Middlesex Centre Master Servicing Plan – Water Servicing

Final Servicing Report

April 22, 2024

Prepared for:

The Municipality of Middlesex Centre

Prepared by:

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Revision	Description	Author		Quality Check		Independent Review	
0	Draft	CR/GW	20231117	JS	20231117	JP	20231127
1	Final	CR	20240416	JS	20240416	JP	20240419

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Prepared by ______________________________
(signature)

Christène Razafimaharo, P.Eng

Prepared by ______________________________
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Gillian Wilton, EIT

Reviewed by ______________________________
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Jasmin Sidhu, P.Eng

Approved by ______________________________
(signature)

Jeff Paul, P.Eng

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Stantec Consulting Ltd. (Stantec) was retained by the Municipality of Middlesex Centre (the Municipality) to update its Master Servicing Plan (MSP), which was last updated in 2010. The MSP considers the Municipality's water, wastewater, stormwater and solid waste infrastructure. The MSP aims to be a roadmap to guide the Municipality's future infrastructure decisions, considering existing and future conditions over a 20 year horizon (to the year 2046).

This report addresses the potable water servicing infrastructure component of the 2023 MSP. Other components of the 2023 MSP are addressed in separate reports. The existing potable water servicing systems within each settlement were reviewed in terms of supply, pumping, storage and conveyance. Potable water servicing issues under existing and growth conditions were identified, and alternative solutions to address these issues were developed and assessed.

Infrastructure projects for each recommended alternative solution were identified. The table below presents each project, with the corresponding timeline and opinion of probable cost.

Settlement	Project ID & Description	Project Timeline (Trigger)	OPC (Material & Construction Only) [2023$]	Total OPC (incl. Contingency & Engineering) [2023$]
Ilderton	**ILD-PMP-2** Expand Ilderton BPS	MDD = 34 L/s in Ilderton Or Population (RES+EMP) = 6,124 persons i.e., 2035 under current projections	$0.6M	$0.9M
	ILD-ST-4 Build new storage on new site	MDD = 30 L/s in Ilderton Or Population (RES+EMP) = 5,488 persons i.e., 2030 under current projections	$4.5M	$7.0M
Komoka	**KKD-SUP-2A** Extend the existing water distribution system southwest along Glendon Dr	Coincident with development	$3.7M	$5.8M
	KKD-PMP-2A Expand Komoka BPS	MDD = 53.7 L/s in KKD Or Population (RES+EMP) = 11,948 persons i.e., 2027 under current projections	$0.7M	$1.1M
	KKD-PMP-2B/KK-PSIREL-4A Expand Komoka IPS	Short-term (to address existing minimum pressure issues in Kilworth)	$0.7M	$1.1M

Settlement	Project ID & Description	Project Timeline (Trigger)	OPC (Material & Construction Only) [2023$]	Total OPC (incl. Contingency & Engineering) [2023$]
	KKD-ST-2A Expand existing storage (in-ground reservoir)	MDD = 71 L/s in KKD Or Population (RES+EMP) = 15,645 persons i.e., 2034 under current projections	$1.9M	$3.0M
	KKD-ST-2B/ KK-PSIREL-4B Replace existing Komoka ET	Earliest of: • Medium-term to address future minimum pressure issues in Kilworth, observed when PHD = ~1.6 x existing PHD, i.e., 2036 under current projections • Needed to meet overall storage needs for KKD when combined with KKD-ST-A MDD = 71 L/s in KKD Or Population (RES+EMP) = 15,645 persons i.e., 2034 under current projections	$6.9M	$10.8M
	KK-PSIREL-4C Upgrade existing watermains	Once Komoka ET has been replaced (see KKD-ST-2B), i.e., Medium-term to address future minimum pressure issues in Kilworth, observed when PHD = ~1.6 x existing PHD, i.e., 2036 under current projections	$2.4M	$3.8M
Kilworth	**KIL-WM-2A** Supply Old Kilworth	Municipality/Old Kilworth residents' decision to proceed with connecting to the existing distribution system	$5.3M	$8.3M
	KK-PSIREL-4D New watermain looping between Komoka and Kilworth	Short-term (for reliability)	$1.3M	$2.0M
Delaware	**DEL-PMP-2** Expand Delaware BPS	MDD = 13 L/s in Delaware Or Population (RES+EMP) = 2,716 persons i.e., short-term under current projections	$0.4M	$0.7M
	DEL-ST-4 Build new storage (reservoir or ET) on new site	Coincident with employment lands' development.	$2.8M	$4.4M
	DEL-WM-2 Upgrade existing watermains	Coincident with upstream Delaware BPS upgrade, i.e., MDD = 13 L/s in Delaware Or Population (RES+EMP) = 2,716 persons i.e., short-term under current projections	$2.9M	$4.6M

Settlement	Project ID & Description	Project Timeline (Trigger)	OPC (Material & Construction Only) [2023$]	Total OPC (incl. Contingency & Engineering) [2023$]
Arva	**ARV-SUP-2** Connect to LHWPSS	Coincident with development	$1.3M	$2.0M
	ARV-REL-2 Build new storage (reservoir) & BPS	Coincident with development	$2.6M	$4.0M

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by the Municipality of Middlesex Centre (the Municipality) to update its Master Servicing Plan (MSP), which was last updated in 2010. The MSP considers the Municipality's water, wastewater, stormwater and solid waste infrastructure. The MSP aims to be a roadmap to guide the Municipality's future infrastructure decisions, considering existing and future conditions over a 20 year horizon (to the year 2046).

This report addresses the potable water servicing infrastructure component of the 2023 MSP. Other components of the 2023 MSP are addressed in separate reports.

1.1 BACKGROUND

The Municipality completed its Official Plan (OP) review, dated August 2023. The intent of the OP is to provide guidance for growth and development within the Municipality, and outline goals and policies pertaining to land use and servicing of the different settlement areas. The current 2023 MSP supplements the OP and provides guidance on the servicing infrastructure needs of the Municipality to meet the growth and development needs presented in the OP.

1.2 REVIEW OF PREVIOUS STUDIES

Previous studies pertaining to potable water servicing infrastructure in the Municipality were reviewed for this 2023 MSP. Their review will inform the existing conditions assessment, and considerations for future servicing needs. This background review is structured by settlement area for which background studies were available. Background studies were available for the following areas:

- Overall municipality;
- Ilderton;
- Komoka-Kilworth;
- Delaware;
- Denfield;
- Birr; and,
- Melrose.

Background studies for other settlement or hamlet areas were not available.

1.2.1 Overall Municipality

The following studies pertaining to the overall municipality's water servicing were reviewed:

- Initial Conditions Survey Report (2007)

This report presents a conditions assessment of the Municipality's water and wastewater systems, conducted in 2007. Short- and long-term capital requirements were identified.

- Middlesex Centre Master Servicing Plan (Stantec, 2010)

The 2010 Middlesex Centre MSP recommended the projects presented in **Table 1-1**. The status of each project as of the 2023 MSP is also presented.

Table 1-1: Status of Projects and Recommendations from the 2010 MSP

Settlement	Project/Recommendation	Status
Ilderton	Storage upgrades within 1-5 years	Completed
	Need for water distribution looping to address water security for areas along Ilderton Rd, west of Ilderton St.	Completed *New watermains in GIS*
	Need for water distribution looping to address water security for areas along Willow Ridge Rd W and Dogwood Trail.	Not completed
Delaware	Storage upgrades within 1-5 years	Completed
	Connection of the Delaware distribution system to the Komoka distribution system within 1-5 years	Completed
Arva	Undertaking a Class EA to determine servicing options for Arva within 5-10 years	Not completed
Melrose	Connection of the Melrose distribution system to the Komoka-Mt. Brydges water supply system within 1-5 years	Class EA completed; design ongoing

Projects which have not been implemented since the 2010 MSP will be reviewed in the current 2023 MSP.

The 2010 MSP also identified the need for watermain looping within existing servicing areas in Ilderton, and opportunities for looping through future undeveloped areas in Arva. A lack of looping was also identified in Denfield, however opportunities to establish looping were limited given the projected areas at the time. The current 2023 MSP will identify needs and opportunities for watermain looping within the existing water distribution networks, and considering the updates to the future service areas.

1.2.2 Ilderton

The following studies pertaining to the Ilderton water supply system were reviewed:

- Ilderton Water Supply Class EA (Stantec, 2013)

Per the recommendations of the 2010 MSP and other supporting studies, a Class EA was conducted to identify storage alternatives for Ilderton. The recommended alternative was a new elevated tank along the northern limit of Ilderton, west of Hyde Park Rd.

- Ilderton BPS and Elevated Water Storage Upgrades

Per the recommendations of the 2010 MSP and other supporting studies, a new elevated tank was built in Ilderton to provide additional storage capacity (construction completed in 2014), and the Ilderton Booster Pumping Station (BPS) was upgraded (construction completed in 2014). The work completed also included watermain extensions.

1.2.3 Komoka-Kilworth

The following studies pertaining to the Komoka-Kilworth water supply system were reviewed:

- Feasibility Report on the Proposed Interim Upgrades to the Kilworth-Komoka Water Treatment Plant (Stantec, 2005)

This study assessed the design solutions to implement interim (10-year) upgrades to the Kilworth-Komoka WTP.

- Kilworth-Komoka Water Supply Class EA ESR Addendum (Stantec, 2007)

This study identified the opportunity to proceed with connecting the Komoka-Kilworth water supply system to a transmission main from the Lake Huron Primary Water Supply System (LHPWSS).

- Komoka-Kilworth Water Supply Upgrades

The Komoka-Kilworth water supply upgrades were completed in 2010. The upgrades consisted of a 400-mm diameter transmission main along Oxbow Dr from the Arva Reservoir, a BPS within Komoka, an intermediate pumping station (IPS) from the Komoka distribution network to the Kilworth distribution network, and upgrades to the Komoka reservoir.

1.2.4 Delaware

The following studies pertaining to the Delaware water supply system, were reviewed:

- Delaware Water Supply Class EA (Stantec, 2017)
- Delaware Water Servicing Upgrades, including:
  - New Delaware BPS
  - Delaware Standpipe Replacement

Per the recommendations of the 2010 MSP and other supporting studies, water supply upgrades for Delaware (previously supplied by an interconnection to the City of London) were identified and designed. These upgrades consisted of connecting the Delaware distribution network to Komoka (itself supplied by the LHPWSS), replacing the Delaware standpipe to provide additional storage and improve pressures, and building a new booster pump station. These upgrades were completed in 2022.

1.2.5 Denfield

The following study pertaining to the Denfield water supply system was reviewed:

- Denfield Water Storage Facility Class EA (Stantec, 2008)

This study identified the need to provide storage in Denfield, and evaluated different alternatives. The recommended alternative was to build an on-ground storage reservoir, on the site of existing water facilities.

1.2.6 Birr

The following study pertaining to the Birr water supply system was reviewed:

- Birr WTP Upgrades (documented in the Birr Water Treatment System O&M Manual, 2016)

The Birr Water Treatment System was upgraded in 2004. The upgrades consisted of upgrades to monitoring equipment, treatment infrastructure, and disinfection systems.

1.2.7 Melrose

The following studies pertaining to the Melrose water supply system were reviewed:

- Melrose WTP Upgrades (documented in the Certificate of Approval 5831-5TNKAY dated January 28, 2004)

The Melrose WTP was upgraded in 2003. The upgrades consisted of the installation of monitoring equipment, and upgrades to the treatment system to provide primary disinfection.

- Melrose Water Supply Schedule B Municipal Class Environmental Assessment (Stantec, 2017)

The 2010 MSP recommended connecting the Melrose distribution system to the Komoka-Mt. Brydges water supply as a project. The Melrose Water Supply Class EA re-evaluated alternatives for future servicing solutions for Melrose, and identified connecting to the LHWPSS as the preferred alternative.

- Melrose LHPWSS Interconnect (ongoing by Stantec)

The connection to the LHWPSS is currently undergoing design, as part of a separate project. The current MSP will consider the connection to the LHWPSS as fully implemented in the long-term.

1.3 ADDITIONAL DATA SOURCES

In addition to the background studies listed previously, additional data was requested and provided. **Table 1-2** summarizes the different types of data collected, the relevant attributes or information, and their intended use.

Table 1-2: Additional Data Sources

Data Type		Key Attributes/Information	Intended Use
GIS Data	**Asset Data**	Pipe ID Diameter Material Installation year Ownership	Hydraulic model updates and build
	Base Mapping Features	Roads Settlement boundaries Parcels Official Plan land use designations	Mapping, servicing solutions
	Population Data	Population census	Hydraulic model updates and build
	Growth Data	Parcels of future subdivisions	Future conditions assessment and servicing solutions
Design Guidelines		Design criteria Level of service criteria	Hydraulic model updates and build, existing and future conditions assessment, servicing solutions
Design Reports **Process Control Narratives (PCNs)** **Operations & Maintenance (O&M) Reports**		Pump capacity Pump curves Pump duty setpoints	Hydraulic model updates and build
Facility Drawings		Pump station layout Watermain diameter Storage dimensions	Hydraulic model updates and build
Drinking Water Works Permit (DWWP) **Permit to Take Water (PTTW)** **Agreements with the City of London**		Facility equipment Supply capacity	Hydraulic model updates and build, servicing solutions

Data Type	Key Attributes/Information	Intended Use
Supervisory Control and Data Acquisition (SCADA) Data	Flows Pressures Storage levels Pump duty setpoints (inferred)	Hydraulic model updates and build Hydraulic model validation
Hydrant Test Data	Available fire flows	Hydraulic model validation
Development Application Information (Site Plans, Servicing Reports)	Proposed site servicing layout Unit counts	Future conditions assessment and servicing solutions
City of London Water Billing Information	Water consumption records Water billing rates	Servicing solutions and costing

2.0 EXISTING WATER SYSTEM

The Middlesex Centre water distribution system consists of six different sub-systems, supplied directly from the LHPWSS or from the City of London's water distribution system (itself supplied by the LHPWSS). The six municipal sub-systems supply Ilderton, Komoka-Kilworth, Delaware, Arva, Ballymote and Denfield. The Middlesex Centre water distribution system operates under the Drinking Water Works Permit (DWWP) #052-201 Issue Number 5, dated February 4th, 2022. Other hamlet areas receive partial municipal service, or are supplied by private wells. **Table 2-1** provides an overview of the existing water systems in the Municipality, which are subsequently described in more detail. The existing water servicing infrastructure is illustrated in **Figure 2-1** to **Figure 2-12**.

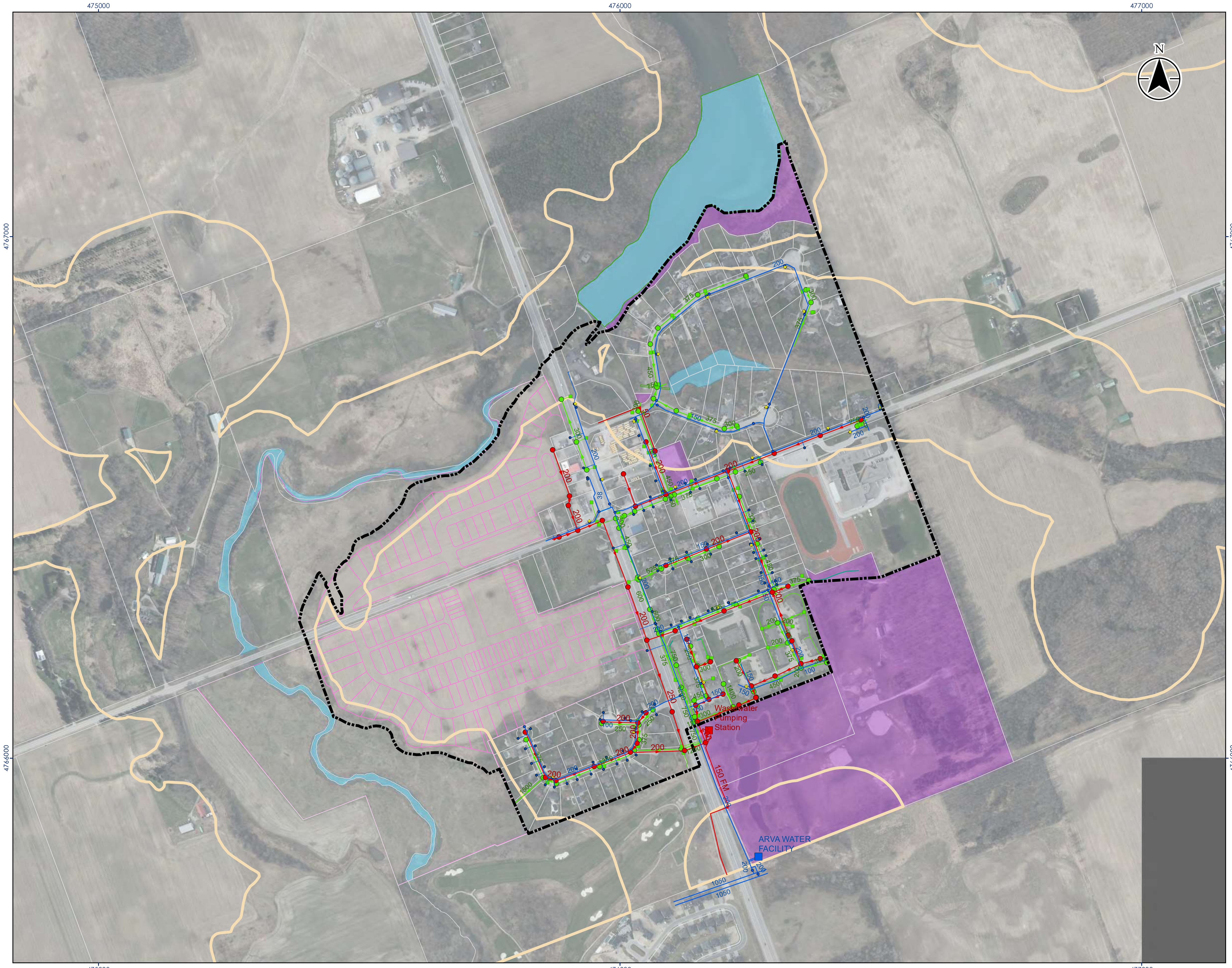
The settlement of Melrose is currently partially serviced by municipal and private wells. As noted in **Section 1.2.7**, there is an ongoing design study to implement a supply connection to the LHWPSS, and the current 2023 MSP will consider the connection to the LHWPSS as fully implemented in the long-term.

Table 2-1: Middlesex Centre Water Distribution System

Settlement Area	Existing Supply	Reservoir (Volume m^3)	Rechlorination	Booster/High-Lift Pumping Capacity[1]		Elevated Storage (Volume m^3)
				Facility	Capacity	
Ilderton	LHWPSS	455	Yes	Ilderton BPS	(VFD) 17 L/s at 59 m TDH (VFD) 17 L/s at 59 m TDH (VFD) 17 L/s at 59 m TDH	2,044
Komoka-Kilworth	LHWPSS	Total: 2,817 Usable: 2,718	Yes	Komoka BPS	(VFD) 53.7 L/s at 34.3 m TDH (VFD) 53.7 L/s at 34.3 m TDH	1,500
				Intermediate PS	(VFD) 91.2 L/s at 20.2 m TDH	
Delaware	LHWPSS (indirect)	None	Yes	Delaware BPS	13 L/s at 12 m TDH 13 L/s at 12 m TDH	2,140
Arva	City of London	None	Yes	Arva Rechlorination Facility Fire Pump	4,500 L/min	None
Ballymote	City of London	None	Yes	N/A		None
Denfield	LHWPSS	130	Yes	Denfield BPS	3.8 L/s at 42.2 m TDH 3.8 L/s at 42.2 m TDH (VFD) 40 L/s at 46 m TDH	None
Birr	Partial Municipal/Private Wells Birr WTP: Well #2: 82 L/min Daily maximum of 88 m^3 Daily maximum of 18 hours/day	51	N/A	Birr WTP	81.7 L/min (1.4 L/s) 81.7 L/min (1.4 L/s)	None
Bryanston	Private Wells	None	N/A	N/A		None
Lobo	Private Wells	None	N/A	N/A		None
Melrose	Partial Municipal/Private Wells Melrose WTP: Well #2: 5.45 L/s at 27 m TDH Well #3: 5.45 L/s at 27 m TDH *Ongoing water supply design study to convert to LHWPSS*	416	N/A	Melrose BPS	Existing 2.35 L/s at 35 m TDH 4.65 L/s at 56 m TDH 38 L/s at 43 m TDH *Proposed* *(VFD) 1.5 L/s at 4.9 m TDH* *(VFD) 5.4 L/s at 44.26 m TDH* *(VFD) 5.4 L/s at 44.26 m TDH* *(VFD) 38 L/s at 44.6 m TDH*	None
Poplar Hill-Coldstream	Private Wells	None	N/A	N/A		None

Notes:

(1) Per DWWP #052-201 Issue Number 5, dated February 4th, 2022.



Stantec

Legend

- Settlement Boundary
- Regulated
- Parcel
- Subdivision
- Municipally Owned Parcel

Water System

- Facility
- Hydrant
- Chamber
- Curb Stop Valve
- Pump
- Test Station
- Valve
- Lateral
- Watermain
- General Structure

Sanitary System

- Facility
- MH
- Sewer

Storm System

- Catchbasin
- MH
- General Feature
- Lateral
- Sewer
- Swale
- SWM Facility

0 260 520 m

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Notes

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Project Location
Municipality of

165630236 REVA
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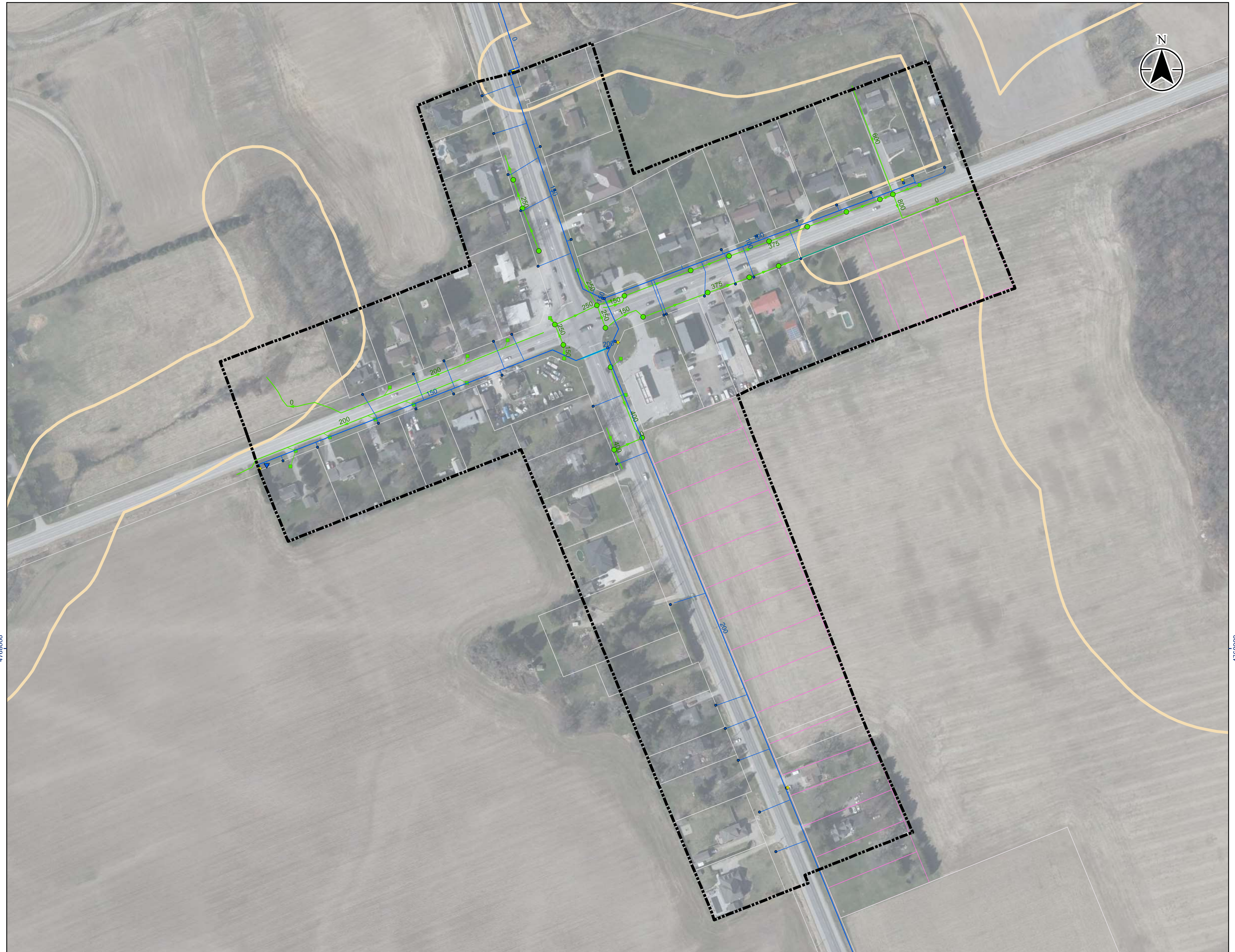
Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
2-1

Title
Asset Shapefile Overview
Arva



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MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
2-2

Title
Asset Shapefile Overview
Ballymote

Stantec

Legend

- Settlement Boundary
- Regulated
- Parcel
- Subdivision
- Municipally Owned Parcel

Water System

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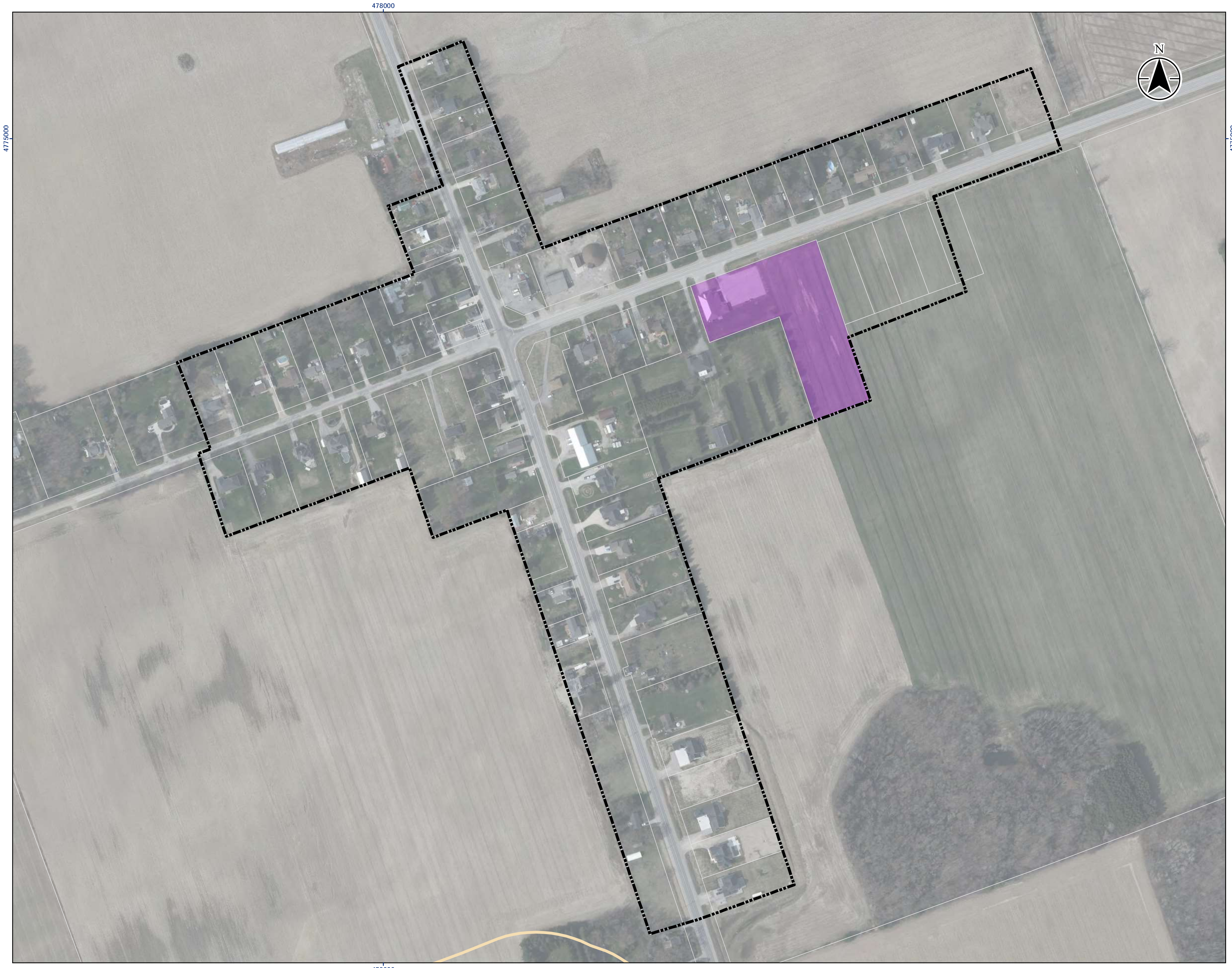
Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
2-3

Title
Asset Shapefile Overview
Birr



Stantec

Legend

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- Subdivision
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MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
2-4

Title
Asset Shapefile Overview
Bryanston

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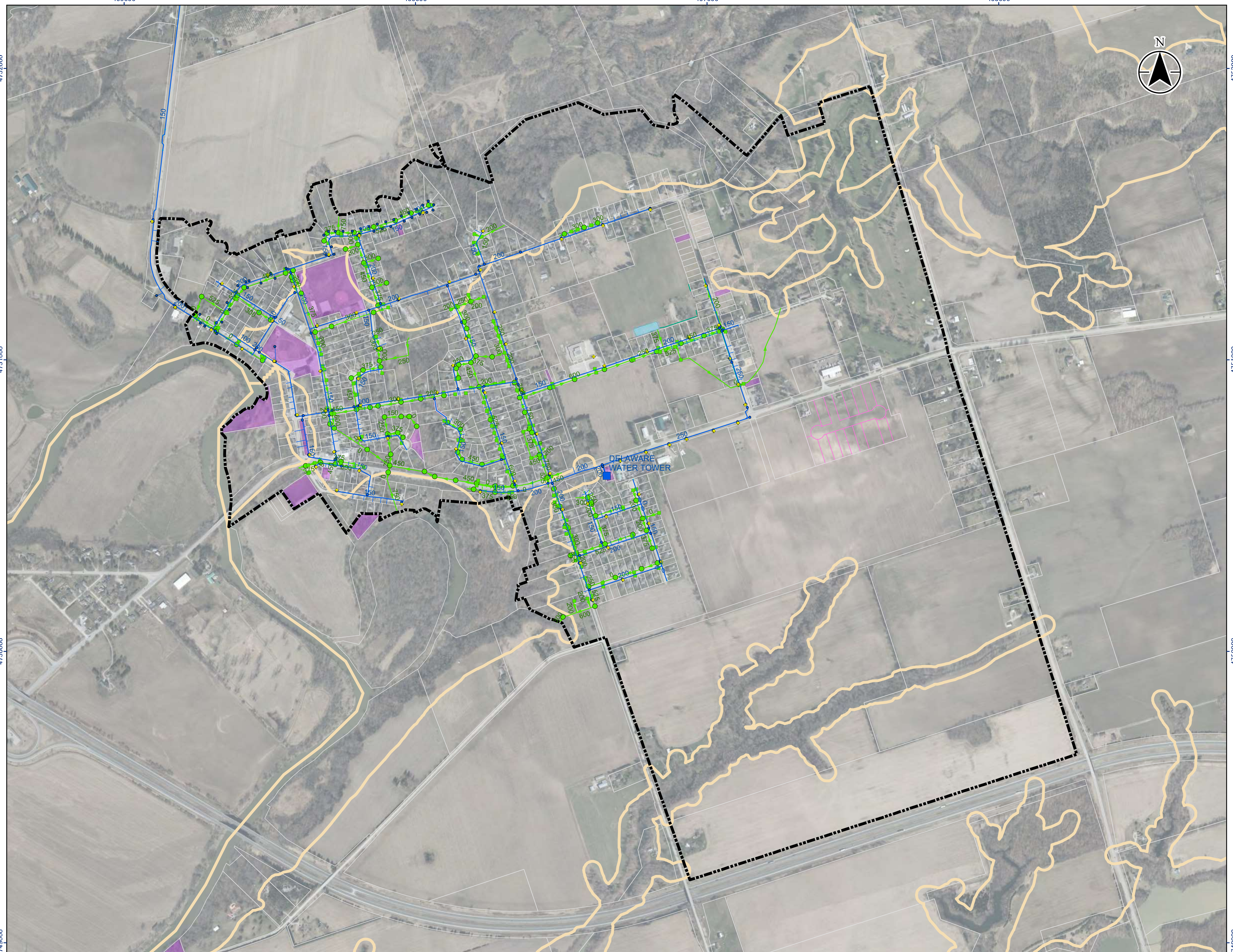

Stantec

N

Legend

- Settlement Boundary
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- Parcel
- Subdivision
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Water System

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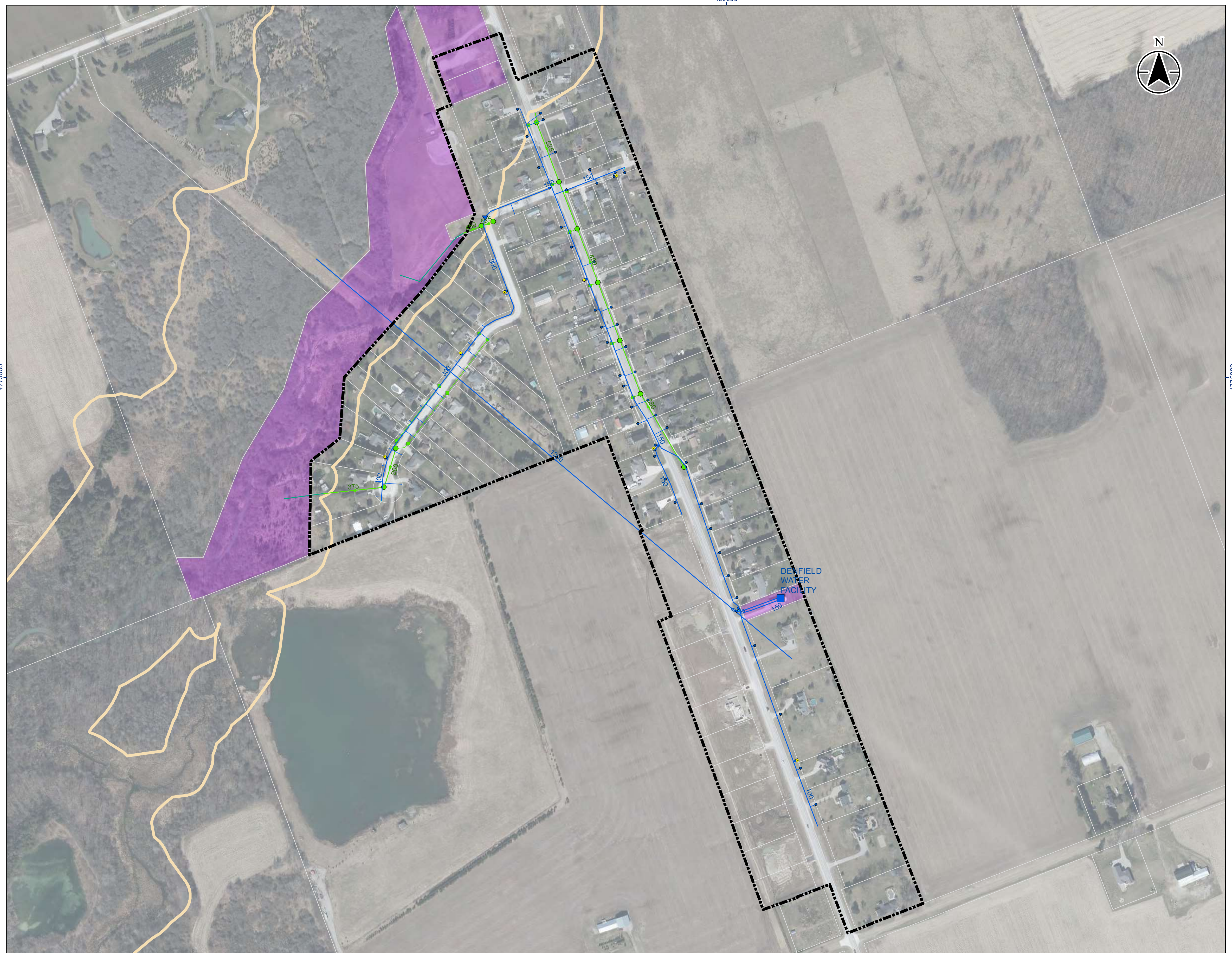
MASTER SERVICING PLAN

Figure No.
2-5

Title
Asset Shapefile Overview
Delaware



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Legend

Settlement Boundary
Regulated
Parcel
Subdivision
Municipally Owned Parcel

Water System
Facility
Hydrant
Chamber
Curb Stop Valve
Pump
Test Station
Valve
Lateral
Watermain
General Structure

Sanitary System
Facility
MH
Sewer

Storm System
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Swale
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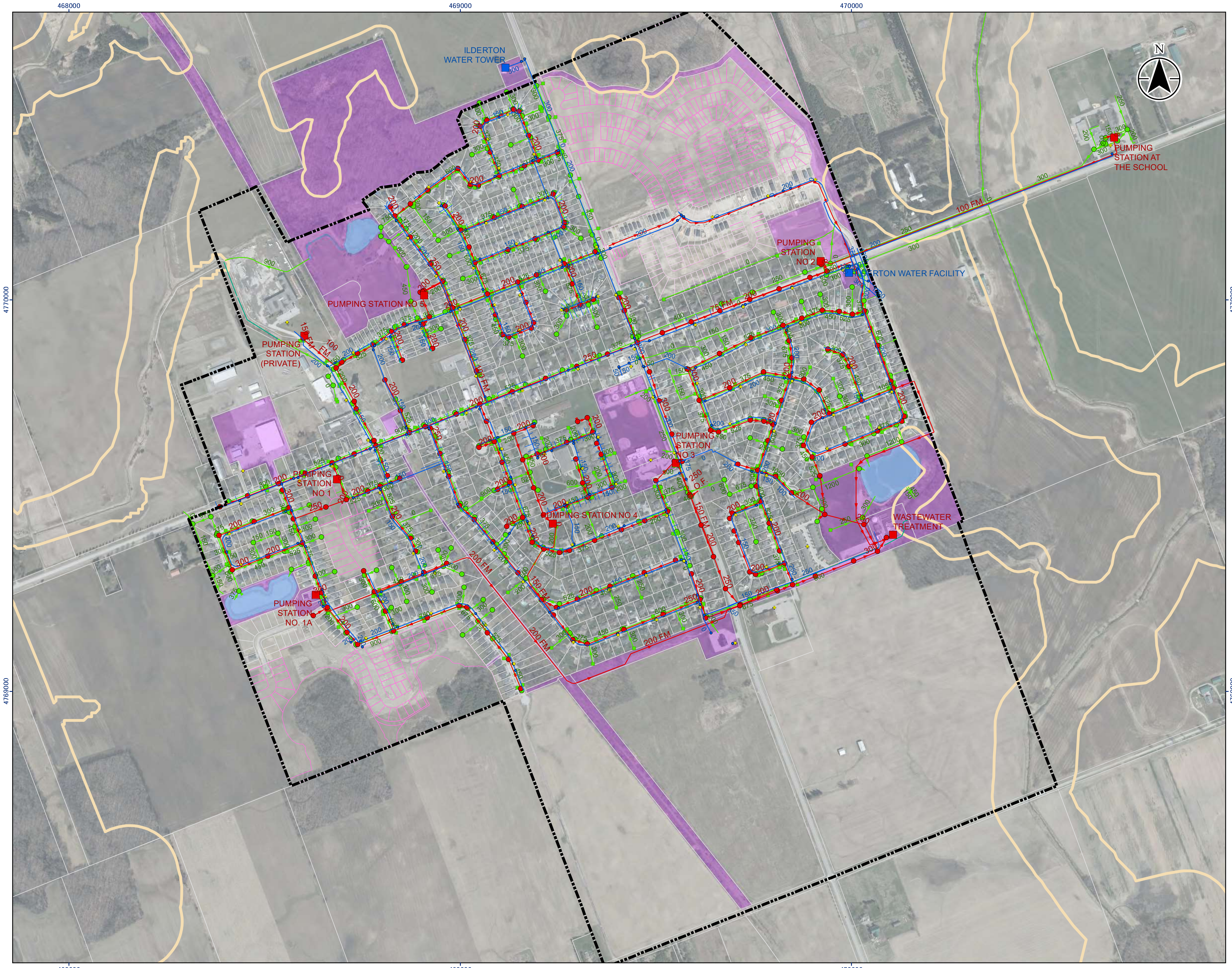
Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
2-6

Title
Asset Shapefile Overview
Denfield



Stantec

Legend

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0 340 680 m

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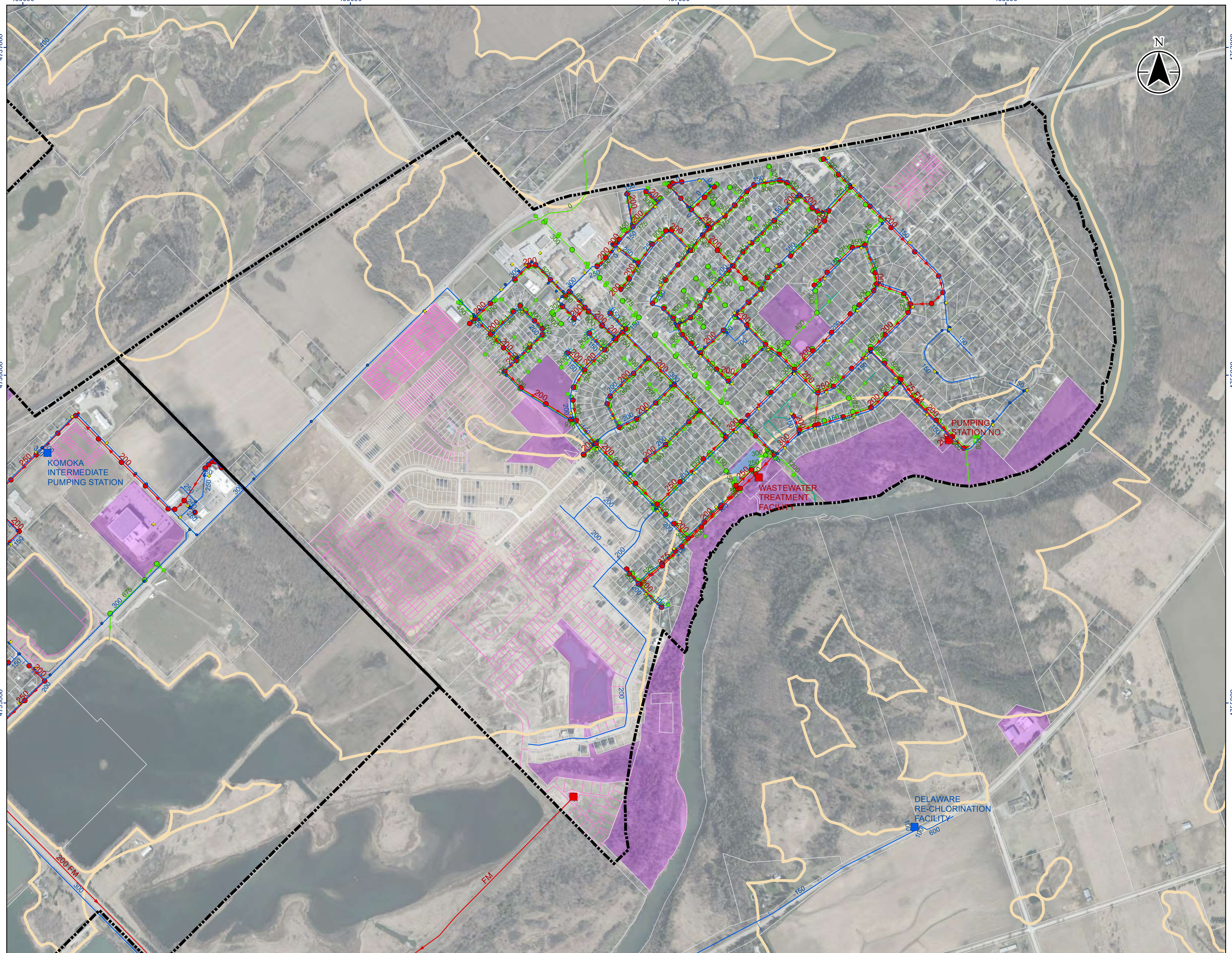
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
2-7

Title
Asset Shapefile Overview
Ilderton



Stantec

Legend

- Settlement Boundary
- Regulated
- Parcel
- Subdivision
- Municipally Owned Parcel

Water System

- Facility
- Hydrant
- Chamber
- Curb Stop Valve
- Pump
- Test Station
- Valve
- Lateral
- Watermain
- General Structure

Sanitary System

- Facility
- MH
- Sewer

Storm System

- Catchbasin
- MH
- General Feature
- Lateral
- Sewer
- Swale
- SWM Facility

0 410 820 m

1:12,000 (At original document size of 11x17)

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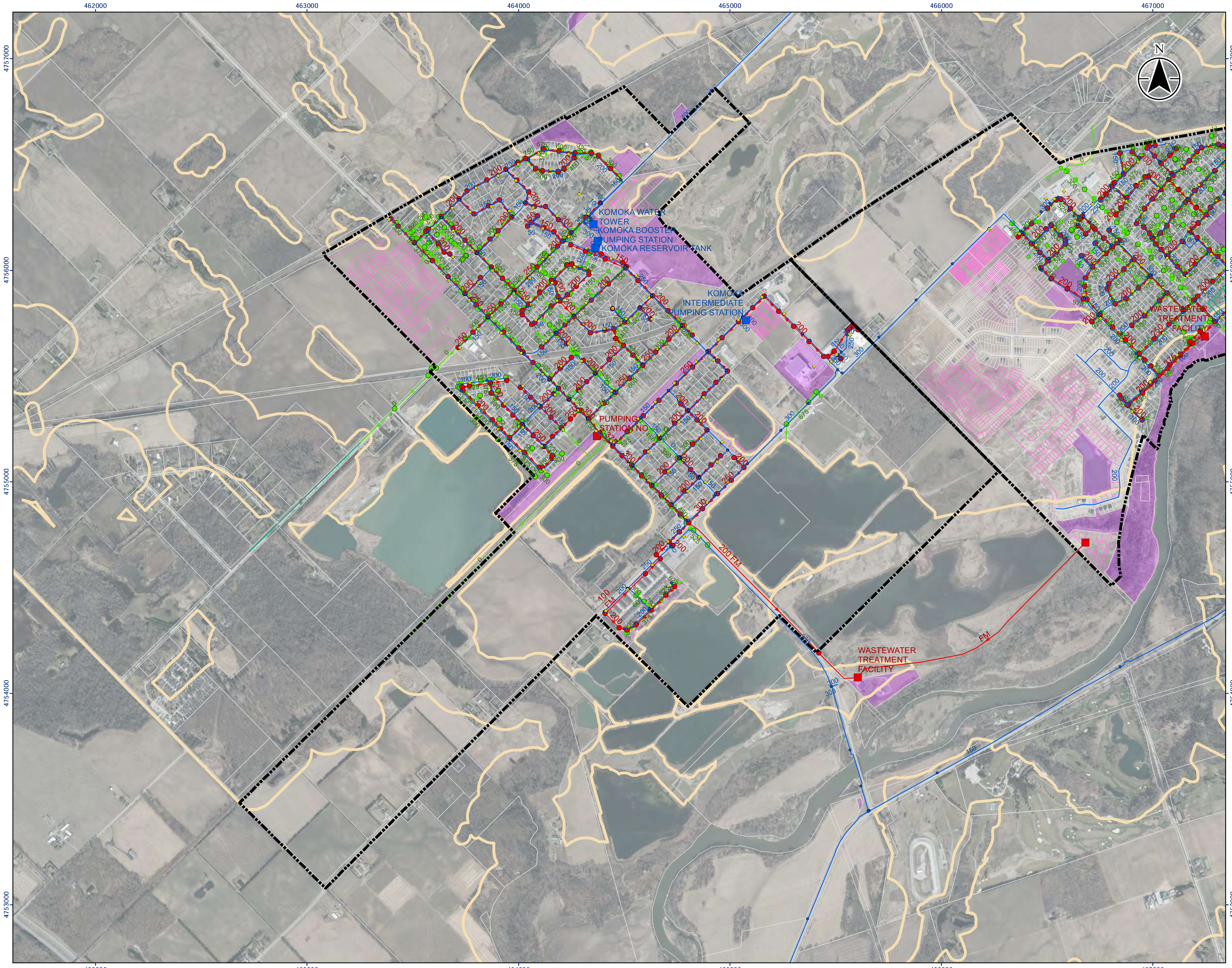
Project Location
Municipality of

165630236 REVA
Prepared by KDB on 2023-02-06

Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
2-8

Title
Asset Shapefile Overview
Kilworth



Stantec

Legend

- Settlement Boundary
- Regulated
- Parcel
- Subdivision
- Municipally Owned Parcel

Water System

- Facility
- Hydrant
- Chamber
- Curb Stop Valve
- Pump
- Test Station
- Valve
- Lateral
- Watermain
- General Structure

Sanitary System

- Facility
- MH
- Sewer

Storm System

- Catchbasin
- MH
- General Feature
- Lateral
- Sewer
- Swale
- SWM Facility

0 640 1,280 m

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Notes

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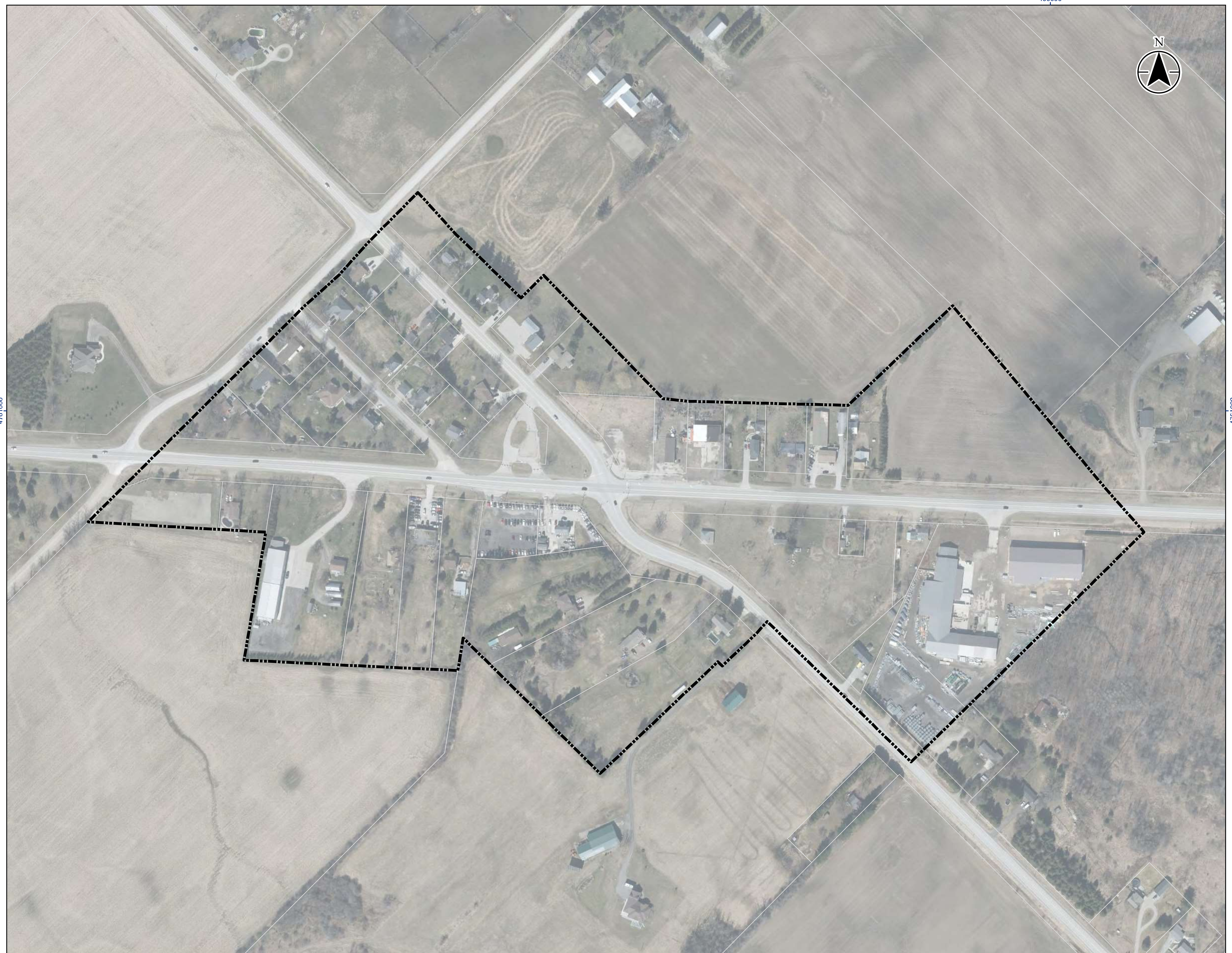
MASTER SERVICING PLAN

Figure No.
2-9

Title
Asset Shapefile Overview
Komoka



Stantec

Legend

- Settlement Boundary
- Regulated
- Parcel
- Subdivision
- Municipally Owned Parcel

Water System
- Facility
- Hydrant
- Chamber
- Curb Stop Valve
- Pump
- Test Station
- Valve
- Lateral
- Watermain
- General Structure

Sanitary System
- Facility
- MH
- Sewer

Storm System
- Catchbasin
- MH
- General Feature
- Lateral
- Sewer
- Swale
- SWM Facility

0 120 240 m

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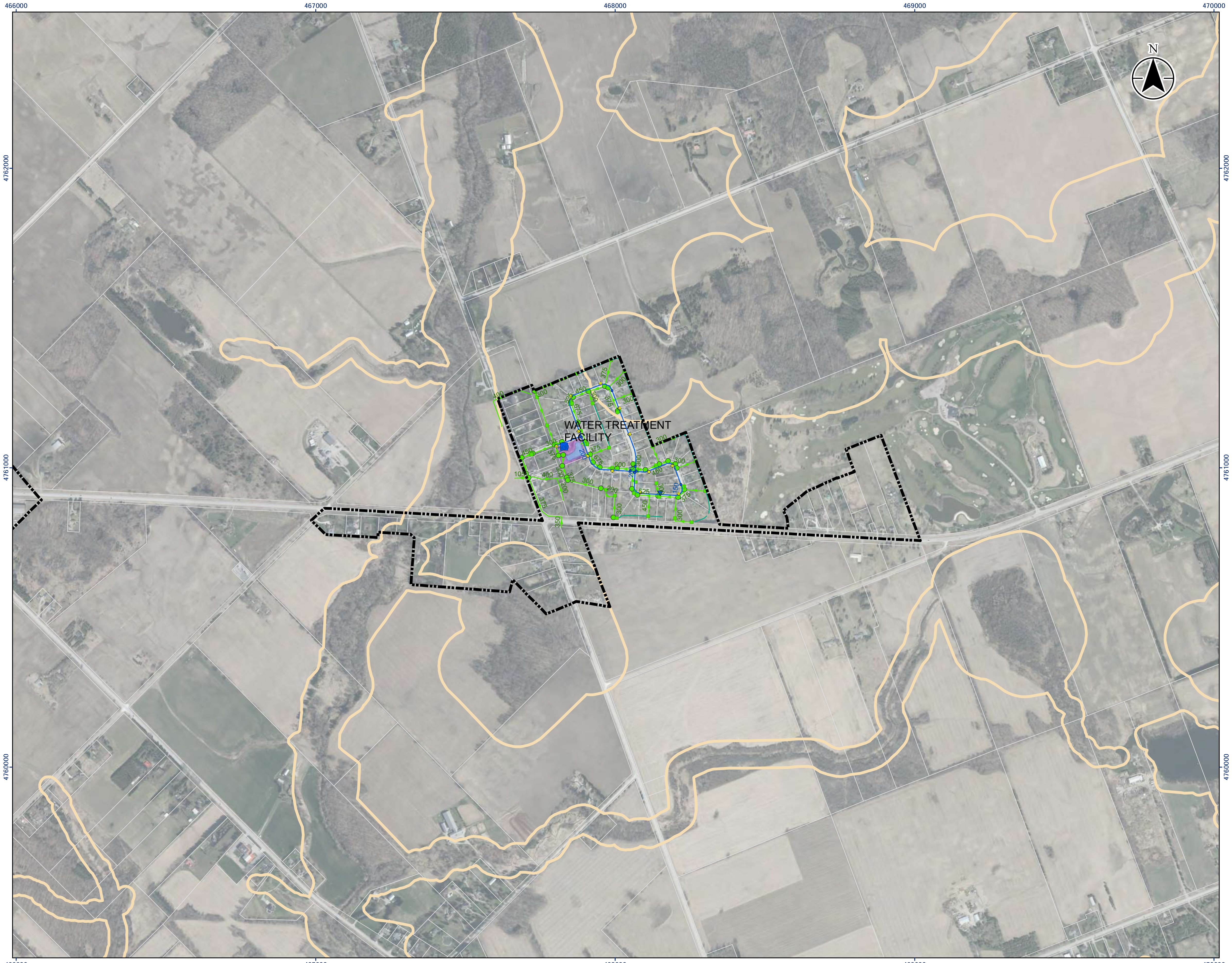
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
2-10

Title
Asset Shapefile Overview
Lobo



Stantec

Legend

- Settlement Boundary
- Regulated
- Parcel
- Subdivision
- Municipally Owned Parcel

Water System

- Facility
- Hydrant
- Chamber
- Curb Stop Valve
- Pump
- Test Station
- Valve
- Lateral
- Watermain
- General Structure

Sanitary System

- Facility
- MH
- Sewer

Storm System

- Catchbasin
- MH
- General Feature
- Lateral
- Sewer
- Swale
- SWM Facility

0 450 900 m

1:13,000 (At original document size of 11x17)

Notes

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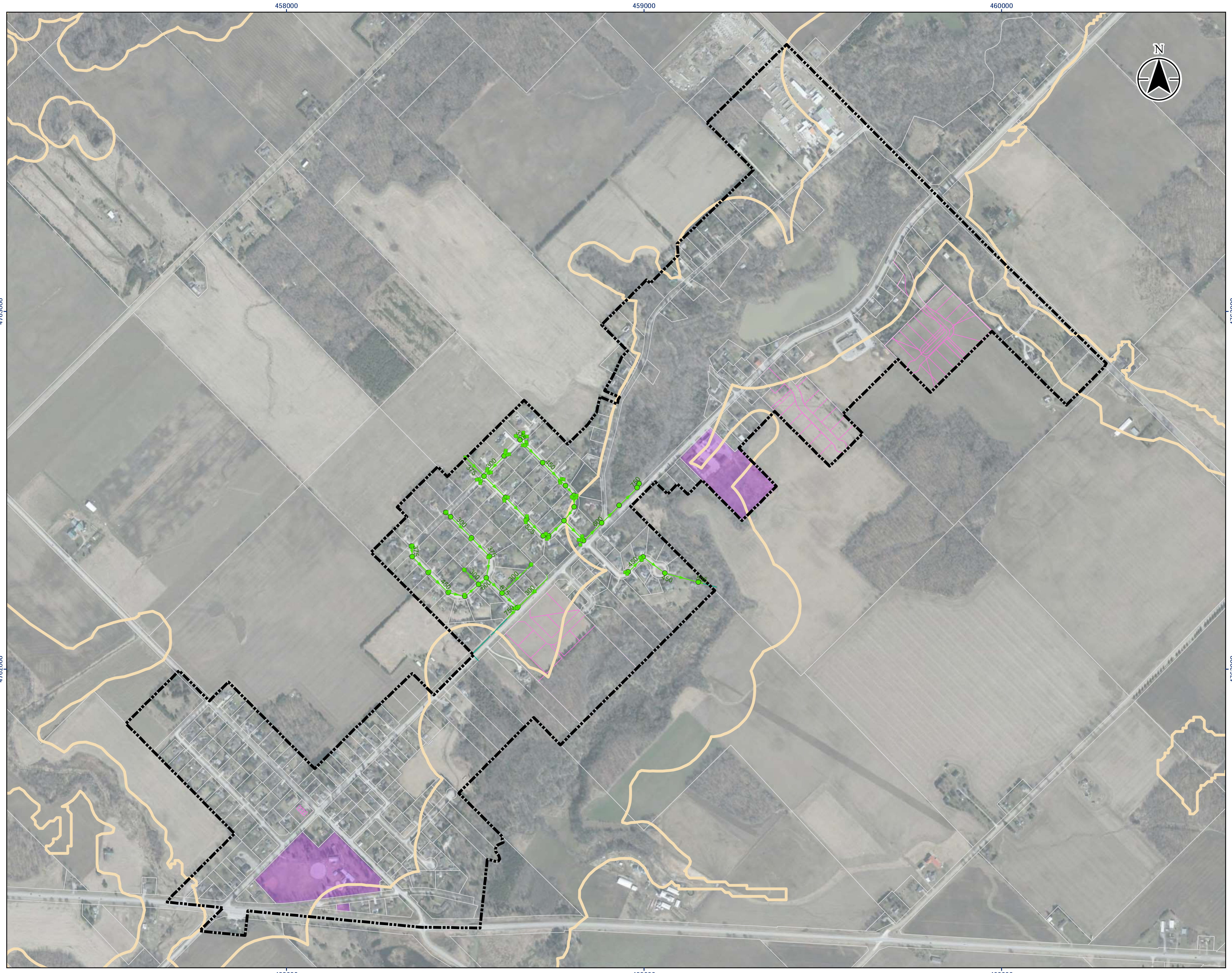
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
2-11

Title
Asset Shapefile Overview
Melrose

V:\01656\active\165630236\preliminary\analysis\gis\mxd\working\165630236_AssetOverview.mxd Revised: 2023-02-06 By: kebuchanan



Stantec

Legend

Settlement Boundary
Regulated
Parcel
Subdivision
Municipally Owned Parcel

Water System
Facility
Hydrant
Chamber
Curb Stop Valve
Pump
Test Station
Valve
Lateral
Watermain
General Structure

Sanitary System
Facility
MH
Sewer

Storm System
Catchbasin
MH
General Feature
Lateral
Sewer
Swale
SWM Facility

0 380 760 m

1:11,000 (At original document size of 11x17)

Notes
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MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
2-12

Title
Asset Shapefile Overview
Poplar Hill/Coldstream

V:\01656\active\165630236\preliminary\analysis\gis\mxd\working\165630236_AssetOverview.mxd Revised: 2023-02-06 By: kebuchanan

2.1 URBAN & COMMUNITY SETTLEMENT AREAS

2.1.1 Ilderton

Ilderton is situated to the northwest of the City of London, near Ilderton Rd & Hyde Park Rd. The Official Plan of the Municipality of Middlesex Centre (2023) designates Ilderton as an *Urban Settlement Area*.

Water is supplied to the Ilderton reservoir by a 300 mm diameter pipe directly connected to the 1200 mm diameter LHPWSS's transmission main. Water is then distributed into the network at the Ilderton BPS, and stored in the Ilderton elevated tank (ET).

As part of the 2010 MSP, a hydraulic model of Ilderton's water distribution system was developed. As part of this 2023 MSP, this model is updated and used to assess current and future infrastructure needs in Ilderton.

2.1.2 Komoka-Kilworth

Kilworth is situated west of the City of London, near Glendon Dr & Coldstream Rd. Komoka is situated west of Kilworth, near Glendon Dr & Komoka Rd. The Official Plan of the Municipality of Middlesex Centre (2023) designates Kilworth-Komoka as an *Urban Settlement Area*.

Water from the LHPWSS is supplied to the Komoka Reservoir by the Komoka-Mt. Brydges booster pumping station. Water is then distributed into the network at the Komoka BPS, and stored in the Komoka ET. An intermediate BPS is used during high demand periods in Kilworth. Since 2022, water is boosted into the Delaware distribution network at the Delaware BPS.

As part of the 2010 MSP, a hydraulic model of the Komoka-Kilworth water distribution system was developed. A separate model for the Delaware water distribution system was merged with this model. As part of this 2023 MSP, this model is updated and used to assess current and future infrastructure needs in Komoka-Kilworth-Delaware.

2.1.3 Delaware

Delaware is situated west of the City of London, near Longwoods Rd & Gideon Dr. The Official Plan of the Municipality of Middlesex Centre (2023) designates Delaware as a *Community Settlement Area*.

Delaware was previously supplied by a direct connection from the City of London. This supply connection was decommissioned in 2022, and replaced by a supply connection from Komoka, with water being boosted at the Delaware BPS. Water is stored in the Delaware standpipe.

As part of the previous 2010 MSP, a hydraulic model of the Delaware water distribution system was developed. This model was merged with the Komoka-Kilworth model. As part of this 2023 MSP, this model is updated and used to assess current and future infrastructure needs in Komoka-Kilworth-Delaware.

2.1.4 Arva

Arva is situated north of the City of London, near Richmond St & Medway Rd. The Official Plan of the Municipality of Middlesex Centre (2023) designates Arva as a *Community Settlement Area*.

Arva is supplied by a direct connection from the City of London distribution system, through a 1,050 mm diameter watermain. Water flows through a small pump station equipped with an inline fire pump, which operates only in the event of a fire demand (rated capacity: 4,500 L/min).

As part of this 2023 MSP, a stand-alone hydraulic model of Arva's water distribution system was developed, and is used to assess current and future infrastructure needs in Arva.

2.2 HAMLET AREAS

2.2.1 Ballymote

Ballymote is situated northeast of the City of London, near Highbury Ave North & Medway Rd. The Official Plan of the Municipality of Middlesex Centre (2023) designates Ballymote as a *Hamlet*.

Ballymote receives water from the City of London through a connection into a 300 mm diameter watermain.

2.2.2 Denfield

Denfield is situated northwest of the City of London, near Denfield Rd & 16 Mile Rd. The Official Plan of the Municipality of Middlesex Centre (2023) designates Denfield as a *Hamlet*.

Denfield currently receives water via a tapped connection to the LHPWSS's 1200 mm diameter transmission main. Water is stored in an on-ground storage tank, and boosted into the distribution system at the Denfield BPS.

2.2.3 Birr

Birr is situated north of the City of London, near Richmond St & 13 Mile Rd. The Official Plan of the Municipality of Middlesex Centre (2023) designates Birr as a *Hamlet*.

Birr is serviced by a combination of private wells and a municipal well. The municipal well services 18 lots along Gwendolyn St. This system has capacity only to service this area and is not intended to be expanded. The remaining households are serviced by private wells.

2.2.4 Bryanston

Bryanston is situated northeast of the City of London, near Highbury Ave North & 12 Mile Rd. The Official Plan of the Municipality of Middlesex Centre (2023) designates Bryanston as a *Hamlet*.

Bryanston has no municipal water infrastructure. Water demand is met through individual private wells and/or treatment systems.

2.2.5 Lobo

Lobo is situated northwest of the City of London, near Egremont Dr & Nairn Rd. The Official Plan of the Municipality of Middlesex Centre (2023) designates Lobo as a *Hamlet*.

Lobo has no municipal water infrastructure. Water demand is met through individual private wells and/or treatment systems.

2.2.6 Melrose

Melrose is situated northwest of the City of London, near Egremont Dr & Vanneck Rd. The Official Plan of the Municipality of Middlesex Centre (2023) designates Melrose as a *Hamlet*.

Water in Melrose is supplied by private well systems. The Wynfield Estates subdivision, situated in Melrose, is serviced by two municipal wells. This well-based system was not designed to be expanded. As a result of declining system condition, high operating costs, increased lifecycle cost and replacement estimates, and ongoing water quality, regulatory and policy impacts, a Class EA was conducted to identify a long-term water servicing solution (Stantec, 2017). The Melrose Water Supply Class EA (Stantec, 2017) identified an interconnection to the LHWPSS transmission as the preferred servicing solution, with retrofits to the WTP to convert the facility to a pumping station.

2.2.7 Poplar Hill – Coldstream

Poplar Hill-Coldstream is situated northwest of the City of London, along Ilderton Rd, between Poplar Hill Rd and Coldstream Rd. The Official Plan of the Municipality of Middlesex Centre (2023) designates Poplar Hill-Coldstream as a *Hamlet*.

Both Poplar Hill and Coldstream have no municipal water infrastructure. Water demand is met through individual private wells and/or treatment systems.

2.3 NON-SETTLEMENT AREAS

Non-settlement areas consist of the following land uses:

- Agriculture;
- Rural Industrial;
- Rural Commercial;
- Parks and Recreations;
- Natural Environment Areas; and,
- Flood Plain.

Non-settlement areas have no infrastructure and thus water demands are met through individual private wells and/or treatment systems.

3.0 EXISTING AND FUTURE POPULATIONS

Existing and future populations were established for this 2023 MSP, and are consistent with the populations used in the wastewater servicing and the waste management components of this MSP. For the water servicing component of the MSP, residential and employment populations are used to calculate water demands used in the supply, storage, pumping capacity and watermain assessments.

3.1 TOTAL POPULATIONS

Stantec established a methodology to estimate total existing populations and future residential and employment growth by using the 2020 Growth Management Study prepared by Watson and Associates and 2021 census data. The methodology was used to obtain total existing and future populations as follows:

- **Residential**: The 2021 census data was used to estimate the residential populations of Middlesex Centre. A Net Under Coverage Rate of 2.8% as per the Ontario 2016 census was applied to this as the 2021 value was not yet released. This was referred to as Adjusted 2021 Population which was used as a base for future projections. Residential growth was projected for each settlement up to 2046 using annual growth rates provided by the Growth Management Study (Watson and Associates, 2020).
- **Employment**: The employment population of each settlement area estimated using GIS data of the industrial, commercial and institutional (ICI) areas designated in the Official Plan. An assumption of 50 jobs per hectare was made for Middlesex Centre to estimate the number of jobs represented by each lot. Manual adjustments were made to the populations of a selection of known businesses to improve accuracy. To project employment population growth up to 2046, the employee growth forecast for Middlesex Centre was used from the Growth Management Study. Only ICI activities were taken into consideration. This was distributed by settlement and added to the current employment populations for each settlement area.

The total existing and future residential and employment populations are used to calculate the demands used in the supply, storage, and pumping capacity assessments. The total populations are presented in **Table 3-1**. Future servicing areas per settlement are illustrated in **Figure 3-1** to **Figure 3-12**. The corresponding water demands are presented in **Section 4.4.1**.

The ongoing design study for the Melrose water supply uses a different population basis than the current 2023 MSP. The populations used in that study are presented in **Table 3-2**.

Table 3-1: Summary of Total Existing and Future Residential (RES) & Employment (EMP) Populations

Horizon	2021		2026		2031		2036		2041		2046	
Settlement Area	**RES**	**EMP**	**RES**	**EMP**	**RES**	**EMP**	**RES**	**EMP**	**RES**	**EMP**	**RES**	**EMP**
Arva	455	318	509	332	571	349	639	365	716	380	803	392
Ballymote	113	0	114	0	115	0	117	0	118	0	119	0
Birr	248	0	250	0	253	0	255	0	258	0	260	0
Bryanston	179	0	181	0	182	0	184	0	186	0	188	0
Coldstream/Poplar Hill	763	0	771	0	779	0	787	0	795	0	803	0
Delaware	1,601	683	1,829	1,074	2,090	1,518	2,387	1,950	2,728	2,359	3,116	2,690
Middlesex Terrace(1)	67	0	67	0	68	0	69	0	70	0	70	0
Denfield	237	0	239	0	241	0	244	0	246	0	249	0
Ilderton	3,695	668	4,160	742	4,684	826	5,273	907	5,937	985	6,685	1,047
Komoka-Kilworth	5,649	1,244	6,939	1,364	8,524	1,501	10,471	1,634	12,862	1,759	15,800	1,861
Kilworth	3,113	255(2)	3,824	279(2)	4,697	307(2)	5,770	335(2)	7,088	360(2)	8,707	381(2)
Komoka	2,536	990(2)	3,115	1,085(2)	3,826	1,194(2)	4,700	1,299(2)	5,774	1,399(2)	7,093	1,480(2)
Lobo	82	0	83	0	84	0	85	0	86	0	86	0
Melrose	296	0	299	0	302	0	305	0	308	0	311	0
Remaining Rural Area	6,075	1,127	6,136	1,188	6,197	1,257	6,259	1,324	6,322	1,388	6,386	1,439
Total	19,458	4,040	21,577	4,700	24,089	5,450	27,075	6,180	30,631	6,870	34,875	7,430

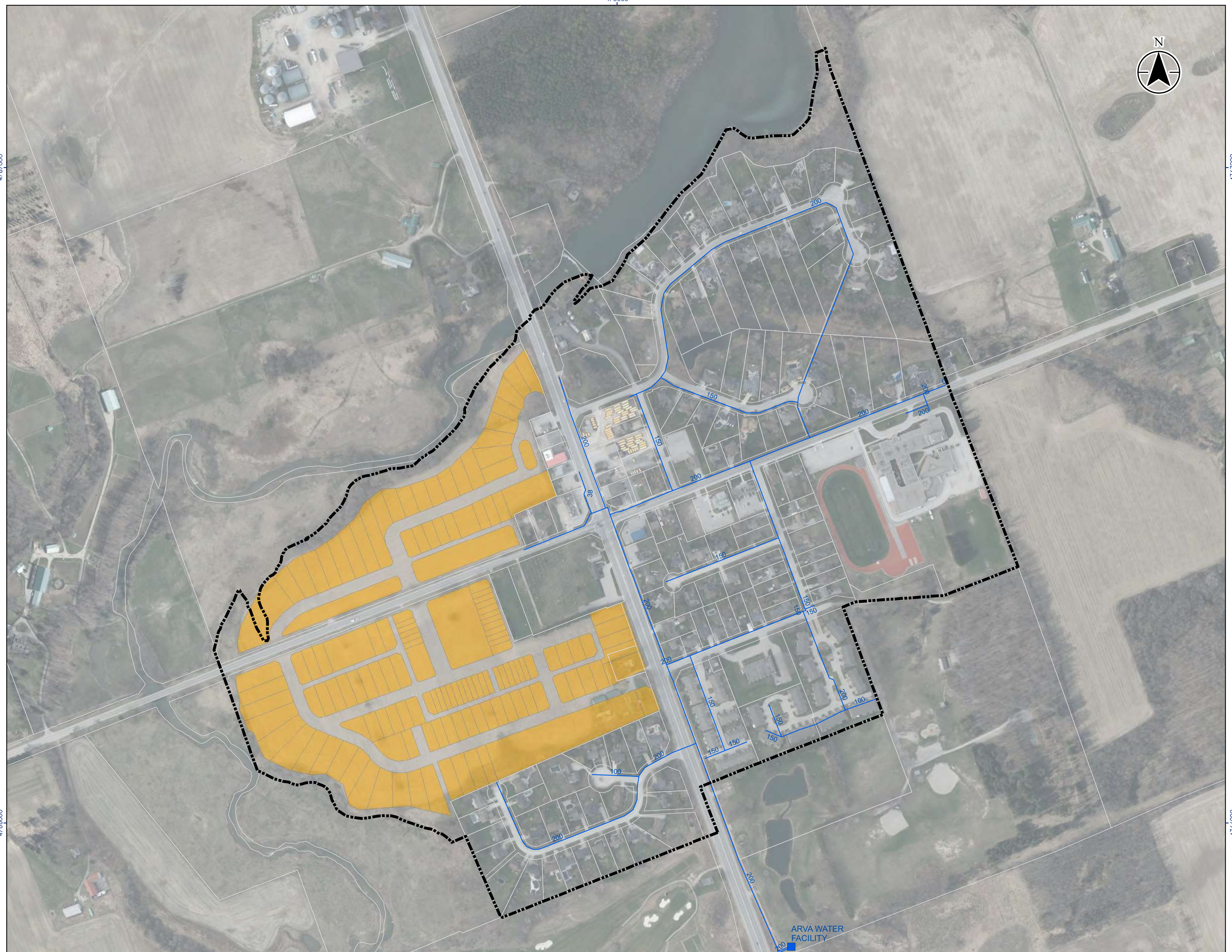
Notes:

(1) For potable water servicing, Middlesex Terrace is considered part of Delaware.

(2) Employment population breakdown between Kilworth and Komoka based on percentage of ICI parcel areas within each settlement (Komoka: 80%; Kilworth: 20%).

Table 3-2: Total Population for Melrose Water Supply Design

Settlement	Total Population		
	Existing Service Area	**Fully Serviced Hamlet**	**Fully Serviced Hamlet + 15 Lots Buffer**
Melrose (Ongoing PDR)	195	333	378



Stantec

Legend

Settlement Boundary

Parcel

Future Servicing

Existing Area to Consider Servicing

Development Area - Residential

Development Area - ICI

Potable Water System

Facility

Pump

Watermain

0 200 400 m

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Project Location
Municipality of Middlesex Centre

165630236 REVA
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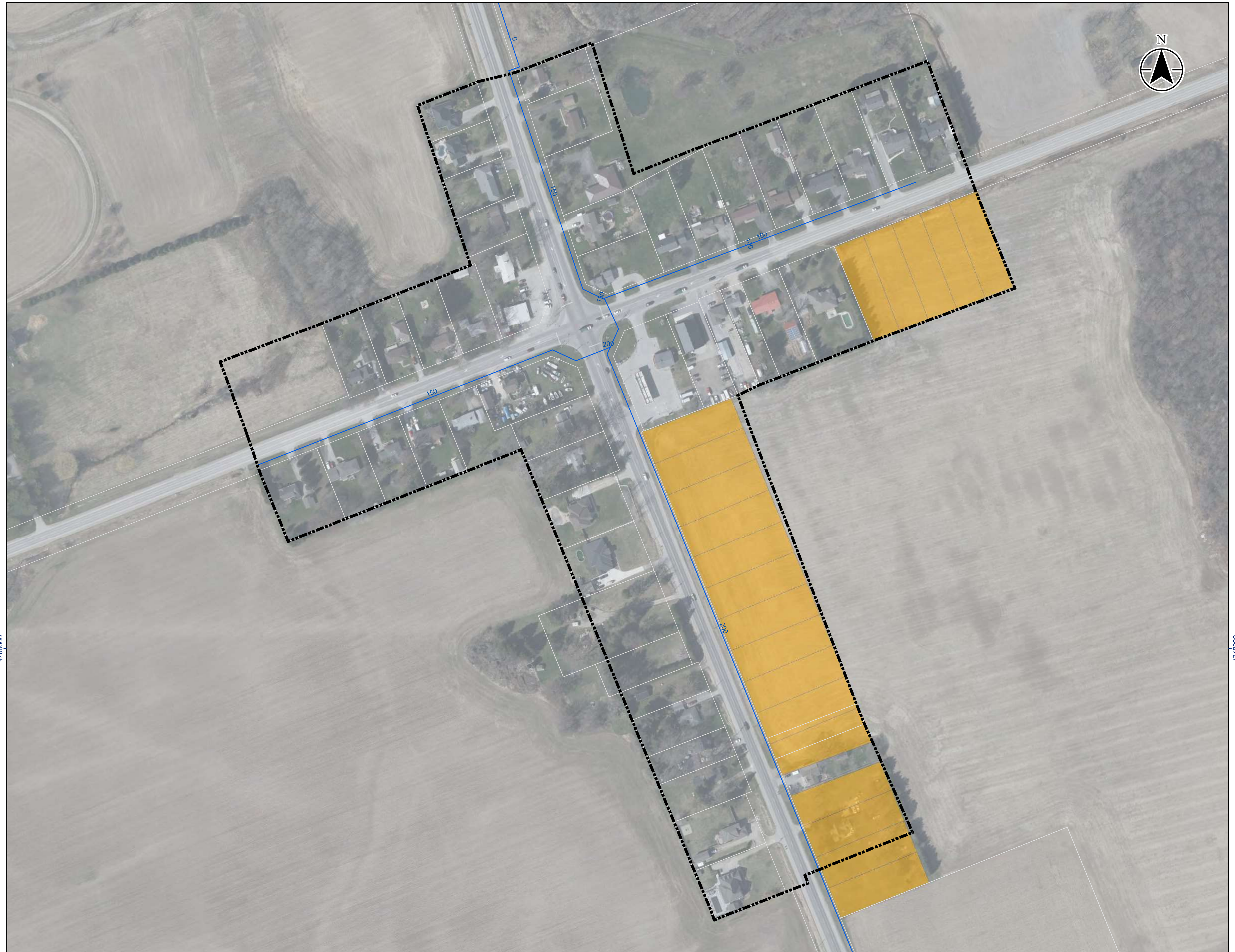
Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
3-1

Title
Future Servicing Areas Arva



Stantec

Legend

- Settlement Boundary
- Parcel

Future Servicing

- Existing Area to Consider Servicing
- Development Area - Residential
- Development Area - ICI

Potable Water System

- Facility
- Pump
- Watermain

0 100 200 m

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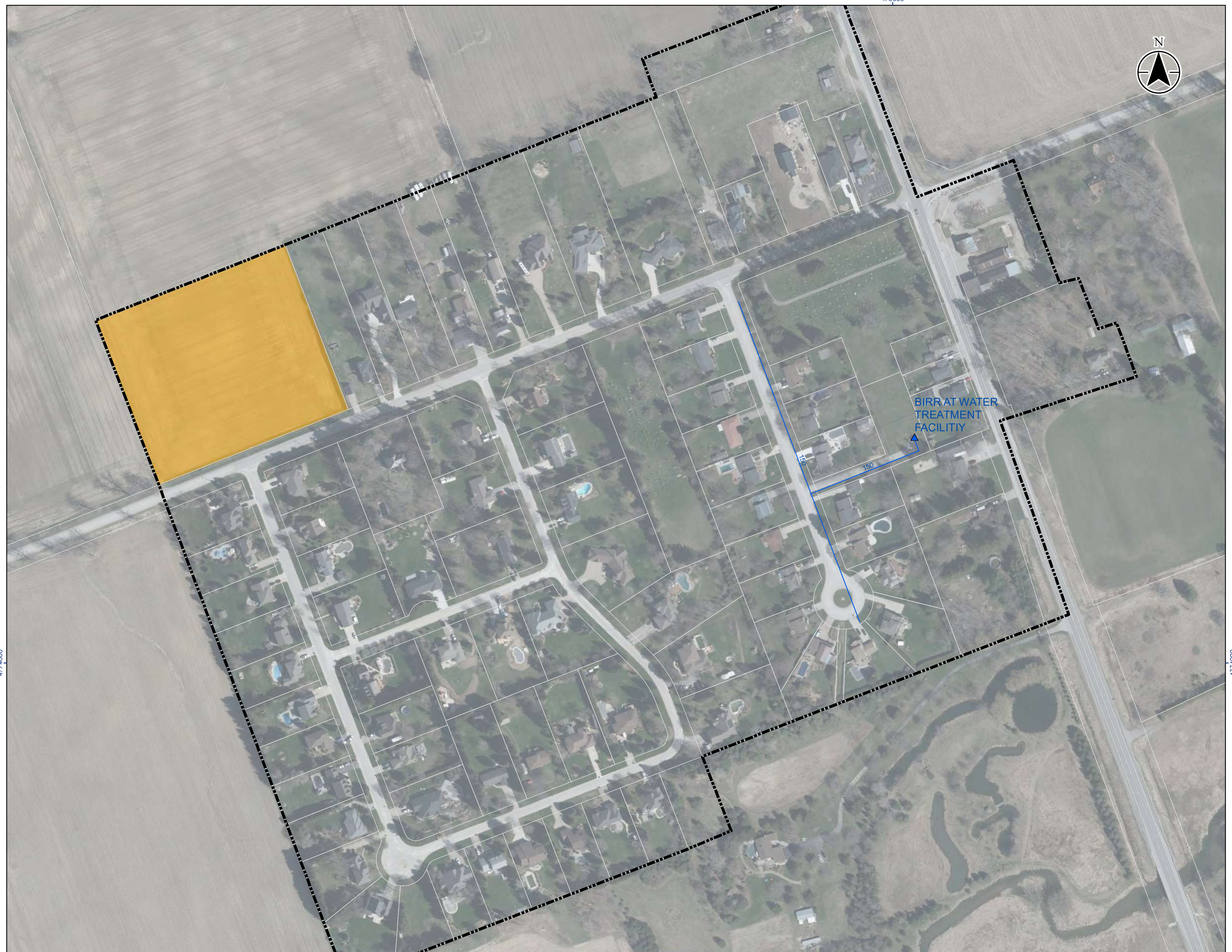
Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
3-2

Title
Future Servicing Areas
Ballymote



Stantec

Legend

- Settlement Boundary
- Parcel

Future Servicing

- Existing Area to Consider Servicing
- Development Area - Residential
- Development Area - ICI

Potable Water System

- Facility
- Pump
- Watermain

0 100 200 m
1:3,000 (At original document size of 11x17)

Notes

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Municipality of Middlesex Centre

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Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
3-3

Title
Future Servicing Areas
Birr

V:\01656\active\165630236\preliminary\analysis\gis\mxd\TM_Water\165630236_Water_FutureServicing_REV.mxd Revised: 2024-04-18 By: kebuchanan

Stantec

Legend

Settlement Boundary

Parcel

Future Servicing

Existing Area to Consider Servicing

Development Area - Residential

Development Area - ICI

Potable Water System

Facility

Pump

Watermain

0 130 260 m

1:4,000 (At original document size of 11x17)

Notes

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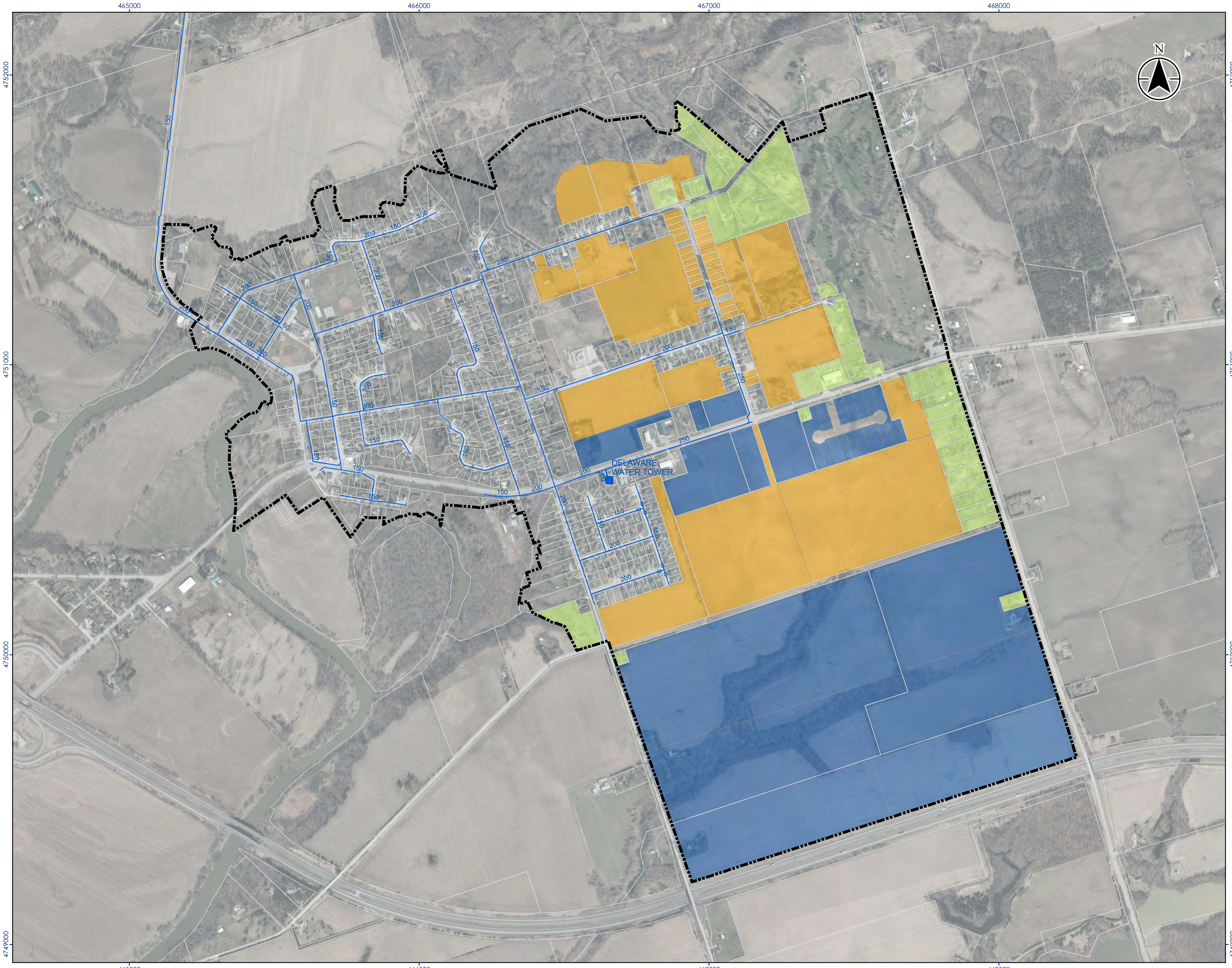
Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
3-4

Title
Future Servicing Areas
Bryanston



Stantec

Legend

- Settlement Boundary
- Parcel

Future Servicing

- Existing Area to Consider Servicing
- Development Area - Residential
- Development Area - ICI

Potable Water System

- Facility
- Pump
- Watermain

0 470 940 m

1:13,500 (At original document size of 11x17)

Notes

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Project Location
Municipality of Middlesex Centre

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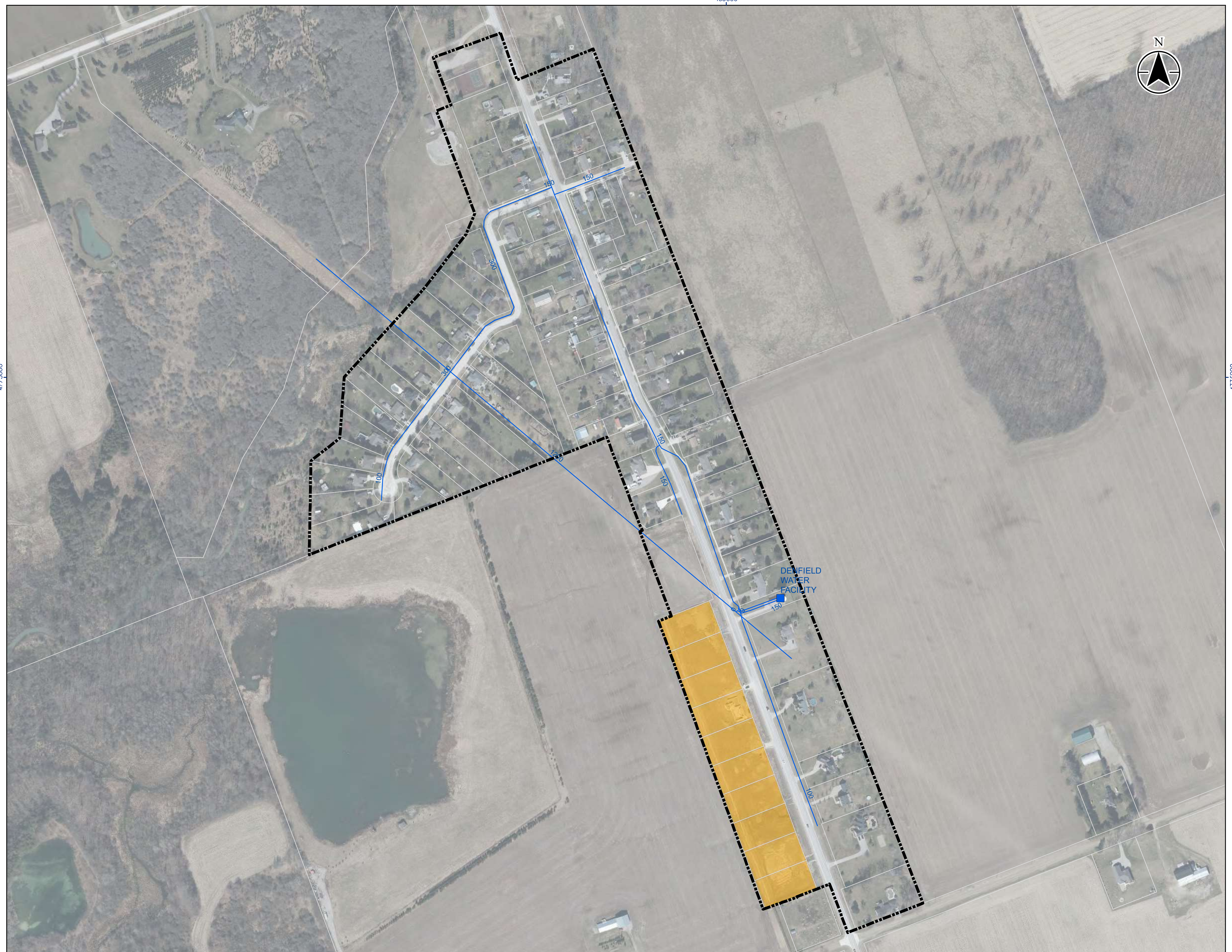
Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
3-5

Title
Future Servicing Areas Delaware



Stantec

Legend

- Settlement Boundary
- Parcel

Future Servicing

- Existing Area to Consider Servicing
- Development Area - Residential
- Development Area - ICI

Potable Water System

- Facility
- Pump
- Watermain

0 170 340 m

1:5,000 (At original document size of 11x17)

Notes

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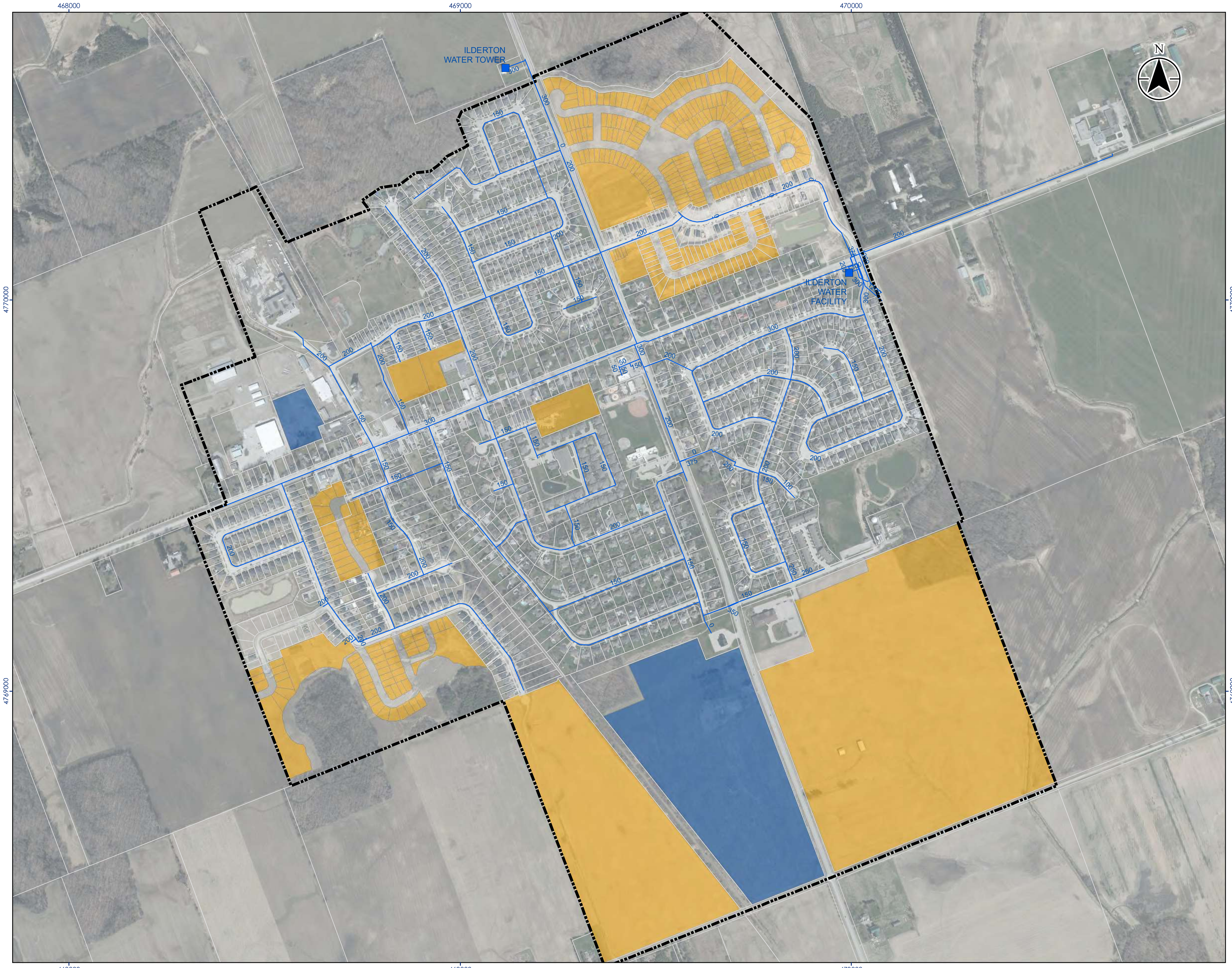
Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
3-6

Title
Future Servicing Areas Denfield



Stantec

Legend

- Settlement Boundary
- Parcel

Future Servicing

- Existing Area to Consider Servicing
- Development Area - Residential
- Development Area - ICI

Potable Water System

- Facility
- Pump
- Watermain

0 340 680 m
1:10,000 (At original document size of 11x17)

Notes

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Project Location
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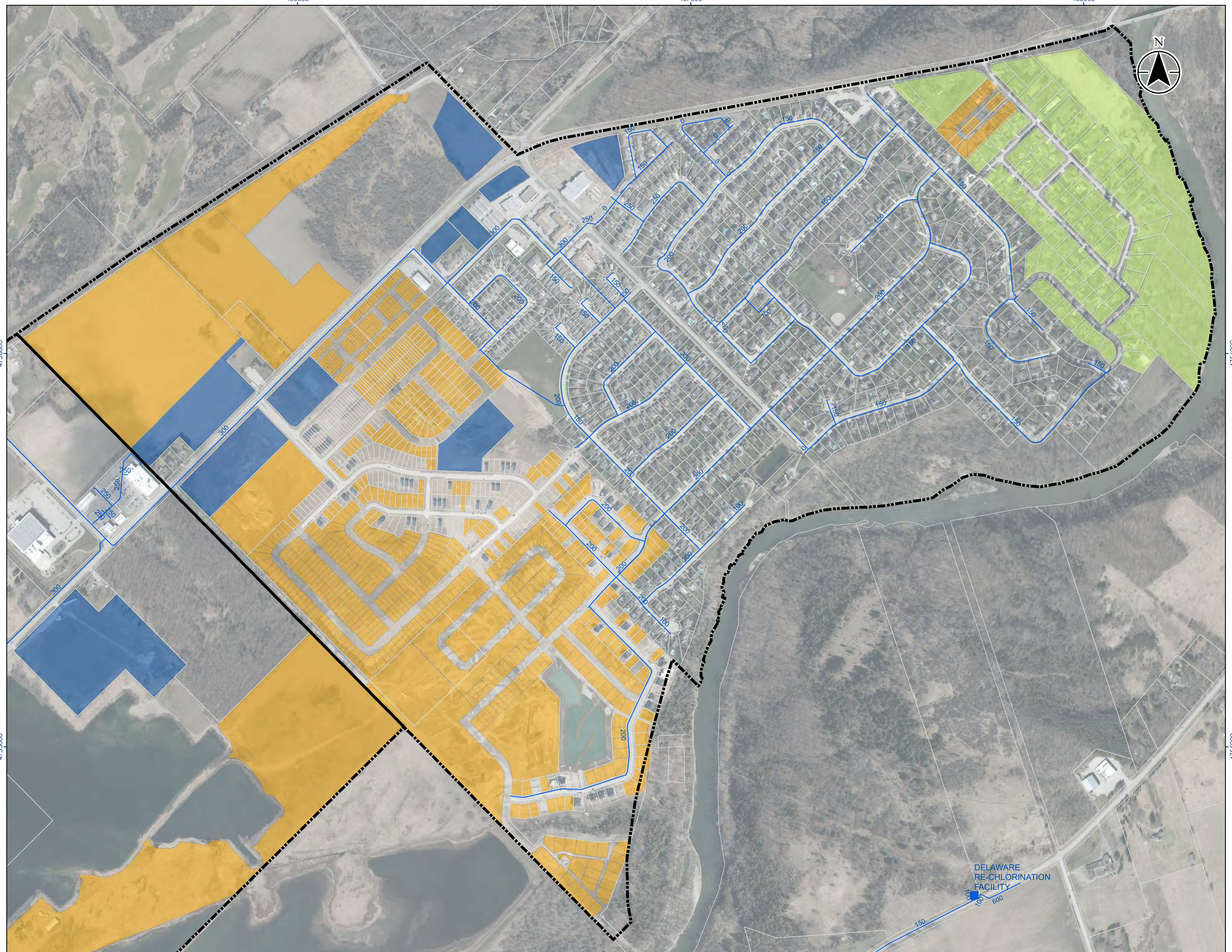
Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
3-7

Title
Future Servicing Areas Ilderton



Stantec

Legend

- Settlement Boundary
- Parcel

Future Servicing

- Existing Area to Consider Servicing
- Development Area - Residential
- Development Area - ICI

Potable Water System

- Facility
- Pump
- Watermain

0 340 680 m

1:10,000 (At original document size of 11x17)

Notes

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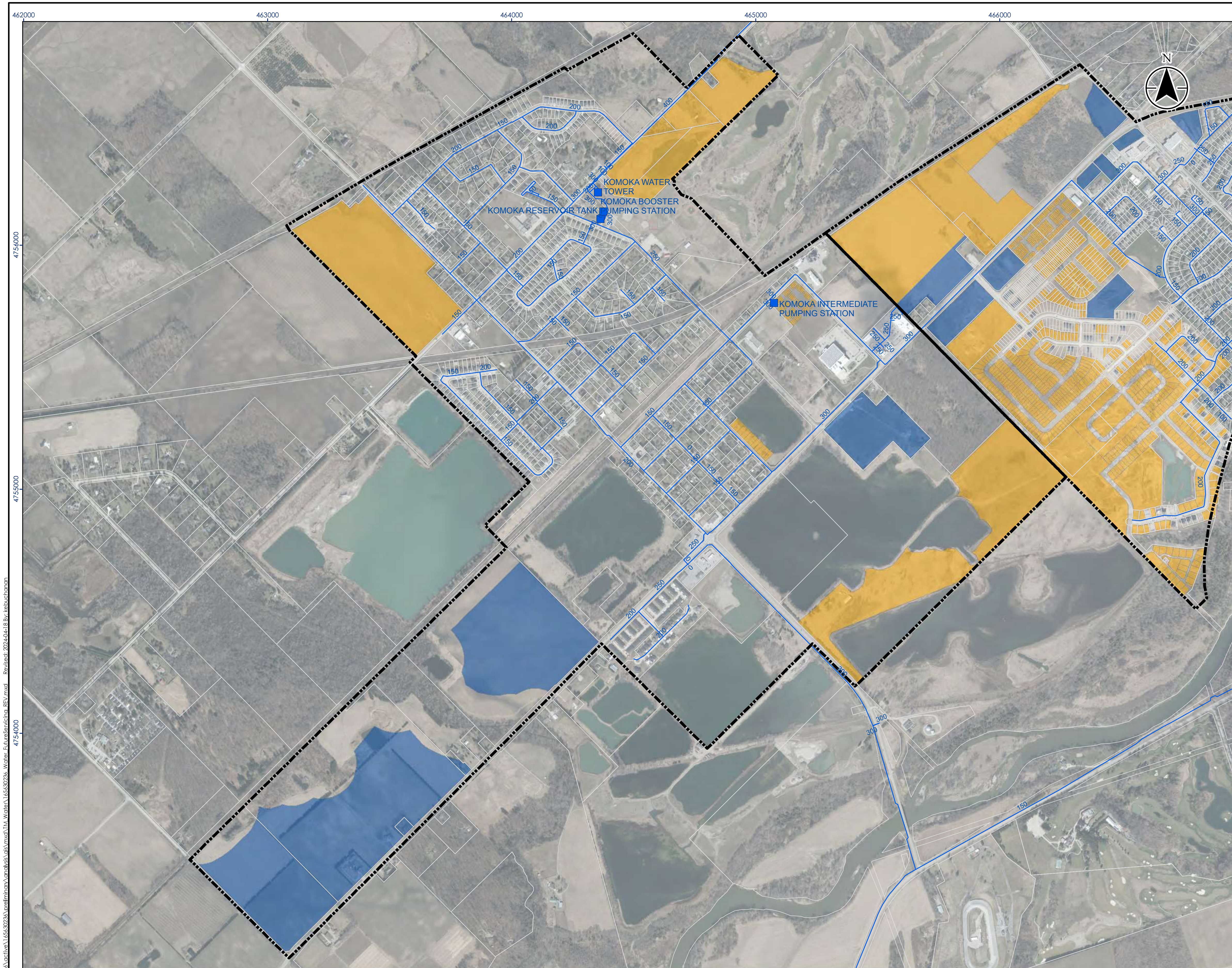
Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
3-8

Title
Future Servicing Areas Kilworth



Stantec

Legend

- Settlement Boundary
- Parcel

Future Servicing

- Existing Area to Consider Servicing
- Development Area - Residential
- Development Area - ICI

Potable Water System

- Facility
- Pump
- Watermain

0 550 1,100 m

1:16,000 (At original document size of 11x17)

Notes

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Project Location
Municipality of Middlesex Centre

165630236 REVA
Prepared by KDB on 2024-04-18

Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
3-9

Title
Future Servicing Areas Komoka

![Stantec]

Stantec

Legend

Settlement Boundary

Parcel

Future Servicing

Existing Area to Consider Servicing

Development Area - Residential

Development Area - ICI

Potable Water System

Facility

Pump

Watermain

0 120 240 m

1:3,500 (At original document size of 11x17)

Notes

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Project Location
Municipality of Middlesex Centre

165630236 REVA
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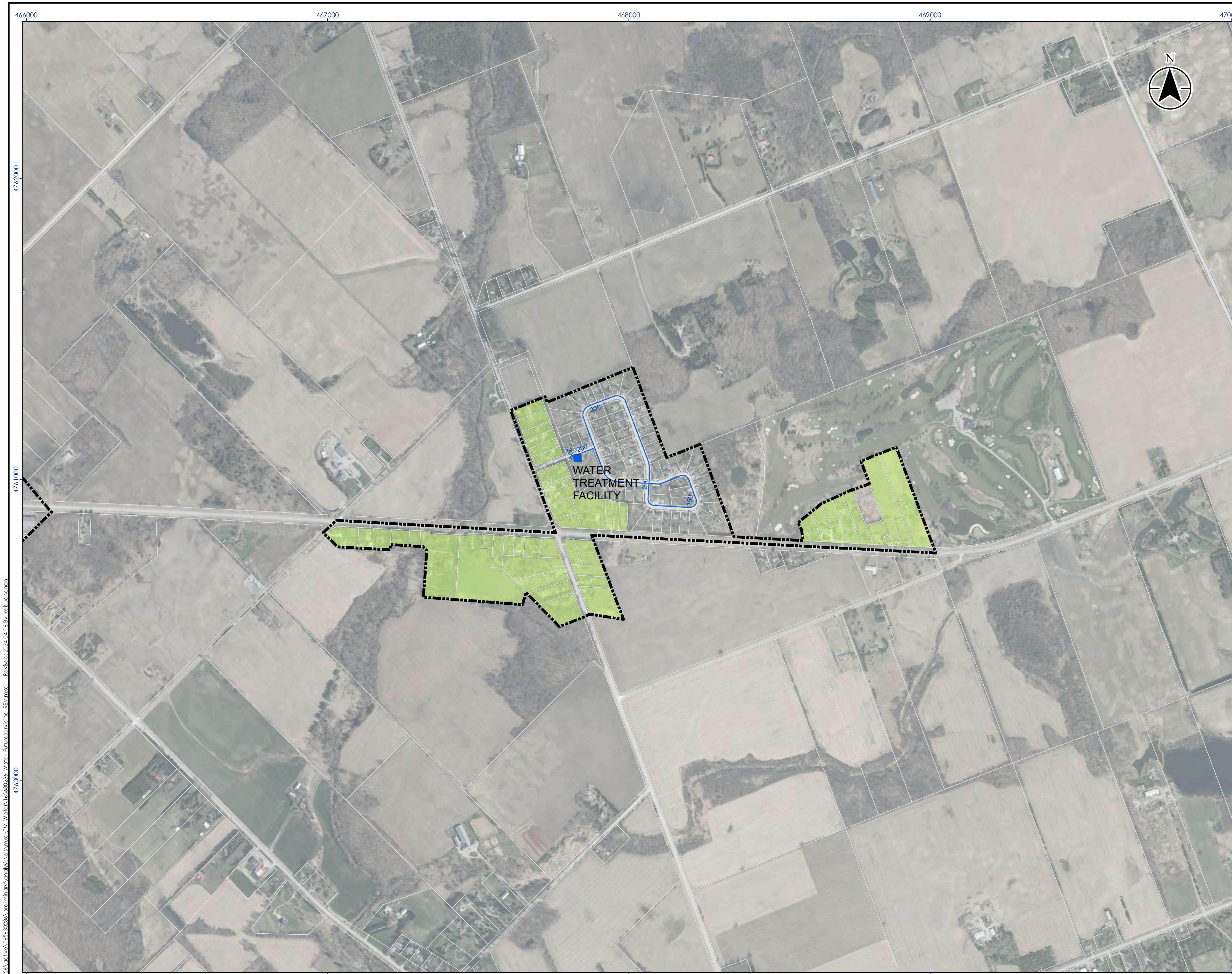
Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
3-10

Title
Future Servicing Areas
Lobo

V:\01656\active\165630236\preliminary\analysis\gis\mxd\TM_Water\165630236_Water_FutureServicing_REV.mxd Revised: 2024-04-18 By: kebuchanan



Stantec

Legend

Settlement Boundary

Parcel

Future Servicing

Existing Area to Consider Servicing

Development Area - Residential

Development Area - ICI

Potable Water System

Facility

Pump

Watermain

0 450 900 m

1:13,000 (At original document size of 11x17)

Notes

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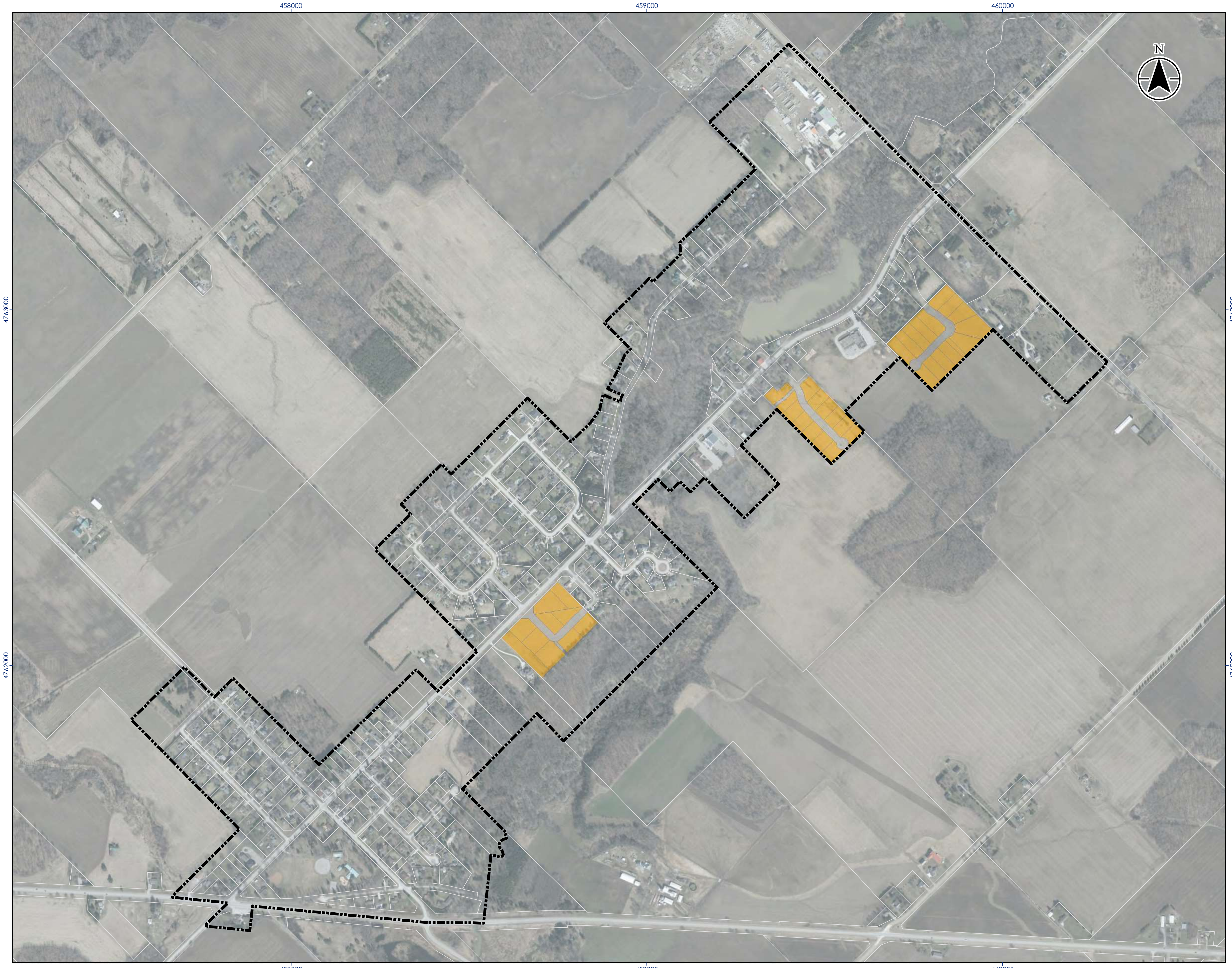
Project Location
Municipality of
Middlesex Centre

165630236 REVA
Prepared by KDB on 2024-04-18

Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
3-11

Title
Future Servicing Areas
Melrose



Stantec

Legend

- Settlement Boundary
- Parcel

Future Servicing

- Existing Area to Consider Servicing
- Development Area - Residential
- Development Area - ICI

Potable Water System

- Facility
- Pump
- Watermain

0 380 760 m

1:11,000 (At original document size of 11x17)

Notes

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Project Location
Municipality of Middlesex Centre

165630236 REVA
Prepared by KDB on 2024-04-18

Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
3-12

Title
Future Servicing Areas
Poplar Hill/Coldstream

3.2 SPATIALLY DISTRIBUTED POPULATIONS

For the watermain assessment using the hydraulic model, spatially distributed residential and employment demands are needed. Hydraulic models are available for the settlements of Arva, Ilderton, Komoka, Kilworth and Delaware (as listed in **Table 4-4**). The spatially distributed populations are determined based on GIS information as follows:

- **Residential**: GIS parcel information was used to determine existing equivalent population based on land use type (low density residential, medium density residential) and population densities per the design guidelines (presented in **Table 3-3**). Future population is based on spatially distributing the residential population growth presented in **Table 3-1** onto the growth areas presented in **Figure 3-1** to **Figure 3-12**, using uniform population growth density within each settlement.
- **Employment**: GIS parcel information was used to determine existing equivalent ICI population based on population densities per the design guidelines (presented in **Table 3-3**). Future ICI population is based on spatially distributing the employment population growth presented in **Table 3-1** onto the growth areas presented in **Figure 3-1** to **Figure 3-12**, using uniform employment population growth density within each settlement.
- **Schools**: Existing school student counts were obtained from reports (where available), or estimated based on design guidelines (presented in **Table 3-3**). No specific growth information on school population was provided, or is assumed to be included in the employment/ICI growth.

The resulting total existing and future populations are presented in **Table 3-4**. Due to the different approach used to determine the existing population based on GIS information and design guideline parameters, the resulting total existing populations will differ from the totals determined using census information presented in **Table 3-1**. In most of the settlements, the spatial distribution approach overestimates the total (residential + employment) population. For the purposes of long-term planning and sizing of watermains, these overestimations are acceptable, as there is less flexibility to incrementally upsize watermains. They are thus sized with additional buffer capacity, accommodating potential uncertainties in the population projections.

Table 3-3: Population Density by Land Use (per the Middlesex Infrastructure Design Standards [January 2018])

Land Use	Population Density
Low Density Residential	3 people/unit
Medium Density Residential	2.4 people/unit
ICI	100 people/hectare
Elementary School	400 students
Secondary School	1500 students

Table 3-4: Existing Unit Counts and Growth Areas (Based on GIS) and Equivalent Population for Hydraulic Model Allocation

Horizon	Existing Unit Counts (Based on GIS) and Equivalent Populations								Growth Areas (Based on GIS) and Equivalent Populations					Future (Existing + Growth) Populations	
Settlement	**Low Density Residential (units)**	**Medium Density Residential (units)**	**ICI Area (hectares)**	**School Capacity (students)**	**Low Density Population (ppl)**	**Medium Density Population (ppl)**	**Total Residential Population** ***(Difference with Table 3-1)***	**Total ICI Equivalent Population** ***(Difference with Table 3-1)***	**Residential Growth Areas (ha)**	**Existing Units Not Yet Serviced (units)**	**ICI Areas (ha)**	**Total Residential Population Growth**	**ICI Equivalent Population**	**Total Residential Population**	**Total ICI Equivalent Population**
Arva	112	66	7.9	1,233	336	158	494 *(+39)*	787 *(+469)*	+16.7	-	-	+348	-	842	787
Ilderton	1,120	158	29.2	501	3,360	379	3,739 *(+44)*	2,925 *(+2,257)*	+94.6	-	+22.2	+2,990	+380	6,729	3,305
Delaware	525	20	32.2	1,059	1,575	48	1,623 *(+22)*	3,224 *(+2,541)*	+89.8	-	+144.8	+1,515	+2,007	3,138	5,231
Kilworth	698	66	10.4	0	2,094	158	2,252 *(-861)*	1,035 *(+780)*	+92.9	+78	+15.7	+6,051	+120	8,303	1,155
Komoka	712	150	40.2	1,002	2,136	360	2,496 *(-40)*	4,021 *(+3,031)*	+69.7	-	+61.3	+4,557	+491	7,053	4,512

4.0 ASSESSMENT OF EXISTING SYSTEMS

The following section describes the applicable standards and design guidelines used to define the target level of service (LOS) criteria for the baseline conditions assessment, and identification of future servicing needs. These criteria are then used to assess the existing systems, under existing and growth demand conditions.

4.1 APPLICABLE STANDARDS AND DESIGN GUIDELINES

The following standards and design guidelines were referred to throughout this 2023 MSP for the assessment of the water systems:

- Middlesex Infrastructure Design Standards (January 2018)

The Middlesex Infrastructure Design Standards (last updated in January 2018) outline minimum standards for the design and construction of watermains. The standards provide design criteria and target LOS requirements which are used to assess the municipality's water systems.

- Ontario Ministry of the Environment, Conservation and Parks (MECP) *Design Guidelines for Drinking-Water Systems* (2019)

The MECP Design Guidelines (last updated in 2019) outline requirements for storage assessment. Furthermore, the MECP Guidelines provide design criteria ranges, which are compared against the parameters derived and used in this 2023 MSP.

- City of London *Design Specifications & Requirements Manual* (August 2019)

The City of London Design Specifications & Requirements Manual (August 2019) also outline minimum standards for the design and construction of watermains. For this 2023 MSP, reference to these standards is made to complement local and provincial guidelines.

- Great Lakes – Upper Mississippi River Board (GLUMRB) *Recommended Standards for Water Works* (2022)

The GLUMRB *Recommended Standards for Water Works* (last updated in 2022), also known as the "Ten State Standards", provide guidelines for the design of public water supply systems. For this 2023 MSP, reference to these standards is made to complement local and provincial guidelines.

- American Water Works Association (AWWA) Standards

The AWWA standards are industry accepted standards which pertain to the design and production of water in various areas of water treatment and supply. For this 2023 MSP, reference to these standards is made to complement local and provincial guidelines.

4.2 POLICY REVIEW

The following policies were reviewed and considered as part of the assessment of the existing potable water servicing systems.

4.2.1 Safe Drinking Water Act, 2002

The Safe Drinking Water Act (2002; last amended in 2021) encompasses all the aspects and responsibilities for operating a drinking water system in Ontario, to ensure safe drinking water access and prevent related health hazards:

> *The purposes of this Act are as follows:*
>
> *1. To recognize that the people of Ontario are entitled to expect their drinking water to be safe.*
>
> *2. To provide for the protection of human health and the prevention of drinking water health hazards through the control and regulation of drinking water systems and drinking water testing.*

4.2.1.1 Safe Water Drinking Act, 2002 - Ontario Regulation 169/03 Ontario Drinking Water Quality Standards

The Safe Water Drinking Act, 2002 - Ontario Regulation 169/03 Ontario Drinking Water Quality Standards (O. Reg. 169/03; last amended in 2020) provides the standards and compliance requirements for Ontario drinking water. These are presented into schedules, each providing the standards for microbiological, chemical, and radiological water quality parameters.

4.2.1.2 Safe Water Drinking Act, 2002 - Ontario Regulation 170/03 Drinking Water Systems

The Safe Water Drinking Act, 2002 - Ontario Regulation 170/03 Drinking Water Systems (O. Reg. 170/03; last amended in 2022) regulates municipal and private water systems that provide water to year-round residential developments and designated facilities that serve vulnerable populations such as children and the elderly.

4.2.1.3 Safe Water Drinking Act, 2002 - Ontario Regulation 188/07 Licensing of Municipal Drinking Water Systems

The Safe Water Drinking Act, 2002 - Ontario Regulation 188/07 Licensing of Municipal Drinking Water Systems (O. Reg. 188/07; last amended in 2008) pertains to the validity of municipal drinking water licenses (timeline & ownership).

4.2.1.4 Safe Water Drinking Act, 2002 – Ontario Regulation 453/07 Financial Plans

The Safe Water Drinking Act, 2002 – Ontario Regulation 453/07 Financial Plans (O. Reg. 453/07; last amended in 2008) pertains to the requirement to prepare financial plan in order to obtain and maintain a drinking water license.

4.2.2 Sustainable Water and Sewage Systems Act, 2002

The Sustainable Water and Sewage Systems Act (2002) outlines the requirements for municipalities to report on the cost of water and wastewater services, and define plans for cost recovery (e.g., taxes, rate payers, grants, reserve funds).

4.2.3 Ontario Water Resources Act

The Ontario Water Resources Act (last amended in 2021) governs water quality and quantity in Ontario.

> *The purpose of this Act is to provide for the conservation, protection and management of Ontario's waters and for their efficient and sustainable use, in order to promote Ontario's long-term environmental, social and economic well-being.*

4.2.3.1 Ontario Water Resources Act – Ontario Regulation 903/90 Wells

The Ontario Water Resources Act – Ontario Regulation 903/90 Wells (O. Reg. 903/90; last amended in 2020) pertains to the design, construction, operation, and decommissioning of wells.

4.2.3.2 Ontario Water Resources Act -Ontario Regulation 387/04 Water Taking and Transfer

The Ontario Water Resources Act -Ontario Regulation 387/04 Water Taking and Transfer (O. Reg. 387/04; last amended in 2021) pertains to the issuing of permits to take and transfer water, and permit holders' data collection and reporting duties. An application for permitting should consider issues related to the protection of ecosystems, water availability, the intended water use, and the return of water.

4.3 TARGET LEVEL OF SERVICE

4.3.1 Water Demand Design Criteria

Water demands for the supply, pumping, storage and watermain assessments are calculated based on the populations presented in **Section 3.0**, combined with water demand rates and peaking factors for different demand conditions.

The Average Day Demand (ADD) water demand rate per the Middlesex Infrastructure Design Standards (January 2018) is 350 L/c/d. While this design value is appropriate for the site-level design of watermains for new subdivisions/sites where historical water consumption information is not available, it is higher than actual water consumption rates, and can lead to oversizing of system-level water servicing infrastructure for master-planning purposes. As shown in **Table 4-1**, historical water consumption rates back-calculated from SCADA range from 122 L/c/d to 262 L/c/d, depending on the settlement. Based on a similar review for the wastewater systems, a planning-level water consumption rate of 240 L/c/d is generally used across all settlements, for both the existing and growth demands. The following exceptions were made:

- For the water supply assessment for Arva, the higher historical water consumption rate of 160 L/c/d was used to calculate water demands and costs comparable to the billing records from the City of London for January-March 2023. This forms the basis of the water supply alternative solutions assessment for Arva, presented in **Section 5.3.1**.
- The ongoing design study for the Melrose water supply uses the design guidelines rate of 350 L/c/d.

Peaking factors are applied to the ADD to calculate Maximum Day Demand (MDD) and Peak Hour Demand (PHD). For the capacity assessment, peaking factors per the Middlesex Infrastructure Design Standards (January 2018) are applied, which decrease with increasing population (as peaks are less pronounced relative to average consumption), for optimized sizing of supply, pumping and storage infrastructure. For the hydraulic assessment, uniform peaking factors are applied, to provide buffer in the sizing of watermains, as there is less flexibility to incrementally upsize watermains once they are built.

Table 4-1: Water Demand Rates for Average Day Demand

Settlement Area	Historical Water Consumption Rates[1] (L/c/d)	Water Consumption Rates (L/c/d)			
		Capacity Assessment		Hydraulic Modelling	
		Existing	Growth	Existing	Growth
Arva	149 - 161	Supply: 160[2] Storage & Pumping: 240	240	240	240
Ballymote	164 - 238	240	240	N/A – Not Modelled	
Birr	N/A	240	240	N/A – Not Modelled	
Bryanston	N/A	240	240	N/A – Not Modelled	
Coldstream/Poplar Hill	N/A	240	240	N/A – Not Modelled	
Delaware **Middlesex Terrace[3]**	160 - 178	240	240	240	240
Denfield	175 - 262	240	240	N/A – Not Modelled	
Ilderton	160 - 167	240	240	240	240
Komoka-Kilworth	152 - 170[4]	240	240	240	240
Komoka-Kilworth-Delaware	184[5]	240	240	240	240
Lobo	N/A	240	240	N/A – Not Modelled	
Melrose	122 - 149	MSP: 240 PDR: 350[6]	MSP: 240 PDR: 350[6]	N/A – Not Modelled	
Remaining Rural Areas	N/A	240	240	N/A – Not Modelled	

<u>Notes</u>:

(1) Unless otherwise noted, historical water consumption rates are back calculated from 2020-2022 SCADA data, using 2021 population.

(2) For the water supply assessment for Arva, the higher historical water consumption rate of approximately 160 L/c/d was used to calculate water demands and costs comparable to the billing records from the City of London for January-March 2023.

(3) For potable water servicing, Middlesex Terrace is considered part of Delaware.

(4) Based on SCADA data from 2020-2021; 2022 data would include Delaware demands, as the Delaware system was connected to Komoka-Kilworth in October 2022.

(5) Based on SCADA data at the Komoka BPS from November 2022 to December 2022, following connection of the Delaware system to Komoka-Kilworth.

(6) The ongoing preliminary design for the Melrose water supply project is based on a water consumption rate of 350 L/c/d.

Table 4-2: Peaking Factors

Population	Capacity Assessment		Hydraulic Modelling	
	MDD (x ADD)	PHD (x ADD)	MDD (x ADD)	PHD (x ADD)
500 – 1,000	2.75	4.13	2.0	4.0
1,001 – 2,000	2.5	3.75		
2,001 – 3,000	2.25	3.38		
3,001 – 10,000	2	3		
10,001 – 25,000	1.9	2.85		

4.3.2 Supply

Current water supply agreements and relevant regulatory documents (e.g., PTTWs) are reviewed and compared against current and projected demands. This is to confirm whether existing water supply can provide sufficient capacity for demands within each community, and to identify if future supply capacity increases or new servicing solutions are needed. Supply capacity is compared against existing and projected demands as follows:

- For settlements supplied by the LHWPSS, the existing and projected MDD demands are reported. The LHWPSS does not impose a limit on its supply of MDD, but the reported MDD demands can inform future LHWPSS infrastructure planning and agreements.
- For settlements supplied by the City of London, the existing and projected service areas (serviced parcels) are compared against the existing agreements' boundaries. The existing agreements do not specify a limit on their supply, but the projected service areas can inform future revisions to the servicing area boundaries.
- For settlements supplied by municipal wells, the existing and projected demands are compared against the well supply capacity. The selected demand scenario will depend on the system layout, and whether storage is available to offset peak demands (in which case, the MDD scenario is used) or not (in which case, the PHD scenario is used).
- For settlements supplied by private wells, no demand comparison is presented, as individual private well capacities are outside the scope of this 2023 MSP.

4.3.3 Pumping

Pumping within each settlement and facility is assessed based on the firm capacity, i.e., the capacity without the largest pump out of service. Where balancing storage is available within the system, firm capacity is compared against MDD demand. In systems without balancing storage to offset peak demands, firm capacity is compared against peak demands (the greater of PHD or MDD+FF).

4.3.4 Storage

Storage requirements are assessed using the MECP *Design Guidelines for Drinking-Water Systems* (2019), according to which reservoir storage is a function of the population serviced and includes an allowance for the following storage components:

- **Fire Storage (Volume A)** is the volume of water required to fight fires at a prescribed fire flow rate and for a minimum required duration. The MECP design guidelines provide fire flow rates and durations based on population. The product of fire flow rate and duration yield the required fire storage.
- **Equalization Storage (Volume B)** is the volume of water stored in order to augment pumped flow (maximum day flow) during periods of high demand (during peak hour). During periods of low consumption (less than maximum day demand) excess flows are used to fill the reservoir. The MECP recommends equalization storage equivalent to 25% of the maximum day demand.
- **Emergency Storage (Volume C)** is the volume of water stored for unexpected contingencies, such as equipment failure at the water supply facility. The MECP recommends emergency storage equivalent to 25% of both fire and equalization storage.

4.3.5 Water Distribution Network

4.3.5.1 Pressures

The Middlesex Infrastructure Design Standards (January 2018) outline watermain design requirements to maintain target pressures under different demand scenarios. Per these guidelines, watermains are to be sized to maintain the greater of:

- Maximum day demand plus fire flow (MDD+FF) at a pressure not less than 140 kPa (20 psi) at any hydrant lateral or potential fire service connection;
    - For the water distribution network assessment, a target fire flow of 76 L/s (4,500 L/min) as listed in the City of London *Design Specifications & Requirements Manual* is used.
- Maximum hourly demand (PHD) at a pressure not less than 275 kPa (40 psi) in residential areas and not less than 310 kPa (45 psi) in industrial areas;
- Average day demand (ADD) at a pressure not less than 275 kPa (40 psi) in residential areas; and,
- Maximum residual pressure should not exceed 550 kPa (80 psi) and minimum residential pressure shall not be below 275 kPa (40 psi).

These requirements are summarized in **Table 4-3**, and are used to assess infrastructure requirements under existing and future demand conditions.

Table 4-3: Watermain Design Pressure Requirements

Pressure Scenario	Service Area Type	Pressure	
		kPa	psi
Minimum MDD+FF	Hydrant laterals Potential fire service connections	140	20
Minimum PHD	Residential areas	275	40
	Industrial areas	310	45
Minimum ADD recommended	Residential area	275	40
Minimum all conditions	Any	275	40
Maximum all conditions	Any	550	80

4.3.5.2 Velocities and Head Losses

Per the Middlesex Infrastructure Design Standards (January 2018), watermains are to be sized considering the following maximum velocities:

- PHD conditions: 1.5 m/s
- FF conditions: 2.4 m/s.

Additionally, an industry standard head loss rate of 1 m/km under MDD and PHD demand conditions is used to identify watermains which could become conveyance constraints in the future.

For master-planning existing infrastructure assessment purposes, modelled velocities and head losses may exceed the thresholds listed above. While potential conveyance constraints can thus be identified and flagged for monitoring of head losses and pressures, watermain upgrades are only recommended if these constraints translate into pressure deficiencies.

4.3.5.3 Network Looping

The watermain distribution networks' level of looping is assessed qualitatively. Looping within a network is beneficial for redundancy in the event of a watermain break and for water quality. While the Middlesex Infrastructure Design Standards (January 2018) do not specify criteria for defining vulnerable service areas (VSAs), other industry design standard (e.g., the City of Ottawa) identify VSAs as areas supplied by a single feed where ADD ≥ 50 m^3/d.

4.3.5.4 Summary of Water Distribution Networks

The baseline conditions involve assessing the water distribution system within each settlement. Most of the settlements have a water distribution systems, however, some smaller settlements which are supplied mainly by private wells do not. Some settlements were assessed using a hydraulic model, which involved looking at the reliability, conveyance, and fire flows of the system, if a hydraulic model was available for the settlement. A summary of the water distribution networks is provided below in **Table 4-4.** Further discussions regarding the distribution systems for the settlements are detailed in the subsequent sections of this report.

Table 4-4: Water Distribution System Summary

Settlement	Supplied By	Water Distribution System Present? (Y/N)	Hydraulic Model Used (Y/N)?
Ilderton	LHWPSS	Y	Y
Komoka-Kilworth	LHWPSS	Y	Y
Delaware	LHWPSS (indirect)	Y	Y
Arva	City of London	Y	Y
Ballymote	City of London	Y	N
Denfield	LHWPSS	Y	N
Birr	Partial Municipal/Private Wells	Y	N
Bryanston	Private Wells	N	N
Lobo	Private Wells	N	N
Melrose	Partial Municipal/Private Wells *Ongoing water supply design study to convert to LHWPSS*	Y	N
Poplar Hill-Coldstream	Private Wells	N	N

4.4 TECHNICAL ASSESSMENT

4.4.1 Water Demands

4.4.1.1 Water Demands for Capacity Assessment

Water demands for the supply, pumping and storage capacity assessment are based on total populations (residential RES + employment EMP) determined using census data and growth projections, as described in **Section 3.1**. The water consumption rates presented in **Table 4-1** and the peaking factors presented in **Table 4-2** are used to generate water demands, which are summarized in **Table 4-5**.

The demands considered in the ongoing Melrose water supply design study are presented in **Table 4-6**.

4.4.1.2 Unit Demands for Hydraulic Modelling

Water demands for the hydraulic models and watermain assessment are based on spatially distributed population determined using GIS information, as described in **Section 3.2**. The water consumption rates presented in **Table 4-1** and the peaking factors presented in **Table 4-2** are used to generate water demands, which are summarized in **Table 4-7**.

Table 4-5: Water Demands for Supply, Storage and Pumping Capacity Assessment

Horizon	2021					2026					2031					2036					2041					2046				
Parameter	**Population**		**Demands (MLD)**			**Population**		**Demands (MLD)**			**Population**		**Demands (MLD)**			**Population**		**Demands (MLD)**			**Population**		**Demands (MLD)**			**Population**		**Demands (MLD)**		
Settlement Area	**RES**	**EMP**	**ADD**	**MDD**	**PHD**	**RES**	**EMP**	**ADD**	**MDD**	**PHD**	**RES**	**EMP**	**ADD**	**MDD**	**PHD**	**RES**	**EMP**	**ADD**	**MDD**	**PHD**	**RES**	**EMP**	**ADD**	**MDD**	**PHD**	**RES**	**EMP**	**ADD**	**MDD**	**PHD**
Arva	455	318	0.2	0.5	0.8	509	332	0.2	0.6	0.8	571	349	0.2	0.6	0.9	639	365	0.2	0.7	1.0	716	380	0.3	0.7	1.1	803	392	0.3	0.8	1.2
Ballymote	113	0	0.0	0.1	0.1	114	0	0.0	0.1	0.1	115	0	0.0	0.1	0.1	117	0	0.0	0.1	0.1	118	0	0.0	0.1	0.1	119	0	0.0	0.1	0.1
Birr	248	0	0.1	0.2	0.2	250	0	0.1	0.2	0.2	253	0	0.1	0.2	0.3	255	0	0.1	0.2	0.3	258	0	0.1	0.2	0.3	260	0	0.1	0.2	0.3
Bryanston	179	0	0.0	0.1	0.2	181	0	0.0	0.1	0.2	182	0	0.0	0.1	0.2	184	0	0.0	0.1	0.2	186	0	0.0	0.1	0.2	188	0	0.0	0.1	0.2
Coldstream/Poplar Hill	763	0	0.2	0.5	0.8	771	0	0.2	0.5	0.8	779	0	0.2	0.5	0.8	787	0	0.2	0.5	0.8	795	0	0.2	0.5	0.8	803	0	0.2	0.5	0.8
Delaware	1,601	683	0.5	1.4	2.1	1,829	1,074	0.7	1.7	2.6	2,090	1,518	0.9	2.2	3.2	2,387	1,950	1.0	2.6	3.9	2,728	2,359	1.2	3.1	4.6	3,116	2,690	1.4	3.5	5.2
Middlesex Terrace	67	0	0.0	0.0	0.1	67	0	0.0	0.0	0.1	68	0	0.0	0.0	0.1	69	0	0.0	0.0	0.1	70	0	0.0	0.0	0.1	70	0	0.0	0.0	0.1
Denfield	237	0	0.1	0.2	0.2	239	0	0.1	0.2	0.2	241	0	0.1	0.2	0.2	244	0	0.1	0.2	0.2	246	0	0.1	0.2	0.2	249	0	0.1	0.2	0.2
Ilderton	3,695	668	1.0	2.1	3.1	4,160	742	1.2	2.4	3.5	4,684	826	1.3	2.6	4.0	5,273	907	1.5	3.0	4.5	5,937	985	1.7	3.3	5.0	6,685	1,047	1.9	3.7	5.6
Komoka-Kilworth	5,649	1,244	1.7	3.3	5.0	6,939	1,364	2.0	4.0	6.0	8,524	1,501	2.4	4.8	7.2	10,471	1,634	2.9	5.8	8.7	12,862	1,759	3.5	7.0	10.5	15,800	1,861	4.2	8.5	12.7
Kilworth	3,113	255	0.8	1.6	2.4	3,824	279	1.0	2.0	3.0	4,697	307	1.2	2.4	3.6	5,770	335	1.5	2.9	4.4	7,088	360	1.8	3.6	5.4	8,707	381	2.2	4.4	6.5
Komoka	2,536	990	0.8	1.9	2.9	3,115	1,085	1.0	2.3	3.4	3,826	1,194	1.2	2.7	4.1	4,700	1,299	1.4	3.4	5.0	5,774	1,399	1.8	3.9	5.8	7,093	1,480	2.1	4.6	7.0
Lobo	82	0	0.0	0.1	0.1	83	0	0.0	0.1	0.1	84	0	0.0	0.1	0.1	85	0	0.0	0.1	0.1	86	0	0.0	0.1	0.1	86	0	0.0	0.1	0.1
Melrose	296	0	0.1	0.2	0.3	299	0	0.1	0.2	0.3	302	0	0.1	0.2	0.3	305	0	0.1	0.2	0.3	308	0	0.1	0.2	0.3	311	0	0.1	0.2	0.3
Remaining Rural Area	6,075	1,127	1.7	3.5	5.2	6,136	1,188	1.8	3.5	5.3	6,197	1,257	1.8	3.6	5.4	6,259	1,324	1.8	3.6	5.5	6,322	1,388	1.9	3.7	5.6	6,386	1,439	1.9	3.8	5.6
Komoka-Kilworth-Delaware	7,250	1,928	2.2	4.4	6.6	8,768	2,438	2.7	5.4	8.1	10,613	3,019	3.3	6.5	9.8	12,858	3,584	3.9	7.9	11.8	15,590	4,118	4.7	9.5	14.2	18,916	4,551	5.6	11.3	16.9

Table 4-6: Melrose Water Demands (Ongoing PDR)

Horizon	Existing Service Area				Fully Service Hamlet				Fully Serviced Hamlet + 15 Lots Buffer			
Settlement Area	**Total Population**	**Demands (MLD)**			**Total Population**	**Demands (MLD)**			**Total Population**	**Demands (MLD)**		
		ADD	**MDD**	**PHD**		**ADD**	**MDD**	**PHD**		**ADD**	**MDD**	**PHD**
Melrose	195	0.1	0.2	0.3	333	0.1	0.3	0.5	378	0.1	0.4	0.5

Table 4-7: Water Demands for Hydraulic Modelling of Distribution Systems

Horizon	Existing					Future (2046)				
Parameter	**Population**		**Modelled Demands (MLD)**			**Future (Existing + Growth) Populations**		**Modelled Demands (MLD)**		
Settlement	**Total Residential Population**	**ICI Equivalent Population**	**ADD**	**MDD**	**PHD**	**Total Residential Population**	**Total ICI Equivalent Population**	**ADD**	**MDD**	**PHD**
Arva	494	787	0.2	0.5	0.9	842	787	0.3	0.6	1.3
Ilderton	3,739	2,925	1.1	2.1	4.3	6,729	3,305	1.9	3.7	7.5
Delaware (incl. Middlesex Terrace)	1,623	3,224	0.6	1.2	2.3	3,138	5,231	1.4	2.9	5.7
Kilworth	2,252	1,035	0.6	1.2	2.4	8,303	1,155	2.5	5.0	10.1
Komoka	2,496	4,021	0.9	1.7	3.5	7,053	4,512	1.6	3.2	6.3

4.4.2 Ilderton

4.4.2.1 Supply

The Ilderton system is supplied by the LHWPSS. The current MDD demand in 2021 is 2,094 m^3/d [24 L/s]. There are currently no issues noted with the existing supply capacity. In order to determine if the projected increased demands can be satisfied by the upstream supply infrastructure, they will need to be reviewed with the LHWPSS.

4.4.2.2 Pumping

The available firm capacity at the Ilderton BPS is 34 L/s. There are currently no issues with the pumping capacity since the firm capacity is greater than the MDD demand. However, the pumping capacity is expected to reach its limit when the combined residential and employment population reaches 6,124 people, which is expected to be in year 2035 based on current growth projections. Once the pumping capacity has reached its limit, it will require upgrades to accommodate the future growing demand.

4.4.2.3 Water Storage

The 2010 MSP identified the need for additional storage in Ilderton. A new ET has since been constructed, which provides additional storage to the settlement area. The available storage at the Ilderton Reservoir and Ilderton ET is 455 m^3 and 2,050 m^3, respectively. No issues have been identified for the storage capacity of the existing conditions. However, future storage upgrades are required once the combined residential and employment population reaches 5,488 people, which is expected to be in 2030 based on current growth projections.

4.4.2.4 Water Distribution System

The water distribution system of Ilderton was assessed using the hydraulic model. The findings from the hydraulic model are detailed in the sections below.

Reliability

To assess the reliability of the system, VSAs were identified to determine if any feeds exist that pose issues on reliability of the system (i.e., dead-end feeds). A VSA, in this context, refers to an area or building with an average daily demand greater than 50 m^3/d. Four dead-end feeds were identified in Ilderton; however, reliability is provided to the dead-end feed on Hyde Park Rd through a storage reservoir (Ilderton ET) and the remaining three dead ends were not found to create a VSA (ADD < 50 m^3/d). In the event of a watermain break from the Ilderton ET, water can still be supplied to the settlement through the Ilderton BPS, meaning the reliability is sufficient in the existing system.

The 2010 MSP identified the need for water distribution looping to address reliability for areas along Williow Ridge Rd W and Dogwood Trail (see **Table 1-1**). Based on the latest GIS data from the Municipality, while Willow Ridge Rd itself is fully looped, Dogwood Trail remains a dead-end feed. However, as noted previously, Dogwood Trail is not a dead-end creating a VSA, as ADD along Dogwood Trail is < 50 m^3/d.

Conveyance

The conveyance of the system was assessed by the pipe velocity under PHD, head loss rate (m/km) under MDD and PHD, minimum pressure under PHD, and maximum pressure under ADD. In order for a system to have sufficient conveyance, it should have a pipe velocity ≤ 1.5 m/s, head loss rate of ≤ 1 m/km, maximum pressure under ADD < 80 psi and minimum pressure over PHD > 40 psi.

Pipe Velocity (≤ 1.5 m/s): No pipes were identified to have a PHD velocity > 1.5 m/s in the Ilderton water distribution system, under existing and future demands.

Head Loss Rate (≤ 1 m/km): When looking at the head loss rates, under existing MDD and PHD conditions, there is potential for bottlenecking on Hyde Park Rd (between Ilderton Rd and the Ilderton ET) since a head loss rate ≥ 1.5 m/km was identified, when the system is solely fed from the Ilderton ET. Nonetheless, when system supply is distributed between the Ilderton ET and the BPS, head losses are within acceptable ranges. These bottlenecks do not translate into pressure issues under existing and growth conditions. Therefore, it is recommended to monitor head losses with growth. The system should also be assessed for looping or twinning opportunities from the Ilderton ET, or for the implementation of new pumping or storage facilities, as this may be beneficial for alleviating flows through the Hyde Park Rd watermain and for preventing potential bottlenecking.

Potential looping or twinning opportunities could be explored and implemented as part of development in the Timberwalk subdivision. Since these watermains would be implemented internally within the subdivisions and as growth proceeds, these were not identified as master plan projects.

Pressure (ADD max < 80 psi; PHD min > 40 psi): Under ADD conditions, high pressures ≤ 90 psi were identified in the existing service areas on the southeast side of the distribution system, both under existing and future demands. Under PHD conditions, all minimum pressures were identified to be > 40 psi, both under existing and future demands. Should high pressures be a concern for existing properties in this area, PRVs can be installed on local service lines.

Fire Flow

For the water system in Ilderton under both existing and growth demands, it was determined that a fire flow of 76 L/s [4,500 L/min] or greater is available at a residual pressure of 20 psi at all locations except in dead-ends, while maintaining pressures above 20 psi across the rest of the system.

Additional looping in the south (of the Songbird Ln watermain) should be considered as it could be beneficial for fire flows and reliability. Potential looping or twinning opportunities could be explored and implemented as part of development south of Ilderton. Since these watermains would be implemented as growth proceeds, these were not identified as master plan issues.

4.4.3 Komoka-Kilworth-Delaware

4.4.3.1 Supply

The Komoka-Kilworth-Delaware system is supplied by LHWPSS (Delaware being supplied indirectly). The current MDD demand in 2021 is 3,309 m^3/d [38 L/s] for Komoka-Kilworth, and 1,411 m^3/d [16 L/s] for Delaware. There are currently no issues noted with the existing supply capacities. In order to determine if the projected increased demands can be satisfied, they will need to be reviewed with the LHWPSS.

The areas within Old Kilworth are currently supplied by private wells. There is the potential to extend the existing water distribution network to Old Kilworth.

Some parcels in Delaware are also currently supplied by private wells. These could be considered for future servicing from the water distribution network in conjunction with adjacent developments.

4.4.3.2 Pumping

There are three pumping stations for Komoka-Kilworth-Delaware: Komoka BPS, Komoka-Kilworth IPS, and Delaware BPS. The three stations are reviewed independently below.

Komoka BPS: The available firm capacity at the Komoka BPS is 53.7 L/s. The 2021 MDD demand of Komoka-Kilworth-Delaware (52.1 L/s) is near the firm capacity, indicating an imminent need for pumping upgrades. This is due to a higher water consumption rate (240 L/cap/d) than back-calculated using SCADA (~184 L/cap/d). SCADA measurements currently report pump flows of ~30 L/s, i.e., within the Komoka BPS's firm pumping capacity. Hence, upgrades to the system are not required immediately, but will be needed in the short-term to accommodate the future growing demand. It is recommended that pumped flows continue to be monitored to confirm the timeline for capacity upgrades. Using an adjusted existing water consumption rate of 184 L/cap/d, upgrades are required once the combined residential and employment population reaches 11,948 people, which is expected to be in 2027 based on current growth projections.

Komoka-Kilworth IPS: The Komoka-Kilworth IPS consists of a single booster pump for Kilworth during peak/high demands, therefore the firm capacity of the facility alone is 0 L/s. Nonetheless, the peak demand pumping capacity is 91.2 L/s. No existing issues have been identified since the peak demand pumping capacity is greater than the existing PHD demand (28 L/s). Komoka-Kilworth IPS is not expected to reach its capacity during this planning horizon and therefore no upgrades are required based on rated capacity alone. However, as demonstrated in the conveyance assessment (**Section 4.4.3.4**), based on system hydraulics and operational capacity (i.e., at the modelled TDH), there is a need to upgrade the Komoka-Kilworth IPS, to address pressure issues in Kilworth.

Delaware BPS: The available firm capacity at the Delaware BPS is 13 L/s. The 2021 MDD demand is greater than firm pumping capacity. This is due to a higher water consumption rate (240 L/cap/d) than back-calculated using SCADA (on average, ~155 L/cap/d). SCADA measurements currently report pump flows of ~12 L/s, i.e., within the Delaware BPS's firm pumping capacity. Hence, no upgrades to the system are required immediately, but are needed when the combined residential and employment population reaches 2,770 people, in the short-term. It is recommended that pumped flows continue to be monitored to confirm the timeline for capacity upgrades.

4.4.3.3 Water Storage

There are three water storage facilities for the Komoka-Kilworth-Delaware area: Komoka BPS Reservoir, Komoka ET, and Delaware Standpipe. The assessment for each storage facility is included below.

Komoka BPS Reservoir and Komoka ET: These two facilities provide collective storage to the Komoka-Kilworth-Delaware area. The available storage of the Komoka BPS reservoir and Komoka ET is 2,718 m^3 (usable volume) and 1,500 m^3, respectively, totaling 4,218 m^3 of storage. No issues have been identified for the storage capacity of the existing conditions. However, future upgrades of the storage facility are required once the combined residential and employment population reaches 15,645 people, which is expected to be in 2034 based on current growth projections.

Delaware Standpipe: The total volume of the Delaware Standpipe is 2,140 m^3. For the storage capacity assessment, an operational volume of 1,634 m^3 is used, which accounts for the approximate working volume of 400 m^3, a fire storage volume of 805 m^3, and an emergency volume of 429 m^3, based on the standpipe's design. No issues have been identified for the storage capacity of the existing conditions. Future upgrades of the storage facility are required once the combined residential and employment population reaches 3,394 people, which is expected to be in 2029 based on current growth projections. However, the Komoka ET can provide additional storage for this area (via the Delaware BPS). Therefore, upgrades can be deferred until the combined residential and employment population reaches 6,350, which is expected to be past 2046 based on current growth projections.

It should be noted that Kilworth does not have any storage facilities. It is recommended to consider implementing a storage facility in Kilworth to accommodate future growth and reliability. Storage could help address future pressure issues, as head losses in the distribution system increase with higher demands, which is further discussed in **Section 4.4.3.4**. Reliability of the Komoka-Kilworth-Delaware areas will also be further discussed in **Section 4.4.3.4.**

4.4.3.4 Water Distribution System

The water distribution system of Komoka-Kilworth-Delaware was assessed using the hydraulic model. The findings from the hydraulic model are detailed in the sections below. Infrastructure needs under buildout conditions were identified.

Reliability

When assessing the reliability within Komoka, the areas serviced by the Duke St watermain and the areas serviced by the Glendon Dr watermain (to the southwest) are found to be VSAs (ADD > 50 m^3/d) and therefore should consider the potential for looping. The entire settlement of Kilworth is serviced by a single feed from Komoka along Glendon Dr (from Tunks Ln to Springfield Way), creating a VSA. In the event of a watermain break from Komoka to Kilworth, the entire settlement could be left without water. The Municipality is planning a new (twin) watermain along Glendon Dr, which will increase the reliability of supply. Future storage and looping could also be considered in Kilworth to respond to this issue.

Delaware has one single feed along Springer Rd (from Longwoods Rd to William St) supplying a subdivision which results in a VSA and multiple long single feeds/dead ends which service a small population but do not result in a VSA (ADD < 50 m^3/d). It is recommended to consider looping in these areas if adjacent growth is expected to occur. In the event that the watermain breaks from Komoka to the Delaware BPS or from the BPS to Delaware, Delaware will be able to be supplied by the standpipe and therefore has sufficient reliability.

Conveyance

Pipe Velocity (≤ 1.5 m/s): No pipes were identified to have a PHD velocity > 1.5 m/s in the Komoka-Kilworth-Delaware water distribution system under existing conditions. However, under growth conditions, velocities exceeding > 1.5 m/s are observed in the pipes along Queen St to Tunks Ln, and along Komoka Rd, due to the growth and resulting flows in Kilworth and south of Komoka. The high velocities (and corresponding high head losses) translate into pressure deficiencies in these areas.

Head Loss Rate (≤ 1 m/km): When looking at the head loss rates for Komoka under existing MDD conditions, no constraints were identified. Under existing and growth PHD conditions, as well as growth MDD conditions, values > 1 m/km were found along Komoka Rd, Queen St, and Oxbow Dr, which translate into pressure deficiencies downstream. Potential solutions to address these bottlenecks include upsizing or twinning the watermains, or providing storage within Kilworth to offset the peak flows. While the Municipality is currently planning a new (twin) watermain along Glendon Dr, it was found that additional watermain upsizing or twinning is also needed further upstream to reduce the observed losses.

The head loss rates within Kilworth were all within acceptable levels for both PHD and MDD existing and growth conditions.

When looking at the Delaware water system, no constraints were identified for existing and growth MDD conditions. Head loss rates > 1 m/km were identified along Gideon Dr for PHD conditions. Since the head loss along Gideon Dr is high (> 5 m/km) and considering that this 150 mm watermain acts as a primary feedermain from the BPS, it would be beneficial to upsize or twin/loop this pipe.

Pressure (ADD max < 80 psi; PHD min > 40 psi): The pressures in existing and growth ADD conditions in Komoka do not show any constraints. However, under MDD and PHD existing conditions, pressures slightly below 40 psi are observed near the Komoka ET, suggesting the static HGL maintained by the ET may be too low. Under growth conditions, compounded with the watermain constraints previously described, minimum pressure issues are observed south of Komoka.

In Kilworth, existing minimum pressures are above 40 psi under PHD conditions, provided the Komoka IPS is operating. Existing maximum pressures near the river were identified to have pressures of 80-90 psi under ADD conditions. Developments near the river could require PRVs. Under growth conditions, minimum pressure issues arise in Kilworth under PHD conditions, due to the upstream Komoka ET and Komoka watermain constraints previously described. Potential solutions to address these pressure deficiencies include raising the operating HGL in the Komoka ET (by replacing the ET), upsizing or twinning the Komoka watermains, upgrading the Komoka IPS, or providing storage within Kilworth to offset the peak flows. Higher operating HGLs in the Komoka ET and at the discharge of the

Komoka IPS should be confirmed during design; areas which may experience high pressures under higher operating HGLs could require PRVs.

In Delaware, no pressure constraints were identified in PHD conditions. In ADD conditions, areas near the river were also identified to have pressure of 80 - 90 psi. In order to address these issues, developments near the river could require PRVs.

Fire Flow

For the water system in Komoka under existing demands, it was determined that a fire flow of 76 L/s [4,500 L/min] or greater is available at a residual pressure of 20 psi at all locations except in dead-ends or areas serviced by a single feed, while maintaining pressures above 20 psi across the rest of the system. Under growth conditions, however, due to the peak flow constraints described previously, fire flow deficiencies are observed in the south of Komoka, without any system upgrades.

For the water system in Kilworth under existing demands, it was determined that a fire flow of 76 L/s [4,500 L/min] or greater is available at a residual pressure of 20 psi at all locations except in dead-ends or areas serviced by a single feed, while maintaining pressures above 20 psi across the rest of the system. Without any system upgrades, the available fire flows decrease under growth conditions, due to the peak flow constraints described previously.

The potential solutions described to address minimum pressure constraints (upgrade of the Komoka ET, watermain upgrades in Komoka, Komoka IPS upgrade) can help address the fire flow deficiencies observed under growth conditions.

For the water system in Delaware under both existing and growth demands, it was determined that a fire flow of 76 L/s [4,500 L/min] or greater is available at a residual pressure of 20 psi at all locations except in dead-ends or areas serviced by a single feed, while maintaining pressures above 20 psi across the rest of the system. Potential new watermain looping through development areas can also improve the available fire flows.

4.4.4 Arva

4.4.4.1 Supply

The Arva system is directly supplied by the City of London (and hence, indirectly by the LHWPSS). The current MDD demand in 2021 is 510 m^3/d [6 L/s]. There are currently no issues noted with the existing supply capacities. In order to determine if the projected increased demands can be satisfied, they will need to be compared against the approved extent of the City of London service area, should this remain the preferred servicing alternative in the future. However, there is the potential to supply Arva directly from the LHWPSS as well.

The 2010 MSP recommended undertaking a Class EA to determine servicing options for Arva. Servicing options are being reviewed as part of the current 2023 MSP.

4.4.4.2 Pumping

The Arva Water Supply Facility receives normal supply from the City of London. The fire pump has a capacity of 75 L/s, which is sufficient to supply existing and future MECP fire flows (64 L/s). The Arva Water Supply Facility pump is not expected to reach its capacity during this planning horizon and therefore no upgrades are required.

4.4.4.3 Water Storage

There is no existing storage facility in place for the Arva water system. Arva is sufficiently supplied by the City of London and therefore, no water storage facility is required for the future planning horizon. However, since Arva is supplied entirely from a single feed from the City of London (along Richmond St), there is a potential benefit in considering a storage facility in the future. Having a storage facility located in Arva will help assist in the overall reliability of the system in the event of a break in the single feed. Reliability is additionally discussed in **Section 4.4.4.4**.

4.4.4.4 Water Distribution System

The water distribution system of Arva was assessed using the hydraulic model. The findings from the hydraulic model are detailed in the sections below.

Reliability

Arva is supplied by a single feed from the City of London, making it a VSA (ADD > 50 m^3/d). In the event of a watermain break, the entire settlement of Arva would be left without water since there is no local storage available to supplement the water supply. The Municipality noted that the watermain along Richmond St, which is the primary feed into Arva, has already experienced breaks. To respond to the poor reliability of this system, future storage should be considered.

Conveyance

Pipe Velocity (≤ 1.5 m/s): No pipes were identified to have a PHD velocity > 1.5 m/s in the Arva water distribution system, under existing or future conditions.

Head Loss Rate (≤ 1 m/km): When assessing the water system in Arva, no constraints were identified in MDD conditions. A head loss rate of > 1 m/km was identified along Richmond St during PHD conditions, under existing demands. With growth, head losses through the Richmond St watermain increase with increased demands and flows. For this reason, in addition to the considerations for reliability, twinning/looping would also be beneficial for the system. Storage within Arva would also be beneficial to offset peak demands, thus reducing flows and head losses through the Richmond St watermain.

Pressure (ADD max < 80 psi; PHD min > 40 psi): No pressure constraints were identified in Arva under PHD conditions, under existing and future demands. However, under ADD conditions, pressures from 80-90 psi were identified in the southwest, in existing service areas. Should high pressures be a concern for existing properties in this area, PRVs can be installed on local service lines.

Fire Flow

For the water system in Arva under both existing and growth demands, it was determined that a fire flow of 76 L/s [4,500 L/min] or greater is available at a residual pressure of 20 psi at all locations except in dead-ends serviced by small diameter watermains (100 mm), while maintaining pressures above 20 psi across the rest of the system.

4.4.5 Ballymote

4.4.5.1 Supply

The Ballymote system is supplied by the City of London. The current MDD demand in 2021 is 75 m^3/d [0.9 L/s]. There are currently no issues noted with the existing supply capacities. In order to determine if the projected increased demands can be satisfied, they will need to be compared against the approved extent of the City of London service area.

4.4.5.2 Pumping

There are no existing pumps in place for the Ballymote water system. No pumping system is required for the future planning horizon.

4.4.5.3 Water Storage

There is no existing storage facility in place for the Ballymote water system. Ballymote is sufficiently supplied by the City of London and therefore, no water storage facility is required for the future planning horizon.

4.4.5.4 Water Distribution System

Ballymote has a small municipal distribution system which is serviced by the City of London. No hydraulic modelling information was available for this system; therefore, it has not been assessed.

4.4.6 Denfield

4.4.6.1 Supply

The Denfield system is supplied by LHWPSS. The current MDD demand in 2021 is 156 m^3/d [1.8 L/s]. There are currently no issues noted with the existing supply capacities. In order to determine if the projected increased demands can be satisfied, they will need to be reviewed with LHWPSS.

4.4.6.2 Pumping

The available firm capacity at the Denfield BPS is 8 L/s. There are currently no issues with the pumping capacity since the firm capacity is greater than the MDD demand. The fire pump has a capacity of 40 L/s, which is sufficient to supply existing and future MECP fire flows (38 L/s). The Denfield BPS is not expected to reach its capacity during this planning horizon and therefore no upgrades are required.

4.4.6.3 Water Storage

The available storage at the Denfield BPS and Rechlorination Facility is 130 m^3. The storage provided is sufficient for equalization and emergency storage, however, it falls short for providing storage for fire flow. Fire flows for this system are provided by the fire pumps (40 L/s) (see **Section 4.4.6.2**). Therefore, no upgrades are required for this planning horizon.

4.4.6.4 Water Distribution System

Denfield has a small municipal distribution system which is serviced by LHWPSS. No hydraulic modelling information was available for this system; therefore, it has not been assessed.

4.4.7 Birr

4.4.7.1 Supply

The Birr system is supplied by partial municipal and private wells. The current MDD demand in 2021 for the entire settlement is 164 m^3/d [1.9 L/s], and the PHD demand 246 m^3/d [2.8 L/s]. 18 parcels are currently serviced by the well system, with a 2021 MDD demand of 36 m^3/d [0.4 L/s] and PHD demand of 54 m^3/d [0.6 L/s], and no further growth projected. The existing PHD demand is within the well's pumping capacity (82 L/min [1.4 L/s]), and the existing MDD demand over a period of 18 hours (48 m^3/d) is within the daily maximum limit of 88 m^3, therefore no issues have been identified with the existing supply capacities. Demands within Birr are projected to increase with development on one parcel (MDD increase of less than +10 m^3/d), which is not adjacent to the current municipal system. Supply servicing solutions will need to be identified, which could also consider interest from existing private wells to connect to a municipal system.

4.4.7.2 Pumping

The Birr WTP has a firm pumping capacity of 81.7 L/min (1.4 L/s), which is greater than the existing 2021 PHD demand in the area serviced by the municipal well system (18 parcels, PHD = 0.6 L/s). No further growth within this servicing area is projected, therefore no pumping issues were identified. Pumping for new growth areas within Birr could be a design option depending on the supply alternative solution selected for Birr.

4.4.7.3 Water Storage

There is a 51 m^3 storage reservoir at the Birr WTP, intended for disinfection contact time prior to pumping into the distribution system. It is therefore not assessed for its fire flow and balancing storage capacity. Storage for new growth areas within Birr could be a design option depending on the supply alternative solution selected for Birr.

4.4.7.4 Water Distribution System

Birr has a small municipal distribution system. No hydraulic modelling information was available for this system; therefore, it has not been assessed.

4.4.8 Bryanston

4.4.8.1 Supply

The Bryanston system is supplied by private wells. The current MDD demand in 2021 is 118 m^3/d [1.4 L/s]. There are currently no issues noted for the existing supply capacities of the private wells. Projected increases in demands should be serviced from private wells or reviewed against municipal supply capacity.

4.4.8.2 Pumping

There are no existing pumps in place for the Bryanston water system. No pumping system is required for the future planning horizon.

4.4.8.3 Water Storage

There is no existing storage facility in place for the Bryanston water system. Bryanston is sufficiently supplied by private wells and therefore, no water storage facility is required for the future planning horizon.

4.4.8.4 Water Distribution System

Bryanston does not have a municipal distribution system and therefore, has not been assessed.

4.4.9 Lobo

4.4.9.1 Supply

The Lobo system is supplied by private wells. The current MDD demand in 2021 is 54 m^3/d [0.6 L/s]. There are currently no issues noted for the existing supply capacities of the private wells. Projected increases in demands should be serviced from private wells or reviewed against municipal supply capacity.

4.4.9.2 Pumping

There are no existing pumps in place for the Lobo water system. No pumping system is required for the future planning horizon.

4.4.9.3 Water Storage

There is no existing storage facility in place for the Lobo water system. Lobo is sufficiently supplied by private wells and therefore, no water storage facility is required for the future planning horizon.

4.4.9.4 Water Distribution System

Lobo does not have a municipal distribution system and therefore, has not been assessed.

4.4.10 Melrose

4.4.10.1 Supply

The Melrose system is supplied by partial municipal and private wells. The current MDD demand in 2021 is 195 m^3/d [2 L/s]. There are currently no issues noted for the existing supply capacities of the well system. However, it was found that existing private well areas could potentially be serviced by the municipal system. A Class EA study for the Melrose Water Supply was completed in 2017, which evaluated different water supply alternatives, and identified an interconnect with the Komoka-Mt. Brydges Secondary Transmission Main (LHPWSS) as the preferred alternative, and the Municipality has since proceeded with the design of the required infrastructure. Projected increases in demands (and interest from existing private wells to connect to municipal system) should be reviewed against municipal supply capacity (and future LHWPSS supply).

4.4.10.2 Pumping

The Melrose PDR (Stantec, 2023) determined that a new BPS would be designed and implemented at the existing Melrose WTP. The new design may consist of up to four new vertical turbine pumps, each equipped with a VFD. The pumps may consist of: one jockey pump rated at 1.5 L/s, two duty/standby pumps rated at 5.4 L/s, and one “high demand” or fire pump rated at 38 L/s. This results in a firm pumping capacity of approximately 12 L/s. The PDR has recommended that the municipality proceed in the new design without a jockey pump. This was determined because while the jockey pump could offer some energy savings, the extend was found to be minor when compared to the capital cost and maintenance requirements (Stantec, 2023). If the jockey pump is not used, the system will have a firm pumping capacity of approximately 10.8 L/s.

4.4.10.3 Water Storage

The Melrose PDR (Stantec, 2023) determined that the existing water volume of the on-site water storage facility is 415.8 m^3. The required storage at Melrose WTP was found to be 438 m^3 for the existing serviced area and 478 m^3 for a fully serviced area with 15 additional lots, both of which are above the current storage facility volume. Although the provided storage falls below the required storage, no further upgrades are being proposed as part of the PDR. This is because information gathered suggested that residents would not be receptive to on-grade storage (i.e., Greatario tank, similar to Denfield). As a part of the future planning horizon, it is recommended to consider future storage for growth and servicing the rest of the hamlet. This is thought to be more ideal if and when the distribution system is extended in the future to service the rest of the hamlet (in combination with pumping).

4.4.10.4 Water Distribution System

Melrose has a small municipal distribution system. No hydraulic modelling information was available for this system; therefore, it has not been assessed.

4.4.11 Poplar Hill-Coldstream

4.4.11.1 Supply

The Poplar Hill-Coldstream system is supplied by private wells. The current MDD demand in 2021 is 504 m^3/d [6 L/s]. There are currently no issues noted for the existing supply capacities of the private well system. Projected increases in demands should be serviced from private wells or reviewed against the potential to implement a municipal system.

4.4.11.2 Pumping

There are no existing pumps in place for the Poplar Hill-Coldstream water system. No pumping system is required for the future planning horizon.

4.4.11.3 Water Storage

There is no existing storage facility in place for the Poplar Hill-Coldstream water system. Poplar-Hill-Coldstream is sufficiently supplied by private wells and therefore, no water storage facility is required for the future planning horizon.

4.4.11.4 Water Distribution System

Poplar Hill-Coldstream does not have a municipal distribution system and therefore, has not been assessed.

4.4.12 Summary of Identified Issues

Table 4-8 summarizes the identified potable water servicing issues per settlement, based on the technical assessment presented previously. Alternative solutions for each of these issues are developed in **Section 5.0**.

Table 4-8: Summary of Potable Water Servicing Issues by Settlement

Settlement	Issue ID	Potable Water Servicing Issues
Ilderton	**ILD-SUP**	Increase in water supply needed with growth
	ILD-ST	Increase in storage capacity needed with growth
	ILD-PMP	Increase in pumping capacity needed with growth
Komoka-Kilworth-Delaware	**KKD-SUP**	Increase in water supply in Komoka-Kilworth-Delaware needed with growth
	KKD-ST	Increase in storage capacity in Komoka-Kilworth needed with growth
	KKD-PMP	Increase in pumping capacity in Komoka-Kilworth needed with growth
	KK-PSIREL	Address future pressure deficiencies and provide supply redundancy in Kilworth
	KIL-WM	Extend existing watermain network to supply Old Kilworth
	DEL-ST	Increase in storage capacity in Delaware needed with growth
	DEL-PMP	Increase in pumping capacity in Delaware needed with growth
	DEL-WM	Twinning/looping/upgrade of Gideon Dr watermain from Delaware BPS to Delaware needed for reliability, existing watermain performance and growth
Arva	**ARV-SUP**	Increase in water supply needed with growth
	ARV-REL	Increase reliability of supply (through watermain twinning or storage) with growth
Ballymote	**BMT-SUP**	Increase in water supply needed with growth
Denfield	**DNF-SUP**	Increase in water supply needed with growth
Birr	**BIR-SUP**	Increase in water supply needed with growth
Small Settlements (Bryanston, Lobo, Poplar Hill-Coldstream)	**STL-SUP**	Increase in water supply needed with growth
Melrose	*None within current 2023 MSP horizon; servicing has been addressed in 2017 Class EA study, and the Municipality has proceeded with design*	

5.0 DEVELOPMENT OF ALTERNATIVE SOLUTIONS

This section presents the list of alternative solutions to address the issues identified in **Section 4.0**. The intent of this section is to identify recommended solutions, or short-list solutions which are further evaluated using a decision matrix. The assessment is based on the criteria established for this 2023 MSP, and presented in the **MSP Report**. Detailed evaluation matrices are provided in **Appendix A**. Refined scopes or design alternatives for the recommended solutions are presented in **Section 6.0**.

5.1 ILDERTON

5.1.1 Ilderton – Water Supply Alternative Solutions

ILD-SUP-1: Do Nothing

Under this alternative solution, existing supply infrastructure and agreements would be maintained. This is not a viable solution considering projected growth in Ilderton.

ILD-SUP-2: Expand supply capacity from LHWPSS

Under this alternative solution, existing and future demands in Ilderton are supplied by the LHWPSS, via the Ilderton Reservoir & BPS. Future water demands in Ilderton would be considered in LHWPSS master-planning initiatives and future infrastructure sizing. This solution would make optimized use of the existing infrastructure to supply growth.

ILD-SUP-3: Service growth from private wells

Under this alternative solution, private wells would be implemented on each new growth parcel within Ilderton. This is not a viable solution from a master-planning perspective, as it will limit the potential to develop surrounding lands and does not make optimized use of existing infrastructure to supply growth. Nonetheless, private wells could be considered on a case-by-case basis by the Municipality, if a distant property wishes to develop prior to municipal services being readily available.

ILD-SUP-4: Service growth from new communal well system(s)

Under this alternative solution, new communal well systems would be implemented to supply clusters of growth areas within Ilderton. This solution would require additional infrastructure and capital and operational costs, which does not make optimized use of existing infrastructure to supply growth, and is therefore not a viable solution from a master-planning perspective.

Ilderton – Recommended Water Supply Alternative Solution

The recommended water supply alternative solution for Ilderton is **ILD-SUP-2: Expand supply capacity from LHWPSS**.

5.1.2 Ilderton – Storage Alternative Solutions

ILD-ST-1: Do Nothing

Under this alternative solution, existing storage infrastructure would be maintained. This is not a viable solution considering projected growth in Ilderton, and the additional storage capacity required by 2030 (based on current growth projections), without which pressure and reliability issues would arise.

ILD-ST-2: Expand existing storage (in-ground reservoir or ET)

Under this alternative solution, the additional storage capacity needed to supply growth in Ilderton would be provided at the existing storage facilities, i.e., the in-ground reservoir at the Ilderton BPS and/or the Ilderton ET. Storage cells would be added, or the existing ET demolished and replaced in its current location. In the case of adding storage cells to an in-ground reservoir, this solution would make optimized use of existing infrastructure, and would be efficient in terms of operational costs since only the existing facilities would be operated.

ILD-ST-3: Build new storage (reservoir or ET) on existing site

Under this alternative solution, the additional storage capacity needed to supply growth in Ilderton would be provided by new storage infrastructure, on the existing ET storage site on Hyde Park Rd.

ILD-ST-4: Build new storage (reservoir or ET) on new site

Under this alternative solution, the additional storage capacity needed to supply growth in Ilderton would be provided at a new storage facility. This solution would require new infrastructure and capital and operational costs. However, it would provide additional reliability and be beneficial in terms of hydraulics.

Ilderton – Recommended Storage Alternative Solutions

The alternative solutions were evaluated using a decision-matrix. Based on the detailed evaluation presented in **Appendix A**, the recommended alternative solution is **ILD-ST-4: Build new storage on new site**. This recommended solution is further refined in **Section 6.0**.

5.1.3 Ilderton – Pumping Alternative Solutions

ILD-PMP-1: Do Nothing

Under this alternative solution, existing pumping infrastructure and capacity at the Ilderton BPS would be maintained. This is not a viable solution considering projected growth in Ilderton, and the additional pumping capacity required by 2034 (based on current growth projections), without which pressure issues would arise.

ILD-PMP-2: Expand Ilderton BPS

Under this alternative solution, the additional pumping capacity needed to supply growth in Ilderton would be provided at the existing Ilderton BPS. Existing pumps would be replaced and/or new pumps would be added, and the existing BPS superstructure would be expanded as needed. This solution would make optimized use of existing infrastructure, and would be efficient in terms of operational costs since only a single facility would be operated. The need for a new BPS was not identified based on hydraulics.

ILD-PMP-3: Build new BPS

Under this alternative solution, the additional pumping capacity needed to supply growth in Ilderton would be provided at a new pumping facility. This solution would require new infrastructure and capital and operational costs. However, it would be inefficient to build and operate a new pumping facility, given that existing and future areas within Ilderton can be serviced by a single pressure zone hydraulically.

Ilderton – Recommended Pumping Alternative Solution

The recommended pumping alternative solution for Ilderton is **ILD-PMP-2: Expand Ilderton BPS**.

5.2 KOMOKA-KILWORTH-DELAWARE

5.2.1 Komoka-Kilworth-Delaware – Water Supply Alternative Solutions

KKD-SUP-1: Do Nothing

Under this alternative solution, existing supply infrastructure and agreements would be maintained. This is not a viable option considering projected growth in Komoka, Kilworth and Delaware.

KKD-SUP-2: Expand supply capacity from LHWPSS

Under this alternative solution, existing and future demands in Komoka, Kilworth and Delaware are supplied by the LHWPSS, via the Komoka Reservoir & BPS. Future water demands in Komoka, Kilworth and Delaware would be considered in LHWPSS master-planning initiatives and future infrastructure sizing. This solution would make optimized use of the existing infrastructure to supply growth.

KKD-SUP-3: Service growth from private wells

Under this alternative solution, private wells would be implemented on each new growth parcel within Komoka, Kilworth and Delaware. This is not a viable solution from a master-planning perspective, as it will limit the potential to develop surrounding lands and does not make optimized use of existing infrastructure to supply growth. Nonetheless, private wells could be considered on a case-by-case basis by the Municipality, if a distant property wishes to develop prior to municipal services being readily available.

KKD-SUP-4: Service growth from new communal well system(s)

Under this alternative solution, new communal well systems would be implemented to supply clusters of growth areas within Komoka, Kilworth and Delaware. This solution would require additional infrastructure and capital and operational costs, which does not make optimized use of existing infrastructure to supply growth, and is therefore not a viable solution from a master-planning perspective.

Komoka-Kilworth-Delaware – Recommended Water Supply Alternative Solution

The recommended water supply alternative solution for Komoka-Kilworth-Delaware is **KKD-SUP-2: Expand supply capacity from LHWPSS**.

5.2.2 Komoka-Kilworth-Delaware – Storage Alternative Solutions

KKD-ST-1: Do Nothing

Under this alternative solution, existing storage infrastructure would be maintained. This is not a viable solution considering projected growth in Komoka-Kilworth-Delaware, and the additional storage capacity required by 2032 (for Komoka-Kilworth; based on current growth projections), without which pressure and reliability issues would arise.

KKD-ST-2: Expand existing storage (in-ground reservoir or ET)

Under this alternative solution, the additional storage capacity needed to supply growth in Komoka-Kilworth-Delaware would be provided at the existing storage facilities, i.e., the in-ground reservoir at the Komoka BPS and/or the Komoka ET. The expansion of the Delaware Standpipe is mainly considered with respect to Delaware's storage needs and alternative solutions are presented in **Section 5.2.4**. Storage cells would be added at the Komoka Reservoir, or the existing Komoka ET replaced in its current location. In the case of adding storage cells to an in-ground reservoir, this solution would make optimized use of existing infrastructure and available land, and would be efficient in terms of operational costs since only the existing facilities would be operated. Hydraulically, it was determined that replacing the aging Komoka ET would be beneficial to improve pressure issues. The current Komoka ET site remains the recommended location for the new ET, based on topography.

KKD-ST-3: Build new storage (reservoir or ET)

Under this alternative solution, the additional storage capacity needed to supply growth in Komoka-Kilworth-Delaware would be provided at a new storage facility within Komoka-Kilworth. The implementation of a new storage facility within Delaware is considered with respect to Delaware's storage needs and alternative solutions are presented in **Section 5.2.4**. While this solution would provide additional reliability and be beneficial in terms of hydraulics, it would require new infrastructure and capital and operational costs, and there is limited land available where an ET could be operated efficiently from a hydraulics perspective. This solution is therefore not viable.

Komoka-Kilworth-Delaware – Recommended Storage Alternative Solution

The recommended pumping alternative solution for Komoka-Kilworth-Delaware is **KKD-ST-2: Expand existing storage**.

5.2.3 Komoka-Kilworth-Delaware – Pumping Alternative Solutions

KKD-PMP-1: Do Nothing

Under this alternative solution, existing pumping infrastructure and capacity at the Komoka BPS and Komoka IPS would be maintained. This is not a viable solution considering projected growth in Komoka-Kilworth-Delaware, and the additional pumping capacity required by 2026 (based on current growth projections), without which pressure issues would arise.

KKD-PMP-2: Expand Komoka BPS & Komoka IPS

Under this alternative solution, the additional pumping capacity needed to supply growth in Komoka-Kilworth-Delaware would be provided at the existing Komoka BPS and Komoka IPS. The expansion of the Delaware BPS is mainly considered with respect to Delaware's pumping needs and alternative solutions are presented in **Section 5.2.7**. Existing pumps would be replaced and/or new pumps would be added, and the existing PS superstructure would be expanded as needed. This solution would make optimized use of existing infrastructure and land available, and would be efficient in terms of operational costs since only a single facility would be operated. The need for a new BPS was not identified based on hydraulics.

KKD-PMP-3: Build new BPS

Under this alternative solution, the additional pumping capacity needed to supply growth in Komoka-Kilworth-Delaware would be provided at a new pumping facility. The implementation of a new pumping facility within Delaware is mainly considered with respect to Delaware's pumping needs and alternative solutions are presented in **Section 5.2.7**. This solution would require new infrastructure and capital and operational costs. However, it would be inefficient to build and operate a new pumping facility, given that existing and future areas within Komoka-Kilworth-Delaware can be serviced by the available pumping facilities hydraulically. New pumping facilities would be needed if new at-grade storage is implemented as part of the selected storage alternative solutions, however this is not considered as part of the overall pumping alternative solutions being assessed.

Komoka-Kilworth – Recommended Pumping Alternative Solution

The recommended pumping alternative solution for Komoka-Kilworth-Delaware is **KKD-PMP-2: Expand Komoka BPS & Komoka IPS**.

5.2.4 Komoka-Kilworth - Pressure Deficiencies & Supply Reliability in Kilworth Alternative Solutions

KK-PSIREL-1: Do Nothing

Under this alternative solution, existing watermain infrastructure would be maintained. Given observed operating pressures deficiencies within Kilworth under growth conditions, due to high head losses in the Queen St watermain in Komoka and a low static HGL at the Komoka ET, this is not a viable option.

KK-PSIREL-2: Upgrade existing watermains

Under this alternative solution, existing watermains would be decommissioned and replaced within the same alignment, or twinned within the same alignment. Given observed operating pressures deficiencies within Kilworth under growth conditions, due to high head losses in the Queen St watermain in Komoka, there is a need to increase conveyance capacity. Considering the limited available public rights-of-way (ROW) in Komoka, existing watermains would be upgraded or twinned. The extent of watermain upgrades needed is approximately 5.5 km, resulting in high capital costs, however the improvement in minimum pressures in marginal.

KK-PSIREL-3: Provide new storage within Kilworth

Under this alternative solution, a new storage facility (at-grade with BPS or ET) would be built within Kilworth, to offset peak demand supply from Komoka and provide reliability within Kilworth in the event of a watermain break. There is limited available municipally-owned land within Kilworth to implement new storage, and residents might not be receptive to this new infrastructure.

KK-PSIREL-4: Upgrade existing watermains, storage and pumping in Komoka

Under this alternative solution, addressing pressure deficiencies in Kilworth would be achieved by a combination of existing upstream infrastructure upgrades in Komoka. The existing Komoka ET and Komoka-Kilworth IPS would be upgraded, which would also contribute to meeting the overall storage and pumping needs for the settlements. Given the Komoka ET upgrades (and potential to increase operating HGLs), watermain upgrades would be needed to accommodate the increased flows. The extent of the watermain upgrades, however, would be less than under Alternative Solution KK-PSIREL-2.

Komoka-Kilworth (Pressure Deficiencies in Kilworth) – Recommended Alternative Solution

The alternative solutions were evaluated using a decision-matrix. Based on the detailed evaluation presented in **Appendix A**, the recommended alternative solution is **KK-PSIREL-4: Upgrade existing watermains, storage and pumping in Komoka**. This recommended solution is further refined in **Section 6.0**.

5.2.5 Kilworth - Old Kilworth Servicing Alternative Solutions

KIL-WM-1: Do Nothing

Under this alternative solution, existing watermain infrastructure would be maintained, and no new watermains would be built to service Old Kilworth.

KIL-WM-2: Build new watermains

Under this alternative solution, new watermains would be built along the existing ROWs in Old Kilworth, to service the existing properties.

Kilworth (Old Kilworth Servicing) – Recommended Watermain Alternative Solution

The recommended watermain solution for Kilworth to service Old Kilworth is **KIL-WM-2: Build new watermains**.

5.2.6 Delaware – Storage Alternative Solutions

DEL-ST-1: Do Nothing

Under this alternative solution, existing storage infrastructure would be maintained. This is not a viable solution considering projected growth in Delaware, and the additional storage capacity required by 2040 (based on current growth projections, and considering the contribution of the Komoka ET to overall storage in Delaware), without which pressure and reliability issues would arise.

DEL-ST-2: Expand existing storage (standpipe)

Under this alternative solution, the additional storage capacity needed to supply growth in Delaware would be provided at the existing storage facilities, i.e., the Delaware Standpipe on Longwoods Rd. The existing standpipe would be demolished and replaced in its current location. This solution would make optimized use of available land, and would be efficient in terms of operational costs since only the existing facility would be operated. However, the standpipe was recently upgraded, therefore this option might not be viable considering the age of the infrastructure.

DEL-ST-3: Build new storage (reservoir or ET) on existing site

Under this alternative solution, the additional storage capacity needed to supply growth in Delaware would be provided by new storage infrastructure, on the existing standpipe storage site on Longwoods Rd.

DEL-ST-4: Build new storage (reservoir or ET) on new site

Under this alternative solution, the additional storage capacity needed to supply growth in Delaware would be provided at a new storage facility. This solution would require new infrastructure and capital and operational costs. However, it would provide additional reliability and be beneficial in terms of hydraulics.

Delaware – Recommended Storage Alternative Solution

The alternative solutions were evaluated using a decision-matrix. Based on the detailed evaluation presented in **Appendix A**, the recommended alternative solution is **DEL-ST-4: Build new storage (reservoir or ET) on new site**. This recommended solution is further refined in **Section 6.0**.

5.2.7 Delaware – Pumping Alternative Solutions

DEL-PMP-1: Do Nothing

Under this alternative solution, existing pumping infrastructure and capacity at the Delaware BPS would be maintained. This is not a viable solution considering projected growth in Delaware, and the additional pumping capacity required in the short-term, without which pressure issues would arise.

DEL-PMP-2: Expand Delaware BPS

Under this alternative solution, the additional pumping capacity needed to supply growth in Delaware would be provided at the existing Delaware BPS. Existing pumps would be replaced and/or new pumps would be added, and the existing PS superstructure would be expanded as needed. This solution would make optimized use of existing infrastructure recently built and land available, and would be efficient in terms of operational costs since only a single facility would be operated. The need for a new BPS was not identified based on hydraulics, however, there is the potential to implement a new BPS in conjunction with a new storage facility, should the new storage facility consist of an at-grade reservoir. These can be explored as part of design alternatives for specific development areas.

DEL-PMP-3: Build new BPS

Under this alternative solution, the additional pumping capacity needed to supply growth in Delaware would be provided at a new pumping facility. This solution would require new infrastructure and capital and operational costs. However, it would be inefficient to build and operate a new pumping facility, given that existing and future areas within Delaware can be serviced by the available pumping facilities hydraulically. Nonetheless, there is the potential to implement a new BPS in conjunction with a new storage facility, should the new storage facility consist of an at-grade reservoir. These can be explored as part of design alternatives for specific development areas, but are not considered as part of the overall pumping alternative solutions for Delaware.

Delaware – Recommended Pumping Alternative Solution

The recommended pumping alternative solution for Delaware is **DEL-PMP-2: Expand Delaware BPS**. A new BPS could also be implemented as part of the development of specific areas, in conjunction with new at-grade reservoirs. These can be explored as part of design alternatives.

5.2.8 Delaware - Gideon Dr Watermain Constraints Alternative Solutions

DEL-WM-1: Do Nothing

Under this alternative solution, the existing watermain infrastructure along Gideon Dr would be maintained. However, as identified in **Section 4.4.3.4**, velocities in the Gideon Dr watermain exceed the target maximum velocities.

DEL-WM-2: Upgrade existing watermains

Under this alternative solution, the existing watermain along Gideon Dr would be decommissioned and replaced within the same alignment, or twinned within the same alignment.

DEL-WM-3: Build new watermains

Under this alternative solution, a new watermain would be built to connect the Delaware BPS to Delaware, via Carriage Rd.

Delaware (Gideon Dr Watermain Constraints) – Recommended Watermain Alternative Solutions

The alternative solutions were evaluated using a decision-matrix. Based on the detailed evaluation presented in **Appendix A**, the recommended alternative solution is **DEL-WM-2: Upgrade existing watermains**. This recommended solution is further refined in **Section 6.0**

5.3 ARVA

5.3.1 Arva – Water Supply Alternative Solutions

ARV-SUP-1: Do Nothing

Under this alternative solution, existing supply infrastructure and agreements would be maintained. This includes maintaining the boundaries of the City of London water service area as defined in the agreement with the City.

ARV-SUP-2: Connect to LHWPSS

Under this alternative solution, existing and future demands in Arva would be supplied by the LHWPSS, with the implementation of a new connection to the LHWPSS infrastructure at a new Arva Reservoir & BPS. This solution would require new infrastructure and capital costs, however operational costs currently associated with water consumption billing from the City of London and rehabilitating the existing infrastructure (Richmond St watermain) could be transferred to obtaining supply from the LHWPSS.

ARV-SUP-3: Service growth from private wells

Under this alternative solution, private wells would be implemented on each new growth parcel within Arva. This is not a viable solution from a master-planning perspective, as it will limit the potential to develop surrounding lands and does not make optimized use of existing infrastructure to supply growth.

Furthermore, current growth areas are located within a single subdivision, hence supplying each parcel from a private well would not be efficient.

ARV-SUP-4: Service growth from new communal well system(s)

Under this alternative solution, new communal well systems would be implemented to supply clusters of growth areas within Arva. This solution could be considered for the new subdivision planned within Arva, however it would require additional infrastructure and capital and operational costs, which does not contribute to the settlements' overall water supply needs, and is therefore not a viable solution from a master-planning perspective.

Arva – Recommended Water Supply Alternative Solution

The alternative solutions were evaluated using a decision-matrix. Based on the detailed evaluation presented in **Appendix A**, the recommended alternative solution is **ARV-SUP-2: Connect to LHWPSS**. This recommended solution is further refined in **Section 6.0**.

5.3.2 Arva – Reliability (Storage/Watermains) Alternative Solutions

ARV-REL-1: Do Nothing

Under this alternative solution, no new storage facility would be built within Arva, hence no additional infrastructure capital and operational costs would be incurred. However, without storage, there could be reliability issues, should there be a break in supply from the City of London.

ARV-REL-2: Build new storage (reservoir or ET)

Under this alternative solution, a new storage facility would be built within Arva, with the associated additional infrastructure capital and operational costs. A new storage facility would provide reliability, should there be a break in supply from the City of London. Additionally, considering the potential for the implementation of water supply from the LHWPSS (identified in **Section 5.3.1**), storage within Arva could help offset peak demands, leading to a reduction in the new watermain sizing from the LHWPSS.

ARV-REL-3: Upgrade or loop existing watermains

Under this alternative solution, the existing watermain along Richmond St would be rehabilitated within the same alignment, or a new watermain would be built to provide looping, to mitigate the risk of watermain breaks.

Arva – Recommended Reliability (Storage/Watermains) Alternative Solution

The alternative solutions were evaluated using a decision-matrix. Based on the detailed evaluation presented in **Appendix A**, the recommended alternative solution is **ARV-REL-2: Build new storage**. This recommended solution is further refined in **Section 6.0**.

5.4 OTHER COMMUNITIES

5.4.1 Ballymote – Water Supply Alternative Solutions

BMT-SUP-1: Do Nothing

Under this alternative solution, existing supply infrastructure and agreements would be maintained. This includes maintaining the boundaries of the City of London water service area as defined in the agreement with the City. This is not a viable alternative solution considering projected growth in Ballymote, where some of the growth parcels identified are outside the currently agreed upon service area.

BMT-SUP-2: Expand City of London water service agreement area

Under this alternative solution, existing supply infrastructure from the City of London would be maintained, however, the boundaries of the water service area as defined in the agreement with the City would be expanded as needed based on future growth areas. This solution would make optimized use of the existing infrastructure to supply growth.

BMT-SUP-3: Expand supply capacity from LHWPSS

Under this alternative solution, existing and future demands in Ballymote would be supplied by the LHWPSS, with the implementation of a new connection to the LHWPSS infrastructure. This solution would require new infrastructure and capital costs. However, this is not a viable solution given the projected MDD growth of only +0.01 MLD by 2046, and the distance from LHWPSS infrastructure.

BMT-SUP-4: Service growth from private wells

Under this alternative solution, private wells would be implemented on each new growth parcel within Ballymote. This is not a viable solution from a master-planning perspective, as it will limit the potential to develop surrounding lands and does not make optimized use of existing infrastructure to supply growth. Furthermore, current growth areas are located within 2 main growth areas, hence supplying each parcel from private wells would not be efficient.

BMT-SUP-5: Service growth from new communal well system(s)

Under this alternative solution, new communal well systems would be implemented to supply clusters of growth areas within Ballymote. This solution could be considered for each of the 2 new growth areas planned, however it would require additional infrastructure and capital and operational costs, which does not make optimized use of existing infrastructure. It is therefore not a viable master-planning solution.

Ballymote – Recommended Water Supply Alternative Solution

The recommended water supply alternative solution for Ballymote is **BMT-SUP-2: Expand City of London water service agreement area**.

5.4.2 Denfield – Water Supply Alternative Solutions

DNF-SUP-1: Do Nothing

Under this alternative solution, existing supply infrastructure and agreements would be maintained. This is not a viable option considering projected growth in Denfield.

DNF-SUP-2: Expand supply capacity from LHWPSS

Under this alternative solution, existing and future demands in Denfield are supplied by the LHWPSS, via the Denfield BPS & Rechlorination Facility. Future water demands in Denfield would be considered in LHWPSS master-planning initiatives and future infrastructure sizing. This solution would make optimized use of the existing infrastructure to supply growth.

DNF-SUP-3: Service growth from private wells

Under this alternative solution, private wells would be implemented on each new growth parcel within Denfield. This is not a viable solution from a master-planning perspective, as it will limit the potential to develop surrounding lands and does not make optimized use of existing infrastructure to supply growth. Furthermore, current growth areas consist of adjacent parcels along Denfield Rd, hence supplying each parcel from a private well would not be efficient.

DNF-SUP-4: Service growth from new communal well system(s)

Under this alternative solution, new communal well systems would be implemented to supply clusters of growth areas within Denfield. This solution could be considered for the adjacent parcels planned within Denfield, however it would require additional infrastructure and capital and operational costs, which does not make optimized use of existing infrastructure, and is therefore not a viable solution from a master-planning perspective.

Denfield – Recommended Water Supply Alternative Solution

The recommended water supply alternative solution for Denfield is **DNF-SUP-2: Expand supply capacity from LHWPSS**.

5.4.3 Birr – Water Supply Alternative Solutions

BIR-SUP-1: Do Nothing

Under this alternative solution, existing supply infrastructure would be maintained. This is not a viable option considering projected growth in Birr.

BIR-SUP-2: Connect to LHWPSS

Under this alternative solution, existing and future demands in Birr would be supplied by the LHWPSS, with the implementation of a new connection to the LHWPSS infrastructure. This solution would require new infrastructure and capital and operational costs. However, this is not a viable solution given the size of Birr, the projected 2046 growth of only +0.008 MLD (only 1 growth parcel was identified), and the distance from LHWPSS infrastructure.

BIR-SUP-3: Service growth from private wells or a new communal well system

Under this alternative solution, private wells would be implemented in the new growth area within Birr. Should multiple properties be developed on that parcel, each property would be supplied by an individual well, or a new communal well system would be implemented. Since this area is not adjacent to the existing communal well system within Birr, this could be a viable solution to allow development to proceed. Other adjacent existing properties within Birr are also already supplied by private wells, and could be serviced by a new communal well system, should there be interest. Whether individual wells or a communal well system is to be implemented will depend on the type of development planned on this parcel (i.e., single property vs multiple properties), and should be reviewed once more information on the planned development is known.

Birr – Recommended Water Supply Alternative Solution

The recommended water supply alternative solution for Birr is **BIR-SUP-3: Service growth from private wells or a new communal well system**.

5.4.4 Small Settlements (Bryanston, Lobo, Poplar-Hill Coldstream) – Water Supply Alternative Solutions

STL-SUP-1: Do Nothing

Under this alternative solution, existing supply infrastructure would be maintained. This is not a viable option considering projected growth in each of these settlements.

STL-SUP-2: Expand supply capacity from LHWPSS

Under this alternative solution, existing and future demands in Birr would be supplied by the LHWPSS, with the implementation of a new connection to the LHWPSS infrastructure. This solution would require new infrastructure and capital and operational costs. However, this is not a viable solution given the size of these small settlements, the projected 2046 MDD growth of only +0.01 MLD, and the distance from LHWPSS infrastructure.

STL-SUP-3: Service growth from private wells or new communal well systems

Under this alternative solution, private wells would be implemented in each new growth area within each small settlement. Should multiple properties be developed in those areas, each property would be supplied by an individual well, or a new communal well system would be implemented. Since existing properties in these small settlements are currently serviced by private wells only, this could be a viable solution to allow development to proceed. Other adjacent existing properties within each settlement already supplied by private wells could be serviced by the new communal well systems, should there be interest. Whether individual wells or a communal well system is to be implemented will depend on the type of development planned in each growth area (i.e., single property vs multiple properties), and should be reviewed once more information on the planned developments is known.

Small Settlements (Bryanston, Lobo, Poplar-Hill Coldstream) – Recommended Water Supply Alternative Solution

The recommended water supply alternative solution for small settlements is **STL-SUP-3: Service growth from private wells or new communal well system**.

5.5 SUMMARY OF RECOMMENDED SOLUTIONS

Table 5-1 summarizes the recommended solutions established for each settlement and potable water servicing issue identified. These solutions are further refined into projects in **Section 6.0**.

Table 5-1: Summary of Potable Water Servicing Issues by Settlement and Recommended Alternative Solutions

Settlement	Issue ID	Potable Water Servicing Issues	Recommended Alternative Solution
Ilderton	**ILD-SUP**	Increase in water supply needed with growth	ILD-SUP-2: Expand supply capacity from LHWPSS
	ILD-ST	Increase in storage capacity needed with growth	ILD-ST-4: Build new storage (reservoir or ET) on new site
	ILD-PMP	Increase in pumping capacity needed with growth	ILD-PMP-2: Expand Ilderton BPS
Komoka-Kilworth-Delaware	**KKD-SUP**	Increase in water supply in Komoka-Kilworth-Delaware needed with growth	KKD-SUP-2: Expand supply capacity from LHWPSS
	KKD-ST	Increase in storage capacity in Komoka-Kilworth needed with growth	KKD-ST-2: Expand existing storage (reservoir or ET)
	KKD-PMP	Increase in pumping capacity in Komoka-Kilworth needed with growth	KKD-PMP-2: Expand Komoka BPS & Komoka IPS
	KK-PSIREL	Address future pressure deficiencies and provide supply redundancy in Kilworth	KK-PSIREL-4: Upgrade existing watermains, storage and pumping in Komoka
	KIL-WM	Extend existing watermain network to supply Old Kilworth	KIL-WM-2: Build new watermains
	DEL-ST	Increase in storage capacity in Delaware needed with growth	DEL-ST-4: Build new storage (reservoir or ET) on new site
	DEL-PMP	Increase in pumping capacity in Delaware needed with growth	DEL-PMP-2: Expand Delaware BPS
	DEL-WM	Twinning/looping/upgrade of Gideon Dr watermain from Delaware BPS to Delaware needed for reliability, existing watermain performance and growth	DEL-WM-2: Upgrade existing watermains

Settlement	Issue ID	Potable Water Servicing Issues	Recommended Alternative Solution
Arva	**ARV-SUP**	Increase in water supply needed with growth	ARV-SUP-2: Connect to LHWPSS
	ARV-REL	Increase reliability of supply (through watermain twinning or storage) with growth	ARV-REL-2: Build new storage (reservoir or ET)
Ballymote	**BMT-SUP**	Increase in water supply needed with growth	BMT-SUP-2: Expand City of London water service agreement area
Denfield	**DNF-SUP**	Increase in water supply needed with growth	DNF-SUP-2: Expand supply capacity from LHWPSS
Birr	**BIR-SUP**	Increase in water supply needed with growth	BIR-SUP-3: Service growth from private wells or a new communal well system
Small Settlements (Bryanston, Lobo, Poplar Hill-Coldstream)	**STL-SUP**	Increase in water supply needed with growth	STL-SUP-3: Service growth from private wells or new communal well systems

6.0 RECOMMENDED PROJECTS

Recommended solutions were established in **Section 5.5** for each settlement and potable water servicing issue identified. In this section, each selected solution is refined and a specific project scope defined. An implementation plan consisting of opinions of probable cost (OPC) and project timelines is presented.

6.1 REFINED PROJECTS

6.1.1 Ilderton – Refined Projects

The recommended projects for the Ilderton water servicing to meet future growth needs are as follows:

- **ILD-PMP-2: Expand Ilderton BPS**
  - Add +9 L/s of pumping capacity at 59 m TDH to the existing Ilderton BPS. This upgrade can be accommodated within the existing Ilderton BPS building.
- **ILD-ST-4: Build new storage on new site**
  - Build a new 2,000 m^3 storage facility on Hyde Park Rd, at the south end of Ilderton on proposed development lands.

6.1.2 Komoka-Kilworth-Delaware – Refined Projects

The recommended projects for the Komoka-Kilworth-Delaware water servicing to meet future growth needs are as follows:

- **KKD-SUP-2: Expand supply capacity from LHWPSS**
  - **KKD-SUP-2A**: Extend the existing water distribution system to service employment development lands southwest of Komoka, along Glendon Dr, with 1.8 km of 200 mm diameter watermain (extend existing watermain to Amiens Rd).
- **KKD-PMP-2: Expand Komoka BPS & Komoka IPS**
  - **KKD-PMP-2A**: Add +58.9 L/s of pumping capacity at 34.3 m TDH to the existing Komoka BPS. This upgrade can be accommodated within the existing Komoka BPS building.
  - **KKD-PMP-2B/KK-PSIREL-4A**: Upgrade the Komoka IPS (increase rated capacity to 90 L/s at 45 m TDH). A new (larger) PS building may be required to accommodate this upgrade.
- **KKD-ST-2: Expand existing storage (in-ground reservoir or ET)**
  - **KKD-ST-2A**: Expand the existing at-grade storage reservoir at the Komoka BPS; add a total volume of 3,334 m^3 when combined with the Komoka ET replacement (KKD-ST-2B).
  - **KKD-ST-2B/KK-PSIREL-4B**: Decommission the existing Komoka ET and replace with a higher and larger ET; add a total volume of 3,334 m^3 when combined with the Komoka BPS reservoir expansion (KKD-ST-2A).
- **KK-PSIREL-4: Upgrade existing watermains, storage and pumping**
  - **KK-PSIREL-4C**: Twin existing watermain on Queen St (from Oxbow Dr to Railway Ave) and on Railway Ave (from Queen St to Tunks Ln) with 1.1 km of 300 mm diameter watermain.

  - **KK-PSIREL-4D**: Twin the existing watermain on Glendon Dr from Tunks Ln to Crestview Dr, to increase reliability of supply to Kilworth.

6.1.3 Kilworth – Refined Projects

The recommended projects for the Kilworth water servicing to meet future growth needs are as follows:

- **KIL-WM-2: Build new watermains**
  - **KIL-WM-2A**: Build 2.6 km of new 150 mm diameter watermain within the existing ROWs in Old Kilworth to service existing properties.

6.1.4 Delaware – Refined Projects

The recommended projects for the Delaware water servicing to meet future growth needs are as follows:

- **DEL-PMP-2: Expand Delaware BPS**
  - Add +20 L/s of pumping capacity to the existing Delaware BPS. This upgrade can be accommodated within the existing Delaware BPS building.
- **DEL-ST-4: Build new storage (reservoir or ET) on new site**
  - Build a new 1,300 m^3 storage facility in the employment development lands in the south of Delaware, adjacent to the proposed sanitary PS #1.
    - The design alternatives are:
      - **DEL-ST-4A**: Build a new reservoir and BPS
      - **DEL-ST-4B**: Build a new standpipe.
    - Water consumption in employment areas can be highly variable depending on the type of industry, therefore a new reservoir and BPS may be preferred, as there is flexibility in the sizing (incremental implementation). The preferred design alternative should be reviewed at the preliminary design stage.
- **DEL-WM-2: Upgrade existing watermains**
  - Upgrade the existing watermain on Gideon Dr (from Komoka Rd to Millcreek Ln) to 2.6 km of 300 mm diameter watermain.

6.1.5 Arva – Refined Projects

The recommended projects for the Arva water servicing to meet future growth needs are as follows:

- **ARV-SUP-2: Connect to LHWPSS**
  - Build a new 1.25 km long 200 mm diameter feedermain on Medway Rd, from PS #4 at the Arva Reservoir to the proposed new water storage facility within Arva (see ARV-REL-2).
- **ARV-REL-2: Build new storage (reservoir or ET)**
  - Build a new 875 m^3 storage facility and 14.7 L/s BPS at the west end of Arva, on Medway Rd, adjacent to the proposed sanitary PS.

6.2 IMPLEMENTATION PLAN

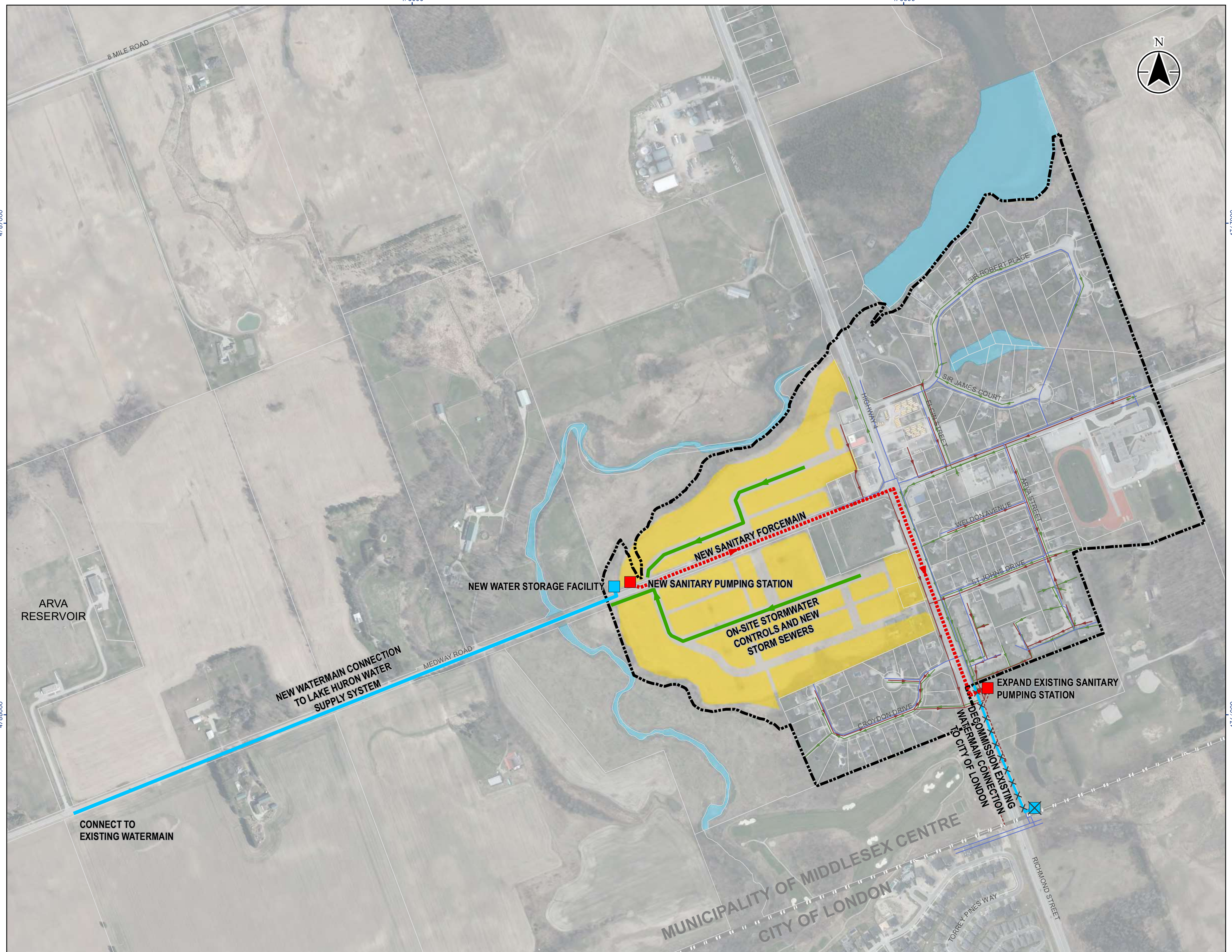
The recommended projects are summarized in **Table 6-1**, along with a recommended project timeline and OPCs. The total OPC includes the following components:

- Material and construction costs;
- Contingency (20% of the material and construction costs);
- Engineering (30% of the material and construction + contingency costs).

The project locations are shown in **Figure 6-1** to **Figure 6-5**.

Table 6-1: Summary of Recommended Potable Water Servicing Projects, Timeline and Opinions of Probable Cost

Settlement	Project ID	Description	Scope	Project Timeline (Trigger)	OPC (Material & Construction Only) [2023$]	Total OPC (incl. Contingency & Engineering) [2023$]
Ilderton	**ILD-PMP-2**	Expand Ilderton BPS	Add +9 L/s of pumping capacity at 59 m TDH to the existing Ilderton BPS.	MDD = 34 L/s in Ilderton Or Population (RES + EMP) = 6,124 persons i.e., 2035 under current projections	$0.6M	$0.9M
	ILD-ST-4	Build new storage on new site	Build a new 2,000 m^3 storage facility on Hyde Park Rd, at the south end of Ilderton on proposed development lands.	MDD = 30 L/s in Ilderton Or Population (RES+EMP) = 5,488 persons i.e., 2030 under current projections	$4.5M	$7.0M
Komoka	**KKD-SUP-2A**	Extend the existing water distribution system	Build 1.8 km of 200 mm diameter watermain along Glendon Dr (extend existing watermain to Amiens Rd), to service employment development lands southwest of Komoka.	Coincident with development	$3.7M	$5.8M
	KKD-PMP-2A	Expand Komoka BPS	Add +58.9 L/s of pumping capacity at 34.3 m TDH to the existing Komoka BPS.	MDD = 53.7 L/s in KKD Or Population (RES+EMP) = 11,948 persons i.e., 2027 under current projections	$0.7M	$1.1M
	KKD-PMP-2B/KK-PSIREL-4A	Expand Komoka IPS	Upgrade the Komoka IPS (increase rated capacity to 90 L/s at 45 m TDH).	Short-term (to address existing minimum pressure issues in Kilworth)	$0.7M	$1.1M
	KKD-ST-2A	Expand existing storage (in-ground reservoir)	Expand the existing at-grade storage reservoir at the Komoka BPS; add a total volume of 3,334 m^3 when combined with the Komoka ET replacement (KKD-ST-2B).	MDD = 71 L/s in KKD Or Population (RES+EMP) = 15,645 persons i.e., 2034 under current projections	$1.9M	$3.0M
	KKD-ST-2B/ KK-PSIREL-4B	Replace existing Komoka ET	Decommission the existing Komoka ET and replace with a higher and larger ET; add a total volume of 3,334 m^3 when combined with the Komoka BPS reservoir expansion (KKD-ST-2A).	Earliest of: • Medium-term to address future minimum pressure issues in Kilworth, observed when PHD = ~1.6 x existing PHD, i.e., 2036 under current projections • Needed to meet overall storage needs for KKD when combined with KKD-ST-A MDD = 71 L/s in KKD Or Population (RES+EMP) = 15,645 person i.e., 2034 under current projections	$6.9M	$10.8M
	KK-PSIREL-4C	Upgrade existing watermains	Twin existing watermain on Queen St (from Oxbow Dr to Railway Ave) and on Railway Ave (from Queen St to Tunks Ln) with 1.1 km of 300 mm diameter watermain.	Once Komoka ET has been replaced (see KKD-ST-2B), i.e., Medium-term to address future minimum pressure issues in Kilworth, observed when PHD = ~1.6 x existing PHD, i.e., 2036 under current projections	$2.4M	$3.8M
Kilworth	**KIL-WM-2A**	Supply Old Kilworth	Build 2.6 km of new 150 mm diameter watermain within the existing ROWs in Old Kilworth to service existing properties.	Municipality/Old Kilworth residents' decision to proceed with connecting to the existing distribution system	$5.3M	$8.3M
	KK-PSIREL-4D	New watermain looping between Komoka and Kilworth	Twin existing watermain on Glendon Dr from Tunks Ln to Crestview Dr, to increase reliability of supply to Kilworth	Short-term (for reliability)	$1.3M	$2.0M
Delaware	**DEL-PMP-2**	Expand Delaware BPS	Add +20 L/s of pumping capacity to the existing Delaware BPS.	MDD = 13 L/s in Delaware Or Population (RES+EMP) = 2,770 persons i.e., short-term under current projections	$0.4M	$0.7M
	DEL-ST-4	Build new storage (reservoir or ET) on new site	Build a new 1,300 m^3 storage facility in the employment development lands in the south of Delaware, adjacent to the proposed sanitary PS #1.	Coincident with employment lands' development.	$2.8M	$4.4M
	DEL-WM-2	Upgrade existing watermains	Upgrade the existing watermain on Gideon Dr (from Komoka Rd to Millcreek Ln) to 2.6 km of 300 mm diameter watermain.	Coincident with upstream Delaware BPS upgrade, i.e., MDD = 13 L/s in Delaware Or Population (RES+EMP) = 2,770 persons i.e., short-term under current projections	$2.9M	$4.6M
Arva	**ARV-SUP-2**	Connect to LHWPSS	Build a new 1.25 km long 200 mm diameter feedermain on Medway Rd, from PS #4 at the Arva Reservoir to the proposed new water storage facility within Arva (see ARV-REL-2).	Coincident with development	$1.3M	$2.0M
	ARV-REL-2	Build new storage (reservoir) & BPS	Build a new 875 m^3 storage facility with a 14.7 L/s BPS at the west end of Arva, on Medway Rd, adjacent to the proposed sanitary PS.	Coincident with development	$2.6M	$4.0M



Stantec

Legend

- Settlement Boundary
- Parcel
- Future Growth Area

Proposed Project

- Sanitary
- Water
- Storm

Existing Servicing

- Sanitary Facility
- Sanitary Sewer
- Sanitary Forcemain
- Water Facility
- Watermain
- Storm Sewer

0 250 500 m

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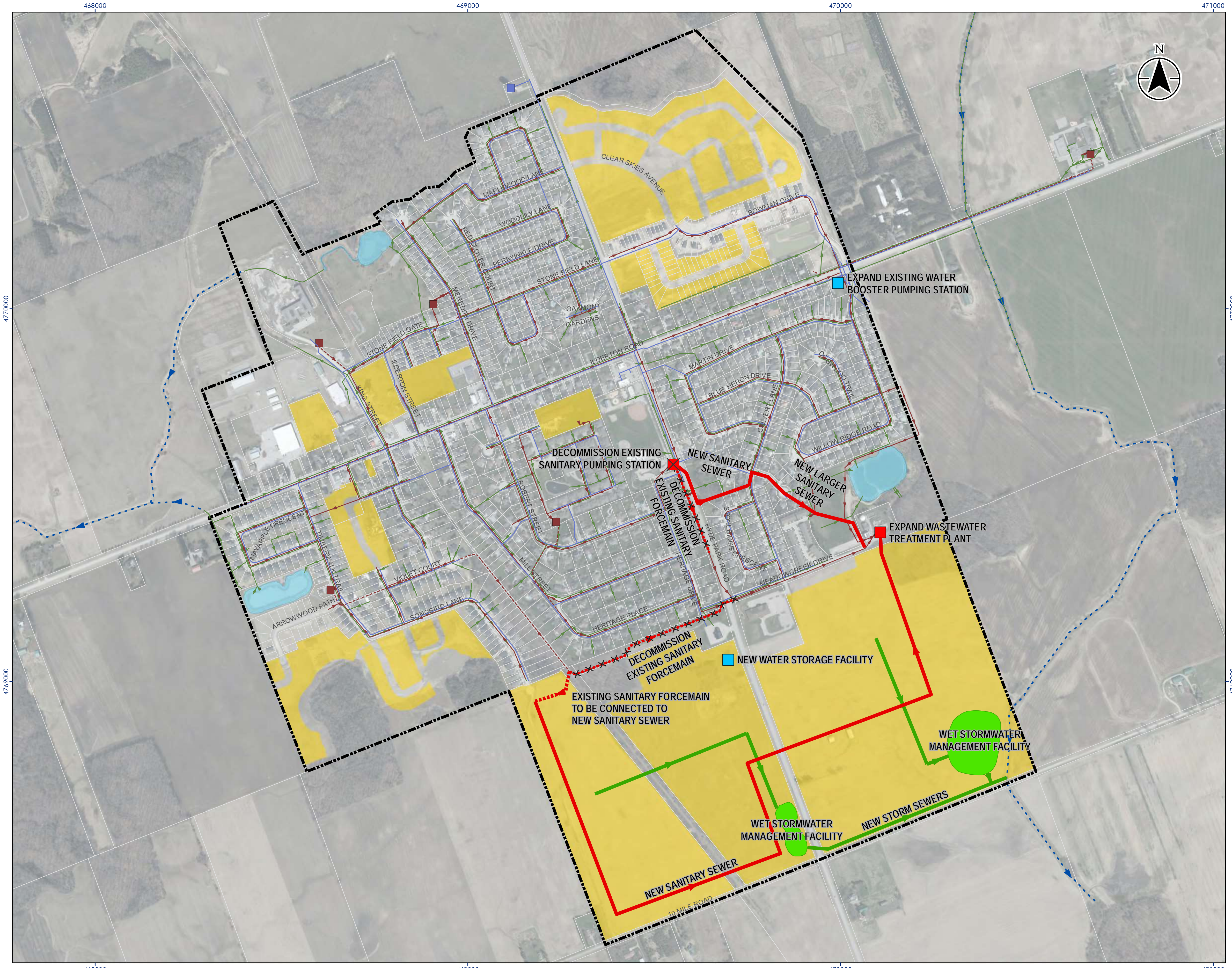
Project Location
Municipality of Middlesex Centre

165630236 REVA
Prepared by KDB on 2024-04-19

Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
6-1

Title
Proposed Projects Arva



Stantec

Legend

- Settlement Boundary
- Parcel
- Future Growth Area

Proposed Project

- Sanitary
- Water
- Storm

Existing Servicing

- Sanitary Facility
- Sanitary Sewer
- Sanitary Forcemain
- Water Facility
- Watermain
- Storm Sewer

0 250 500 m

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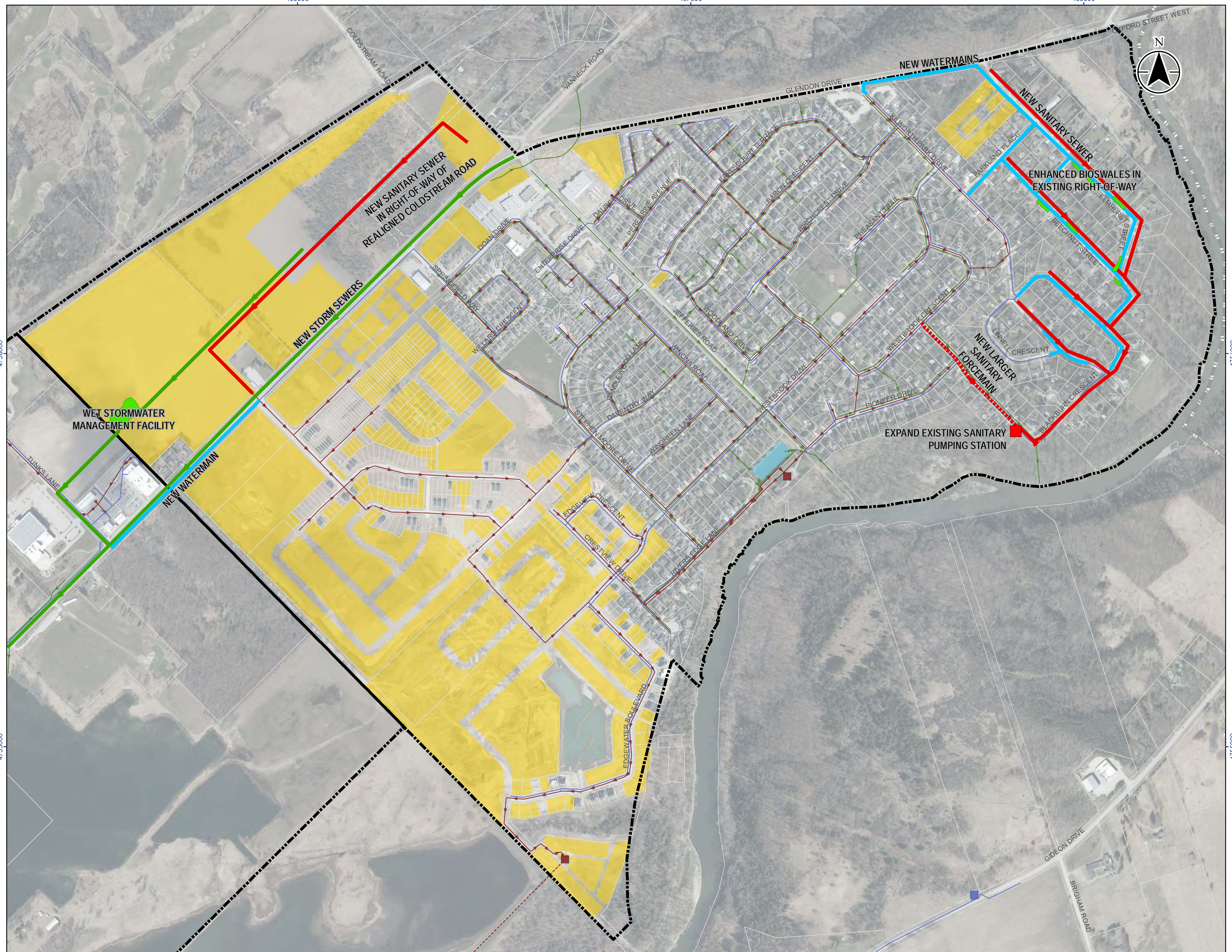
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
6-2

Title
Proposed Projects
Ilderton



Stantec

Legend

Settlement Boundary

Parcel

Future Growth Area

Proposed Project

- Sanitary
- Water
- Storm

Existing Servicing

- Sanitary Facility
- Sanitary Sewer
- Sanitary Forcemain
- Water Facility
- Watermain
- Storm Sewer

0 250 500 m

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Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
MASTER SERVICING PLAN

Figure No.
6-3

Title
Proposed Projects
Kilworth

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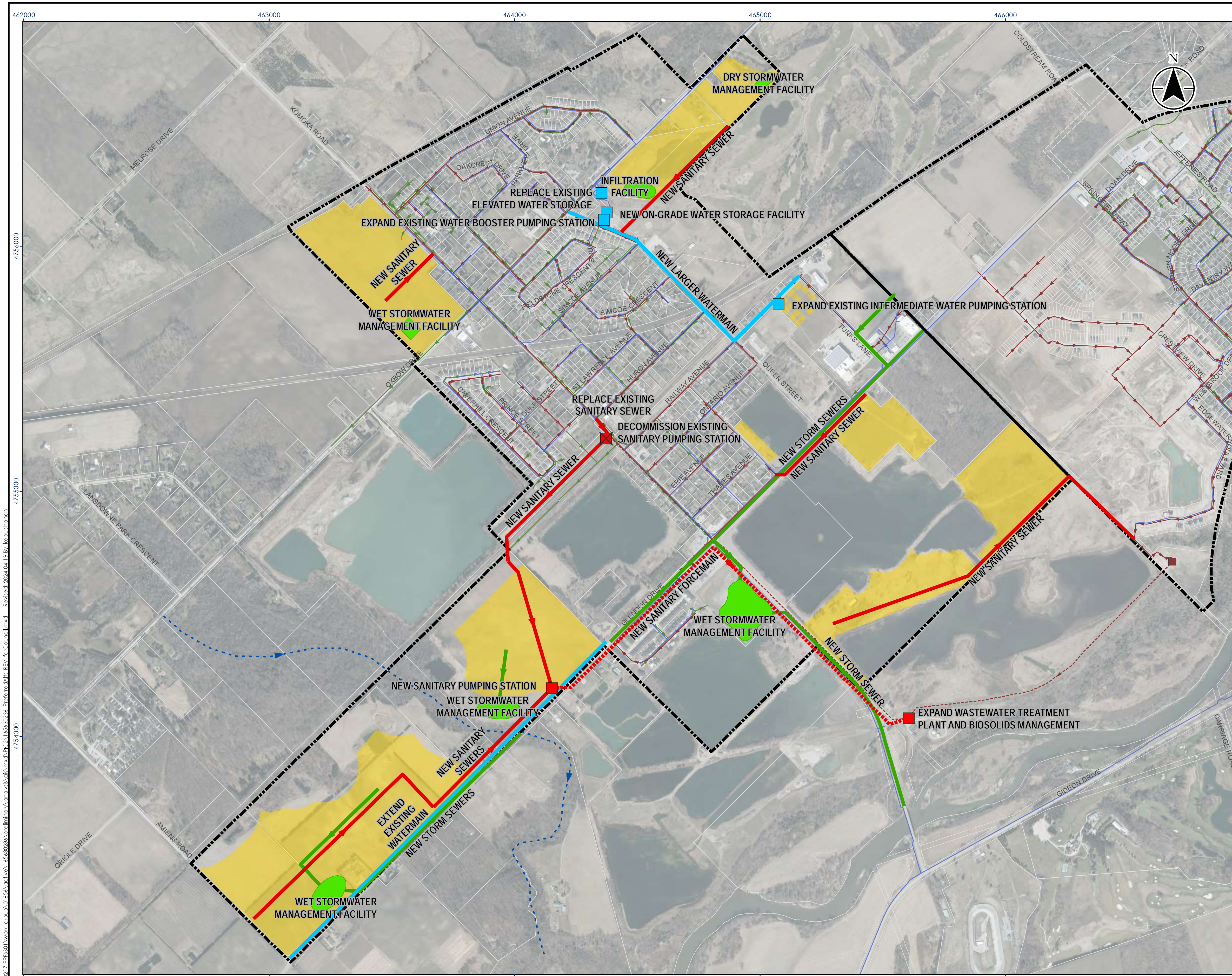

Stantec

Legend

- Settlement Boundary
- Parcel
- Future Growth Area

Proposed Project

- Sanitary
- Water
- Storm

Existing Servicing

- Sanitary Facility
- Sanitary Sewer
- Sanitary Forcemain
- Water Facility
- Watermain
- Storm Sewer

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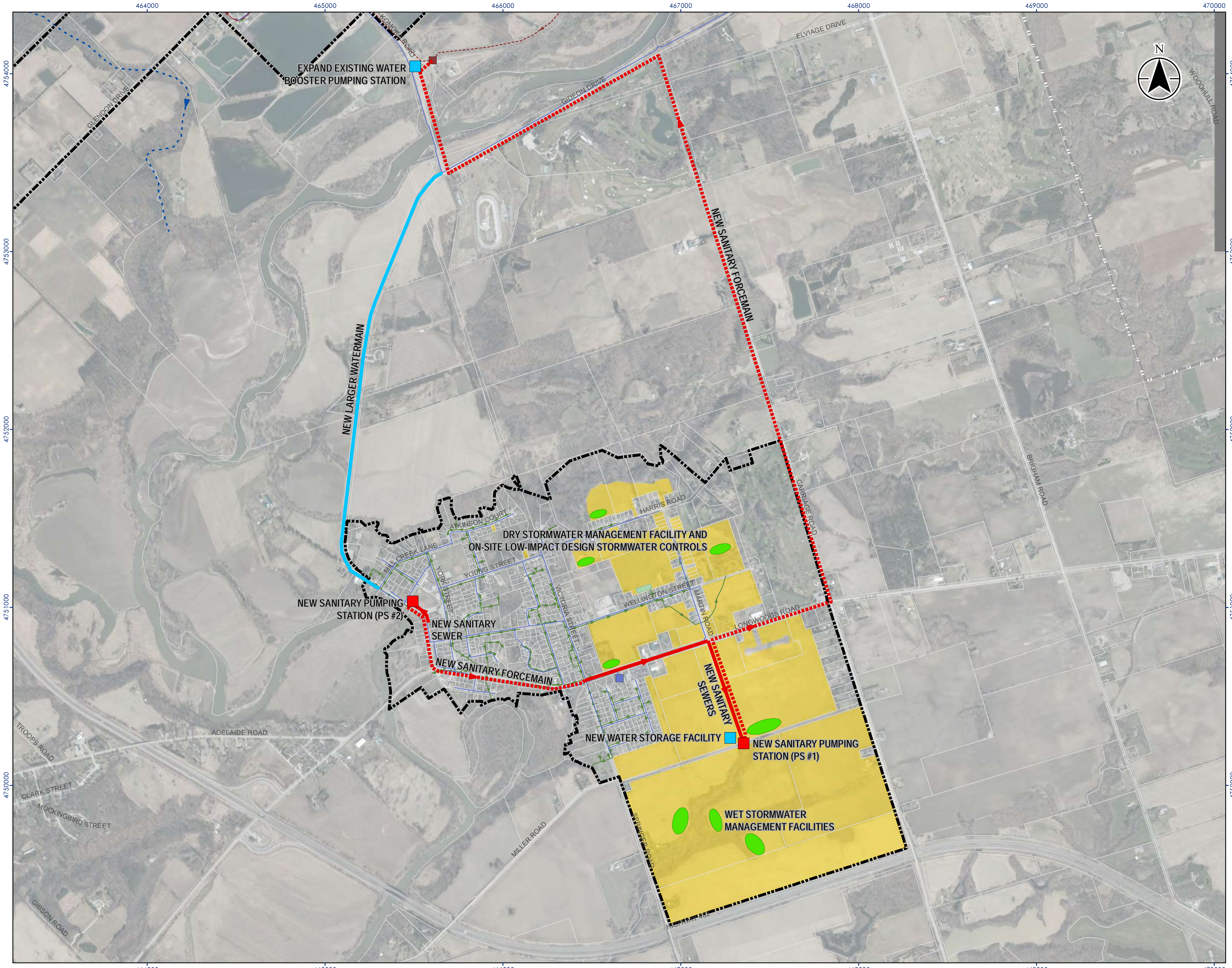
MASTER SERVICING PLAN

Figure No.
6-4

Title
Proposed Projects Komoka



Stantec

Legend

Settlement Boundary
Parcel
Future Growth Area

Proposed Project

Sanitary
Water
Storm

Existing Servicing

Sanitary Facility
Sanitary Sewer
Sanitary Forcemain
Water Facility
Watermain
Storm Sewer

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MASTER SERVICING PLAN

Figure No.
6-5

Title
Proposed Projects Delaware

7.0 SUMMARY & NEXT STEPS

This TM addresses the potable water servicing component of the Middlesex Centre Master Servicing Plan. It includes the following discussions:

- Introduction, including background review (**Section 1.0**);
- Overview of the existing water systems (**Section 2.0**);
- Overview of existing and future populations (**Section 3.0**);
- Assessment of existing systems and identification of issues (**Section 4.0**);
- Development of alternative solutions to address the issues identified (**Section 5.0**); and,
- Recommended projects and implementation plan (**Section 6.0**).

The findings of this TM will be used to inform the overall MSP report to guide the Municipality's long-term infrastructure planning to meet its Official Plan goals.

8.0 REFERENCES

Corporation of the City of London. (2019). *Design Specifications & Requirements Manual.*

Great Lakes - Upper Mississippi River Board (GLUMRB). (2022). *Recommended Standards for Water Works.*

Ministry of the Environment, Conservation and Parks. (2019). *Design Guidelines for Drinking-Water Systems.*

Municipality of Middlesex Centre. (2016). *Birr Water Treatment System O&M Manual.*

Municipality of Middlesex Centre. (2018). *Infrastructure Design Standards.*

Municipality of Middlesex Centre. (2023). *Official Plan of the Municipality of Middlesex Centre.*

Ontario Water Resources Act. (n.d.).

Ontario Water Resources Act – Ontario Regulation 903/90 Wells . (n.d.).

Ontario Water Resources Act -Ontario Regulation 387/04 Water Taking and Transfer. (n.d.).

Safe Drinking Water Act. (2002).

Safe Water Drinking Act - Ontario Regulation 169/03 Ontario Drinking Water Quality Standards . (2002).

Safe Water Drinking Act - Ontario Regulation 170/03 Drinking Water Systems. (2002).

Safe Water Drinking Act - Ontario Regulation 188/07 Licensing of Municipal Drinking Water Systems. (2002).

Safe Water Drinking Act – Ontario Regulation 453/07 Financial Plans. (2002).

Stantec. (2005). *Kilworth-Komoka Water Treatment Facility Interim Water Supply Upgrades.*

Stantec. (2007). *Initial Conditions Survey Report - Municipality of Middlesex Centre's Water and Wastewater Systems.*

Stantec. (2007). *Kilworth-Komoka Water Supply Class Environmental Assessment Environmental Study Report Addendum.*

Stantec. (2008). *Denfield Water Storage Class EA.*

Stantec. (2010). *Middlesex Centre Master Servicing Plan Class EA.*

Stantec. (2013). *Ilderton Water Storage Municipal Class EA.*

Stantec. (2017). *Delaware Water Servicing Schedule B Municipal Class Environmental Assessment .*

Stantec. (2017). *Melrose Water Supply Schedule B Municipal Class Environmental Assessment.*

Stantec. (2023). *Preliminary Design Report for the Melrose LHPWSS Interconnect.*

Statistics Canada. (2023, 02 01). *Census Profile, 2021 Census of Population*. Retrieved from https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&SearchText=middlesex%20centre&DGUIDlist=2021A00053539033&GENDERlist=1&STATISTIClist=1&HEADERlist=0

Sustainable Water and Sewage Systems Act. (2002).

Watson & Associates Economists Ltd. (2022). *Growth Management Strategy Technical Report - Final.*

APPENDIX A
ALTERNATIVE SOLUTIONS
EVALUATION MATRICES

165630236 - Middlesex Centre MP

Alternatives Evaluation - Potable Water

Ranking		Storage Alternatives			
		Ilderton			
		ILD-ST-1	ILD-ST-2	ILD-ST-3	ILD-ST-4
Category	Evaluation Criteria	Do Nothing	Expand existing storage (in-ground reservoir or ET)	Build new storage (new reservoir or ET) on existing site	Build new storage (new reservoir or ET) on new site
Socio-Economic	Potential to impact existing residences, businesses and community features Potential effect on approved/planned land uses Potential effects on known or potential significant archaeological resources, built heritage resources and cultural landscape features Potential to accommodate planned significant population and job growth in strategic growth areas	High potential to impact residents due to lower level of service (pressures, reliability) with increased population.	Potential impact on existing residences and land uses as relatively new ET would be replaced with a larger ET. Accommodates population growth, but does not provide additional reliability (single feed to existing ET site).	Potential impact on existing residences and land uses due to new infrastructure on existing site. Accommodates population growth, but does not provide additional reliability (single feed to existing ET site).	Potential impact on existing residences and land uses due to new infrastructure. Accommodates population growth and provides additional reliability to the single feed to the existing ET site.
Natural Environment	Potential to impact fish and aquatic habitat Potential to impact water resources including surface water (i.e. rivers, creeks, etc.), groundwater recharge areas and wellhead protection areas Potential to impact significant natural heritage features Potential to impact significant wildlife habitat and species at risk	No potential to impact fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk.	Possible impact to fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk, depending on selected storage site.	Possible impact to fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk, depending on selected storage site.	Possible impact to fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk, depending on selected storage site.
Technical Considerations	Potential land requirements including land purchase and temporary/permanent easements Constructability Effect on existing utilities and infrastructure Ability to coordinate with existing and planned infrastructure improvements System resiliency and system suitability	No improvement to infrastructure or hydraulics of the water distribution system. No land acquisition required, and no anticipated impacts on existing utilities.	Upgrades infrastructure and improves hydraulics in the water distribution system, but does not address lack of redundancy of single feed to existing ET site. No land acquisition required, and impacts on existing utilities can be mitigated.	Upgrades infrastructure and improves hydraulics in the water distribution system, but does not address lack of redundancy of single feed to existing ET site. No land acquisition required, and impacts on existing utilities can be mitigated.	Upgrades infrastructure and improves hydraulics in the water distribution system. Storage on new site increases redundancy of system, as existing site is currently supplied by a single feed. Land acquisition required for new storage, and impacts on existing utilities can be mitigated.
Financial	Lifecycle operations and maintenance costs Estimated capital cost	No capital cost. Operational costs due to aging infrastructure may increase.	Higher capital cost than Alternative ILD-ST-3, since it requires decommissioning of existing infrastructure. But lower operational & maintenance costs than Alternative ILD-ST-3, since only one storage facility would be in operation.	Lower capital cost than Alternative ILD-ST-2, since it does not require decommissioning of existing infrastructure. But higher operational & maintenance costs than Alternative ILD-ST-2, due to new infrastructure. Similar costs to Alternative ILD-ST-4.	Lower capital cost than Alternative ILD-ST-2, since it does not require decommissioning of existing infrastructure. But higher operational & maintenance costs than Alternative ILD-ST-2, due to new infrastructure. Similar costs to Alternative ILD-ST-3.
Summary Ranking	Well Aligned with Criteria Somewhat Aligned with Criteria Least Aligned with Criteria	Least Preferred Alternative	Moderately Preferred Alternative	Moderately Preferred Alternative	Most Preferred Alternative

165630236 - Middlesex Centre MP

Alternatives Evaluation - Potable Water

Ranking		Pressure Deficiency & Reliability Alternatives			
		Komoka-Kilworth (Pressure Deficiencies & Reliability in Kilworth)			
		KK-PSIREL-1	KK-PSIREL-2	KK-PSIREL-3	KK-PSIREL-4
Category	**Evaluation Criteria**	**Do Nothing**	**Upgrade existing watermains**	**Provide new storage within Kilworth**	**Upgrade existing watermains, storage and pumping**
Socio-Economic	**Potential to impact existing residences, businesses and community features**	High potential to impact residents due to lower level of service (pressures, reliability) with increased population.	Potential impact on existing residences and land uses due to construction. Accommodates population growth and provides additional reliability.	Potential impact on existing residences and land uses due to construction. Accommodates population growth and provides additional reliability.	Potential impact on existing residences and land uses due to construction. Leverages existing infrastructure and sites. Accommodates population growth and provides additional reliability.
	Potential effect on approved/planned land uses				
	Potential effects on known or potential significant archaeological resources, built heritage resources and cultural landscape features				
	Potential to accommodate planned significant population and job growth in strategic growth areas				
Natural Environment	**Potential to impact fish and aquatic habitat**	No potential to impact fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk.	Low potential to impact fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk.	Possible impact to fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk, depending on selected alignment.	Possible impact to fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk, depending on selected alignment.
	Potential to impact water resources including surface water (i.e. rivers, creeks, etc.), groundwater recharge areas and wellhead protection areas				
	Potential to impact significant natural heritage features				
	Potential to impact significant wildlife habitat and species at risk				
Technical Considerations	**Potential land requirements including land purchase and temporary/permanent easements**	No improvement to infrastructure or hydraulics of the water distribution system. No land acquisition required, and no anticipated impacts on existing utilities.	Upgrades infrastructure but marginally improves hydraulics in the water distribution system. No land acquisition required, and impacts on existing utilities can be mitigated.	Upgrades infrastructure and improves hydraulics in the water distribution system. Land acquisition may be required, and impacts on existing utilities can be mitigated.	Upgrades infrastructure and improves hydraulics in the water distribution system. No land acquisition required, and impacts on existing utilities can be mitigated.
	Constructability				
	Effect on existing utilities and infrastructure				
	Ability to coordinate with existing and planned infrastructure improvements				
	System resiliency and system suitability				
Financial	**Lifecycle operations and maintenance costs**	No capital cost. Operational costs due to aging infrastructure may increase.	Higher capital cost than KK-PSIREL-3 and KK-PSIREL-4.	Lower capital cost than KK-PSIREL-2 and KK-PSIREL-4.	Lower capital cost than KK-PSIREL-2 and KK-PSIREL-3.
	Estimated capital cost				
Summary Ranking	**Well Aligned with Criteria** **Somewhat Aligned with Criteria** **Least Aligned with Criteria**	**Least Preferred Alternative**	**Moderately Preferred Alternative**	**Moderately Preferred Alternative**	**Most Preferred Alternative**

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Alternatives Evaluation - Potable Water

Ranking		Storage Alternatives			
		Delaware			
		DEL-ST-1	DEL-ST-2	DEL-ST-3	DEL-ST-4
Category	Evaluation Criteria	Do Nothing	Expand existing storage (standpipe)	Build new storage (new reservoir or ET) on existing site	Build new storage (new reservoir or ET) on new site
Socio-Economic	Potential to impact existing residences, businesses and community features Potential effect on approved/planned land uses Potential effects on known or potential significant archaeological resources, built heritage resources and cultural landscape features Potential to accommodate planned significant population and job growth in strategic growth areas	High potential to impact residents due to lower level of service (pressures, reliability) with increased population.	Potential impact existing residences and land uses as relatively new standpipe would be replaced with a larger standpipe. Accommodates population growth.	Potential impact on existing residences and land uses due to new infrastructure on existing site. Accommodates population growth, but does not provide additional reliability.	Potential impact on existing residences and land uses due to new infrastructure. Accommodates population growth and provides additional reliability.
Natural Environment	Potential to impact fish and aquatic habitat Potential to impact water resources including surface water (i.e. rivers, creeks, etc.), groundwater recharge areas and wellhead protection areas Potential to impact significant natural heritage features Potential to impact significant wildlife habitat and species at risk	No potential to impact fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk.	Low potential to impact fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk.	Possible impact to fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk, depending on selected storage site.	Possible impact to fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk, depending on selected storage site.
Technical Considerations	Potential land requirements including land purchase and temporary/permanent easements Constructability Effect on existing utilities and infrastructure Ability to coordinate with existing and planned infrastructure improvements System resiliency and system suitability	No improvement to infrastructure or hydraulics of the water distribution system. No land acquisition required, and no anticipated impacts on existing utilities.	Upgrades infrastructure and improves hydraulics in the water distribution system. No land acquisition required, and impacts on existing utilities can be mitigated.	Upgrades infrastructure and improves hydraulics in the water distribution system. No land acquisition required, and impacts on existing utilities can be mitigated.	Upgrades infrastructure and improves hydraulics in the water distribution system. No land acquisition required, and impacts on existing utilities can be mitigated.
Financial	Lifecycle operations and maintenance costs Estimated capital cost	No capital cost. Operational costs due to aging infrastructure may increase.	Higher capital cost than Alternative DEL-ST-3, since it requires decommissioning of existing infrastructure. But lower operational & maintenance costs than Alternative DEL-ST-3, since only one storage facility would be in operation.	Lower capital cost than Alternative DEL-ST-2, since it does not require decommissioning of existing infrastructure. But higher operational & maintenance costs than Alternative DEL-ST-2, due to new infrastructure. Similar costs to Alternative DEL-ST-4.	Lower capital cost than Alternative DEL-ST-2, since it does not require decommissioning of existing infrastructure. But higher operational & maintenance costs than Alternative DEL-ST-2, due to new infrastructure. Similar costs to Alternative DEL-ST-3.
Summary Ranking	Well Aligned with Criteria Somewhat Aligned with Criteria Least Aligned with Criteria	Least Preferred Alternative	Moderately Preferred Alternative	Moderately Preferred Alternative	Most Preferred Alternative

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Alternatives Evaluation - Potable Water

Ranking		Watermain Alternatives		
		Delaware (Gideon Dr Watermain Constraints)		
		DEL-WM-1	DEL-WM-2	DEL-WM-3
Category	**Evaluation Criteria**	**Do Nothing**	**Upgrade existing watermains**	**Build new watermains**
Socio-Economic	Potential to impact existing residences, businesses and community features	High potential to impact residents due to lower level of service (pressures, reliability) with increased population.	Potential impact on existing residences and land uses due to construction. Accommodates population growth and provides additional reliability.	Potential impact on existing residences and land uses due to construction. Accommodates population growth and provides additional reliability.
	Potential effect on approved/planned land uses			
	Potential effects on known or potential significant archaeological resources, built heritage resources and cultural landscape features			
	Potential to accommodate planned significant population and job growth in strategic growth areas			
Natural Environment	Potential to impact fish and aquatic habitat	No potential to impact fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk.	Possible impact to fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk.	Possible impact to fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk, depending on selected alignment.
	Potential to impact water resources including surface water (i.e. rivers, creeks, etc.), groundwater recharge areas and wellhead protection areas			
	Potential to impact significant natural heritage features			
	Potential to impact significant wildlife habitat and species at risk			
Technical Considerations	Potential land requirements including land purchase and temporary/permanent easements	No improvement to infrastructure or hydraulics of the water distribution system. No land acquisition required, and no anticipated impacts on existing utilities.	Upgrades infrastructure and improves hydraulics in the water distribution system. No land acquisition required, and impacts on existing utilities can be mitigated.	Upgrades infrastructure and improves hydraulics in the water distribution system. No land acquisition required, and impacts on existing utilities can be mitigated.
	Constructability			
	Effect on existing utilities and infrastructure			
	Ability to coordinate with existing and planned infrastructure improvements			
	System resiliency and system suitability			
Financial	Lifecycle operations and maintenance costs	No capital cost. Operational costs due to aging infrastructure may increase.	Lower capital cost than DEL-WM-3.	Higher capital cost than DEL-WM-2.
	Estimated capital cost			
Summary Ranking	Well Aligned with Criteria	Least Preferred Alternative	Most Preferred Alternative	Moderately Preferred Alternative
	Somewhat Aligned with Criteria			
	Least Aligned with Criteria			

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Alternatives Evaluation - Potable Water

Ranking		Water Supply Alternatives			
		Arva			
		ARV-SUP-1	ARV-SUP-2	ARV-SUP-3	ARV-SUP-4
Category	Evaluation Criteria	Do Nothing	Connect to LHWPSS (with storage within Arva)	Service growth from private wells	Service growth from new communal well systems
Socio-Economic	Potential to impact existing residences, businesses and community features	High potential to impact residents due to lack of reliability in the event of a watermain break. Population growth increases vulnerability of service area.	Reduces vulnerability of the service area in the event of a watermain break. Accommodates population growth.	High potential to impact residents due to limitations on surrounding land use. Not suitable to accommodate projected growth across service area.	High potential to impact residents due to limitations on surrounding land use. May be suitable to growth projected in service area (single subdivision).
	Potential effect on approved/planned land uses				
	Potential effects on known or potential significant archaeological resources, built heritage resources and cultural landscape features				
	Potential to accommodate planned significant population and job growth in strategic growth areas				
Natural Environment	Potential to impact fish and aquatic habitat	No potential to impact fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk.	Low potential to impact fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk.	Potential to impact fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk with the implementation of new wells.	Potential to impact fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk with the implementation of new wells.
	Potential to impact water resources including surface water (i.e. rivers, creeks, etc.), groundwater recharge areas and wellhead protection areas				
	Potential to impact significant natural heritage features				
	Potential to impact significant wildlife habitat and species at risk				
Technical Considerations	Potential land requirements including land purchase and temporary/permanent easements	No improvement to infrastructure or hydraulics of the water distribution system. No land acquisition required, and no anticipated impacts on existing utilities.	Upgrades infrastructure and improves hydraulics in the water distribution system. No land acquisition required (infrastructure implemented within existing right-of-way) and impacts on existing utilities can be mitigated.	Need to establish well capacity. No improvement to infrastructure or hydraulics of the water distribution system. No land acquisition required, and no anticipated impacts on existing utilities, as servicing would be on private property.	Need to establish well capacity. No improvement to infrastructure or hydraulics of the water distribution system. Potential land acquisition required for new communal wells, and potential impact on existing utilities & integration with existing system.
	Constructability				
	Effect on existing utilities and infrastructure				
	Ability to coordinate with existing and planned infrastructure improvements				
	System resiliency and system suitability				
Financial	Lifecycle operations and maintenance costs	No capital cost. Higher operational costs than ARV-SUP-2, including City of London supply and Richmond St watermain rehabilitation. Preliminary lifecycle analysis demonstrates higher net present value (NPV) within 10-year horizon.	Higher capital cost than ARV-SUP-1, but lower operational costs. Preliminary lifecycle analysis demonstratese lower NPV within 10-year horizon.	Costs borne privately. No capital cost. Operational costs due to aging infrastructure may increase.	Higher capital costs to construct new communal well supply infrastructure. Operational costs increase to operate and maintain new communal well supply.
	Estimated capital cost				
Summary Ranking	Well Aligned with Criteria Somewhat Aligned with Criteria Least Aligned with Criteria	Moderately Preferred Alternative	Most Preferred Alternative	Least Preferred Alternative	Least Preferred Alternative

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Alternatives Evaluation - Potable Water

Ranking		Reliability Alternatives		
		Arva		
		ARV-REL-1	ARV-REL-2	ARV-REL-3
Category	**Evaluation Criteria**	**Do Nothing**	**Build new storage (reservoir or ET)**	**Upgrade or loop existing watermains**
Socio-Economic	Potential to impact existing residences, businesses and community features	High potential to impact residents due to lack of reliability in the event of a watermain break. Population growth increases vulnerability of service area.	Reduces vulnerability of the service area in the event of a watermain break. Accommodates population growth.	Reduces vulnerability of the service area in the event of a watermain break. Accommodates population growth.
	Potential effect on approved/planned land uses			
	Potential effects on known or potential significant archaeological resources, built heritage resources and cultural landscape features			
	Potential to accommodate planned significant population and job growth in strategic growth areas			
Natural Environment	Potential to impact fish and aquatic habitat	No potential to impact fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk.	Possible impact to fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk, depending on selected storage site.	Possible impact to fish and aquatic habitat, water resources, significant natural heritage resources, and significant wildlife habitat and species at risk, depending on selected watermain alignment.
	Potential to impact water resources including surface water (i.e. rivers, creeks, etc.), groundwater recharge areas and wellhead protection areas			
	Potential to impact significant natural heritage features			
	Potential to impact significant wildlife habitat and species at risk			
Technical Considerations	Potential land requirements including land purchase and temporary/permanent easements	No improvement to infrastructure or hydraulics of the water distribution system. No land acquisition required, and no anticipated impacts on existing utilities.	Upgrades infrastructure and improves hydraulics of the water distribution system. Implementation can be coordinated with development, and impacts on existing utilities can be mitigated.	Upgrades infrastructure and improves hydraulics of the water distribution system. Limited corridrs available for looping. Impacts on existing utilities can be mitigated.
	Constructability			
	Effect on existing utilities and infrastructure			
	Ability to coordinate with existing and planned infrastructure improvements			
	System resiliency and system suitability			
Financial	Lifecycle operations and maintenance costs	No capital cost.	Higher estimated capital cost and operation & maintenance costs than alternative ARV-REL-1 and ARV-REL-3.	Higher estimated capital cost and operation & maintenance costs than alternative ARV-REL-1 and lower than ARV-REL-2.
	Estimated capital cost			
Summary Ranking	Well Aligned with Criteria Somewhat Aligned with Criteria Least Aligned with Criteria	**Least Preferred Alternative**	**Most Preferred Alternative**	**Moderately Preferred Alternative**