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TECHNICAL MEMORANDUM No. 1

Issued Date:	June 30, 2026	File No.:	2279-244
Previous Issue Date:	March 5, 2026	City File No:	3242-11
To:	Teresa Dohm, GradTech,	Revision No.	4
From:	Mitchell Brook, P.Eng.		
Client:	City of Nanaimo		
Project Name:	2080 and 2160 East Wellington Road Development Review		
Subject:	Water System Review		

1. Objective

The objective of this technical memorandum is to review the available fire flows at the proposed development and confirm the offsite improvements required to service the development.

2. Background

2.1 2080 and 2160 East Wellington Road Development

The proposed development is located in the East Wellington area of the City and consists of two separate lots, 2080 and 2160 East Wellington Road, as shown in **Figure 2279-244-01**. The development is serviced by Pressure Zone 13 (135.5m/445'). The site is currently zone I2 Light Industrial and R1 Single Dwelling Residential. It is our understanding that the lots are to be rezoned to full I2 zoning.

A preliminary water network has not been provided for 2160 East Wellington Road at this time. The assumed pipe locations and diameters are shown on the enclosed figure.

For the purposes of this review the following water system improvements have been assumed:

- 1) Upgrade of the existing 250 mm dia. watermain on East Wellington Road from 2060 East Wellington Road to the proposed connection at 2160 East Wellington. It is our understanding that a portion of this main is currently under construction from 2060 East Wellington to 2080 East Wellington.
- 2) 2080 East Wellington Road will be serviced by a 200 mm dia. and 300 mm dia. watermain as detailed on drawings 28257, 28258 and 28259 that have been provided by the City.
- 3) It is our understanding that the existing 250 mm dia. watermain on East Wellington Road will be upgraded to 300 mm dia. to the connection to 2160 East Wellington Road as part of the proposed development of 2090 East Wellington Road.
- 4) Extension of the existing watermain from Northfield Road to the northwest corner of 2160 East Wellington Road.
- 5) Watermain loop connection to Boxwood Road utilizing the existing 250 mm dia. watermain crossing of the Nanaimo Parkway
- 6) A PRV interconnection between Pressure Zone 13 and Pressure Zone 15 at the northwest corner of 2160 East Wellington Road.

2.2 2080 East Wellington Road Development

In addition to the above noted improvements an interim scenario for the water servicing to 2080 East Wellington Road will be reviewed to determine the impacts on the available fire flow without the



Issued: June 30, 2026
Previous Issue: March 5, 2026

proposed future looping and PRV connection to Pressure Zone 15. The proposed piping associated with this development is shown on **Figure 2279-244-01**.

3. Water Demands

3.1 Domestic Demands

Based on information provided by the City the industrial land use will have an equivalent population of 437. Unit water demand rates used for this analysis were taken from the Manual of Engineering Standards and Specifications (MOESS) and are shown in **Table 1** below:

Table 1: Per Capita Demands

Scenario	Demand Rate
Average Day Demand (ADD)	455 lpcd
Maximum Day Demand (MDD)	1,135 lpcd
Peak Hour Demand (PHD)	1,820 lpcd

Applying the unit rate demands listed above to the project equivalent population for the development the demand rate is calculated as shown in **Table 2** below:

Table 2: Water Demands

Scenario	Demand (lps)
ADD	2.30
MDD	5.74
PHD	9.21

The proposed demands were allocated to the nodes adjacent to the proposed development.

3.2 Fire Flow Demand

The required fire flows of the development are based on Table W-1 of the City of Nanaimo MOESS for the current zoning and are summarized below in **Table 3**:

Table 3: Fire Flow Demands

Land Use	Required Fire Flow (lps)
I2 Light Industrial	300

4. Hydraulic Capacity Performance and Design Criteria

Based on the MOESS design standards, the criteria outlined below in **Table 5** was used to assess the hydraulic impact of the proposed development on the City water system.

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2026-JUL-02
Current Planning

Issued: June 30, 2026
Previous Issue: March 5, 2026

Table 5: Analysis Criteria

Criteria	Analysis Scenario	Parameter Value
Minimum Residual Pressure	PHD	300 kPa (44 psi)
Minimum Residual Pressure (hydrant)	MDD+FF	150 kPa (22 psi)
Minimum Residual Pressure (system)	MDD+FF	35 kPa (5 psi)
Maximum Velocity	MDD+FF	3.5 m/s

5. Hydraulic Capacity Analysis – 2080 East Wellington Road

The proposed development at 2080 East Wellington Road was review independently from the proposed development at 2160 East Wellington Road to determine the impacts on the available fire flow **should the future watermain looping and proposed PRV connection near the Parkway and Northfield Road not be constructed.**

5.1 Pressure Analysis

The model was evaluated under 2023 and 2043 peak hour demand conditions to determine the residual pressure at the development under existing conditions prior to system modifications. For this review the proposed piping improvements for 2160 East Wellington Road have not been included in the review. The results are summarized in the table below:

Table 5: 2080 East Wellington Road - Peak Hour Pressures

Location	2023			2043		
	Elevation (m)	HGL (m)	Pressure (psi)	Elevation (m)	HGL (m)	Pressure (psi)
Node 1	86.0	130.9	64	86.0	130.9	64
Node 2	88.0	130.9	61	88.0	130.9	61
Node 3	87.0	130.9	62	87.0	130.9	62
City Hydrant 3597	81.7	130.9	70	81.7	130.9	70

As shown in **Table 5** above the peak hour pressures for the 2023 and 2043 conditions at the development connections are above the required 44 psi.

5.2 Fire Flow Analysis

The model was evaluated under 2023 and 2043 maximum day demand conditions to determine the available fire flow at the development under existing conditions, prior to system modifications. The City's requirement of a maximum pipe velocity of 3.5 m/s was not used for the existing watermains during the analysis to provide a more realistic representation of available fire flows in the system. For this review the proposed piping improvements for 2160 East Wellington Road have not been included in the review

The available fire flows at the proposed development under existing conditions without any system improvements, are listed in **Table 6**.

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Current Planning

Issued: June 30, 2026

Previous Issue: March 5, 2026

Table 6: 2080 East Wellington Road - Available Fire Flows

Location	Required Fire Flow (lps)	Available Fire Flow (lps)		Max Pipe Velocity (m/s)	
		2023	2043	2023	2043
Node 1	300	275	275	3.9	3.9
Node 2	300	193	193	6.1	6.1
Node 3	300	205	205	6.5	6.5
City Hydrant 3597	300	300	300	4.2	4.2

As shown in **Table 6** the proposed piping network **cannot** provide the required fire flows with the exception of City Hydrant 1237, however the velocities in the distribution system are greater than 3.5 m/s.

It should be noted that the **maximum fire flow available at 2080 East Wellington Road is 250 lps at Node 1** while maintaining a maximum velocity of 3.5 m/s in the proposed 300 mm dia. main from East Wellington Road.

As the final hydrant spacing for the proposed development is not known at this time, the maximum fire flow for 2080 East Wellington Road **should be limited to 200 lps**, as supply from three hydrants may not be possible based on future road networks or building locations.

As per MOESS Section 5.07.7 the maximum flow per hydrant is 100 lps. In order to provide the available **fire flow of 200 lps** for the development a minimum of two hydrants are required. For the purposes of this analysis the following hydrants have been evaluated:

- Node 1
- Node 2

The water model was evaluated under 2023 and 2043 maximum day demand condition, with the 3.5 m/s velocity constraint for all proposed piping upgrades, to determine the maximum velocities in the development. A summary of the hydrant pressures under the proposed maximum day plus fire flow and pipe velocities are listed in the **Table 7 and 8** below:

Table 7: Hydrant Flow and Pressures

Location	Fire Flow (lps)	2023 Residual Pressure (psi)	2043 Residual Pressure (psi)
Node 1	100	42	42
Node 2	100	33	33

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Current Planning

Issued: June 30, 2026
Previous Issue: March 5, 2026

Table 8: Pipe Flow and Velocities

Location	Pipe Dia (mm)	2023		2043	
		Flow (lps)	Velocity (m/s)	Flow (lps)	Velocity (m/s)
East Wellington Rd (PRV Station to Westwood Road)	300	176	2.5	183	2.6
East Wellington Rd (Westwood Rd to Hydrant 3597)	300	200	2.8	203	2.9
East Wellington Rd (Hydrant 3597 to 2080 East Wellington)	300	200	2.8	202	2.9
E. Wellington Rd to Node 1	300	200	2.8	200	2.8
Node 1 to Node 2	200	100	3.2	100	3.2

As shown in the above tables the distribution system can provide a maximum fire flow of 200 lps for the proposed development while maintaining a maximum velocity of 3.5 m/s in the distribution system.

6. Hydraulic Capacity Analysis – 2080 & 2160 East Wellington Road

For the proposed development the following servicing scenarios have been evaluated:

Scenario 1 – Full buildout of the proposed development with the future connection to Pressure Zone 15

Scenario 2 – Full buildout of the proposed development without the future connection to Pressure Zone 15 and service of the development from Pressure Zone 13.

For the above noted scenarios, the proposed upgrade of the existing 250 mm dia. watermain on East Wellington Road to 300 mm dia. has been included in the model analyses. The proposed water servicing options are shown on **Figure 2279-244-01** for reference.

5.2.1 Pressure Analysis

The model was evaluated under 2023 and 2043 peak hour demand conditions to determine the residual pressure at the development for the noted improvement scenarios. The results are summarized in the table below:

Table 9: Peak Hour Pressures

Location	Elevation (m)	Residual Pressure (psi)			
		2023		2043	
		Scenario 1	Scenario 2	Scenario 1	Scenario 2
Node 1	86.0	64	63	64	63
Node 2	88.0	61	61	61	61
Node 3	87.0	62	62	62	62
Node 4	88.0	61	61	61	61
Node 5	92.0	55	55	55	55
Node 6	89.0	59	59	59	59
Node 7	87.0	62	62	62	62

Issued: June 30, 2026
Previous Issue: March 5, 2026

Table 9: Peak Hour Pressures

Location	Elevation (m)	Residual Pressure (psi)			
		2023		2043	
		Scenario 1	Scenario 2	Scenario 1	Scenario 2
Node 8	95.0	51	51	51	51
Node 9	96.0	49	49	49	49
City Hyd 3597	81.7	70	70	70	70
City Hyd 1383	85.1	65	65	65	65

As shown in **Table 9** above the peak hour pressures for the 2023 and 2043 conditions at the development connections are above the required 44 psi.

5.4 2160 & 2080 East Wellington Road Development Fire Flow Analysis

The model was evaluated under 2023 and 2043 maximum day demand conditions to determine the available fire flow at the development under existing conditions, prior to system modifications. The model was also evaluated without the City's requirement of a maximum pipe velocity of 3.5 m/s to provide a more realistic representation of available fire flows in the system.

The available fire flows at the proposed development under existing conditions without any system improvements, are listed in **Table 10 & 11**.

Table 10: Available Fire Flows with 3.5 m/s Velocity Constraint

Location	Required Fire Flow (lps)	2023				2043			
		Avail Fire Flow (lps)		Max Pipe Vel (m/s)		Avail Fire Flow (lps)		Max Pipe Vel (m/s)	
		Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Node 1	300	246	240	3.5	3.5	246	240	3.5	3.5
Node 2	300	109	109	3.5	3.5	109	109	3.5	3.5
Node 3	300	109	109	3.5	3.5	109	109	3.5	3.5
Node 4	300	300	239	2.6	3.5	300	239	2.6	3.5
Node 5	300	300	215	2.6	3.2	300	215	2.6	3.2
Node 6	300	300	211	2.6	3.2	300	211	2.6	3.2
Node 7	300	300	214	2.6	3.1	300	214	2.6	3.1
Node 8	300	300	175	2.6	3.1	300	175	2.6	3.1
Node 9	300	300	154	2.6	2.6	300	154	2.6	2.6
City Hyd 3597	300	300	240	2.6	3.5	300	240	2.6	3.5
City Hyd 1383	300	171	171	3.5	3.5	171	171	3.5	3.5

Issued: June 30, 2026
Previous Issue: March 5, 2026

Table 11: Available Fire Flows without 3.5 m/s Velocity Constraint

Location	Required Fire Flow (lps)	2023				2043			
		Avail Fire Flow (lps)		Max Pipe Vel (m/s)		Avail Fire Flow (lps)		Max Pipe Vel (m/s)	
		Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Node 1	300	300	275	4.2	4.0	300	275	4.2	4.0
Node 2	300	226	193	7.2	6.1	226	192	7.2	6.1
Node 3	300	240	202	7.6	6.4	240	202	7.6	6.4
Node 4	300	300	245	2.6	3.5	300	245	2.6	3.5
Node 5	300	300	215	2.6	3.2	300	215	2.6	3.2
Node 6	300	300	211	2.6	3.1	300	211	2.6	3.1
Node 7	300	300	214	2.6	3.1	300	214	2.6	3.1
Node 8	300	300	175	2.6	2.6	300	175	2.6	2.6
Node 9	300	300	154	2.6	2.3	300	153	2.6	2.3
City Hyd 3597	300	300	300	2.6	4.3	300	300	2.6	4.3
City Hyd 1383	300	300	253	6.1	5.1	300	253	6.1	4.5

As shown in **Table 10 and 11** in order to provide the required 300 lps fire flow the connection to Pressure Zone 15 is required.

It should be noted that there is a reduction in the available fire flows from the analysis in **Section 5.2** due to the increase in the domestic demands with the addition of the proposed development at 2160 East Wellington Road.

The available fire flows at the proposed development at 2160 East Wellington Road range from 150 lps to 245 lps without the construction of the proposed connection to Pressure Zone 15, depending on the location and elevation of the hydrants in the analysis.

The final hydrant spacing required for the development should be reviewed at the detailed design phase. As noted in the City's MoESS the maximum hydrant spacing for industrial zoning is 90 m.

As per MOESS Section 5.07.7 the maximum flow per hydrant is 100 lps. In order to provide the available fire flow for the development a minimum of three hydrants are required. For the purposes of this analysis the following hydrants have been evaluated:

- Node 4
- Node 5
- Node 6

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Issued: June 30, 2026
Previous Issue: March 5, 2026

The water model was evaluated under 2023 and 2043 maximum day demand condition, with the 3.5 m/s velocity constraint for all proposed piping upgrades, to determine the maximum velocities in the development.

A summary of the hydrant pressures under the proposed maximum day plus fire flow and pipe velocities are listed in the **Table 12, 13 and 14** below:

Table 12: Hydrant Flow and Pressures

Location	Scenario 1			Scenario 2		
	Fire Flow (lps)	2023 Residual Pressure (psi)	2043 Residual Pressure (psi)	Fire Flow (lps)	2023 Residual Pressure (psi)	2043 Residual Pressure (psi)
Node 4	100	44	43	73	29	30
Node 5	100	39	38	74	22	22
Node 6	100	43	42	73	25	26
Total	300			220		

It should be noted that the maximum available fire flow under scenario 2 is based on the elevations and locations of the nodes listed. As shown in Table 12 the residual pressure of 22 psi at Node 5 is the limiting factor in the available fire flow.

Table 13: 2023 - Pipe Flow and Velocities

Location	Pipe Dia (mm)	2023			
		Scenario 1		Scenario 2	
		Flow (lps)	Velocity (m/s)	Flow (lps)	Velocity (m/s)
E. Wellington Rd (PRV Station to Westwood Rd)	300	157	2.2	193	2.7
E. Wellington Rd (Westwood Rd to 2160 E. Wellington Rd)	300	154	2.2	227	3.2
East Wellington Rd to Node 4	300	152	2.2	225	3.2
Node 4 to Node 5	300	52	0.7	152	2.2
Node 5 to Node 6	300	48	0.7	78	1.1
Node 6 to Node 7	300	147	2.1	5.7	0.1
Node 7 to Node 8	300	153	2.2	5.7	0.1
Node 8 to Node 9	300	153	2.2	0.0	0.0
Node 9 to Node 10	300	153	2.2	0.0	0.0
Node 10 to Boxwood Rd	250	113	2.3	0.0	0.0
Node 10 to Northfield Rd	200	40	1.3	0.0	0.0

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Issued: June 30, 2026
Previous Issue: March 5, 2026

Table 14: 2043 - Pipe Flow and Velocities

Location	Pipe Dia (mm)	2043			
		Scenario 1		Scenario 2	
		Flow	Velocity	Flow	Velocity
		(lps)	(m/s)	(lps)	(m/s)
E. Wellington Rd (PRV Station to Westwood Rd)	300	160	2.2	198	2.8
E. Wellington Rd (Westwood Rd to 2160 E. Wellington Rd)	300	156	2.2	227	3.2
East Wellington Rd to Node 4	300	154	2.2	225	3.2
Node 4 to Node 5	300	54	0.8	152	2.1
Node 5 to Node 6	300	46	0.7	78	1.1
Node 6 to Node 7	300	146	2.1	5.7	0.1
Node 7 to Node 8	300	151	2.1	5.7	0.1
Node 8 to Node 9	300	151	2.1	0.0	0.0
Node 9 to Node 10	300	151	2.1	0.0	0.0
Node 10 to Boxwood Rd	250	112	2.3	0.0	0.0
Node 10 to Northfield Rd	200	40	1.3	0.0	0.0

Note: **Bold** indicates proposed upgrades

As shown in the tables above the proposed improvements can provided the available fire flow for each scenario.

It should be noted that the flow distribution between Scenario 1 and Scenario 2 varies due to the addition of the connection to Pressure Zone 15 in Scenario 1. The flows between Nodes 6 to Node 10 vary significantly under Scenario 2 as the flows will be limited to the domestic demands only and will not contribute to the fire flow noted, as this pipe will be a deadend watermain.

7. Impact of Proposed Development

In order to assess the impact of the development on the rest of the City water distribution system, simulation results from the model in Pressure Zone 13 were compared between scenarios with and without the development and proposed improvements. The results are summarized below in **Table 15**:

Table 15: Pressure Zone Impact Analysis Summary Pressure Zone 13

Location	Scenario	2023		2043	
		Without Development	With Development	Without Development	With Development
# of Low Pressure Deficiencies	PHD	0	0	0	0
PHD Average Pressure	PHD	85	86	85	86
# of Fire Flow Deficiencies	MDD	27	26	22	26
Average Available Fire Flows	MDD	214	223	207	223

Issued: June 30, 2026
Previous Issue: March 5, 2026

Overall, the development will have no “negative” hydraulic impact on the City water distribution system in the 2023 and 2043 scenarios.

8. Cost Estimates

The cost estimates shown in **Table 16 and 17** are Class ‘D’ (feasibility study) made without preliminary design input and include a 30% contingency and 30% allowance for engineering, legal, financial, and administration. They are derived from our in-house construction cost data from similar watermain projects constructed in the mid Vancouver Island Area. They are in 2025 dollars and are exclusive of GST and does not include any inflationary allowances.

Table 16: 2080 East Wellington Road Cost Estimates (2025 Dollars exc GST)

Project	Diameter	Quantity	Unit Price	Extension
Onsite Improvements				
Proposed Onsite Watermain	200	165	\$1,500	\$247,500
Proposed Onsite Watermain	300	140	\$2,000	\$280,000
Offsite Improvements				
East Wellington Road Watermain Upgrades	300	40		By Others
Subtotal				\$527,500

Table 17: 2160 East Wellington Road Cost Estimates (2025 Dollars exc GST)

Project	Diameter	Quantity	Unit Price	Extension
Onsite Improvements				
Proposed Onsite Watermain	300	915	\$2,000	\$1,830,000
Offsite Improvements				
Boxwood Road Watermain Loop	250	285	\$1,800	\$513,000
Northfield Road Watermain Extension	200	260	\$1,500	\$390,000
PRV Station			\$250,000	\$250,000
East Wellington Road Watermain Upgrades	300	200	\$2,000	\$470,000
Subtotal				\$3,383,000

9. Conclusions

The following conclusions are presented as a result of this technical memorandum:

- 1) Pressure Zone 13 (PZ-13 (135.5 m/445')) will provide a peak hour residual pressure of between 49 psi and 65 psi at the proposed development under 2043 demand conditions.
- 2) The maximum available fire flow at 2080 East Wellington Road is 200 lps. In order to maintain velocities in the distribution system below 3.5 m/s under, the following offsite improvements are required:

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Current Planning

Issued: June 30, 2026

Previous Issue: March 5, 2026

- a. Upgrade the existing 250 mm dia. on East Wellington Road to 300 mm from Hydrant 3597 to 2080 East Wellington Road (40 m). This work is to be completed as part of the development at 2060 East Wellington Road.
- 3) The available fire flows at the proposed development at 2160 East Wellington Road range from 150 lps to 245 lps without the construction of the proposed connection to Pressure Zone 15.
- 4) To provide the required 300 lps for the proposed development at 2160 East Wellington Road the following offsite improvements are required:
 - a. Installation of a 250 mm dia. watermain from the northwest end of the development to Boxwood Road (approx. 285 m)
 - b. Installation of a 200 mm dia. watermain from the northwest end of the development to Northfield Road.
 - c. Installation of a new PRV station at the northwest end of the development to supplement flows to the pressure zone from Pressure Zone 15.
 - d. Upgrade the existing 250 mm dia. on East Wellington Road to 300 mm from Hydrant 3597 to 2160 East Wellington Road (235 m).
- 5) The Class D Estimate for the water system improvements are:
 - a. 2080 East Wellington Road - \$527,500.
 - b. 2160 East Wellington Road - \$3,383,000.
- 6) The fire hydrant spacing is to be in accordance with the City's MOESS.
- 7) There are no negative effects on the distribution system with the proposed development.

10. Recommendations

Based on the results discussed in this technical memorandum we recommend the following:

- 1) The proposed development be serviced by the proposed watermain network shown on **Figure 2279-244-01**.
- 1) The following offsite improvements are required to service the development at 2080 East Wellington Road:
 - a. Upgrade the existing 250 mm dia. on East Wellington Road to 300 mm from Hydrant 3597 to 2080 East Wellington Road (40 m). This work is to be completed as part of the development at 2060 East Wellington Road.
- 2) The following offsite improvements are required to service the development at 2160 East Wellington Road:
 - a. A 250 mm dia. watermain from the northwest end of the development to Boxwood Road (approx. 285 m)
 - b. A 200 mm dia. watermain from the northwest end of the development to Northfield Road (approx. 260m).
 - c. A new PRV station at the northwest end of the development to supplement flows to the pressure zone from Pressure Zone 15.
 - d. Upgrade the existing 250 mm dia. on East Wellington Road to 300 mm from Hydrant 3597 to 2160 East Wellington Road (235 m).

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2026-JUL-02
Current Planning

Technical Memorandum No. 1
2080 and 2160 East Wellington Road Development Review

Issued: June 30, 2026

Previous Issue: March 5, 2026

3) The Class D Estimate for the water system improvements are:

- a. 2080 East Wellington Road - \$527,500.
- b. 2160 East Wellington Road - \$3,383,000.

4) The onsite hydrant spacing for the proposed development be reviewed to ensure that the minimum spacing specified in the MoESS is achieved.

Yours truly,

KOERS & ASSOCIATES ENGINEERING LTD.

Prepared By:



Mitchell Brook, P.Eng

Project Manager

Permit to Practice No. 1001658

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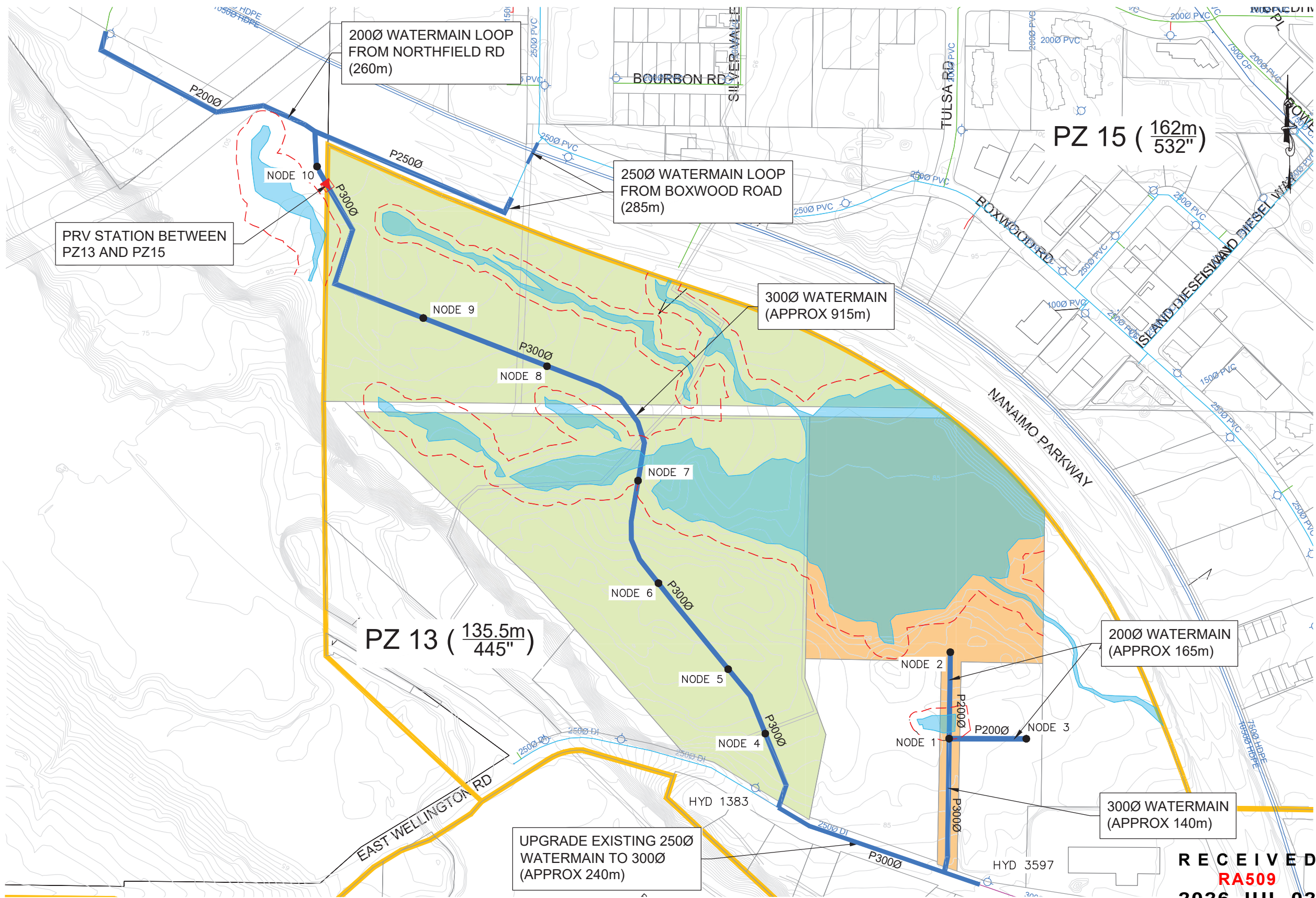
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LEGEND

- PRESSURE REDUCING VALVE
- 100 DIA. PIPING
- 150 DIA. PIPING
- 200 DIA. PIPING
- 250 DIA. PIPING
- 300 DIA. PIPING
- 350 DIA. AND LARGER PIPING
- 70m GROUND ELEVATION CONTOUR
- PRESSURE ZONE BOUNDARY
- PROPOSED WATERMAIN (DIA.)
- PZ 15 (162m / 532") PRESSURE ZONE
- 2160 EAST WELLINGTON PROPOSED DEVELOPMENT
- 2080 EAST WELLINGTON PROPOSED DEVELOPMENT
- WETLAND AREA
- WETLAND SETBACK



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RA509
2026-JUL-02
Current Planning

4	JUN2026	MB	FOR REPORT		MB
3	MAR2026	MB	FOR REPORT		MB
2	FEB2025	MB	FOR REPORT		MB
1	NOV2024	MB	FOR REPORT		MB
No.	Date	By	Revisions		Eng.

Design by	Date
MB	NOV 2024
Drawn by	
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Scale	Horiz. 1:4000 (11X17)/vert.
Cost Center	Sheet 1 of 1
Eng File No.	2279-244
Dwg No.	2279-244-01

Project	WATER MODEL REVIEW ASSIGNMENT 3242-11
Title	2080 AND 2160 EAST WELLINGTON RD DEVELOPMENT REVIEW 300 Ips FIRE FLOW