.....	12
2.4.2.2 Development Timing	12
2.4.2.3 Public/Environmental Disturbance	12
2.4.2.4 Indicative Cost Estimate.....	13
2.4.2.5 Evaluation on Sanitary Sewer Servicing Alternatives.....	13
Section 3.0 Evaluation of Phased Development Alternatives (A to D)	13
3.1 Proposed Distribution of Population Growth.....	14
3.1.1 Proposed Distribution of New Growth Population – For Residential Intensification Areas.....	14 14
3.1.2 Proposed Distribution of New Growth Population - Alternative A (Do Nothing).....	15 15
3.1.3 Proposed Distribution of New Growth Population - Alternative B.....	15 15
3.1.4 Proposed Distribution of New Growth Population - Alternative C.....	16 16

Table of Contents

	Page
3.1.5	Proposed Distribution of New Growth Population - Alternative D16
3.2	Preliminary Sanitary Flow Evaluation 17
3.2.1	Sanitary Flow Evaluation - Alternative A (Do Nothing)18
3.2.2	Sanitary Flow Evaluation - Alternative B18
3.2.3	Sanitary Flow Evaluation - Alternative C19
3.2.4	Sanitary Flow Evaluation - Alternative D20
3.3	Sanitary Flow Hydraulic Analysis 20
3.3.1	Sanitary Flow Hydraulic Analysis - Alternative A (Do Nothing)21
3.3.1.1	Baden Alternative A (Do Nothing)21
3.3.1.2	New Hamburg Alternative A (Do Nothing)22
3.3.2	Sanitary Flow Hydraulic Analysis - Alternative B22
3.3.2.1	Baden Alternative B22
3.3.2.2	New Hamburg Alternative B22
3.3.3	Sanitary Flow Hydraulic Analysis - Alternative C23
3.3.3.1	Baden Alternative C23
3.3.3.2	New Hamburg Alternative C23
3.3.4	Sanitary Flow Hydraulic Analysis - Alternative D24
3.3.4.1	Baden Alternative D24
3.3.4.2	New Hamburg Alternative D24
3.4	Proposed Sewer Alignment 25
3.4.1	Alternative B26
3.4.2	Alternative C26
3.4.3	Alternative D27
3.5	Preliminary Cost Estimate 28
3.6	Evaluation Matrix 30
3.6.1	Hydraulic Compatibility30
3.6.2	Optimum Development Timing31
3.6.3	Least Public/Environmental Disturbance33
3.6.4	Least Indicative Cost Estimate34
Section 4.0	Conclusions and Recommendations 34
4.1	Conclusions 34
4.2	Timing of Capital Expenditure 35
4.3	Recommendations 38

**List of Figures
(Following Text)**

Figure 1-1	Baden 2012 New Development Areas
Figure 1-2	New Hamburg 2012 New Development Areas (1 of 2)
Figure 1-3	New Hamburg 2012 New Development Areas (2 of 2)
Figure 2-1A	Flow Analysis 2012 Conditions Baden - Foundry Street (Plan)
Figure 2-1B	Flow Analysis 2012 Conditions Baden - Foundry Street (Profile)
Figure 2-2A	Flow Analysis 2012 Conditions Baden - Snyder's Road West (Plan)
Figure 2-2B	Flow Analysis 2012 Conditions Baden - Snyder's Road West (Profile)
Figure 2-3A	Flow Analysis 2012 Conditions Baden - Tannery Street (Plan)
Figure 2-3B	Flow Analysis 2012 Conditions Baden - Tannery Street (Profile)
Figure 2-4A	Flow Analysis 2012 Conditions Baden - Village Green Way (Plan)
Figure 2-4B	Flow Analysis 2012 Conditions Baden - Village Green Way (Profile)
Figure 2-5A	Flow Analysis 2012 Conditions Baden - Highway 7/8 (Plan)
Figure 2-5B	Flow Analysis 2012 Conditions Baden - Highway 7/8 (Profile)
Figure 2-6A	Flow Analysis 2012 Conditions New Hamburg - Highway 7/8 (Plan)
Figure 2-6B	Flow Analysis 2012 Conditions New Hamburg - Highway 7/8 (Profile)
Figure 2-7A	Flow Analysis 2012 Conditions New Hamburg - Riverside Drive (Plan)
Figure 2-7B	Flow Analysis 2012 Conditions New Hamburg - Riverside Drive (Profile)

**List of Figures
(Following Text)**

Figure 2-8A	Flow Analysis 2012 Conditions New Hamburg - Milton P/S to HWY 7 (Plan)
Figure 2-8B	Flow Analysis 2012 Conditions New Hamburg - Milton P/S to HWY 7 (Profile)
Figure 2-9A	Flow Analysis 2012 Conditions New Hamburg - Milton P/S to Huron St. (Plan)
Figure 2-9B	Flow Analysis 2012 Conditions New Hamburg - Milton P/S to Huron St. (Profile)
Figure 2-10A	Flow Analysis 2012 Conditions New Hamburg - Milton P/S to Huron St. (Plan)
Figure 2-10B	Flow Analysis 2012 Conditions New Hamburg - Milton P/S to Huron St. (Profile)
Figure 2-11A	Flow Analysis 2012 Conditions New Hamburg - Conestoga Rd to Smith's Creek Dr. (Plan)
Figure 2-11B	Flow Analysis 2012 Conditions New Hamburg - Conestoga Rd to Smith's Creek Dr. (Profile)
Figure 2-12A	Flow Analysis 2012 Conditions New Hamburg - Conestoga Rd (Plan)
Figure 2-12B	Flow Analysis 2012 Conditions New Hamburg - Conestoga Rd (Profile)
Figure 2-13A	Flow Analysis 2012 Conditions New Hamburg - Jantzi Pl. to Hinks St. (Plan)
Figure 2-13B	Flow Analysis 2012 Conditions New Hamburg - Jantzi Pl. to Hinks St. (Profile)
Figure 2-14A	Flow Analysis 2012 Conditions New Hamburg - Forest Glen P/S (Plan)
Figure 2-14B	Flow Analysis 2012 Conditions New Hamburg - Forest Glen P/S (Profile)
Figure 2-15	Delineation of Growth Areas - Baden
Figure 2-16	Delineation of Growth Areas - New Hamburg
Figure 2-17	Alternative A - Utilization of Existing Sanitary Linear Infrastructure - Baden

**List of Figures
(Following Text)**

Figure 2-18	Alternative A - Utilization of Existing Sanitary Linear Infrastructure - New Hamburg
Figure 2-19	Alternative B - Proposed Sanitary Linear Infrastructure and Pump Stations - Baden
Figure 2-20	Alternative B - Proposed Sanitary Linear Infrastructure and Pump Stations - New Hamburg
Figure 2-21	Alternative C - Proposed Sanitary Linear Infrastructure and Pump Stations - Baden
Figure 2-22	Alternative C – Proposed Sanitary Linear Infrastructure and Pump Stations - New Hamburg
Figure 2-23	Alternative D - Proposed Sanitary Linear Infrastructure and Pump Stations - Baden
Figure 2-24	Alternative D - Proposed Sanitary Linear Infrastructure and Pump Stations - New Hamburg
Figure 2-25	Sanitary Evaluation Sub-Catchment Areas - Baden
Figure 2-26	Sanitary Evaluation Sub-Catchment Areas - New Hamburg
Figure 2-27	Sample Sanitary Sewer Evaluation Matrix for Baden & New Hamburg
Figure 3-1A	Flow Analysis Baden Alternative A (Do Nothing) – Foundry Street (Plan)
Figure 3-1B	Flow Analysis Baden Alternative A (Do Nothing) – Foundry Street (Profile)
Figure 3-2A	Flow Analysis Baden Alternative A (Do Nothing) – Snyder's Road West (Plan)
Figure 3-2B	Flow Analysis Baden Alternative A (Do Nothing) – Snyder's Road West (Profile)
Figure 3-3A	Flow Analysis Baden Alternative A (Do Nothing) – Village Green Way (Plan)
Figure 3-3B	Flow Analysis Baden Alternative A (Do Nothing) – Village Green Way (Profile)
Figure 3-4A	Flow Analysis Baden Alternative A (Do Nothing) – Tannery Street (Plan)

List of Figures (Following Text)

Figure 3-4B	Flow Analysis Baden Alternative A (Do Nothing) – Tannery Street (Profile)
Figure 3-5A	Flow Analysis Baden Alternative A (Do Nothing) – Foundry Street (Plan)
Figure 3-5B	Flow Analysis Baden Alternative A (Do Nothing) – Foundry Street (Profile)
Figure 3-6A	Flow Analysis Baden Alternative A (Do Nothing) – Highway 7/8 (Plan)
Figure 3-6B	Flow Analysis Baden Alternative A (Do Nothing) – Highway 7/8 (Profile)
Figure 3-7A	Flow Analysis New Hamburg Alternative A (Do Nothing) – Highway 7/8 (Plan)
Figure 3-7B	Flow Analysis New Hamburg Alternative A (Do Nothing) – Highway 7/8 (Profile)
Figure 3-8A	Flow Analysis New Hamburg Alternative A (Do Nothing) – Jacob Street (Plan)
Figure 3-8B	Flow Analysis New Hamburg Alternative A (Do Nothing) – Jacob Street (Profile)
Figure 3-9A	Flow Analysis New Hamburg Alternative A (Do Nothing) – Riverside Drive (Plan)
Figure 3-9B	Flow Analysis New Hamburg Alternative A (Do Nothing) – Riverside Drive (Profile)
Figure 3-10A	Flow Analysis New Hamburg Alternative A (Do Nothing) – Bleams Road East (Plan)
Figure 3-10B	Flow Analysis New Hamburg Alternative A (Do Nothing) – Bleams Road East (Profile)
Figure 3-11A	Flow Analysis New Hamburg Alternative A (Do Nothing) – Asmus Street (Plan)
Figure 3-11B	Flow Analysis New Hamburg Alternative A (Do Nothing) – Asmus Street (Profile)

List of Figures (Following Text)

Figure 3-12A	Flow Analysis New Hamburg Alternative A (Do Nothing) – Milton P/S (Plan)
Figure 3-12B	Flow Analysis New Hamburg Alternative A (Do Nothing) – Milton P/S (Profile)
Figure 3-13A	Flow Analysis New Hamburg Alternative A (Do Nothing) – Grant Street (Plan)
Figure 3-13B	Flow Analysis New Hamburg Alternative A (Do Nothing) – Grant Street (Profile)
Figure 3-14A	Flow Analysis New Hamburg Alternative A (Do Nothing) – Conestoga Road (Plan)
Figure 3-14B	Flow Analysis New Hamburg Alternative A (Do Nothing) – Conestoga Road (Profile)
Figure 3-15A	Flow Analysis New Hamburg Alternative A (Do Nothing) – Forest Glen P/S (Plan)
Figure 3-15B	Flow Analysis New Hamburg Alternative A (Do Nothing) – Forest Glen P/S (Profile)
Figure 3-16A	Flow Analysis Baden Alternative B – Foundry Street (Plan)
Figure 3-16B	Flow Analysis Baden Alternative B – Foundry Street (Profile)
Figure 3-17A	Flow Analysis Baden Alternative B – Snyder's Road West (Plan)
Figure 3-17B	Flow Analysis Baden Alternative B – Snyder's Road West (Profile)
Figure 3-18A	Flow Analysis Baden Alternative B – Village Green Way (Plan)
Figure 3-18B	Flow Analysis Baden Alternative B – Village Green Way (Profile)
Figure 3-19A	Flow Analysis Baden Alternative B – Tannery Street (Plan)
Figure 3-19B	Flow Analysis Baden Alternative B – Tannery Street (Profile)
Figure 3-20A	Flow Analysis Baden Alternative B – Foundry Street (Plan)
Figure 3-20B	Flow Analysis Baden Alternative B – Foundry Street (Profile)
Figure 3-21A	Flow Analysis Baden Alternative B – Highway 7/8 (Plan)
Figure 3-21B	Flow Analysis Baden Alternative B – Highway 7/8 (Profile)
Figure 3-22A	Flow Analysis New Hamburg Alternative B – Highway 7/8 (Plan)

List of Figures (Following Text)

Figure 3-22B	Flow Analysis New Hamburg Alternative B – Highway 7/8 (Profile)
Figure 3-23A	Flow Analysis New Hamburg Alternative B – Jacob Street (Plan)
Figure 3-23B	Flow Analysis New Hamburg Alternative B – Jacob Street (Profile)
Figure 3-24A	Flow Analysis New Hamburg Alternative B – Riverside Drive (Plan)
Figure 3-24B	Flow Analysis New Hamburg Alternative B – Riverside Drive (Profile)
Figure 3-25A	Flow Analysis New Hamburg Alternative B – Bleams Road East (Plan)
Figure 3-25B	Flow Analysis New Hamburg Alternative B – Bleams Road East (Profile)
Figure 3-26A	Flow Analysis New Hamburg Alternative B – Asmus Street (Plan)
Figure 3-26B	Flow Analysis New Hamburg Alternative B – Asmus Street (Profile)
Figure 3-27A	Flow Analysis New Hamburg Alternative B – Milton P/S (Plan)
Figure 3-27B	Flow Analysis New Hamburg Alternative B – Milton P/S (Profile)
Figure 3-28A	Flow Analysis New Hamburg Alternative B – Grant Street (Plan)
Figure 3-28B	Flow Analysis New Hamburg Alternative B – Grant Street (Profile)
Figure 3-29A	Flow Analysis New Hamburg Alternative B – Conestoga Road (Plan)
Figure 3-29B	Flow Analysis New Hamburg Alternative B – Conestoga Road (Profile)
Figure 3-30A	Flow Analysis New Hamburg Alternative B – Forest Glen P/S (Plan)
Figure 3-30B	Flow Analysis New Hamburg Alternative B – Forest Glen P/S (Profile)
Figure 3-31A	Flow Analysis Baden Alternative C – Foundry Street (Plan)
Figure 3-31B	Flow Analysis Baden Alternative C – Foundry Street (Profile)
Figure 3-32A	Flow Analysis Baden Alternative C – Snyder's Road West (Plan)
Figure 3-32B	Flow Analysis Baden Alternative C – Snyder's Road West (Profile)
Figure 3-33A	Flow Analysis Baden Alternative C – Village Green Way (Plan)
Figure 3-33B	Flow Analysis Baden Alternative C – Village Green Way (Profile)
Figure 3-34A	Flow Analysis Baden Alternative C – Tannery Street (Plan)
Figure 3-34B	Flow Analysis Baden Alternative C – Tannery Street (Profile)
Figure 3-35A	Flow Analysis Baden Alternative C – Foundry Street (Plan)

List of Figures (Following Text)

Figure 3-35B	Flow Analysis Baden Alternative C – Foundry Street (Profile)
Figure 3-36A	Flow Analysis Baden Alternative C – Highway 7/8 (Plan)
Figure 3-36B	Flow Analysis Baden Alternative C – Highway 7/8 (Profile)
Figure 3-37A	Flow Analysis New Hamburg Alternative C – Highway 7/8 (Plan)
Figure 3-37B	Flow Analysis New Hamburg Alternative C – Highway 7/8 (Profile)
Figure 3-38A	Flow Analysis New Hamburg Alternative C – Jacob Street (Plan)
Figure 3-38B	Flow Analysis New Hamburg Alternative C – Jacob Street (Profile)
Figure 3-39A	Flow Analysis New Hamburg Alternative C – Riverside Drive (Plan)
Figure 3-39B	Flow Analysis New Hamburg Alternative C – Riverside Drive (Profile)
Figure 3-40A	Flow Analysis New Hamburg Alternative C – Bleams Road East (Plan)
Figure 3-40B	Flow Analysis New Hamburg Alternative C – Bleams Road East (Profile)
Figure 3-41A	Flow Analysis New Hamburg Alternative C – Asmus Street (Plan)
Figure 3-41B	Flow Analysis New Hamburg Alternative C – Asmus Street (Profile)
Figure 3-42A	Flow Analysis New Hamburg Alternative C – Milton P/S (Plan)
Figure 3-42B	Flow Analysis New Hamburg Alternative C – Milton P/S (Profile)
Figure 3-43A	Flow Analysis New Hamburg Alternative C – Grant Street (Plan)
Figure 3-43B	Flow Analysis New Hamburg Alternative C – Grant Street (Profile)
Figure 3-44A	Flow Analysis New Hamburg Alternative C – Conestoga Road (Plan)
Figure 3-44B	Flow Analysis New Hamburg Alternative C – Conestoga Road (Profile)
Figure 3-45A	Flow Analysis New Hamburg Alternative C – Forest Glen P/S (Plan)
Figure 3-45B	Flow Analysis New Hamburg Alternative C – Forest Glen P/S (Profile)
Figure 3-46A	Flow Analysis Baden Alternative D – Foundry Street (Plan)
Figure 3-46B	Flow Analysis Baden Alternative D – Foundry Street (Profile)
Figure 3-47A	Flow Analysis Baden Alternative D – Snyder's Road West (Plan)
Figure 3-47B	Flow Analysis Baden Alternative D – Snyder's Road West (Profile)
Figure 3-48A	Flow Analysis Baden Alternative D – Village Green Way (Plan)

List of Figures (Following Text)

Figure 3-48B	Flow Analysis Baden Alternative D – Village Green Way (Profile)
Figure 3-49A	Flow Analysis Baden Alternative D – Tannery Street (Plan)
Figure 3-49B	Flow Analysis Baden Alternative D – Tannery Street (Profile)
Figure 3-50A	Flow Analysis Baden Alternative D – Foundry Street (Plan)
Figure 3-50B	Flow Analysis Baden Alternative D – Foundry Street (Profile)
Figure 3-51A	Flow Analysis Baden Alternative D – Highway 7/8 (Plan)
Figure 3-51B	Flow Analysis Baden Alternative D – Highway 7/8 (Profile)
Figure 3-52A	Flow Analysis New Hamburg Alternative D – Highway 7/8 (Plan)
Figure 3-52B	Flow Analysis New Hamburg Alternative D – Highway 7/8 (Profile)
Figure 3-53A	Flow Analysis New Hamburg Alternative D – Jacob Street (Plan)
Figure 3-53B	Flow Analysis New Hamburg Alternative D – Jacob Street (Profile)
Figure 3-54A	Flow Analysis New Hamburg Alternative D – Riverside Drive (Plan)
Figure 3-54B	Flow Analysis New Hamburg Alternative D – Riverside Drive (Profile)
Figure 3-55A	Flow Analysis New Hamburg Alternative D – Bleams Road East (Plan)
Figure 3-55B	Flow Analysis New Hamburg Alternative D – Bleams Road East (Profile)
Figure 3-56A	Flow Analysis New Hamburg Alternative D – Asmus Street (Plan)
Figure 3-56B	Flow Analysis New Hamburg Alternative D – Asmus Street (Profile)
Figure 3-57A	Flow Analysis New Hamburg Alternative D – Milton P/S (Plan)
Figure 3-57B	Flow Analysis New Hamburg Alternative D – Milton P/S (Profile)
Figure 3-58A	Flow Analysis New Hamburg Alternative D – Grant Street (Plan)
Figure 3-58B	Flow Analysis New Hamburg Alternative D – Grant Street (Profile)
Figure 3-59A	Flow Analysis New Hamburg Alternative D – Conestoga Road (Plan)
Figure 3-59B	Flow Analysis New Hamburg Alternative D – Conestoga Road (Profile)

List of Figures (Following Text)

- Figure Alt B 3-1 Alternative B Sanitary Sewer from Railway to Highway 7/8 (1 of 2)
- Figure Alt B 3-2 Alternative B Sanitary Sewer from Railway to Highway 7/8 (2 of 2)
- Figure Alt B 3-3 Alternative B Sanitary Sewer on Christner Road (1 of 2)
- Figure Alt B 3-4 Alternative B Sanitary Sewer on Christner Road (2 of 2)
- Figure Alt B 3-5 Alternative B Sanitary Sewer from Christner Road to Waterloo St. (1 of 1)
- Figure Alt B 3-6 Alternative B Sanitary Sewer on Waterloo St. (1 of 2)
- Figure Alt B 3-7 Alternative B Sanitary Sewer on Waterloo St. (2 of 2)
- Figure Alt C 3-1 Alternative C Sanitary Sewer from Railway to Highway 7/8 (1 of 2)
- Figure Alt C 3-2 Alternative C Sanitary Sewer from Railway to Highway 7/8 (2 of 2)
- Figure Alt C 3-3 Alternative C Sanitary Sewer on Christner Road (1 of 2)
- Figure Alt C 3-4 Alternative C Sanitary Sewer on Christner Road (2 of 2)
- Figure Alt C 3-5 Alternative C Sanitary Sewer from Christner Road to Waterloo St. (1 of 1)
- Figure Alt C 3-6 Alternative C Sanitary Sewer on Waterloo St. (1 of 2)
- Figure Alt C 3-7 Alternative C Sanitary Sewer on Waterloo St. (2 of 2)
- Figure Alt D 3-1 Alternative D Sanitary Sewer from Railway to Highway 7/8 (1 of 2)
- Figure Alt D 3-2 Alternative D Sanitary Sewer from Railway to Highway 7/8 (2 of 2)
- Figure Alt D 3-3 Alternative D Sanitary Sewer on Waterloo St. (1 of 5)
- Figure Alt D 3-4 Alternative D Sanitary Sewer on Waterloo St. (2 of 5)
- Figure Alt D 3-5 Alternative D Sanitary Sewer on Snyder's Road (3 of 5)
- Figure Alt D 3-6 Alternative D Sanitary Sewer on Snyder's Road (4 of 5)
- Figure Alt D 3-7 Alternative D Sanitary Sewer on Nafziger Road (5 of 5)

**List of Tables
(Following Text)**

Table 1-1	Township of Wilmot (Baden/New Hamburg) Estimated Population Growth
Table 1-2	Estimated Flows Compared to BNHWWMPU Phased Effluent Limits
Table 1-3	New Developments in the Town of Baden
Table 1-4	New Development in the Town of New Hamburg
Table 1-5	2012 Population, Peak Flow and Entry Manhole - New Developments in the Town of Baden
Table 1-6	2012 Population, Peak Flow and Entry Manhole - New Developments in the Town of New Hamburg
Table 3-1	Proposed Distribution of New Growth Population – Alternative A (Do Nothing)
Table 3-2	Proposed Distribution of New Growth Population – Alternative B
Table 3-3	Proposed Distribution of New Growth Population – Alternative C
Table 3-4	Proposed Distribution of New Growth Population – Alternative D
Table 3-5	Preliminary Sanitary Flow Evaluation – Alternative A (Do Nothing)
Table 3-6	Preliminary Sanitary Flow Evaluation – Alternative B
Table 3-7	Preliminary Sanitary Flow Evaluation – Alternative C
Table 3-8	Preliminary Sanitary Flow Evaluation – Alternative D
Table 3-9	Preliminary Cost Estimate – Alternative B
Table 3-10	Preliminary Cost Estimate – Alternative C
Table 3-11	Preliminary Cost Estimate – Alternative D
Table 3-12	Evaluation Matrix for Sanitary Servicing Alternatives

Section 1.0 Introduction and Background

The Township of Wilmot (Township) is responsible for the long term operation and maintenance of the wastewater collection system for the communities of Baden and New Hamburg. The wastewater generated from these two communities is currently pumped to, and treated at the New Hamburg Wastewater Treatment Plant (WWTP). The WWTP presently contains a total of three Sequencing Batch Reactors (SBR), with approval for the full time operation of two of the three, based on the Ministry of the Environment (MOE) Certificate of Approval (C of A) effluent limit of 5,200 m³/day. In 2007 the Region of Waterloo (Region) commissioned the completion of a Region wide Wastewater Treatment Master Plan Study (WWTMPS), and in 2011 a further Baden and New Hamburg Water and Wastewater Master Plan Update (BNHWWMPU) – Master Plan Report was also commissioned by the Region. The BNHWWMPU provided recommendations for future expansion and/or changes in regulatory requirements for the WWTP, with the view of expanding the plant's treatment capacity beyond the present effluent limit of 5,200 m³/day as shown in Table 1-2.

1.1 General

Based on the most recent study completed by the Region in 2011, the recommendations in the BNHWWMPU report were identified as the most comprehensive wastewater treatment option recommended for upgrading the New Hamburg Wastewater Treatment Plant. Therefore the recommendations from the BNHWWMPU report form the basis for the Wastewater Servicing Study for New Growth Areas in Baden and New Hamburg.

The recommended changes included under the BNHWWMPU are outlined as follows:

Phase 1 – Optimize New Hamburg WWTP and resolve existing SCADA programming issues in 2012	<ul style="list-style-type: none"> 2016 Upgraded Effluent Limit: 5,400 m³/day
Phase 2 – Upgrade/Expand as per SBR Expansion Complete	<ul style="list-style-type: none"> 2018 Upgraded Effluent Limit: 7,800 m³/day
Phase 3a – Membrane Phase 1 Commissioned to meet Low Population Projections	<ul style="list-style-type: none"> 2028 Upgraded Effluent Limit: 8,100 m³/day
Phase 3b – Membrane Phase 2 Commissioned to meet High Population Projections	<ul style="list-style-type: none"> 2034 Upgraded Effluent Limit: 9,100 m³/day

1.2 Study Purpose and Objective

The scope of assignment for the wastewater servicing study, for new growth areas in Baden and New Hamburg is to assist the Township in evaluating sanitary infrastructure needs associated with the recommendations proposed by the BNHWWMPU study, based on the

anticipated upgrading of the New Hamburg Wastewater Treatment Plant. The goal of the wastewater servicing study is to formulate and evaluate development options that maximize the development of new growth areas while minimizing capital costs, to provide guidelines for the planning and budgeting of major capital expenditures for sanitary servicing.

1.2.1 Forecasted Population within the Township of Wilmot

The New Hamburg WWTP services both the residential and employment populations for the Towns of Baden and New Hamburg. For the purpose of assessing the infrastructure needs associated with the Township's estimated growth, population forecast scenarios were selected as indicated within Table 1-1. These provide the anticipated population growth to occur in the planning period between 2012 and 2041.

1.2.2 Evaluation of Population Forecasts under BNHWWMPU Recommendations

To evaluate the population forecasts under the BNHWWMPU recommendations, an average per capita (equivalent population) flow rate was required to determine the estimated population loading on the New Hamburg WWTP. Sanitary flow data measured entering the treatment plant for the years 2010, 2011 and the first 7 months of 2012 were provided by the Ontario Clean Water Agency (OCWA) who operate the plant. Based on the forecasted populations (for the years 2010 to 2012) which represent the high population growth scenario anticipated within the BNHWWMPU an average per capita flow was determined by dividing measured plant flow data by the forecasted population data. This averaged to an equivalent flow rate of 200 L/capita/day. A conservative flow rate of 240 L/capita/day (increasing averaged equivalent flow rate by 20 percent) was utilized to estimate the treatment plant flow rate. The estimated total population sanitary flows (m³/day) compared to the BNHWWMPU Phased Effluent Limit flows (m³/day) have been presented in Table 1-2.

1.2.3 Development of Baseline 2012 Sanitary Sewer Model

The baseline sanitary hydraulic model for the Baden/New Hamburg Township has been derived by the updating of the 2008 Hydraulic Environmental Protection Agency (EPA) Storm Water Management (SWM) Model by incorporating 2012 flows from new development areas located within the towns of Baden and New Hamburg. The purpose for the original 2008 SWM Model was part of a study to investigate and identify Inflow/Infiltration (I/I) problem areas within the Township's public sewer collection system, installed prior to 1985. In the same 2008 study, flow monitors were installed at inlet and outlet sewers in strategically located manholes within Baden and New Hamburg to measure flow data during actual precipitation events to provide real time information on the effects I/I had on each individual catchment area. The 2008 flow modeling data was also utilized to calibrate the 2008 SWM Model to accurately depict the existing I/I situation occurring within both Baden and New Hamburg. Therefore the updated

2012 baseline SWM Model should reflect the most updated condition of the existing sanitary trunk sewer network, with both the Towns of Baden and New Hamburg.

1.2.3.1 New Development to 2012

The 2012 new development areas have been identified, in consultation with the Township, as outlined on Figure 1-1 for Baden and Figures 1-2 to 1-3 for New Hamburg. The anticipated populations from these development areas have been incorporated into the 2008 SWM model to form the 2012 SWM Baseline Model.

The projection of post 2008 to current 2012 sanitary flows from the new development areas were based on the supply of development information from the Township, and have been included with Table 1-3 and Table 1-4:

1.2.3.2 Estimate of New Development Population and Sanitary Flow

Based on the Township of Wilmot Official Plan, the population forecast and household forecast for the year 2016 was 22,300 and 8,000, respectively. Therefore the population per household equates to $22,300/8,000$ to 2.79 persons per household. This factor was utilized as a conservative measure to estimate the population within the new developments in Baden and New Hamburg, irrespective of the housing type or density. The residential sanitary flow per person was calculated based on the residential average flow rate of $0.35 \text{ m}^3/\text{person}/\text{day}$, as per Part B.3.1.2.1 of the 2013 Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS).

The average sanitary flow per person was multiplied by a peaking factor calculated by the Harmon Formula to provide a peak flow that was added to the infiltration allowance of 0.15 L/s/ha (based on the approximate area (ha) of each new development). The summation of the peaked sanitary flow with the infiltration allowance provided the sanitary flow contribution from each new development area, used to calculate and update the 2012 hydraulic SWM Model for both Baden and New Hamburg. The estimated 2012 populations, Peak Flow input and sanitary flow entry point into the hydraulic model for each of the associated new developments are identified within Tables 1-5 and 1-6.

The newly upgraded 2012 Hydraulic SWM Model forms the baseline model utilized to evaluate Phased Development options for the anticipated populations in the years 2016, 2018, 2029 and 2041.

Section 2.0 Selection of Phased Development Options for Evaluation

The scope of assignment for the wastewater servicing study, for new growth areas in Baden and New Hamburg is to assist the Township in evaluating sanitary infrastructure needs associated with the proposed upgrading of the New Hamburg WWTP. The goal of the wastewater servicing study is to formulate and evaluate development options that maximize the development of new growth areas while minimizing public and environmental concerns and capital costs, to provide guidelines for the planning and budgeting of major capital expenditures for sanitary servicing.

2.1 Baseline Hydraulic Sanitary SWMM Model

The existing 2008 hydraulic SWM model for trunk sanitary sewers within Baden and New Hamburg has been upgraded to reflect the existing 2012 flow conditions, based on increased new development population growth.

The 2012 baseline SWM model was run to identify capacity constraints within the existing sewer network. The maximum precipitation period utilized as a conservative measure within the hydraulic model, was based on rainfall hydrograph data taken on the date of July 11, 2008. A heavy storm event was recorded on this date that saw rainfall totals reach 125 mm over a 6 hour period, within Wilmot Township. The totals from this rain event exceeded the 100-year rainfall volume for this storm incident. Based on the July 11, 2008 sanitary flow monitoring information incorporated within the 2012 baseline hydraulic SWM model, the sanitary flows evaluated in the baseline hydraulic model were considered conservative, based on the high volume of inflow measured during the selected storm event period.

The 2012 baseline modeling results are presented on Figures 2-1A to 2-14B, and present the plan view of each of the trunk sewer components, followed by the profile view of the sanitary flow hydraulic grade line. The evaluation period selected in the model was based on the July 11, 2008 storm event, for Baden and New Hamburg.

The following outlines a description of the 2012 baseline modeling results shown on Figures 2-1A to 2-14B for Baden and New Hamburg:

- **Figures 2-1A and 2-1B Baden** – The profile view of the hydraulic grade line along the main trunk sewer located on Foundry Street to the Baden Pump Station identifies minor surcharging at MH14, but additional capacity within the remaining existing trunk sewer.
- **Figures 2-2A and 2-2B Baden** – This section of trunk sewer is located upstream of the intersection of Snyder's Road West and Foundry Street, where surcharging at MH14 has been identified.

- **Figures 2-3A and 2-3B Baden** – This sewer section carries sanitary flow from Snyder's Road East along Tannery Street to connect back into the southern portion of the Foundry Street trunk sewer. Additional flow capacity remains available for this 375 mm to 400 mm diameter sewer sections.
- **Figures 2-4A and 2-4B Baden** – Carries sanitary flows from Brewery Street to the southern portion of Foundry Street. Additional flow capacity remains available for this 300 mm to 400 mm diameter sewer section.
- **Figures 2-5A and 2-5B New Hamburg** – Transports sewage flows along the eastern arm of the 450 mm diameter gravity sewer from Highway 7/8 to the Morningside Pump Station. Additional flow capacity remains available within this sewer section.
- **Figures 2-6A and 2-6B New Hamburg** – Collects sewage flows along the western arm through the 600 mm diameter gravity sewer from Highway 7/8 to the Morningside Pump Station. This sewer section surcharges at the Highway 7/8 crossing, where the capacity has been restricted due to a decrease in sewer diameter under the highway from 600 mm to 450 mm diameter. The sewer section downstream of Highway 7/8 maintains additional sewer carrying capacity.
- **Figures 2-7A and 2-7B New Hamburg** – Carries sanitary flow from Boullee Street, along Riverside Drive to the north side of Highway 7/8 through a 300 mm diameter gravity sewer. Additional capacity has been identified within this sewer section. Sewer surcharging has been identified at MH446, north of Highway 7/8.
- **Figures 2-8A and 2-8B New Hamburg** – Extends the main trunk sewer line located downstream of the New Hamburg Milton Street Pump Station No. 2 at MH1-62 to the east side of the Nith River at MH447. Surcharging along this trunk sewer has been identified. Sanitary flows from the Milton Pump Station No. 2, are pumped through forcemain into an outgoing 300 mm diameter sewer down Waterloo Street, through an inverted 250 mm diameter siphon across the Nith River, into an existing 375 mm diameter trunk sewer where the sewer crosses the Nith River a second time to MH446. The hydraulic grade line has been identified to surcharge above the sewer obverts from MH1-62, MH1-59 and along the 375 mm diameter sewer upstream of MH1-50. Surcharging is also identified along Asmus Street to the end at MH446. In both 2009 and 2012 hydraulic models the July 11, 2008, 100-year rain event, resulted in the discharge of sanitary flow through the New Hamburg Milton Street Pump Station No. 2 overflow into the Nith River. Therefore this section of existing trunk sewer has been identified as a bottleneck within the model, limiting capacity to carry additional development flows.
- **Figures 2-9A and 2-9B New Hamburg** – This section of sewer commences at the New Hamburg Milton Street Pump Station No. 2, carrying sewage flow to MH1A. Similar to the situation on Figures 2-8A and 2-8B, this sewer section has been identified in the model as a bottlenecked trunk sewer.

- **Figures 2-10A to 2-14B New Hamburg** – Are all sewer sections modeled upstream of the New Hamburg Milton Street Pump Station No. 2, that are all affected by the bottlenecked trunk sewer identified on Figures 2-8A to 2-9B.

2.2 Township Planned Development Intensification

The population intensification projections provided for the Township of Wilmot in Table 1-1 represented the starting point for selecting phased servicing options, to cover the development years 2016 to 2029, and years 2029 to ultimate 2041 build out. The development areas are presented on Figures 2-15 and 2-16 for Baden and New Hamburg, respectively, and are classified as residential, industrial and future intensification, with the proposed development time periods listed. New commercial and institutional growth areas were not included as part of the scope of this assignment, and have been incorporated within the broad based estimate of the Township growth projections classified.

The conditions for future development within Baden and New Hamburg include the following, limiting parameters:

- Population density for each proposed residential development area will not exceed 40 persons per hectare
- Industrial growth shall be estimated based on a population limit of 100 persons/hectare
- The population distribution between future intensification areas and residential growth areas shall adhere to the ratio of 40 percent to 60 percent, respectively
- The total population increase in both Baden and New Hamburg from the year 2012 to 2041 are based on the anticipated total residential and employment growth identified by the Township, that shows a 10,645 and 4,255 residential and employment growth increase
- The capacity of existing Foundry Street, Baden WWPS, Milton Street, New Hamburg WWPS #2 and Morningside WWPS were based on the Installed Capacity Figures retrieved from Section 4, of the BNHWWMPU study
- The capacity of both the existing Baden West WWPS and the Forest Glen WWPS were retrieved from the Forest Glen Subdivision Sewage Lift Station and Baden West Subdivision Wastewater Pumping Station Design Briefs supplied by the Township
- The total population between the two Towns will be maintained at the current ratio of approximately 40 percent to 60 percent, for Baden and New Hamburg, respectively

2.3 Selection of Phased Sanitary Sewer Servicing Alternatives

A total of four (4) sanitary servicing alternatives for Baden and New Hamburg were selected, that include the following:

- 1) Alternative A – Utilization of Existing Sanitary Linear Infrastructure:
 - This is the Do Nothing alternative that excludes all new development areas and only services areas already connected to the existing sewer infrastructure
 - Refer to Figure 2-17 and Figure 2-18 for the layout of Alternative A, within Baden and New Hamburg, respectively.
- 2) Alternative B – Proposed Sanitary Linear Infrastructure and Pump Stations:
 - This alternative includes the installation of a proposed Baden Development O Pump Station, the upgrading of the Foundry Street Pump Station, complete with the proposed twinning of the forcemain to New Hamburg.
 - This alternative also includes for the installation of the proposed New Hamburg Christner Road Pump Station on the west side on Christner Road, that pumps sanitary flows through a proposed forcemain across the railway tracks through Industrial Development N to the gravity sewer on connection on Highway 7/8.
 - Sanitary flows from proposed new post 2029 Residential Development Areas X, W and M travel south along Nafziger Road, crossing west along the railway tracks and underneath to connect to the proposed trunk sewer through Industrial Development N. This Alternative also includes for the upgrading of the existing Morningside Pump Station to handle the additional flow increase from the new development areas.
 - Refer to Figure 2-19 and Figure 2-20 for the layout of Alternative B, within Baden and New Hamburg, respectively. The "NO FLOW" notes included on Figure 2-19 and Figure 2-20 apply to areas where no additional population growth is anticipated, as noted under Table 3-2 Proposed Distribution of Additional Population – Alternative B.
- 3) Alternative C – Proposed Trunk Sewers in New Hamburg and Pump Stations:
 - This alternative is similar to Alternative B for Baden, and differs by the introduction of a proposed sanitary trunk sewer upsizing along Snyder's Road West and along Foundry Street. This alternative also includes upgrading of the Foundry Street Pump Station and the inclusion of the proposed forcemain twinning to New Hamburg.
 - Alternative C differs from Alternative B in New Hamburg in the proposed location for the Christner Road Pump Station. The other difference is that proposed post 2029 Residential Development Areas X and W, and proposed Residential Growth Area Q and a portion of Industrial Area AA travel south on Nafziger Road beyond the railway

tracks to connect at the existing sewer that services the Wilmot Recreation Complex. The upgrading of the Morningside Pump Station is also included in this option.

- Refer to Figure 2-21 and Figure 2-22 for the layout of Alternative C, within Baden and New Hamburg, respectively. The "NO FLOW" notes included on Figure 2-21 and Figure 2-22 apply to areas where no additional population growth is anticipated, as noted under Table 3-3 Proposed Distribution of Additional Population – Alternative C.

4) Alternative D – Proposed Sanitary Linear Infrastructure and Pump Stations:

- This alternative is similar to Alternative C for Baden. The difference exists on Snyder's Road West where the sanitary flow from proposed post 2029 Residential Development Areas Y and Z have been re-directed west to New Hamburg instead of towards the Baden Foundry Street Pump Station.
- Alternative D differs from both Alternative B and C in that the proposed Christner Road Pump Station has been replaced by the upgrading of the existing Forest Glen Pump Station that redirects existing and new proposed flows south through the proposed forcemain, under the railway tracks and into the same gravity trunk sewer through Industrial Area N.
- Refer to Figure 2-22 and Figure 2-23 for the layout of Alternative D, within Baden and New Hamburg, respectively. The "NO FLOW" notes included on Figure 2-22 and Figure 2-23 apply to areas where no additional population growth is anticipated, as noted under Table 3-4 Proposed Distribution of Additional Population – Alternative D. The "ADDITIONAL CAPACITY" notes included on the Figures denote the possibility for the inclusion of additional population servicing beyond the year 2041 as noted on Figures Alt D 3-5, Alt D 3-6 and Alt D 3-7.

The selection of the sewer servicing alternatives have been based preliminary on a desktop review. The evaluation of the existing ground elevation within each Town determined the gravity sewer flow direction to the respective existing Baden/New Hamburg pump station and identified existing low areas or flood plain areas. These have been identified on Figures 2-17 to 2-24. Each sanitary servicing alternative selected transfer sanitary flows from each proposed development area to terminate at the New Hamburg Waste Water Treatment Plant located off Haysville Road, near the south east corner of New Hamburg. The identified alternatives contain a mixture of sub-options for transporting flow, that include the upgrading of exiting gravity sewers, twining of existing forcemain, installation of a new pump stations and the evaluation of a gravity trunk sewers on Nafziger Road. The evaluation of each servicing alternative identifies a mixture of sub options from more than one servicing alternative, with the focus of providing the Township with the best sanitary servicing option. A general description of each of the selected alternative options is summarized as follows:

2.3.1 Alternative A – Utilization of Existing Sanitary Linear Infrastructure (Do Nothing Alternative)

The alternative is based on the Do Nothing option that dictates no additional upgrading of the existing sewers in Baden and New Hamburg will be completed. Based on reviewing the Figures 2-17 and 2-18 for Alternative A, it has been concluded that proposed Development Areas Q, X, W in Baden and L, M, B, C, D and E in New Hamburg would remain unserviceable. Other development areas that include the future intensification areas would be remain serviceable, dependent on the capacity limits on the existing trunk sewers and pump stations. The Development Areas F and G in New Hamburg would require the installation of a new gravity line to the existing Forest Glen Waste Water Pump Station (WWPS). Planned population increases would be distributed throughout the Township's serviceable development areas. The reserve capacity of the existing sewer network would be tested by applying population increases throughout the years from 2016 to 2041.

2.3.2 Alternative B – Proposed Sanitary Linear Infrastructure and Pump Stations

This alternative is aimed at servicing all proposed future development areas. On Figures 2-1A and 2-1B the 2012 SWM Model for Baden identified additional flow capacity within the existing trunk sewer on Foundry Street. Unlike in Alternative A, the Baden Development Area O is serviced by a proposed pump station/forcemain that will transfer flows to the intersection of Snyder's Road West and Foundry Street. All other sewer servicing of Baden is similar to Alternative A, with the exception that the existing Baden Pump Station located on Foundry Street will be upgraded and the sanitary forcemain to the Morningside Pump Station will be twinned. Residential Development Areas Q, X and W are proposed to be serviced by a trunk sewer flowing west on Snyder's Road, crossing Industrial Area N to the east side of Morningside Pump Station.

Within New Hamburg all new development areas are proposed to be serviced through the installation of a gravity trunk sewer that travels south on Nafziger Road, turning west along the north side of the existing railway line to connect to the newly installed forcemain, flowing by gravity underneath the railway line towards the existing 375 mm diameter gravity line across Highway 7/8, to the east side of Morningside WWPS. This alternative also incorporates the upgrading of the Morningside WWPS and the inclusion of a new pump station within the proposed residential development Area B, which will carry sanitary flows from a proposed gravity sewer from development Areas B, C, F and G. The new sanitary sewers, forcemain and pump stations will be sized to accommodate the proposed population increases.

2.3.3 Alternative C – Proposed Sanitary Linear Infrastructure and Pump Stations

This alternative for Baden differs from Alternative B by including the proposed flows from development Areas Z and Y into an upgraded trunk sewer installed east along Snyder's Road West and an upgraded trunk sewer along Foundry Street to the Baden WWPS. With anticipated increased flow from the new development areas, this alternative also includes the twinning the existing forcemain from the Baden WWPS to the Morningside WWPS in New Hamburg.

In New Hamburg, this alternative offers a trunk sewer along Nafziger Road that carries gravity fed sanitary flows from development Areas Q, X, W and a portion of Industrial Area AA, across the railway tracks to the existing 300 mm diameter sewer installed to service the Wilmot Recreation Complex. Where Alternative C differs from Alternative B, the proposed new pump station is situated within Development Area E, in the significant floodplain area that is defined unlikely for residential growth. Sanitary flows from development Areas B, C, F, G, L and M are proposed to travel by gravity flow into this new pump station, where the forcemain will transfer these flows to the north side of the existing railway track, where it flows by gravity through to connect to the existing gravity sewer on the south side of Highway 7/8 opposite proposed Industrial Area N. The Morningside Pump Station is also proposed to be upgraded to handle the flows generated by the proposed new developments. The baseline 2012 hydraulic SWM Model is modified to include upgrading sewer pipes in New Hamburg and Baden, to reflect the flow effects from the proposed increases in population.

2.3.4 Alternative D – Proposed Sanitary Linear Infrastructure and Pump Stations

Within New Hamburg Alternative D differs from Alternative B and C, by not requiring a New Pump Station on Christner Rd. Instead the existing Forest Glen Pump Station is proposed to be upgraded to transfer all existing flows including the new development flows from Development Areas F, G, L, M, X, W, Q, Z and Y. The proposed 2016 to 2029 Residential Development Areas B, C, D and E are not serviced in this alternative. Within Baden, this alternative will be similar to what is proposed in Alternative B and C, excluding flow loadings from post 2029 Residential Development Areas Y and Z. The Foundry Street Pump Station in Baden and the Morningside Pump Station in New Hamburg both require upgrading to handle the flow increase from the new development areas. The baseline 2012 hydraulic SWM Model is modified to include upgrading sewer pipes in New Hamburg and Baden, to reflect the flow effects from the proposed increases in population.

2.4 Sanitary Sewer Servicing Evaluation Matrix

The sanitary sewer servicing evaluation matrix has been tailored specifically to evaluate the optimal balance between proposed monetary benefit from maximizing development growth,

and minimizing public and environmental impact for the Township. The matrix will evaluate the selected options for both 2016 to 2029 developments and 2029 to 2041 ultimate build out developments. This forms the evaluation matrix that provides recommendations for the optimum sewer servicing alternative selected for the Township.

2.4.1 Delineation of Sub-Catchment Areas

The towns of Baden and New Hamburg have been divided into a total of 27 proposed separate development areas from A to H, J to Z, AA and BB. The envisioned split into sub-catchment areas was originally identified on Figures 2-25 and 2-26 for Baden and New Hamburg. Based on the diversity of servicing options that differ between each separate Sanitary Servicing Alternative, the sub-catchment areas have been re-grouped into five sub-catchment areas that have been denoted per each Alternative as follows:

- Sub-Catchment 1 (include the following):
 - Alternative A (Areas F and G)
 - Alternative B (Areas F, G, L and Christner Rd. Pump Station)
 - Alternative C (Areas F, G, M, L and Christner Rd. Pump Station)
 - Alternative D (Areas F, G, M, W, X, Q, Y, Z)
- Sub-Catchment 2 (include the following):
 - Alternative A & D (No Applicable Areas)
 - Alternative B (Areas Q, M, X and W)
 - Alternative C (Areas X, W, Q and AA)
- Sub-Catchment 3 (include the following):
 - Alternative A, B & C (Areas Z, Y, P, O, S, R, V, T, U, BB and AA)
 - Alternative D (Areas P, O, S, R, V, T, U, BB and AA)
- Sub-Catchment 4 (include the following):
 - Alternative A & D (No Applicable Areas)
 - Alternative B & C (Areas B and C)
- Sub-Catchment 5 (include the following):
 - Alternative A, B, C & D (Areas A, N, H, J and K)

The selection of proposed development areas within each respective sub-catchment, are not dependent on location, or Town affiliation, but have been grouped based on the respective sanitary options proposed to service the developments.

2.4.2 Matrix Evaluation Criteria

The proposed servicing options for the sub-catchments within each sanitary servicing alternative, are categorized into four main evaluation criteria. These include the following:

<i>Evaluation Criteria</i>	<i>Weighted Factor (percent)</i>	
1.	Hydraulic Compatibility	10%
2.	Development Timing	5%
3.	Public/Environmental Disturbance	20%
4.	Indicative Cost Estimate	65%

The weighted factor is based on the importance assigned to each evaluation criteria.

The summary on each evaluation criteria is included as follows:

2.4.2.1 Hydraulic Compatibility

The hydraulic compatibility criteria involves the technical evaluation on the compatibility of proposed sewer sub-options for servicing each sub-catchment. The topographical information used to complete this technical evaluation is derived from available GIS contours within the areas around Baden and New Hamburg. The sewer sub-catchment servicing options that include proposed gravity trunk sewers, new pump station, or upgrading of existing services will be evaluated to determine whether they are feasible or not. Factors such as existing topographical ground elevations, depth of sewer and creek crossings, may end up eliminating a portion of these sewer servicing sub-options.

2.4.2.2 Development Timing

The development timing criteria evaluates the timing options for the development areas to investigate whether the development priority should be changed by altering post 2029 growth to 2016 to 2029 development, and vice versa with the goal of minimizing public/environmental disturbance or capital/operational costs.

2.4.2.3 Public/Environmental Disturbance

The public/environmental disturbance criteria will assess the impact of each sewer servicing alternative on both the public and environmental impacts that sewer construction will have on the Towns. This includes assessment on public disturbance due to construction/ business/ traffic delays, to environmental impacts on tree/green areas, water ways and groundwater impact.

2.4.2.4 Indicative Cost Estimate

The indicative cost estimate criteria on sewer servicing alternatives is defined as an indicative estimate, that will not be sufficiently accurate to warrant approval as a cost objective, and provides for a rough cost projection used for assessing each sanitary servicing option for planning purposes. The estimated, indicative costs will range from between +50 percent and -20 percent. The capital construction costs along with annual operational costs will be estimated for each servicing option, where the operational life of 80 years will be assigned to newly installed gravity sewers and an operational life of 50 years will be assigned to newly installed pump stations and forcemains. The cost comparisons between the differing sewer servicing options will be based on bringing all capital, replacement and annual costs to present 2013 costs to provide a fair value comparison of all of the available options.

2.4.2.5 Evaluation on Sanitary Sewer Servicing Alternatives

The assessment on each sewer servicing option, under each criteria, for each sub-catchment will be graded on a scale from 0 to 5, where a 5 will represent the best option and 0 will represent an unfeasible option. Once a grade is determined for each sub-catchment option, the grade will be multiplied by the Criteria Weighted Factor where the product for each alternative option will be compared to determine the optimum sub-catchment sewer servicing option, to satisfy Sanitary Servicing for the Township of Wilmont to the year 2041.

Refer to Figure 2-27 for the sample Sanitary Sewer Evaluation Matrix.

Section 3.0 Evaluation of Phased Development Alternatives (A to D)

The evaluation on the phased alternatives investigated each based on the criteria of hydraulic compatibility, development timing, public/environmental disturbance and estimated capital cost. The four alternative phased development options are outlined as follows:

- 1) Alternative A – Utilization of Existing Sanitary Linear Infrastructure:
 - The Do Nothing alternative
 - Includes Sanitary Flows from New Hamburg Development Areas F and G
- 2) Alternative B – Proposed Sanitary Linear infrastructure and Pump Stations:
 - Baden Development O Pump Station
 - Baden Twinning of Forcemain to Morningside Pump Station

- New Hamburg West Christner Road Pump Station
 - New Hamburg Sewers Along Snyder's Road West that run South along Nafziger Road
- 3) Alternative C – Proposed Sanitary Linear infrastructure and Pump Stations:
- Baden Development O Pump Station
 - Baden Twining of Forcemain to Morningside Pump Station
 - Baden Upgrading of Existing Sewers along Snyder's Road West and Foundry Street
 - New Hamburg East Christner Road Pump Station
 - New Hamburg Sewers on Nafziger Road to Existing Sanitary Sewer that Services Wilmot Recreation Centre
- 4) Alternative D – Proposed Sanitary Linear infrastructure and Pump Stations:
- Baden Development O Pump Station
 - Baden Twining of Forcemain to Morningside Pump Station
 - Baden Upgrading of Existing Sewers along Foundry Street
 - New Hamburg Upgrading the Existing Forest Glen Pump Station
 - New Hamburg Sewers West along Snyder's Road West and South along Nafziger Road that Connect to Forest Glen Pump Station

Refer to Figures 2-17 to 2-24 that identify on plan view the sanitary servicing option for each of the four Alternatives A to D.

3.1 Proposed Distribution of Population Growth

Discussions were held in consultation with the Township to determine the appropriate distribution of proposed Population Growth, based on the estimated population increases established under the Township's planned intensification. Population estimates were generated within each New Development/Industrial Area for each proposed alternative. These were included in Tables 3-1 to 3-4 in the form of Proposed Distribution of Additional Population Tables. The estimated population increase has been distributed throughout the years from 2016 to 2041 and have been generated based on the estimated population growth identified within the forecasted population of the Township of Wilmont, which can also be found in Table 1.1.

3.1.1 Proposed Distribution of New Growth Population – For Residential Intensification Areas

It had been noted in discussions with the Township, that based on the agreed approach of utilizing the 60 people per hectare cap on population for Future Intensification Areas, the total

required intensification population (anticipated 40 percent of New Population Growth) could not be adequately accounted for within the development areas proposed by the Township for Future Intensification, that include the following Areas A, H, J, K, T, U, V, R and S. Therefore there remained a "Required Additional Population" (RAP) that represented residential intensification population without a defined future intensification area to settle within. This is displayed on the smaller charts to the right of Tables 3-1 to 3-4 where population represented by the "ResInten" caption represents the additional Future Intensification Population without a defined future intensification area.

It was decided in discussions with the Township that the RAP would be accounted for after the Hydraulic Models were evaluated for each proposed alternative, where existing sewers in urban areas that have additional capacity, would be identified for Future Intensification allowing the absorption of the RAP.

3.1.2 Proposed Distribution of New Growth Population - Alternative A (Do Nothing)

The new growth population for this alternative was distributed within areas already serviced by existing sanitary infrastructure. The anticipated population has been distributed according to the commencement years noted at the top row of Table 3-1 for Baden and New Hamburg. The Do Nothing alternative as shown on Figures 2-17 and 2-18, has been selected as the default alternative and includes populations distributed for Industrial Growth in Areas AA, BB and N as well as Residential Growth Areas for 2016 to 2018, that include Residential Development Area O, in Baden where sanitary servicing has been expected to connect into the existing Livingston Boulevard sanitary sewer stubs on the north side of the development. Also included is the Residential Development Area P that has been expected to connect into the existing Wagler Avenue sewer stubs on the west side of the development.

The New Hamburg Development Areas F and G were further sub-divided into Areas 1 and 2, where both F2 and G1 represent the sub-areas north of the existing creek on the properties that flows north into the Nith River. The estimated populations within these sub-areas along with Development Area F1 for the years between 2016 and 2018, were also included as serviceable under Alternative A, by gravity sewer connection to the Forest Glen Pump Station.

3.1.3 Proposed Distribution of New Growth Population - Alternative B

Population growth in Alternative B includes new development areas, based on the capacity limits identified under the Township's planned intensification. Industrial population growth for the years 2016 to 2018 have been assigned to Baden within Industrial Growth Area AA and in New Hamburg within Industrial Growth Area N, as both of these areas are already serviced by existing sanitary infrastructure. The majority of growth intensification was not proposed until 2029 to allow the Township time to plan and fund the necessary capital works to service these

new development areas. This is reflected in the installation of the proposed Christner Road Pump Station to be located on the western side of proposed Residential Development Area C, which will service proposed Development Areas B and C, allowing the trunk sewers from Development Areas F1, F2, G1, G2 and L to be constructed in the year 2041 and beyond. Refer to Figures 2-19 and 2-20 for the Plan View of proposed sanitary linear infrastructure servicing of Alternative B in Baden and New Hamburg.

3.1.4 Proposed Distribution of New Growth Population - Alternative C

The population growth distribution for Alternative C in Baden was similar to the same population growth distribution presented in Alternative B. Figure 2-21 presents the proposed sanitary linear infrastructure servicing of Baden for Alternative C. It differs from Alternative B in proposing the sanitary upgrading of the trunk sewers on Snyder's Road West and Foundry Street.

The population growth distribution in Alternative C differs from Alternative B in the Residential Development Sub-Areas F1, F2, G1, G2 and Residential Development Areas B and C. In Alternative B the Residential Development Areas B and C were scheduled to commence development in 2029, where in Alternative C the development works have been pushed to 2041. In Alternative C for Development Areas F1, F2, G1 and G2 the population intensification has been forwarded to the year 2029. The change in population distribution is due to the revised location of the proposed Christner Road Pump Station as noted on Figure 2-22 for New Hamburg. The proposed Christner Road Pump Station location has been shifted towards the east between the proposed Unlikely for Residential Growth Areas D and E. This change incorporates a proposed gravity sewer bringing sanitary flows from the Residential Development Areas B and C, independent from Residential Development Areas F, G and L, providing the Township the option to delay development in Areas B and C.

3.1.5 Proposed Distribution of New Growth Population - Alternative D

The population growth distribution for Alternative D in Baden was similar to the same population growth distribution presented in Alternative C. The only difference was that the Residential Development Areas X and Y for Alternative D travelled west towards New Hamburg and were not included in the flows to the Foundry Street Pump Station in Baden. Figure 2-23 presents the proposed sanitary linear infrastructure servicing of Baden for Alternative D.

Alternative D includes the upgrading of the existing Forest Glen Pump Station to handle the additional flows from proposed Development Areas F1, F2, G1, G2, L, M, X and W. This differs from Alternatives B and C by not requiring the addition of a new pump station on Christner Street. The implementation of this alternative also cancels the pre-2041 development potential of Areas B and C. The population distribution for this alternative includes the main

development in the year 2029 of Areas F1, F2, G1 and G2. Development for Areas L and M would commence in the year 2041. Refer to Figure 2-24 for the New Hamburg Plan View of Alternative D sanitary servicing option.

It was also noted for the population distribution in Alternative D that based on the removal of post 2029 Residential Development Areas Y and Z from the Baden sanitary network, and inclusion of the same population into the New Hamburg sanitary network, there exists a required "ResSub" value of 800 persons included under the Required Additional Baden Population. This "ResSub" value is made up again within New Hamburg with the addition of populations from post 2029 Residential Development Areas L and M.

3.2 Preliminary Sanitary Flow Evaluation

The SWM Model that has been updated with the new development populations, was limited to only evaluate the hydraulic capacity of the main sanitary trunk sewers within Baden and New Hamburg. The capacity of the minor sanitary sewer branches were not included within the SWM Model. Therefore, these minor sanitary sewer branches were evaluated in the preliminary sanitary flow evaluation.

Sanitary Sewer Preliminary Evaluation Tables 3-5 to 3-8 were generated to evaluate the capacity on the existing minor sanitary sewer branches that will be affected by the introduction of the additional population from the new development areas that are serviced under Alternative Options A to D. The information presented in the tables consist of the calculation of sewer flows utilizing manning's equation, based on the Residential, Industrial and Infiltration allowances from the Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS). Development timing was not taken into consideration in the flow capacity evaluations included in the hydraulic SWM Model or preliminary Manning's evaluation tables. The flow capacity evaluation was based on full population build out to beyond the year 2041.

The sewage flow rates have been calculated from the proposed new development areas within the existing sewer infrastructure on Livingston Boulevard, Isaac Shantz Drive, Wagler Avenue and Jacob Crescent. These are presented in Tables 3-5 to 3-8 for sanitary servicing Alternatives A to D, as shown in blue coloured text.

Key sanitary sewer runs highlighted in yellow in Tables 3-5 to 3-8, represent the bottleneck locations that exist between the new development and the major trunk sewer existing in the SWM Model. The flow capacity generated by the new development area was evaluated for surcharging at these bottleneck locations.

The proposed new development areas identified in Alternatives A, B, C and D are presented in Tables 3-5 to 3-8 in green coloured text.

A summary on the results of the preliminary sanitary flow evaluation for each of the four Alternatives A to D are presented as follows.

3.2.1 Sanitary Flow Evaluation - Alternative A (Do Nothing)

The Alternative A for Baden and New Hamburg represents the "Do Nothing" alternative that exists as the default alternative. This refers to increasing population and sewer loading to test the state of the existing sewer system. Sewer flow loadings were introduced by populating development areas, already serviced by existing sewers. Populations were introduced into the following areas:

1. Future Intensification - Baden Areas (S, R, V, U, T); New Hamburg Areas (H, K, J)
2. Residential development that can be serviceable by the existing sewage network - Baden Areas (O, P, Y, Z); New Hamburg Areas (F1, F2)
3. Industrial Areas serviceable by the existing sewer network - Baden Areas (AA, BB)

The sanitary flow evaluation on existing minor sanitary sewer branches are shown in Table 3-5. Surcharging within the existing sewers were identified on Livingston Boulevard, Isaac Shantz Drive, and Wagler Avenue. The surcharging was due to the introduction of sanitary flows from the Proposed Residential Development Areas O, P, Y and Z. It was concluded that the capacity of the existing minor trunk sewers was not capable of handling the increase in population introduced by the proposed additional population of these areas. In Baden the minor sewer branch along Livingstone Boulevard has been identified as under capacity, not able to accept the additional sanitary flow from the proposed Residential Development Area O. Therefore a separate pumping station would be required in Alternatives B, C and D to transfer flows specifically from Area O to the intersection of Snyder's Road West and Foundry Street. It has also been noted from Table 3-1 that a large portion of proposed new development population, that include, Residential Development Areas B, C, D, E, L, M, W, X and Q were not included within this alternative as these development areas exist outside the reach of the existing sewer network. Therefore due to the many surcharge locations identified in the minor sewer branches, along with the inability to service a large portion of proposed Residential Development Areas, the Alternative A default option has been concluded not feasible.

3.2.2 Sanitary Flow Evaluation - Alternative B

The sanitary servicing Alternative B for Baden and New Hamburg includes the introduction of new populations into the following development areas:

1. Future Intensification - Baden Areas (S, R, V, U, T); New Hamburg Areas (H, K, J)
2. Residential Development - Baden Areas (O, P, Y, Z); New Hamburg Areas (B, C, F1, F2, G1, G2, L, A)
3. Industrial Development – Baden Areas (AA, BB); New Hamburg Area (N)

Population from the proposed post 2029 Residential Development Areas W, M & X along with the 2016 to 2029 Residential Development Area Q, were excluded from the total residential population, as the forecasted population total to the year 2041 for the Township of Wilmot was met without the need for these development areas. Surcharging within sewers in the Baden, Livingstone Boulevard subdivision occurred only within the existing sewer on Wagler Ave, between MH269 to MH280, the peak design flow of 24.91 L/S exceeds the existing pipe capacity of 23.2 L/S by 1.71 L/S, resulting in a conservative surcharge height of 0.3 m (conservative, based on Manning's Equation) above the obvert at MH269. The other Baden surcharging condition occurs on Snyder's Road East between MH68 and MH67 where the peak design flow of 18.40 L/S exceeds the existing pipe capacity of 17.7 L/S by 0.7 L/S, resulting in a surcharge height of 0.05 m (conservative, based on Manning's Equation) above the pipe obvert at MH68. The surcharge heights for the sewer pipe on Wagler Avenue and Snyder's Road East are considered negligible. The surcharge heights are not significant enough to result in service backups into surrounding homes.

3.2.3 Sanitary Flow Evaluation - Alternative C

The sanitary servicing Alternative C for Baden and New Hamburg includes the introduction of new populations into the following development areas:

1. Future Intensification - Baden Areas (S, R, V, U, T); New Hamburg Areas (H, K, J)
2. Residential Development - Baden Areas (O, P, Y, Z); New Hamburg Areas (B, C, F1, F2, G1, G2, L, A)
3. Industrial Development – Baden Areas (AA, BB); New Hamburg Area (N, AA)

The population distribution within this alternative is similar to Alternative B in excluding Residential Development Areas (W, M, X and Q). The exception exists under Industrial Development, where the post-2029 Industrial Area AA has been split to be serviced through Baden and New Hamburg. Surcharging exists on Wagler Avenue and at Snyder's Road East, similar to Alternative B. All other existing and proposed pipe lengths that exist outside of the hydraulic model have been found to be adequate to handle the peak design flows.

3.2.4 Sanitary Flow Evaluation - Alternative D

The sanitary servicing Alternative D for Baden and New Hamburg includes the introduction of new populations into the following development areas:

1. Future Intensification - Baden Areas (S, R, V, U, T); New Hamburg Areas (H, K, J)
2. Residential Development - Baden Areas (O, P, Y, Z); New Hamburg Areas (F1, F2, G1, G2, L, M, A)
3. Industrial Development – Baden Areas (AA, BB); New Hamburg Area (N)

The population distribution in this alternative differs from Alternatives B and C in that the proposed Residential Development Areas B and C have been removed from the population distribution and the proposed Residential Development Area M has been added. Like in Alternative B and C, the proposed residential development areas (W, X & Q) have not been included and the same surcharging scenario exists on Wagler Avenue and at Snyder's Road East.

3.3 Sanitary Flow Hydraulic Analysis

The sanitary flow hydraulics was based on the maximum precipitation period that was utilized as a conservative measure, within the hydraulic model of each alternative. This precipitation period was based on the rainfall hydrograph data taken on the date of July 11, 2008. The totals from this rain event exceed the 100-year rainfall volume for this length of storm, providing a very conservative SWM Model containing contributions of high inflow and infiltration flows (measured prior to the recent completion of I/I rehabilitation works). It should be noted that due to the 100-year flow rate generated in the July 11, 2008 rain event, the SWM Model assumed that a portion of excess flows were discharged through the New Hamburg Milton Street Pump Station overflow, and into the Nith River. Therefore the flow rate exiting the New Hamburg Milton Street Pump Station maintains a constant flow rate of 0.034 m³/s, irrespective of the actual amount of flow entering into the Pump Station.

Analysis of the Hydraulic Modeling results have been plotted on both Plan and Profile View for the sanitary servicing Alternatives A, B, C and D. These can be found on Figures 3-1A to 3-59B. In the Plan View (denoted with an "A" after the figure number) the pipe segments highlighted in Red identify pipes that have surcharged to a height of 600 mm above the outgoing pipe obvert. Pipe segments highlighted in Blue identify surcharge heights less than 600 mm above the pipe obvert. Within the Region of Waterloo's DGSSMS the minimum required pipe depth for sanitary sewers is stipulated at 2.8 m below the final road grade. Therefore an allowable surcharge height of 0.6 m was defaulted as an acceptable surcharge limit, providing at least 2.2 m cover above the obvert of the sewer, providing enough grade to prevent backflow flooding to surrounding properties. The Profile View (denoted with a "B" after the figure

number) displays the sanitary flow rate, the modeled hydraulic grade line and the top of grade above the sewer section.

Based on the 2012 base flow modeling results, it was concluded that although the rainfall data was taken from the July 11, 2008 rainfall event, that the capacity of the Milton Street Pump Station was already limited in capacity. Therefore the new development areas that were selected within New Hamburg for Alternatives B, C and D did not discharge flow into the existing sewer network, leading to the Milton Street Pump Station within New Hamburg, but instead proposed for new or upgraded pump stations to transfer sanitary flows by forcemain directly to the Highway 7/8 existing 450 mm diameter sanitary sewer that extends from MH415 to MH432. Therefore no new flows were introduced into the existing New Hamburg sanitary sewer network.

The hydraulic SWM Model for Alternatives A, B, C and D also assumed increased capacity (beyond existing) at the Baden, Foundry Street Pump Station and at the New Hamburg, Morningside Pump Station. This was defaulted within the hydraulic model to allow for the capacity testing of the gravity trunk sewers.

3.3.1 Sanitary Flow Hydraulic Analysis - Alternative A (Do Nothing)

The sanitary flow hydraulic analysis report for Alternative A (Do Nothing) are included on Figure 3-1A to Figure 3-15B.

3.3.1.1 Baden Alternative A (Do Nothing)

The hydraulic model resulted in surcharging on Snyder's Road West and Foundry Street as shown on Figures 3-1A to 3-2B. The 200 mm diameter trunk sewer on Snyder's Road West and the 250 mm to 300 mm diameter trunk sewer along Foundry Street where heavily surcharged. Surcharging occurs from the upstream end of these trunk sewers until MH6 on the south end of Foundry Street, where the sewer diameter increases to 450 mm and can handle the additional flow capacity.

From Figures 3-3A to 3-6A no surcharging occurs within the larger diameter sewers that are capable of maintaining the sanitary flow capacity to the Morningside Pump Station located at MH432.

The surcharging identified on Snyder's Road West and Foundry Street dismisses this as a viable alternative option for Baden. Therefore the "Do Nothing" Alternative A option is not recommended for Baden.

3.3.1.2 New Hamburg Alternative A (Do Nothing)

The hydraulic model resulted in surcharged conditions on Figures 3-8A, 3-8B, 3-10A to 3-10B that occur around the intersection of Bleams Road West and Jacob Street, Figures 3-11A to 3-11B that occur along the main from Mill Street, Asmus Street, through the Norm S. Hill Park back to Jacob Street, Figures 3-12A to 3-12B that occur from the Milton Street Pump Station to Mill Street and on Figure 3-15B that identifies the surcharge at the Forest Glen Pump Station.

Reviewing the surcharge conditions resulting from the implementation of the Alternative A "Do Nothing" option. It is concluded that the "Do Nothing" Alternative A option is not recommended for servicing New Hamburg.

3.3.2 Sanitary Flow Hydraulic Analysis - Alternative B

The sanitary flow hydraulic analysis report for Alternative B are included on Figure 3-16A to Figure 3-30B.

3.3.2.1 Baden Alternative B

The Baden hydraulic model for the Alternative B option included the upgrading of sewers on Figure 3-16A and Figure 3-16B, along Livingstone Boulevard, Foundry Street and Snyder's Road West. The sewer diameters were upsized to accommodate the flow increase from the addition of the new development areas. The upgrades to the sewers from Livingstone Boulevard to the MH6 on Foundry Street were sized to maintain the required flow capacity modeled within the trunk sewer system. For design and construction, the sewer along Foundry Street from MH12 to MH6 will be proposed to be upgraded to a 375 mm diameter sewer to match into the upstream sewer pipe size. The upgrading of the existing sanitary sewer from 200 mm diameter to 300 mm diameter, on Snyder's Road West is also identified on Figure 3-17A and Figure 3-17B.

All other sewers modeled within the Baden area meet the required capacity necessary to accommodate the population increase from the proposed Baden development areas.

3.3.2.2 New Hamburg Alternative B

The New Hamburg hydraulic model for the Alternative B option included the upgrading of sewers on Jacob Street, Bleams Road West, the park land between Asmus Street and Jacob Street and the siphon crossing of the Nith River near Huron Street. These are all presented on Figure 3-23A, 3-23B, 3-25A and Figure 3-25B. The sanitary trunk sewer on Jacob Street and Bleams Road West was upsized in the model from 375mm to 600mm to accommodate the additional flow capacity from the proposed 2016 to 2029 Residential Development Area A and

proposed Future Intensification Areas J, K, and H, but was limited in size increase by the existing downstream sewer between MH446 and MH18 that crosses under Highway 7/8 and is sized to 600 mm diameter. The hydraulic model still identifies surcharging within the upsized sewer near the intersection of Bleams Road West and Jacob Street, but the amount of surcharging is considered acceptable based on the existing high ground elevation over the sewer that exceeds 2.5 m providing enough grade separation to prevent backflow to surrounding properties. The trunk sewer alignment through the park between Asmus Street and Jacob Street was also upgraded from 375 mm to 600 mm diameter, on Figure 3-26A and Figure 3-26B, to alleviate surcharging. On Figure 3-27A and Figure 3-27B the existing Nith River siphon crossing was recommended to be upgraded from 200 mm diameter to 300 mm diameter. The upstream section of the upgraded siphon to the Milton Street Pump Station remained in a surcharged condition.

All other sewers modeled within the New Hamburg area meet the required capacity necessary to accommodate the population increase from the proposed New Hamburg development areas that include the Residential Development Area A and Future Intensification Areas H, J and K.

3.3.3 Sanitary Flow Hydraulic Analysis - Alternative C

The sanitary flow hydraulic analysis report for Alternative C are included on Figure 3-31A to Figure 3-45B.

3.3.3.1 Baden Alternative C

In Baden the hydraulic SWM Model for Alternative C was similar to the Alternative B modeling result. The Baden model maintained the same upgrades to the existing sanitary sewers on Livingstone Boulevard, Snyder's Road West and Foundry Street.

All other sewers modeled within the Baden area have met the required capacity necessary to accommodate the population increase from the proposed Baden development areas.

3.3.3.2 New Hamburg Alternative C

The sanitary flow input and physical characteristics of the sanitary network existing in New Hamburg was identical in models for Alternative B and C. The difference in surcharging results has been attributed to inconsistencies in the modeling software, that calculated flow increases of 1 L/S in some pipe segments, only to subtract the same flow increase in the proceeding pipe segments. Therefore the same general upgrading of sanitary sewers required within Alternative B have also been recommended within Alternative C.

All other sewers modeled within the New Hamburg area meet the required capacity necessary to accommodate the population increase from the proposed New Hamburg development areas that include Residential Development Area A and Future Intensification Areas H, J and K.

3.3.4 Sanitary Flow Hydraulic Analysis - Alternative D

The sanitary flow hydraulic analysis report for Alternative D are included on Figure 3-46A to Figure 3-59B.

3.3.4.1 Baden Alternative D

The Baden hydraulic model for the Alternative D option was similar to the Alternative B and C model, where the difference existed in not servicing the post 2029 Residential Development Areas Y and Z. The same upgrades to the existing sewers on Livingstone Boulevard and Foundry Street also exist within this alternative.

All other sewers modeled within the Baden area meet the required capacity necessary to accommodate the population increase from the proposed Baden development areas.

3.3.4.2 New Hamburg Alternative D

In New Hamburg Alternative D differs significantly with Alternative B and C, by not including the proposed new Chistner Street Pump Station. Instead the existing Forest Glen Pump Station was proposed to be upgraded to handle the new development flows from proposed 2016 to 2029 Residential Development Areas F and G, post-2029 Residential Development Areas M and L, with the further additional capacity to service flows from post-2029 Residential Development Areas W, X, Y, Z and Q. The upgrading of the Forest Glen Pump Station results in the re-direction of existing flows originally discharged by the pump station east on Waterloo Street, into the newly proposed forcemain heading south to the Highway 7/8 from MH415 to the Morningside Pump Station at MH432. Figures 3-51A and 3-51B present the sanitary sewer from MH415 to MH432. The additional sanitary sewer loading attributed to the new proposed development areas has resulted in the recommendation for upgrading of the existing 450 mm diameter sanitary sewer to a 525 mm diameter, or larger, to handle both the new development flows and the transferred flows from the existing Forest Glen Pump Station. This can be observed by comparing the sanitary flow rate at MH6A on Smith's Creek Drive, from Figure 3-58B of Alternative D to the same flow rates in Alternative B and C where there is a short fall of 0.05 m³/s less flow in Alternative D. This is due to the transfer of existing flows from the original Forest Glen Pump Station away from the New Hamburg Milton Street Pump Station.

All other sewers modeled within Alternative D for the New Hamburg area meet the required capacity necessary to accommodate the population increase from the proposed New Hamburg development areas that include Residential Development Area A and Future Intensification Areas H, J and K.

3.4 Proposed Sewer Alignment

The proposed sewer alignment represents the preliminary plan and profile evaluation on new sanitary servicing of development areas that lay outside of the existing sewer network. This includes the proposed sanitary trunk sewers that carry flows from the railway line north of proposed Industrial Area N, to the Christner Road gravity sewers towards the proposed pump station, to the gravity sewers that carry flows west along Snyder's Road West and along Waterloo Street. The proposed sewer alignments have been completed for proposed Alternatives B, C and D.

Based on the design capacity and proposed sewer gradient calculations completed in Tables 3-5 to 3-8, that confirmed the adequate sizing and grade of the sewers. The layout of the sewers were plotted on Preliminary Plan and Profile drawings to ensure that the existing ground topography could accommodate the pipe elevations and alignments. The plan and profile layouts are presented in the attached Figures as follows:

- Figures Alt B 3-1 to Alt B 3-7 Alternative B Sanitary Sewer Plan and Profile
- Figures Alt C 3-1 to Alt C 3-7 Alternative C Sanitary Sewer Plan and Profile
- Figures Alt D-3-1 to Alt D3-7 Alternative D Sanitary Sewer Plan and Profile

The sanitary gravity trunk sewer connection to existing MH322 within the Industrial Area N is identical for all three Alternatives B, C and D. These are shown on Figures Alt B3-1 to Alt B3-2, Figures Alt C3-1 to Alt C3-2 and Figures Alt D3-1 to Alt D3-2. On these Figures the sanitary sewer is installed at a depth between 5.0 m and 7.5 m from Sta. 1+200 to Sta. 1+725, all other pipe lengths between Sta. 1+000 to Sta. 1+950 have been installed at depths lower than 5.0 m from top of grade.

All proposed forcemain alignments have not been included within the plan and profile drawings, as the forcemain installation elevation is not influenced by existing ground topography. As the figures provided present a very preliminary design, the sizing of the proposed pump stations, location of air release valve chambers and other ancillary structures associated with the forcemain and gravity sewers, were also not included within these drawings.

3.4.1 Alternative B

The plan and profile alignment of the new gravity pipe length sections proposed for Alternative B are presented on Figures Alt B3-1 to Alt B3-7.

The minimum sewer gradient of 0.50 percent and the minimum cover of 3.0 m is maintained on all newly proposed sewer sections.

Summary on the proposed gravity sewer elevations for Alternative B are as follows:

<i>Figure</i>	<i>Station</i>	<i>Length (m)</i>	<i>Sewer Installation Depth</i>		
			<i>3m to 5 m</i>	<i>5m to 7.5 m</i>	<i>>7.5 m</i>
Alt B3-1	1+000 – 1+200	200	X		
	1+200 – 1+600	400		X	
Alt B3-2	1+600 - 1+725	125		X	
	1+725 – 1+950	225	X		
Alt B3-3	1+000 – 1+600	600			X
Alt B3-4	1+600 – 1+950	350			X
	1+950 – 2+100	150		X	
Alt B3-5	2+100 – 2+425	325		X	
	2+425 – 2+550	125	X		
	2+550 – 2+600	50		X	
Alt B3-6	2+600 – 3+100	500	X		
Alt B3-7	3+100 – 3+375	275	X		
Total Length/% of Total Length		3,325	39.8%	31.5%	28.7%

3.4.2 Alternative C

The plan and profile alignment of the new gravity pipe length sections proposed for Alternative C are presented on Figures Alt C3-1 to Alt C3-7.

The minimum sewer gradient of 0.50 percent and the minimum cover of 3.0 m is maintained on all newly proposed sewer sections.

Summary on the proposed gravity sewer elevations for Alternative C are as follows:

<i>Figure</i>	<i>Station</i>	<i>Length (m)</i>	<i>Sewer Installation Depth</i>		
			<i>3m to 5 m</i>	<i>5m to 7.5 m</i>	<i>>7.5 m</i>
Alt C3-1	1+000 – 1+200	200	X		
	1+200 – 1+600	400		X	
Alt C3-2	1+600 - 1+725	125		X	
	1+725 – 1+950	225	X		
Alt C3-3	1+000 – 1+100	100		X	
	1+100 – 1+275	175			X
	1+275 – 1+450	175		X	
	1+450 – 1+600	150			X
Alt C3-4	1+600 – 1+675	75			X
	1+675 – 1+850	175		X	
	1+850 – 1+900	50	X		
Alt C3-5	1+000 – 1+300	300		X	
	1+300 – 1+475	175	X		
Alt C3-6	1+475 – 1+975	500	X		
Alt C3-7	1+975 – 2+250	275	X		
Total Length/% of Total Length		3,100	46.0%	41.1%	12.9%

3.4.3 Alternative D

The plan and profile alignment of the new gravity pipe length sections proposed for Alternative D are presented on Figures Alt D3-1 to Alt D3-7.

The minimum sewer gradient of 0.50 percent and the minimum cover of 3.0 m is maintained on all newly proposed sewer sections.

Summary on the proposed gravity sewer elevations for Alternative D are as follows:

<i>Figure</i>	<i>Station</i>	<i>Length (m)</i>	<i>Sewer Installation Depth</i>		
			<i>3 m to 5 m</i>	<i>5 m to 7.5 m</i>	<i>>7.5 m</i>
Alt D3-1	1+000 – 1+200	200	X		
	1+200 – 1+600	400		X	
Alt D3-2	1+600 - 1+725	125		X	
	1+725 – 1+950	225	X		
Alt D3-3	1+000 – 1+250	250		X	
	1+250 – 1+550	300	X		
	1+550 – 1+600	50		X	
Alt D3-4	1+600 – 1+625	25		X	
	1+625 – 1+975	350		X	
	1+975 – 2+150	175	X		
Alt D3-5	2+150 – 2+700	550	X		
Alt D3-6	2+700 – 2+825	125	X		
	2+825 – 3+050	225		X	
Alt D3-7	1+000 – 1+100	100	X		
	1+100 – 1+125	25		X	
	1+125 – 1+275	100	X		
Total Length/% of Total Length		3,225	55.0%	45.0%	0.0%

Figure Alt D 3-5 to Figure Alt D 3-7 represent the alignment of additional trunk sewers that provide Alternative D with the possibility of further population growth beyond the year 2041. These provide the Township with the flexibility to increase beyond the 35,400 total population noted under development year 2041. This has the added potential to provide additional sewer capacity for the future development of Areas W, X and Q, beyond 2041.

3.5 Preliminary Cost Estimate

Based on the evaluation of the Proposed Distribution of Additional Population in Tables 3-1 to 3-4, Sanitary Sewer Preliminary Evaluations in Tables 3-5 to 3-8 and Proposed Sewer Alignments on Figures Alt B3-1 to Alt D3-7, a Preliminary Cost Estimate was generated for each Alternative B to D and included within Tables 3-9 to 3-11. Each of the alternatives were broken into Sub-Catchment Areas, as indicated on Figures 2-25 and 2-26 and delineated under Section 2.4.1 of this report. A Phased Time Period column is provided at the beginning of each cost estimate table to identify the anticipated phasing of the expected Capital Works.

The cost estimate is based on the Treasury Board of Canada, Class D Estimate, accurate to between +50 percent to -20 percent accuracy. Each cost estimate was based on capital

installation, Operation and Maintenance Costs over 50 years and does not include for land acquisition, easement or legal costs. The cost breakdown between the Township, Region of Waterloo and Property Developers was also not included in the cost breakdown of each of the 3 alternatives.

The preliminary cost estimate for Alternatives B and C were identical in Sub-Catchments 3 and 5 where the selected servicing options were identical. The price differences occurred in Sub-Catchment 1 and Sub-Catchment 4 where changes resulting from the placement of the proposed Christner Pump Station for each alternative has required altering the length of proposed forcemain and gravity sewer that was required in each alternative option. In Alternative D, Sub-Catchment Area 4, Residential Development Areas B and C were not included for development and the upgrading of the Forest Glen Pump Station replaced the need for the proposed Christner Street Pump Station. This re-directed all existing sanitary flow serviced by the Forest Glen Pump Station, away from downtown New Hamburg, directing flows through the new proposed forcemain south to the trunk sewer feeding the Morningside Pump Station. This resulted in the recommendation to upsize the existing trunk sewer that extends from Highway 7/8 at MH415 to MH432 from a 450 mm to 525 mm diameter sewer, increasing the preliminary cost estimate for Sub-Catchment Area 5.

The upgrading of both the existing Baden, Foundry Street Pump Station and the New Hamburg Morningside Pump Station to handle the increase in wet weather peak flows has also be included within each alternative preliminary cost estimate.

The overall cost estimate summary for each alternative option is presented as follows:

	<i>Capital Cost</i>	<i>50 yr O&M</i>	<i>Total</i>
1. Alternative B Preliminary Cost Estimate	\$31,486,034	\$10,000,000	\$41,486,034
2. Alternative C Preliminary Cost Estimate	\$29,856,475	\$10,000,000	\$39,856,475
3. Alternative D Preliminary Cost Estimate	\$28,719,694	\$10,000,000	\$38,719,694

For Alternative D there includes the option for build out beyond 2041 at an additional Preliminary Cost Estimate of \$2,277,044 to service the proposed Residential Development Areas X, W and Q.

The cost estimates have been based on 2013 capital cost construction pricing for sanitary sewer and manhole installation, excluding (HST) and general surface restoration costs. The cost estimate also includes for operation and maintenance costs that have been extrapolated over 50 years of operation. The cost estimates do not include Engineering Design fees.

Alternative D has been evaluated as the most cost effective alternative of the three options. In Alternative D, the re-construction of the existing Forest Glen Pump Station resulted in the removal of sub-Catchment 4 that included Residential Development Areas B and C. Alternative D has the provisional option of servicing beyond the development year 2041, by being able to extend the trunk sewer to service proposed Development Areas W, X & Q, as identified on Figures Alt D3-4 to Alt D3-7. Therefore based on the evaluation on least indicative cost, Alternative D is the recommended sanitary sewer servicing option.

3.6 Evaluation Matrix

The four main evaluation criteria that include Hydraulic Compatibility, Development Timing, Public/Environmental Disturbance and Indicative Cost Estimate have been evaluated in the Evaluation Matrix for Sanitary Servicing Alternatives, found in Table 3-12.

The default Alternative A (Do Nothing) option has been concluded as not a feasible option, therefore it has been excluded from the Evaluation Matrix. The Sub-Catchment Area 2 that includes servicing areas along Nafziger Road in New Hamburg has also been concluded as not a feasible option explored in any of the remaining sanitary servicing alternatives, therefore it has been excluded from the Evaluation Matrix as well. A summary on the evaluation findings for Alternatives B, C and D are presented in the following sections.

3.6.1 Hydraulic Compatibility

From Tables 3-6 to 3-8 identifying the Preliminary Sanitary Flow Evaluation, it can be concluded that all three options for Alternative B, C and D have no noticeable advantages in hydraulic compatibility. The hydraulic modeling for each trunk sewer alternative shown on Figures 3-16A to 3-59B, identify surcharge conditions within each of the sub-catchment areas existing within each sanitary sewer servicing alternative. Under the Proposed Sewer Alignment represented in for all three alternatives included on Figures Alt B3-1 to Alt D3-7, hydraulic compatibility differences have been identified based on the required burial depth for each proposed sanitary sewer alignment. These differences between the alternatives are summarized as follows:

Sub-Catchment Area 1 (Development Areas F, G, L, M, W, X and Q)

Alternative C scored higher than Alternative B, based on the deeper elevation of the proposed trunk sewer in Alternative B. Alternative D scored the highest hydraulic compatibility as it maintained the flexibility and additional capacity to service Residential Development Areas W, X and Q from along Snyder's Road West, beyond the year 2041.

Sub-Catchment Area 3 (Development Areas Y, Z, O, P, R, S, T, V, U, BB, AA)

Alternatives B and C scored the highest hydraulic compatibility as both serviced Residential Development Areas Y and Z, where Alternative D did not these Development Areas.

Sub-Catchment Area 4 (Development Areas B and C)

Alternative C scored higher than Alternative B based on the shallower depth of proposed gravity sewer installation on Christner Road, but Alternative D scored the highest based on not to requiring any servicing within the Sub-Catchment Area.

Sub-Catchment Area 5 (Dev. Areas A, N, H, J and K)

Alternative D included the redirection of existing flows from the Forest Glen Pump Station into the sanitary sewer through Industrial Area N and through the existing Highway 7/8 trunk sewer located on the eastern side of the Morningside Pump Station. This additional flow required the upgrading of the trunk sewer from 450 mm to 525 mm diameter. This had the effect of decreasing the sanitary flow loading to the existing Milton Street Pump Station, improving the hydraulic performance of the New Hamburg sewer network. Therefore the hydraulic compatibility of Alternative D was scored the highest hydraulic compatibility for the three alternatives.

3.6.2 Optimum Development Timing

The optimum development timing reflects the evaluation on the phased time period for recommended development to occur. This is reflected on the first column on Proposed Distribution of Additional Population Tables 3-2 to 3-4 and has also been included on the Preliminary Cost Estimates/Phased Time Period shown in Tables 3-9 to 3-11.

Sub-Catchment Area 1 (Development Areas F, G, L, M, W, X and Q)

This sub-catchment area refers to the servicing of the north portion of New Hamburg and western section of Baden. The proposed development timing within this area commences from year 2020 to beyond 2041.

The timing differences on the servicing of the proposed catchment areas that develop on Waterloo Street in New Hamburg and Snyder's Road East in Baden, are related to the proposed location of the proposed Christner Street Pump Station. In Alternative B flows from Sub-Catchment 4 need to be installed before flows can be serviced for Sub-Catchment Area 1 as the location of the pump station is on the far east side of Christner Road. In Alternative C, the Christner Road Pump Station is located in the middle where gravity flows come to the pump station from the east and west, independent of one another. Therefore, Alternative C provides more flexibility than Alternative B in development timing as Sub-Catchment Area 1 is not

dependent on the sewer servicing of Sub-Catchment Area 4. Sub-Catchment Area 4 is not required for development in Alternative D, therefore there is flexibility for development timing, which can be spread evenly along Waterloo Street and onto Snyder's Road East. Development in this alternative would extend from east to west.

Therefore due to the flexibility provided, Alternative D scores the highest for Optimum Development Timing for Sub-Catchment Area 1.

Sub-Catchment Area 3 (Development Areas Y, Z, O, P, R, S, T, V, U, BB, AA)

The Sub-Catchment Area 3 refers to servicing primarily the Baden area, along Foundry Street and extends along Snyder's Road East and West. The proposed development timing within this area commences from 2018 to 2029 and is similar in Alternative B and C. In Alternative D, there is no need to service the Residential Development Areas X and Y, therefore; there is a development advantage this alternative has over the other two.

Therefore Alternative D has scored highest for Optimum Development Timing in Sub-Catchment Area 3.

Sub-Catchment Area 4 (Development Areas B & C)

The Sub-Catchment Area 4 refers to the sanitary servicing of developments on Chistner Road. As was previously mentioned for Sub-Catchment Area 1, Alternative C scores higher than Alternative B, but Alternative D excludes this Sub-Catchment Area.

Therefore Alternative D scored the highest for Optimum Development Timing for Sub-Catchment Area 4 as this area was not required for development under this alternative.

Sub-Catchment Area 5 (Dev. Areas A, N, H, J & K)

The Sub-Catchment Area 5 services the New Hamburg area, which includes proposed Residential Development Area A, the Future Intensification Area H along Bleams Road West, the Future Intensification Area K along Waterloo Street, the Future Intensification Area J that connects to Hamilton Street and the New Hamburg Industrial Area N that connects into Highway 7/8.

The proposed development timing within this area commences from 2016 to 2022 and is similar in all three sewer servicing alternatives. Therefore all alternatives have scored equally for Optimum Development Timing in Sub-Catchment Area 5.

3.6.3 Least Public/Environmental Disturbance

The least public and environmental disturbance reflects the evaluation of the effect each sanitary sewer servicing alternative has on the public and physical environment. This looks at the social environment and how it affects existing communities, residential areas and natural environment that includes wildlife resources, vegetation and flora.

Sub-Catchment Area 1 (Development Areas F, G, L, M, W, X and Q)

The sub-catchment area 1 includes development along Waterloo Street and Nafziger Road in New Hamburg and along Snyder's Road West in Baden.

All three alternatives have been considered equal in terms of Least Public/Environmental Disturbance in Sub Catchment Area 1.

Sub-Catchment Area 3 (Development Areas Y, Z, O, P, R, S, T, V, U, BB, AA)

The Sub-Catchment Area 3 exists within the Town of Baden. The servicing area within this sub-catchment are identical for Alternatives B and C. Alternative D differs from Alternatives B and C in that it does not include the development of Areas Y and Z within this sub-catchment area. Therefore the short portion of sanitary sewer on Snyder's Road West, just before the intersection with Foundry Street does not require upgrading.

Therefore Alternative D scores the highest for Least Public/Environmental Disturbance in Sub-Catchment Area 3.

Sub-Catchment Area 4 (Development Areas B & C)

In Alternatives B and C, the areas along Waterloo Street and the proposed new pump station installation on Christner Road have a greater social and environmental impact on the residents' of New Hamburg. Development Areas D and E in New Hamburg sit within the Grand River Conservation Authority (GRCA) Flood Plain. In Alternative C the proposed Christner Road Pump Station was proposed for construction within that location. The entire Christner Road travels through the GRCA flood plain, making the environmental disturbance more critical within that area. The social stigma associated with the placement of a sewage pump station, coupled with the environmentally sensitive location of the proposed pump station on Christner Road, provide a larger social and environmental impact caused by Alternatives B and C. Alternative D does not require for any construction on Christner Road and includes the upgrading of an existing pump station that will be both socially and environmentally more acceptable because it does not require any additional new land requirements needed in order to install a new pump station.

Alternative D does not include for any new development within the Christner Road area, therefore it has the least public and environmental impact and scores the highest within the Evaluation Matrix.

Sub-Catchment Area 5 (Development Areas A, N, H, J and K)

Within the New Hamburg Sub-Catchment Area 5, Alternatives B and C are identical. Alternative D differs by including reconstruction upsizing of the existing 450 mm diameter to 575 mm diameter, east gravity sewer from Highway 7/8 to the Morningside Pump Station. The additional construction works to upsize the sewer scores both Alternative B and C higher than Alternative D within this Sub-Catchment Area 5.

3.6.4 Least Indicative Cost Estimate

Based on the Capital Cost and Total Cost assessment Alternative D has been determined to be the least expensive alternative. It also provides the Township with the additional provision to expand beyond the year 2041 into proposed Residential Development Areas W, X and Q.

Section 4.0 Conclusions and Recommendations

4.1 Conclusions

The Evaluation Matrix for Sanitary Servicing has been populated and based on the ranking and weighted factors agreed to within the Evaluation Table, the end result concluded the following:

- Sub Catchment Area 1:
(Servicing Areas F, G, M and L) Recommended Alternative D
- Sub Catchment Area 2:
(Servicing Areas Q, X, and W) Not required for development (N/A)
- Sub Catchment Area 3:
(Servicing Areas Z,Y,O,P,R,S,T,V,U,BB,AA) Recommended Alternative D
- Sub Catchment Area 4:
(Servicing Areas B, C, D and E) Recommended Alternative D
- Sub Catchment Area 5:
(Servicing Areas A, N, H, J and K) Recommended Alternative D*

Therefore the conclusion for the Evaluation Matrix is that Alternative D ranks the highest overall Totals/Alternative Score of 15.89 over 14.00 and 14.10 for Alternatives B and C, respectively.

4.2 Timing of Capital Expenditure

A list of major works and trigger points where when upgrades will be required in the Alternative D option are enclosed as follows:

<i>Est. Time Period</i>	<i>Phase/Town</i>	<i>Major Works Description (Years 2016 to 2018)</i>	<i>Estimated Capital Cost Amount \$</i>
2016-2018	PH1 New Hamburg	A) Sub-Catchment 5 (Development Areas A, N, H, J and K), Reference to Figures 2-24 and 2-26 - Construct new Pump Station Servicing Dev. Area A	\$ 1,850,000
2016-2018	PH1 New Hamburg	B) Sub-Catchment 5 (Development Areas A, N, H, J and K), Reference to Figures 2-24 and 2-26 - Installation of Forcemain from Development A to Bleams Rd. W	\$ 408,000
2016-2018	PH1 New Hamburg	C) Sub-Catchment 5 (Development Areas A, N, H, J and K), Reference to Figures 2-26 and 3-51A - Upgrading trunk sewer to Morningside Pump Station	\$ 2,984,800
2016-2018		Provisional Items =	\$ 786,420
2016 to 2018 Total Capital Cost =			<u>\$ 6,029,220</u>

Trigger Point leading into 2018 is the completion of the upgrading of the Morningside Pump Station.

<i>Est. Time Period</i>	<i>Phase/Town</i>	<i>Major Works Description (Years 2018 to 2021)</i>	<i>Estimated Capital Cost Amount \$</i>
2018-2021	PH1 Baden	D) Sub-Catchment 3 & 5 (Development Areas O, P, R, S, T, V, U, BB, AA), Reference Figures 2-25 and 3-46A - Upgrading of existing trunk sewers along Foundry St.	\$ 2,090,400
2018-2021	PH1 Baden	E) Sub-Catchment 3 and 5 (Development Areas O, P, R, S, T, V, U, BB, AA), Reference Figures 2-25 and 3-46A - Sanitary Railway crossing on Snyder's Road West MH14 to MH12	\$ 150,000
2018-2020	PH2 New Hamburg	F) Sub-Catchment 5 (Development Areas A, N, H, J & K), Reference to Figures 3-53A and 3-56A - Upgrading of existing trunk sewer Bleams Rd.W & Norm S. Hill Park	\$ 1,203,800
2018-2020	PH2 New Hamburg	G) Sub-Catchment 5 (Development Areas A, N, H, J & K), Reference to Figure 3-57A - Upgrade siphon crossing of Nith River near Huron Street	\$ 700,000
2018-2021		Provisional Items =	\$ 621,630
2018 to 2021 Total Capital Cost =			\$ 4,765,830

Trigger Point leading into 2020 is the upgrading of the existing trunk sewers on Foundry Street, Bleams Road West and Norm S. Hill Park.

<i>Est. Time Period</i>	<i>Phase/Town</i>	<i>Major Works Description (Years 2020 to 2022)</i>	<i>Estimated Capital Cost Amount \$</i>
2020-2022	PH3 New Hamburg	H) Sub-Catchment 1 (Development Areas F, G, L, M, W, X, Q), Reference to Figure Alt D3-2 - Sanitary Railway crossing into Dev. Area N	\$ 150,000
2020-2022	PH3 New Hamburg	I) Sub-Catchment 5 (Dev. Areas A,N,H,J & K), Reference to Figures Alt D3-1 to Alt D3-2 - New gravity sewer installation within Industrial Area N	\$ 1,802,876
2020-2022		Provisional Items =	\$ 292,931
2020 to 2022 Total Capital Cost =			\$ 2,245,807

Trigger Point leading into 2022 is the sanitary railway crossing and the new gravity sewer installation within Industrial Area N.

<i>Est. Time</i>	<i>Phase/</i>	<i>Major Works Description</i>	<i>Estimated Capital</i>
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<i>Period</i>	<i>Town</i>		<i>(Years 2022 to 2025)</i>	<i>Cost Amount \$</i>
2022-2025	PH2 Baden	J)	Sub-Catchment 3 & 5 (Development Areas O, P, R, S, T, V, U, BB, AA), Reference to Figure 2-23 - Upgrade existing Foundry St. Pump Station	\$ 1,950,000
2022-2025	PH2 Baden	K)	Sub-Catchment 3 and 5 (Development Areas O, P, R, S, T, V, U, BB, AA), Reference Figures 2-23 to 2-24 - Twinning forcemain from Foundry St. Pump Station to New Hamburg	\$ 2,161,500
2022-2025	PH4 New Hamburg	L)	Sub-Catchment 1 (Development Areas F, G, L, M, W, X, Q), Reference to Figure 2-24 - Install sanitary forcemain from Forest Glen PS to Industrial Area N	\$ 646,600
2022-2025	PH4 New Hamburg	M)	Sub-Catchment 1 (Development Areas F, G, L, M, W, X, Q), Reference to Figures 2-24 and Alt D3-3 - Upgrading of existing Forest Glen Pump Station	\$ 1,100,000
			Provisional Items =	\$ 878,715
2022 to 2025 Total Capital Cost =				\$ 6,736,815

Trigger Points leading into 2025 include the upgrading of the Foundry Street Pump Station, the twinning of the forcemain from Baden to New Hamburg and the Forest Glen Pump Station upgrades and installation of forcemain.

<i>Est. Time Period</i>	<i>Phase/Town</i>		<i>Major Works Description (Years 2025 to 2029)</i>	<i>Estimated Capital Cost Amount \$</i>
2025-2029	PH5 New Hamburg	N)	Sub-Catchment 1 (Development Areas F, G, L, M, W, X, Q) Reference to Figures Alt D3-3 and Alt D3-4 - New gravity sewer installation on Waterloo St to service Dev. Areas F & G	\$ 1,281,814
2026-2029	PH3 Baden	O)	Sub-Catchments 3 and 5 (Development Areas O, P, R, S, T, V, U, BB, AA), Reference to Figure 2-23 - New pump station to service Dev. Area O	\$ 1,850,000
2026-2029	PH3 Baden	P)	Sub-Catchments 3 and 5 (Development Areas O, P, R, S, T, V, U, BB, AA), Reference to Figure 2-23 - Forcemain from Development Area O pump station to Snyder's Rd W/Foundry St.	\$ 870,400
			Provisional Items =	\$ 600,332
2025 to 2029 Total Capital Cost =				\$ 4,602,546

Trigger Points leading into 2029 include the new pump station to service Residential Development Area O and the installation of the forcemain that services the new pump station.

<i>Est. Time Period</i>	<i>Phase/ Town</i>	<i>Major Works Description (Years 2029 to 2033)</i>	<i>Estimated Capital Cost Amount \$</i>
2029-2033	PH6 New Hamburg	Q) Sub-Catchment 1 (Development Areas F, G, L, M, W, X, Q) Reference to Figure Alt D3-4 - New gravity sewer installation on Waterloo St to service Development Areas L and M	\$ 1,021,283
		Provisional Items =	\$ 153,192
2029 to 2033 Total Capital Cost =			\$ 1,174,475

Trigger Point into 2041 would include the new gravity sewer installation into Residential Development Areas L and M.

<i>Est. Time Period</i>	<i>Phase/ Town</i>	<i>Major Works Description (Years Beyond 2041) Provisional</i>	<i>Estimated Capital Cost Amount \$</i>
2041-2044	PH7 New Hamburg	R) Sub-Catchment 1 (Development Areas F,G,L,M,W,X,Q) Reference to Alt D3-4 to Alt D3-7 - (Provisional) gravity sewer installation on Snyder's Rd W & Nafziger Rd	\$ 1,980,038 (Provisional)
		Provisional Items =	\$ 297,005
Beyond 2041 Total Capital Cost =			\$ 2,277,043

4.3 Recommendations

Based on the Population Distribution Tables 3-1 to 3-4, and the evaluation of the upgraded Hydraulic Models generated for Alternative D, there remained the difficulty in placing RAP within the existing urban areas of New Hamburg and Baden. Within New Hamburg along Asmus Street, additional sewer capacity equating to 23 L/s was realized by increasing the sanitary sewer diameter through the ball field onto Jacob Street. Within Baden, there also exists at least 30 L/S capacity within the 450 mm diameter sewer on the bottom end of Foundry Street. The difficulty lies in finding the developable area required to house the Estimated (2368+569 = 2,937) persons, as that would require 49 hectares of urban land for re-development (based on 60 persons/hectare). This 60 persons per hectare development limit may need to be re-evaluated if the Township wishes to adhere to the Provincial Places to Grow Regulation, as the required 49 hectare area already almost exceeds the current urban landscape of both Towns. It is recommended that a further planning study be completed to

look into whether the Township can increase the Future Intensification Density beyond the 60 persons per hectare limit. The Region of Waterloo is also commencing the road reconstruction design of Snyder's Road East in Baden. It is recommended that the Township investigate the selection of proposed intensification areas along Snyder's Road East, capable of housing additional population, which would be recommended to the Region for designing the proposed sanitary system along that roadway.

The proposed Residential Development Area O was evaluated in Alternative A to determine if it was possible to service the new population with a gravity sewer. It was concluded that this was not possible and a proposed pump station would be required. Based on this conclusion, the proposed sanitary connection of the existing Foxwood Development that is located north of the proposed Residential Development Area O would also require a new pump station to direct flows to the New Hamburg Waste Water Treatment Plant. Therefore it has been concluded that the servicing of this existing development is not practical, considering that the area is currently serviced by an onsite treatment facility. Therefore it is not recommended that the Foxwood Development area be serviced by the Region's New Hamburg Waste Water Treatment Plant.

Therefore the recommended alternative for the future Sanitary Servicing for both Baden and New Hamburg to the year 2041 is Alternative D (Figures 2-23 and 2-24), that satisfies being the most hydraulically feasible, with optimum development timing, least public and environmental disturbance and the most cost effective development alternative. The Alternative D sanitary servicing also provides the Township with the additional provision to expand further along Snyder's Road West allowing for the future, beyond 2041 Residential Development of Areas W, Q and X.