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Appendix D
VEC Groundwater Resources

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1.0 RATIONALE FOR THE VALUED ENVIRONMENTAL COMPONENT (VEC)

Thousands of residents in New Brunswick rely on groundwater resources for their domestic water supply. Groundwater can be impacted by concentrations of naturally occurring and anthropogenic sourced contaminants such as mineral deposits surrounding the aquifer or from an accidental release of pollutants. Project related activities (*i.e.,* ground disturbance, wastewater and petroleum product use and storage, *etc*.) may release contaminants into the groundwater that could potentially adversely impact human and / or ecosystem health.

In order to assess any potential impacts of the Project on the groundwater resources, three components have been identified for this VEC:

- *Physiography and Drainage* patterns that describe the physical geography of the landscape;
- *Bedrock and Surficial Geology* that describe the availability of groundwater; and
- Known *Groundwater Quality and Quantity* data that provide baseline conditions for the Project Area.

2.0 BOUNDARIES FOR THE ENVIRONMENTAL EFFECTS ASSESSMENT

2.1 Spatial Boundaries

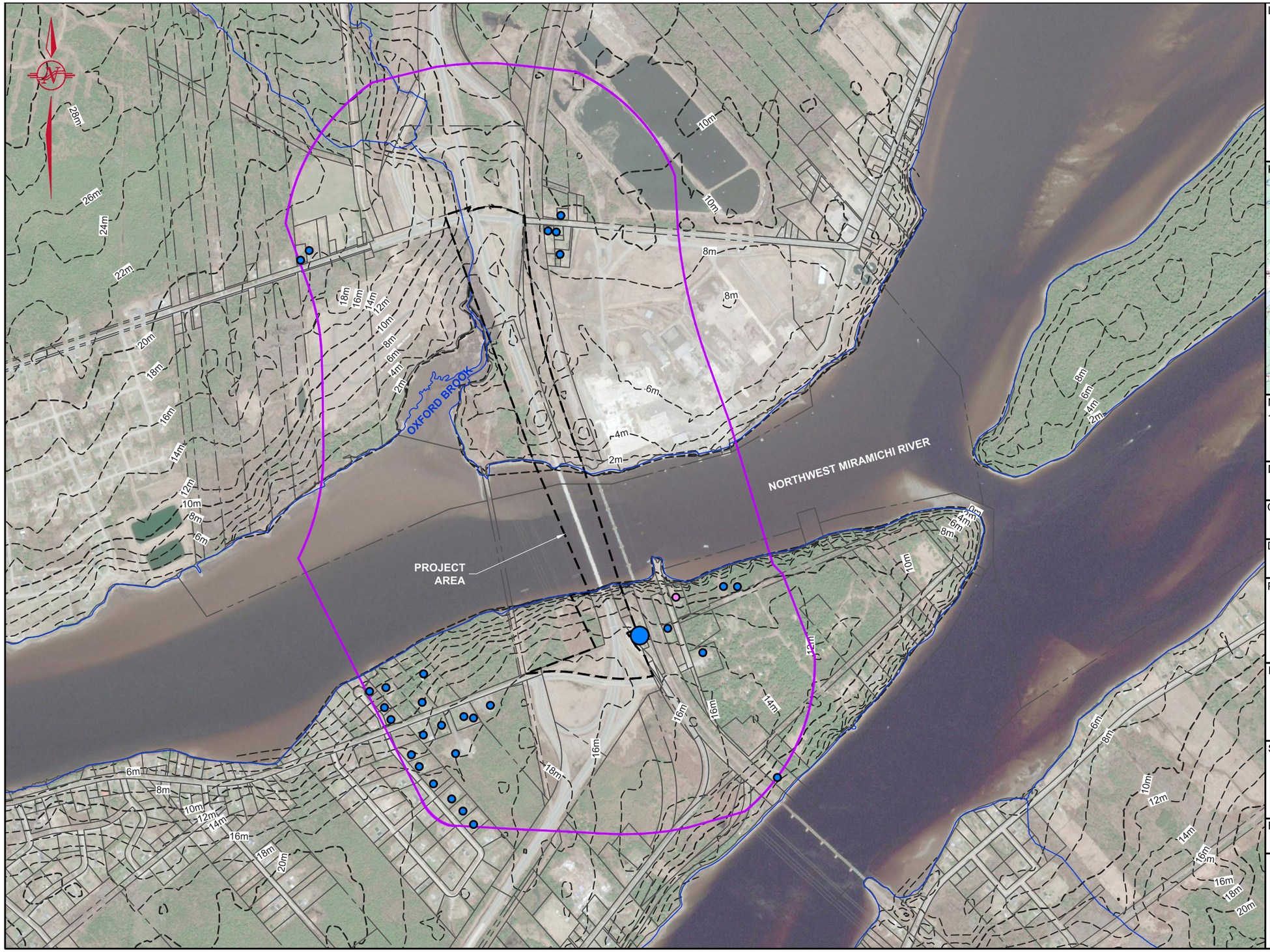
The assessment of the groundwater resources has been completed for two spatial boundaries:

- The Project Area is defined as footprint of ground disturbance required for the Project activities (PIDs 40381345, 40381337, 40437121, 40445330, 40495780, 40164808, portion of 40163826, portion of 40143083, portion of 40336240, and portion of 40437139 (Figure D-1)); and
- The Assessment Area encompasses the area where Project activities may interact with nearby receptors (*i.e.,* residential dwellings and groundwater wells). For the groundwater resources VEC, the Assessment Area is limited to a 500 metre radius of the Project Area (Figure D-1).

2.2 Temporal Boundaries

The assessment of the groundwater resources has been completed for the following temporal boundaries:

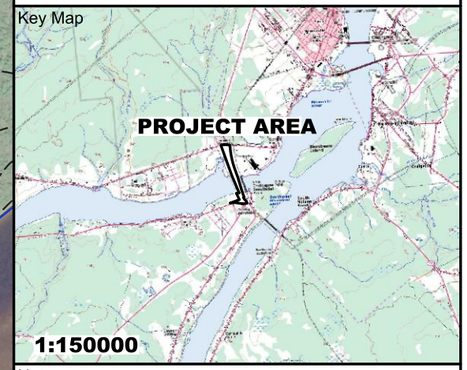
- The construction phase of the Project; and
- The operational and maintenance phase of the Project.



Legend

- RESIDENCE
- SPECIAL CARE HOME
- 0m SNB CONTOUR IN METER.
- PROPERTY LINE
- PROJECT AREA
- ASSESSMENT AREA 0.5km from project area

Key Map



Note

1. THIS DRAWING IS A SCHEMATIC REPRESENTATION. SIZES, LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

Drawn By	Checked By
CHG	JH
Calculations By	**Checked By**
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Date

JUNE 2018

Project

EIA - NORTHWEST MIRAMICHI RIVER
NO.1 ANDERSON BRIDGE REPLACEMENT

Drawing

GROUNDWATER RESOURCES
SPATIAL BOUNDARIES AND TOPOGRAPHY

Scale

1:7500

0 150 300 450m

File No.	Drawing	Revision No.
69214403	FIGURE D-1	0

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3.0 METHODOLOGY

A desktop review of existing information for groundwater resources was undertaken to determine the prevailing VEC conditions and any potential interaction with the Project.

With respect to the Environmental Impact Assessment (EIA) process, interactions or effects of the Project on the groundwater resources have been identified and are discussed below. Where residual effects are anticipated, the proposed methods for mitigating the potential effects have been presented.

3.1 Physiography and Drainage

Natural Resources Canada provides an interactive mapping service, The Atlas of Canada – Toporama, which was reviewed to determine the general topography of the Project Area.

3.2 Bedrock and Surficial Geology

The New Brunswick Department of Energy Resources Development (NBDERD) online mapping was reviewed to determine the bedrock and surficial geology conditions within the Project Area.

3.3 Groundwater Quality and Quantity

The New Brunswick Department of Environment and Local Government (NBDELG) Online Well Log System (OWLS) was accessed to identify groundwater extraction wells located within a 500 metre radius of PID 40336240, a central location of the Project Area (*i.e.,* Assessment Area). The OWLS database is maintained by NBDELG and contains information on water wells constructed since 1994. The NBDELG takes no responsibility and makes no guarantee as to the completeness, accuracy or timeliness of the data provided in this database. The 500 metre radius was the smallest radius possible to generate both well construction and water quality data from the database. Available water chemistry data from the NBDELG database were compared to the Canadian Drinking Water Quality Guidelines (CDWQG; Health Canada, February, 2017).

4.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

4.1 Physiography and Drainage

A review of contour mapping indicates that the northern portion of the Project Area slopes south/southeast towards Oxford Brook and the Northwest Miramichi River. The southern portion of the Project Area slopes north/northwest towards the Northwest Miramichi River. Topography varies from 2 metres to 18 metres above mean sea level throughout the Project Area. The Project Area topography (Natural Resources Canada mapping) is presented in Attachment D-1.

Regionally, the Project Area is located within the Miramichi Valley, which contains the Southwest Miramichi River, the Northwest Miramichi River and their tributaries. The Project Area is located at the outlet of the Northwest Miramichi River, immediately upstream of the confluence with the Southwest Miramichi River. Combined, the entire Miramichi River system is approximately 250 kilometres (km) long and drains an area of approximately 14,000 square km (km^2), of which the Northwest Miramichi River drains approximately 3,900 km^2 (MSA, 2018). The Northwest Miramichi River flows east towards the Miramichi Estuary and eventually to the Gulf of Saint Lawrence.

4.2 Bedrock and Surficial Geology

Surficial geology mapping indicates that the Project Area is covered with blankets and plains of generally 0.5 - 3 metre thick, Late Wisconsinan and/or Early Holocene marine sediments. The marine sediments consist of sand, silt, gravel, and clay deposited in shallow marine water, locally deep, which submerged coastal areas and sections of many valleys following the Late Wisconsinan deglaciation (Rampton, 1984).

Bedrock geology mapping indicates that the Project Area is underlain by Late Carboniferous sedimentary rocks consisting of medium to fine-grained, terrestrial, clastic rock of the Pictou Group (Minto Formation; NBDNR, 2008).

The surficial and bedrock geology described in the NBDELG OWLS indicates that the bedrock in the Project Area is predominately sandstone overlain by sand, gravel and/or clay (NBDELG, 2017).

4.3 Groundwater Quality and Quantity

There were 12 groundwater wells (drilled between 1995 and 2016) identified in the NBDELG database within the Assessment Area. Well driller reports are presented in Attachment D-2 and well construction details for these wells are summarized in Table D-1.

Table D-1 Construction Details for Wells Reported within 500 metres of the Project

Well Construction Component	Minimum	Maximum	Average
Total Well Depth (m)	24.4	32.0	28.0
Casing Depth (m)	8.0	15.2	12.0
Casing Diameter (centimetres)	12.7	15.3	13.2
Estimated Safe Yield (L/min (igpm))	2078 (46)	621 (137)	261 (58)
Water Bearing Fracture Zones (m)	13.7	31.7	23
Depth to Bedrock (m)	7.3	15.9	6.1
Bedrock Type	Sandstone		

Notes:
m = Metres
L / min = Litres per minute
igpm = Imperial gallons per minute

Based on the available data (*i.e.,* nine groundwater chemistry records), exceedances of the Canadian Drinking Water Quality Guidelines (CDWQG) were noted in one or more wells for the following: fluoride, iron, manganese, sodium, total coliforms, turbidity, pH, and total dissolved solids. Table D-2 summarizes the analytical data from the nine records.

Table D-2 Summary of Groundwater Analytical Data

Parameter	Units	CDWQG[1]		Analytical Results (NBDELG OWLS, 2017)								
		MAC[2]	AO[3]	Result 1	Result 2	Result 3	Result 4	Result 5	Result 6	Result 7	Result 8	Result 9
Total Alkalinity	**mg/L**	**-**	**-**	123	111	113	109	28.8	91.6	110	467	115
Aluminium	**mg/L**	**-**	**0.1 / 0.2**	<0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	0.003	0.057	< 0.025
Arsenic	**µg/L**	**10**	**-**	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 0.001	< 1.5	< 1.5
Boron	**mg/L**	**5**	**-**	< 0.012	< 0.013	< 0.01	< 0.012	0.023	< 0.01	< 0.011	0.052	< 0.01
Barium	**mg/L**	**1.0**	**-**	0.049	0.215	0.115	0.203	0.116	0.161	0.327	0.034	0.262
Bromium	**mg/L**	**-**	**-**	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1
Conductivity	**µSIE/cm**	**-**	**-**	264	215	230	221	468	485	228	1090	226
Calcium	**mg/L**	**-**	**-**	37.2	30	28	32	20.9	58.1	30.4	7.53	29.9
Cadmium	**µg/L**	**5**	**-**	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.5	< 0.5
Chloride	**mg/L**	**-**	**≤ 250**	4.83	1.69	1.7	2.09	117	81	2.5	9.7	1.38
Chromium	**µg/L**	**50**	**-**	15	< 10	13	18	< 10	< 10	< 1	10	13
Copper	**µg/L**	**-**	**≤ 1000**	< 10	< 10	< 10	< 10	69	27	< 1	< 10	< 10
E.coli	**Present (Pr) / Absent (Ab)**	**0 (Ab)**	**-**	Ab	Ab	Ab	Ab	Ab	Ab	Ab	Ab	Ab
Fluoride	**mg/L**	**1.5**	**-**	0.124	0.16	0.219	0.216	< 0.1	< 0.1	0.18	**8.58**	0.16
Iron	**mg/L**	**-**	**≤ 0.3**	0.114	< 0.01	0.096	0.087	**1.73**	< 0.01	0.04	0.186	0.034
Hardness	**mg/L**	**-**	**-**	116	102	93	104	69.6	183	99.6	27.9	101
Potassium	**mg/L**	**-**	**-**	1.33	2.02	1.75	1.8	3.9	1.4	1.99	0.939	2.34

Parameter	Units	CDWQG[1]		Analytical Results (NBDELG OWLS, 2017)								
		MAC[2]	AO[3]	Result 1	Result 2	Result 3	Result 4	Result 5	Result 6	Result 7	Result 8	Result 9
Magnesium	**mg/L**	**-**	**-**	5.63	6.51	5.6	5.96	4.26	9.12	5.76	2.21	6.32
Manganese	**mg/L**	**-**	**≤ 0.05**	**0.607**	**0.234**	**0.296**	**0.32**	**0.089**	< 0.005	**0.362**	**0.15**	**0.294**
Nitrite (NO_2)	**mg/L**	**3**	**-**	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05
Nitrate (NO_3)	**mg/L**	**45**	**-**	< 0.05	< 0.05	< 0.05	< 0.05	1.5	0.13	-	< 0.05	< 0.05
Nitrogen Oxides (NO_X)	**mg/L**	**-**	**-**	< 0.05	< 0.05	< 0.05	< 0.05	1.6	0.18	< 0.05	< 0.05	< 0.05
Sodium	**mg/L**	**-**	**≤ 200**	5.97	7.9	5.62	6.17	60.6	18.9	6.6	**231**	7.18
Lead	**µg/L**	**10**	**-**	< 1	< 1	< 1	< 1	1.7	< 1	0.2	< 1	2.35
Sulphate	**mg/L**	**-**	**≤ 500**	4.91	3.99	3.61	3.31	10.1	8.32	3	88.8	3.92
Antimony	**µg/L**	**6**	**-**	< 1	< 1	< 1	< 1	< 1	< 1	< 0.1	< 1	< 1
Selenium	**µg/L**	**50**	**-**	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1	< 1.5	< 1.5
Total Coliform	**Present (Pr) / Absent (Ab)**	**0 (Ab)**	**-**	Ab	**Pr**	Ab	Ab	**Pr**	Ab	0	**Pr**	Ab
Turbidity	**NTU**	**1**	**-**	**1.27**	0.7	**1.38**	0.47	**11**	< 0.2	0.2	**19**	0.44
Titanium	**µg/L**	**-**	**-**	< 1	< 1	< 1	< 1	< 1	< 1	< 0.1	< 1	< 1
Uranium	**µg/L**	**20**	**-**	< 0.5	< 0.5	< 0.5	0.5	< 0.5	< 0.5	0.3	6.38	< 0.5
Zinc	**µg/L**	**-**	**≤ 5000**	10	< 5	< 5	< 5	20	20	2	< 5	26
pH	**unitless**	**-**	**6.5-8.5**	7.79	7.93	7.93	8.12	**6.48**	7.54	8.2	**8.61**	8.01
Total Dissolved Solids	**mg/L**	**-**	**≤ 500**	134.78	119.37	114.95	117.71	243.26	232.88	118	**629.59**	120.813

Results that exceeded the CDWQG Aesthetic Objectives (AO) are bolded and the results that exceeded the CDWQG maximum acceptable concentrations (MAC) are bolded and shaded.

5.0 SUMMARY OF POTENTIAL EFFECTS

5.1 Construction Phase Potential Effects

Potential effects for the groundwater resources VEC are detailed in the following sub-sections for the construction phase of the Project.

5.1.1 Physiography and Drainage

Potential effects to physiography as a result of Project activities are not expected. Some localized changes in topography will be observed with site grading and the construction of embankments, but the overall drainage patterns will remain consistent with existing conditions. The general drainage patterns will continue towards the Northwest Miramichi River. This change is not expected to interact with groundwater resources and therefore physiography and drainage are not discussed further in this VEC assessment.

5.1.2 Bedrock and Surficial Geology Potential Effects

Potential effects to surficial geology as a result of Project activities include ground disturbance, excavation and the placement of fill. These activities are not expected to interact with groundwater resources and are therefore not discussed further in this VEC assessment.

5.1.3 Groundwater Quality and Quantity Potential Effects

Potential effects to groundwater quality as a result of Project activities include the potential for contaminants to be released through spills of fuels and lubricants from construction equipment and the subsequent infiltration into a groundwater resource.

Potential effects to groundwater quantity as a result of the Project are not anticipated as groundwater withdrawal is not required for Project activities. Effects to groundwater quantity are therefore not discussed further in this VEC assessment.

5.2 Operational/Maintenance Phase Potential Effects

Potential effects for the groundwater resources VEC are detailed in the following sub-sections during the operational and maintenance phase of the Project.

5.2.1 Groundwater Quality and Quantity Potential Effects

Potential effects to groundwater quality as a result of the Project include the potential for contaminants to be released into groundwater resources through spills of fuels and lubricants from maintenance equipment and by the release of a contaminant from a vehicular accident. No effects are anticipated relative to groundwater quantity.

5.3 Accidents, Malfunctions and Unplanned Events

There is a potential for accidents to occur during all phases of the Project. Accidents that may impact the groundwater resources within the Project Area include the accidental release of contaminants (*i.e.,* chemicals, petroleum products *etc*.) and subsequent infiltration into a groundwater resources (*i.e.,* into an aquifer).

6.0 PROPOSED MITIGATION MEASURES

The potential effects, standard NBDTI Environmental Management Manual (EMM) mitigation measures and any additional mitigation measures recommended by GEMTEC, to minimize the potential adverse effects to groundwater resources during the construction and operational and maintenance phases of the Project, as summarized in Table D-3. Additionally, an Environmental Management Plan (EMP) will be developed following the Technical Review Committee (TRC) comments for all phases of the Project to summarize the commitments of the EIA report, identify any environmental sensitive features and to identify any specific contingency or emergency response plans for the Project.

Table D-3 Summary of Mitigation Measures for Groundwater Resources

Project Component	Summary of Potential Interaction	Standard NBDTI EMM Mitigation Measures[1]	Additional Recommended Mitigation Measures
Construction Phase			
Groundwater Quality and Quantity	Increased potential for contaminants to be released into groundwater resources through spills of fuels and lubricants from construction equipment.	• 5.1 Asphalt Concrete; • 5.10 Fire Prevention and Contingency; • 5.12 Spill Management; • 5.13 Storage and Handling of Petroleum Products; • 5.14 Storage and Handling of Other Hazard Materials; • 5.17 Temporary Ancillary Facility Management; • 5.19 Vehicle and Equipment Management; • 5.22 Waste Management; and • 5.23 Working Near Environmentally Sensitive Areas, in particular 5.23.4 Groundwater Wells	No additional mitigation measures are recommended by GEMTEC.
Operational / Maintenance Phase			
Groundwater Quality and Quantity	Increased potential for contaminants to be released into groundwater resources through spills of fuels and lubricants from maintenance equipment.	• 5.1 Asphalt Concrete; • 5.10 Fire Prevention and Contingency; • 5.12 Spill Management; • 5.13 Storage and Handling of Petroleum Products; • 5.14 Storage and Handling of Other Hazard Materials; • 5.16 Summer Highway Maintenance; • 5.19 Vehicle and Equipment Management;	No additional mitigation measures are recommended by GEMTEC.

Project Component	Summary of Potential Interaction	Standard NBDTI EMM Mitigation Measures[1]	Additional Recommended Mitigation Measures
		• 5.21 Winter Highway Maintenance; and • 5.23 Working Near Environmentally Sensitive Areas.	
Accidents, Malfunctions and Unplanned Events			
Accidental Release of Contaminants	Increased potential for contaminants to be released into groundwater resources through the accidental release of fuels and lubricants from construction / maintenance equipment.	• 5.10 Fire Prevention and Contingency; • 5.12 Spill Management; • 5.13 Storage and Handling of Petroleum Products; • 5.14 Storage and Handling of Other Hazard Materials; and • 5.19 Vehicle and Equipment Management. • 5.23 Working Near Environmentally Sensitive Areas	No additional mitigation measures are recommended by GEMTEC.

1. Indicates the section of the EMM document where written mitigation measures are presented for each component.

7.0 SUMMARY OF POTENTIAL RESIDUAL EFFECTS

A significant residual effect to groundwater resources can be defined as a depletion or contamination of an aquifer that results in a permanent change to human and/or ecosystem use.

The Project is not expected to result in significant residual effects to groundwater resources within the Project Area or within the Assessment Area. The implementation of the proposed mitigation measures in Table D-3 will minimize the risk of any impacts to groundwater quality.

8.0 REFERENCES

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ATTACHMENTS

D1 - Topographical Map

Toporama

October 31, 2017

1:100,760

0 0.75 1.5 3 mi

0 1.25 2.5 5 km

D2 - Well Drillers Reports

New Nouveau Brunswick

Environment

Report Number **221**

Well Driller's Report

Date printed 2/9/2018

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	New Well	Rotary	06/05/2003

Casing Information

Casing above ground 0.61m Drive Shoe Used? Yes

Well Log	Casing Type	Diameter	From	End	Slotted?
221	**Steel**	**15.24cm**	**0m**	**12.80m**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	7.62m *(BTC - Below top of casing)*	54.6 lpm	0hr	0m	54.6 lpm	No	0 lpm

Well Grouting

There is no Grout information.

Drilling Fluids Used
None

Disinfectant
N/A

Qty 0L

Pump Installed
N/A

Intake Setting (BTC)
24.38m

Driller's Log

Well Log	From	End	Colour	Rock Type
221	**0m**	**7.62m**	**Brown**	**Clay and Sand**
221	**7.62m**	**10.67m**	**Brown**	**Sandstone**
221	**10.67m**	**32.00m**	**Grey**	**Sandstone**

Overall Well Depth
32.00m

Bedrock Level
7.62m

Water Bearing Fracture Zone

Well Log	Depth	Rate
221	**21.34m**	**18.2 lpm**
221	**27.43m**	**36.4 lpm**

Setbacks

Well Log	Distance	Setback From
221	**25.91m**	**Septic Tank**
221	**30.48m**	**Leach Field**
221	**33.53m**	**Right of any Public Way Road**

New Nouveau Brunswick

Environment

Report Number **6419**

Well Driller's Report

Date printed 2/9/2018

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	New Well	Cable Tool	06/10/2003

Casing Information

Casing above ground 0m — Drive Shoe Used? Yes

Well Log	Casing Type	Diameter	From	End	Slotted?
6419	**Steel**	**12.7cm**	**0m**	**13.41m**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Bailer	7.62m *(BTC - Below top of casing)*	45.5 lpm	1hr	7.62m	45.5 lpm	No	0 lpm

Well Grouting

There is no Grout information.

Drilling Fluids Used
None

Disinfectant
Bleach (Javex)
Qty 0L

Pump Installed
N/A
Intake Setting (BTC)
24.38m

Driller's Log

Well Log	From	End	Colour	Rock Type
6419	**0m**	**0.61m**	**Brown**	**Fill**
6419	**0.61m**	**0.91m**	**Brown**	**Topsoil**
6419	**0.91m**	**3.66m**	**Grey**	**Clay and Sand**
6419	**3.66m**	**6.40m**	**Brown**	**Clay**
6419	**6.40m**	**12.50m**	**Brown**	**Sandstone**
6419	**12.50m**	**29.26m**	**Grey**	**Sandstone**

Overall Well Depth
29.26m

Bedrock Level
0m

Water Bearing Fracture Zone

There is no water bearing fracture zone information.

Setbacks

Well Log	Distance	Setback From
6419	**15.24m**	**Septic Tank**
6419	**21.34m**	**Leach Field**

New Nouveau Brunswick

Environment

Report Number **6424**

Well Driller's Report

Date printed 2/9/2018

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	New Well	Cable Tool	07/02/2003

Casing Information

Casing above ground 0.46m Drive Shoe Used? Yes

Well Log	Casing Type	Diameter	From	End	Slotted?
6424	**Steel**	**12.7cm**	**0m**	**13.41m**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Bailer	9.75m	45.5 lpm	1hr	9.75m	45.5 lpm	No	0 lpm
	(BTC - Below top of casing)						

Well Grouting

Well Log	Grout Type	From	End
6424	**Clay(cuttings)**	**1.52m**	**14.02m**

Drilling Fluids Used
None

Disinfectant
Bleach (Javex)
Qty 0L

Pump Installed
N/A
Intake Setting (BTC)
24.38m

Driller's Log

Well Log	From	End	Colour	Rock Type
6424	**0m**	**0.91m**	**Brown**	**Fill**
6424	**0.91m**	**1.52m**	**Brown**	**Soil**
6424	**1.52m**	**3.66m**	**Red**	**Clay**
6424	**3.66m**	**4.57m**	**Brown**	**Sand and Gravel**
6424	**4.57m**	**12.19m**	**Brown**	**Sandstone**
6424	**12.19m**	**28.65m**	**Grey**	**Sandstone**

Overall Well Depth
28.65m

Bedrock Level
4.57m

Water Bearing Fracture Zone

Well Log	Depth	Rate
6424	**19.81m**	**9.1 lpm**
6424	**27.43m**	**45.5 lpm**

Setbacks

Well Log	Distance	Setback From
6424	**6.10m**	**Septic Tank**
6424	**21.34m**	**Leach Field**

New Nouveau Brunswick

Environment

Report Number **6544**

Well Driller's Report

Date printed 2/9/2018

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	New Well		10/21/2002

Casing Information

Casing above ground 0m — Drive Shoe Used? Yes

Well Log	Casing Type	Diameter	From	End	Slotted?
6544	**Steel**	**12.7cm**	**0m**	**13.72m**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
	10.67m	54.6 lpm	1hr	26.21m	0 lpm	No	0 lpm
	(BTC - Below top of casing)						

Well Grouting

There is no Grout information.

Drilling Fluids Used
None

Disinfectant
N/A

Qty 0L

Pump Installed
N/A

Intake Setting (BTC)
26.21m

Driller's Log

Well Log	From	End	Colour	Rock Type
6544	**0m**	**8.53m**	**Brown**	**Clay**
6544	**8.53m**	**12.80m**	**Brown**	**Sandstone**
6544	**12.80m**	**13.11m**	**Brown**	**Granite**
6544	**13.11m**	**19.20m**	**Brown**	**Sandstone**
6544	**19.20m**	**31.70m**	**Grey**	**Sandstone**

Overall Well Depth
31.70m

Bedrock Level
8.53m

Water Bearing Fracture Zone

Well Log	Depth	Rate
6544	**31.70m**	**54.6 lpm**

Setbacks

Well Log	Distance	Setback From
6544	**45.72m**	**Right of any Public Way Road**

New Nouveau Brunswick

Environment

Report Number **15097**

Well Driller's Report

Date printed 2/9/2018

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	New Well	Cable Tool	10/25/2006

Casing Information

Casing above ground 0.38m Drive Shoe Used? Yes

Well Log	Casing Type	Diameter	From	End	Slotted?
15097	**Steel**	**13.97cm**	**0m**	**9.14m**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Bailer	7.92m	45.5 lpm	1hr	7.92m	45.5 lpm	No	0 lpm
	(BTC - Below top of casing)						

Well Grouting

Well Log	Grout Type	From	End
15097	**Clay(cuttings)**	**1.52m**	**9.14m**

Drilling Fluids Used
None

Disinfectant
Bleach (Javex)
Qty 0L

Pump Installed
N/A
Intake Setting (BTC)
21.34m

Driller's Log

Well Log	From	End	Colour	Rock Type
15097	**7.32m**	**8.53m**	**Brown**	**Clay**
15097	**0m**	**0.61m**	**Brown**	**Fill**
15097	**0.61m**	**1.22m**	**Red**	**Clay**
15097	**1.22m**	**7.32m**	**Grey**	**Clay**
15097	**8.53m**	**20.73m**	**Brown**	**Sandstone**
15097	**20.73m**	**30.48m**	**Grey**	**Sandstone**

Overall Well Depth
30.48m

Bedrock Level
8.53m

Water Bearing Fracture Zone

Well Log	Depth	Rate
15097	**13.72m**	**4.55 lpm**
15097	**28.96m**	**45.5 lpm**

Setbacks

Well Log	Distance	Setback From
15097	**15.24m**	**Septic Tank**
15097	**23.16m**	**Leach Field**

New Nouveau Brunswick

Environment

Report Number **25201**

Well Driller's Report

Date printed 2/9/2018

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	New Well	Cable Tool	10/26/2009

Casing Information

Casing above ground 0.51m — Drive Shoe Used? Yes

Well Log	Casing Type	Diameter	From	End	Slotted?
25201	**Steel**	**12.7cm**	**0m**	**15.24m**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Bailer	6.10m	45.5 lpm	1hr	6.10m	45.5 lpm	No	0 lpm
	(BTC - Below top of casing)						

Well Grouting

Well Log	Grout Type	From	End
25201	**Clay(cuttings)**	**1.52m**	**15.24m**

Drilling Fluids Used
None

Disinfectant
Bleach (Javex)
Qty 0L

Pump Installed
N/A
Intake Setting (BTC)
18.29m

Driller's Log

Well Log	From	End	Colour	Rock Type
25201	**14.63m**	**25.91m**	**Grey**	**Sandstone**
25201	**0m**	**0.61m**	**Brown**	**Topsoil**
25201	**0.61m**	**3.66m**	**Red**	**Clay**
25201	**3.66m**	**14.63m**	**Brown**	**Clay**

Overall Well Depth
25.91m

Bedrock Level
0m

Water Bearing Fracture Zone

Well Log	Depth	Rate
25201	**18.59m**	**4.55 lpm**
25201	**24.99m**	**45.5 lpm**

Setbacks

Well Log	Distance	Setback From
25201	**12.19m**	**Right of any Public Way Road**
25201	**15.24m**	**Septic Tank**
25201	**23.16m**	**Leach Field**

New Nouveau Brunswick

Environment

Report Number **26097**

Well Driller's Report

Date printed 2/9/2018

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	New Well	Cable Tool	06/02/2011

Casing Information

Casing above ground 0.46m Drive Shoe Used? Yes

Well Log	Casing Type	Diameter	From	End	Slotted?
26097	**Steel**	**12.7cm**	**0m**	**9.75m**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
	8.23m	45.5 lpm	1hr 27min	8.23m	45.5 lpm	No	0 lpm
	(BTC - Below top of casing)						

Well Grouting

Well Log	Grout Type	From	End
26097	**Clay(cuttings)**	**1.52m**	**9.75m**

Drilling Fluids Used
None

Disinfectant
Bleach (Javex)

Qty 0L

Pump Installed
N/A

Intake Setting (BTC)
21.34m

Driller's Log

Well Log	From	End	Colour	Rock Type
26097	**7.92m**	**9.14m**	**Brown**	**Sandstone**
26097	**0m**	**0.61m**	**Brown**	**Topsoil**
26097	**0.61m**	**3.66m**	**Brown**	**Clay**
26097	**3.66m**	**7.92m**	**Grey**	**Clay**
26097	**9.14m**	**31.09m**	**Grey**	**Sandstone**

Overall Well Depth
31.09m

Bedrock Level
0m

Water Bearing Fracture Zone

Well Log	Depth	Rate
26097	**21.34m**	**9.1 lpm**
26097	**31.09m**	**45.5 lpm**

Setbacks

Well Log	Distance	Setback From
26097	**15.24m**	**Septic Tank**
26097	**24.38m**	**Leach Field**

New Nouveau Brunswick

Environment

Report Number **38796**

Well Driller's Report

Date printed 2/9/2018

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	New Well	Rotary	10/04/2016

Casing Information

Casing above ground 0.56m Drive Shoe Used? Yes

Well Log	Casing Type	Diameter	From	End	Slotted?
38796	**Steel**	**15.24cm**	**0m**	**12.19m**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
	12.19m	136.5 lpm	1hr	12.19m	136.5 lpm	No	0 lpm
	(BTC - Below top of casing)						

Well Grouting

There is no Grout information.

Drilling Fluids Used
None

Disinfectant
12% NaOCl

Qty 0L

Pump Installed
Submersible
Intake Setting (BTC)
21.34m

Driller's Log

Well Log	From	End	Colour	Rock Type
38796	**0m**	**5.49m**	**Brown**	**Clay**
38796	**5.49m**	**10.36m**	**Brown**	**Sandstone**
38796	**10.36m**	**24.99m**	**Grey**	**Sandstone**

Overall Well Depth
24.99m

Bedrock Level
5.49m

Water Bearing Fracture Zone

Well Log	Depth	Rate
38796	**16.76m**	**13.65 lpm**
38796	**22.56m**	**95.55 lpm**

Setbacks

Well Log	Distance	Setback From
38796	**38.10m**	**Right of any Public Way Road**
38796	**24.38m**	**Septic Tank**
38796	**28.96m**	**Leach Field**
38796	**36.58m**	**Right of any Public Way Road**

New Nouveau Brunswick

Environment

Report Number **90410200**

Well Driller's Report

Date printed 2/9/2018

Drilled by			
Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	New Well (NEW WELL)	Cable Tool (CABLE TOOL)	08/15/1995

Casing Information

Casing above ground 0.61m Drive Shoe Used? Yes

Well Log	Casing Type	Diameter	From	End	Slotted?
90410200	**Steel**	**12.7cm**	**0m**	**9.75m**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Bailer	0m	45.5 lpm	1hr	7.62m	59.15 lpm	No	0 lpm

(BTC - Below top of casing)

Well Grouting

There is no Grout information.

Drilling Fluids Used
None

Disinfectant
N/A

Qty 0L

Pump Installed
N/A

Intake Setting (BTC)
21.34m

Driller's Log

Well Log	From	End	Colour	Rock Type
90410200	**15.85m**	**24.38m**	**Brown**	**Sandstone**
90410200	**0m**	**1.22m**	**Brown**	**Fill**
90410200	**1.22m**	**3.66m**	**Brown**	**Clay**
90410200	**3.66m**	**8.53m**	**Brown**	**Sandstone**
90410200	**8.53m**	**15.85m**	**Grey**	**Sandstone**

Overall Well Depth
24.38m

Bedrock Level
3.66m

Water Bearing Fracture Zone

Well Log	Depth	Rate
90410200	**15.85m**	**13.65 lpm**
90410200	**23.16m**	**45.5 lpm**

Setbacks

There is no Setback information.

New Nouveau Brunswick

Environment

Report Number **91141400**

Well Driller's Report

Date printed 2/9/2018

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	New Well (NEW WELL)	Cable Tool (CABLE TOOL)	06/18/1998

Casing Information

Casing above ground 0.61m Drive Shoe Used? Yes

Well Log	Casing Type	Diameter	From	End	Slotted?
91141400	**Steel**	**12.7cm**	**0m**	**7.92m**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Bailer	7.62m *(BTC - Below top of casing)*	54.6 lpm	1hr	7.62m	54.6 lpm	No	0 lpm

Well Grouting

There is no Grout information.

Drilling Fluids Used
None

Disinfectant
Bleach (Javex)
Qty 0L

Pump Installed
N/A
Intake Setting (BTC)
18.29m

Driller's Log

Well Log	From	End	Colour	Rock Type
91141400	**0m**	**1.22m**	**Brown**	**Fill**
91141400	**1.22m**	**5.49m**	**Brown**	**Sand**
91141400	**5.49m**	**7.32m**	**Brown**	**Sandstone**
91141400	**7.32m**	**25.60m**	**Grey**	**Sandstone**

Overall Well Depth
25.60m

Bedrock Level
6.71m

Water Bearing Fracture Zone

Well Log	Depth	Rate
91141400	**14.63m**	**9.1 lpm**
91141400	**24.38m**	**54.6 lpm**

Setbacks

There is no Setback information.

New Nouveau Brunswick

Environment

Report Number **91496900**

Well Driller's Report

Date printed 2/9/2018

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	New Well (NEW WELL)	Cable Tool (CABLE TOOL)	02/26/1999

Casing Information

Casing above ground 0.61m Drive Shoe Used? Yes

Well Log	Casing Type	Diameter	From	End	Slotted?
91496900	**Steel**	**12.7cm**	**0m**	**14.02m**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Bailer	6.71m	45.5 lpm	1hr	6.71m	45.5 lpm	No	0 lpm
	(BTC - Below top of casing)						

Well Grouting

Well Log	Grout Type	From	End
91496900	**Clay(cuttings)**	**0m**	**14.02m**

Drilling Fluids Used
None

Disinfectant
Bleach (Javex)
Qty 2.275L

Pump Installed
N/A
Intake Setting (BTC)
24.38m

Driller's Log

Well Log	From	End	Colour	Rock Type
91496900	**4.27m**	**6.71m**	**Red**	**Clay**
91496900	**0m**	**0.61m**	**Brown**	**Topsoil**
91496900	**0.61m**	**4.27m**	**Brown**	**Clay**
91496900	**6.71m**	**7.92m**	**Brown**	**Sand**
91496900	**7.92m**	**12.50m**	**Brown**	**Sandstone**
91496900	**12.50m**	**28.65m**	**Grey**	**Sandstone**

Overall Well Depth
28.65m

Bedrock Level
7.92m

Water Bearing Fracture Zone

Well Log	Depth	Rate
91496900	**27.43m**	**45.5 lpm**
91496900	**18.90m**	**9.1 lpm**

Setbacks

There is no Setback information.

New Nouveau Brunswick

Environment

Report Number **92035700**

Well Driller's Report

Date printed 2/9/2018

Drilled by

Well Use	Work Type	Drill Method	Work Completed
Drinking Water, Domestic	New Well	Cable Tool	05/19/2001

Casing Information

Casing above ground 0.61m Drive Shoe Used? Yes

Well Log	Casing Type	Diameter	From	End	Slotted?
92035700	**Steel**	**12.7cm**	**0m**	**12.50m**	

Aquifer Test/Yield

Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Bailer	6.10m *(BTC - Below top of casing)*	54.6 lpm	0hr	5.49m	54.6 lpm	No	0 lpm

Well Grouting

There is no Grout information.

Drilling Fluids Used
None

Disinfectant
Bleach (Javex)
Qty 2.275L

Pump Installed
N/A
Intake Setting (BTC)
21.34m

Driller's Log

Well Log	From	End	Colour	Rock Type
92035700	**10.97m**	**21.95m**	**Grey**	**Sandstone**
92035700	**0m**	**1.22m**	**Brown**	**Fill**
92035700	**1.22m**	**3.66m**	**Brown**	**Clay**
92035700	**3.66m**	**10.97m**	**Brown**	**Sandstone**
92035700	**21.95m**	**30.48m**	**Brown**	**Sandstone**

Overall Well Depth
30.48m

Bedrock Level
0m

Water Bearing Fracture Zone

Well Log	Depth	Rate
92035700	**21.95m**	**13.65 lpm**
92035700	**29.26m**	**54.6 lpm**

Setbacks

There is no Setback information.