CAPITAL ENGINEERING GROUP LTD

Municipal / Environmental / Land Development

SERVICING AND STORMWATER MANAGEMENT BRIEF
APEX MOTOR EXPRESS TRUCK TERMNAL
1599 ST. LAURENT BOULEVARD
CITY OF OTTAWA
December 4, 2014

EXISTING CONDITIONS

This site is located along the east side of St. Laurent Boulevard just south of the Belfast Road intersection, in the east central area of the City of Ottawa. Site access is via Triole Street at the south end of the road (dead end). The property is also bound by existing industrial developments on the north and east sides, and by a former railway right of way on the south side (currently used as a drainage ditch). The site has a trapezoidal shape with a gross area of roughly 1.8 hectares.

The site is zoned Industrial (IL) and is currently vacant.

The site topography is relatively flat with a slight down gradient towards the northwest corner. There is an existing ditch running along the east and north property lines, which continues northerly passed the site towards Triole Street.

The existing municipal infrastructure on Triole Street includes a 200 mm diameter watermain, a 250 mm diameter sanitary sewer and a 600 mm diameter storm sewer. The storm sewer continues in the northerly direction towards Belfast Road, eventually outletting into the South Cyrville Drain. The Cyrville Drain is located within the Greens Creek drainage area which is under the jurisdiction of the Rideau Valley Conservation Authority.

An overhead utilities line runs north-south along the west side of Triole Street, terminating at a hydro pole near the property line.

PROPOSED DEVELOPMENT

The property owners propose to build a transfer station for wholesale product distribution. The new development will consist of a warehouse section with a smaller office space. The new building will have truck loading docks on three side of the warehouse and a visitor parking area adjacent to the office, plus additional trailer parking at the back. The setback areas along the property lines will be landscaped.

Site Access will be extended from the current end of Triole Street.

The building foot print will be approximately 1,950 m^2. It will be equipped with a sprinkler system for fire protection.

110 Dossetter Way, Ottawa, Ontario K1G 4S5
Tel: (613) 739-0776 Fax: (613) 739-7302

BUILDING SERVICES

New water and sanitary services will be connected off the municipal infrastructure at the end of Triole Street. The new services will enter the building in the office area, the sanitary on the west side and the water at the front. They will include:

- 200 mm diameter PVC pressure pipe water service, extending up to the new private fire hydrant behind the visitor parking. The remainder of the service to the building will be reduced to 150 mm diameter. A valve and box will also be installed at the property line.

- 150 mm diameter PVC sanitary service, plus a monitoring manhole

The site services are indicated on the Servicing Plan (Dwg. 1408, G1).

This facility will be operated by an average of 22 employees. The average daily sewage flows can be estimated using the City of Ottawa Sewer Design Guidelines (Appendix 4-A), as follows:

22 employees @ 75 liters per employee 1,650 liters per day

The average and peak flow rates based on a 12 hour daily operation and a peak factor of 1.5 are 0.04 and 0.06 liters per second respectively.

The average daily water demand will be similar to the sewage flows or 0.04 L/s. The maximum day and peak hourly demands can be calculated by applying the MOE peaking factors of 9.5 and 14.3 (Table 3.3 – fewer than 500 people). This results in a maximum day and peak hourly demand of 0.36 L/s and 0.54 L/s. Meter sizing will be based on the fixture unit value as detailed in the Water Data Card, to be submitted separately.

FIRE FLOW

Spatial fire flow coverage will be provided by the new private fire hydrant mentioned above. The new hydrant will be installed within 45 m of the Siamese connection to meet the Building Code requirements for a sprinklered building.

The fire flow to supply the proposed sprinkler system will be calculated by the mechanical engineer on the project and the sprinkler system supplier. The initial estimate provided to us is 4,500 liters per minute.

The Hydraulic Grade line at the end of the existing watermain on Triole Street, under Maximum Day demand plus fire flow of 4,500 L/minute (75 L/s), is 106.9 m. Please refer to the attached Boundary Conditions provided by the City.

Head losses through the extended water service are estimated at 11 m and 20 m to the hydrant and building respectively. The ground elevation at the hydrant and floor elevation at the building are 70.25 and 71.22 respectively. This results in residual pressures of 25.65 m (36 psi) at the hydrant, and 15.68 m (22 psi) at the building.

Detailed design of the sprinkler system will be carried out by the system supplier who will ensure that NFPA and Building Code requirements are met. Booster pumps maybe required to meet the minimum pressure for the sprinklers.

POST DEVELOPMENT GRADING AND DRAINAGE

The post development grading and drainage design is indicated on the Grading and Drainage Plan (Dwg. 1408, G2) prepared by Capital Engineering Group Ltd.

The landscaped strip behind the paved parking along the railway right of way will sheet drain directly to the existing ditch within the right of way. The most northern portion of the access driveway and adjacent landscaping will drain downstream of CBMH1. These two areas will not be subject to flow controls.

Runoff from the building and the remaining portion of the site will be directed to a new storm sewer network, made up of a series of catch basins and manholes. The network will consist of two branches, one collecting drainage from the back, east and north, including the east half of the roof. The second branch will collect drainage from the west half of the roof and the adjacent loading docks and access driveways. The two branches will converge to an outlet manhole (CBMH1) located in the access driveway at the north end.

A flow restrictor will be installed in the outlet manhole of CBMH1 to provide the required quantity control of the post development runoff.

The outflow will pass through a quality control unit, then outlet to the municipal storm sewer on Triole Street.

A breakdown of the drainage areas and corresponding runoff coefficients is provided on the Drainage Areas Plan (Dwg. 1408, G3). The sewer design sheet is attached.

STORMWATER MANAGEMENT

Criteria

The City of Ottawa and Rideau Valley Conservation Authority require that post development runoff from this site be subject to SWM quantity and quality control. We have pre-consulted with both agencies, and the following is an outline of the required criteria (see attached).

The City of Ottawa has directed us to control the post development runoff to the 5 year storm event, with a runoff coefficient equivalent to pre-development conditions or 0.5, whichever is less.

Quality control criteria is set by the RVCA. They require a standard level (70 %) TSS removal.

Quantity Control

The 5 and 100 year predevelopment peak flows are calculated using the Rational Method, as follows:

$Q = 2.78\ CIA$

Where C is the runoff coefficient
I is the rainfall intensity in mm/hr,
A is the drainage area in hectares = 1.8 hectares

Since the site is currently vacant, C values of $C_5 = 0.20$ and $C_{100} = 0.25$ will be applied.
Rainfall intensities of $I_5 = 70$ mm/hr and $I_{100} = 120$ mm/hr will be used, based on an assumed concentration time of T = 20 minutes.

$Q_5 = 2.78 \times 1.8 \times 0.2 \times 70 = 70.00$ L/s
$Q_{100} = 2.78 \times 1.8 \times 0.25 \times 120 = 150.1$ L/s

Unrestricted drainage

The uncontrolled drainage areas at the north and south ends of the site are broken down as follows

Asphalt	400 m^2
Landscaping	1,100 m^2
	1,500 m^2

Combined $C_5 = 0.39$, $C_{100} = 0.45$
$Q_5 = 11.0$ L/s
$Q_{100} = 23.0$ L/s

Balance of allowable outflow rates

70.00 – 23.00 = 47.00 L/s

On site retention

The area subject to SWM is broken down as follows:

Building	1,950 m^2
Asphalt and concrete	14,250 m^2
Landscaping	300 m^2
Total	16,500 m^2

Combined C5 = 0.89, C100 = 0.99

The attached spreadsheet provides detailed calculations for on-site retention volumes during major storm events. The results are summarized as follows:

Storm frequency	Outflow Rate	On site Retention
5 year	47.0 L/s	315 m^3
100 year	47.0 L/s	750 m^3

Please note that the outflow rate of 47.00 L/s has also been applied to the 100 year storm calculations. This is a reduction of roughly 50 % in the peak flow compared to predevelopment conditions for the same return period.

On site storage is accommodated by surface ponding. The ponding areas are designated on the Grading and Drainage plan, and are described below.

	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6
Ponding Area	1,720 m^2	1,540 m^2	1,600 m^2	1,700 m^2	1,540 m^2	820 m^2
Maximum Ponding	0.27 m	0.27 m	0.27 m	0.27 m	0.27 m	0.27 m
Storage Capacity	155 m^3	139 m^3	144 m^3	153 m^3	139 m^3	74 m^3
5 Year Depth	0.22 m	0.22 m	0.22 m	0.22 m	0.22 m	0.22 m

Storage in the storm sewer pipes, CB's and CBMH's is 51 m^3.

The total available on site storage is 855 m^3

The outflow rate will be limited to 47.00 L/s by installing a Hydrovex (150VHV-2) flow restrictor in the outlet pipe at CBMH1. The hydraulic heads during the 5 and 100 year storm events are estimated at 2.82 m and 2.87 m respectively. Please refer to the attached head versus discharge graphs for the flow restrictor.

Quality Control

A Vortechs Water Quality unit (Model 2000) will be installed at the storm outlet from the site to provide quality control of the runoff. The unit is sized to provide a net annual Total Suspended Solid (TSS) removal efficiency exceeding the 70 % threshold. Please refer to the attached sizing calculations provided by the supplier. Unit specifications, standard details and installation directions are also enclosed for reference.

Sediment and Erosion Control

Erosion and sediment control measures will be put in place prior construction to minimize off site silt runoff. The measures will conform to MOE Guideline B-6, "Guidelines for Evaluating Construction Activities Impacting on Water Resources". They are detailed on the Erosion and Sediment Control Plan (Dwg.1408, G4).

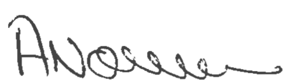
All erosion and sediment control installations will remain in place until pavement and landscaping works are completed.

Review by Other Agencies

The drawings and Brief will be circulated to the Rideau Valley Conservation Authority as part of the site plan application process.

This site is located in an industrial zone and will require Environmental Compliance Approval from the Ministry of Environment, for on-site SWM. Copies of the drawings and documents will be provided to the local MOE office prior to submission of the ECA application.

Prepared by
Capital Engineering Group Ltd.



Andy Naoum, P.Eng.
Senior Consultant

Andy Naoum

From:	Oram, Cody <Cody.Oram@ottawa.ca>
Sent:	December 1, 2014 9:25 AM
To:	Andy Naoum
Subject:	RE: Apex Truck Terminal - 1599 St. Laurent
Attachments:	1599 St-Laurent Nov 2014.pdf

Hi Andy,

The following are boundary conditions, HGL, for hydraulic analysis at 1599 St-Laurent (zone 1E) assumed to be connected to the 203mm on Triole St (see attached PDF for location).

Minimum HGL = 110.2m

Maximum HGL = 118.9m

MaxDay (0.36 L/s) + FireFlow (75 L/s) = 106.9m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

Cody Oram, P.Eng.
Project Manager, Development Review
(Urban Services) Outer
Gestionnaire de projets
(Secteur urbain) Exterieur
PLANNING AND GROWTH MANAGEMENT
URBANISME ET GESTION DE LA CROISSANCE
City of Ottawa | ville d'Ottawa
613.580.2424 ext/poste 13422
Please consider the environment before printing this e-mail.

From: Andy Naoum [mailto:cegl@rogers.com]
Sent: Wednesday, November 26, 2014 1:48 PM
To: Oram, Cody
Subject: RE: Apex Truck Terminal - 1599 St. Laurent

Here is a sketch Cody,

Thanks,
Andy Naoum, P.Eng.
Capital Engineering Group Ltd.
(613) 739-0776

From: Oram, Cody [mailto:Cody.Oram@ottawa.ca]
Sent: November 26, 2014 1:16 PM
To: Andy Naoum
Subject: RE: Apex Truck Terminal - 1599 St. Laurent

Hi Andy,
Can you provide a sketch showing the proposed water service location.
Thank you,
Cody Oram, P.Eng.
Project Manager, Development Review
(Urban Services) Outer
Gestionnaire de projets
(Secteur urbain) Exterieur

City of Ottawa | ville d'Ottawa
613.580.2424 ext/poste 13422

From: Andy Naoum [mailto:cegl@rogers.com]
Sent: Wednesday, November 26, 2014 10:57 AM
To: Oram, Cody
Subject: Apex Truck Terminal - 1599 St. Laurent

Hi Cody,

Can we get the boundary conditions for this site please. The closest fire hydrant is at the end of Triole Street.

The projected water demands are:

Average	0.04 L/s
Maximum Day	0.36 L/s
Peak Hourly	0.54 L/s

The estimated fire flow requirement is 4500 L/minute. The building will be sprinklered.

Thanks,
Andy Naoum, P.Eng.
Capital Engineering Group Ltd.
(613) 739-0776

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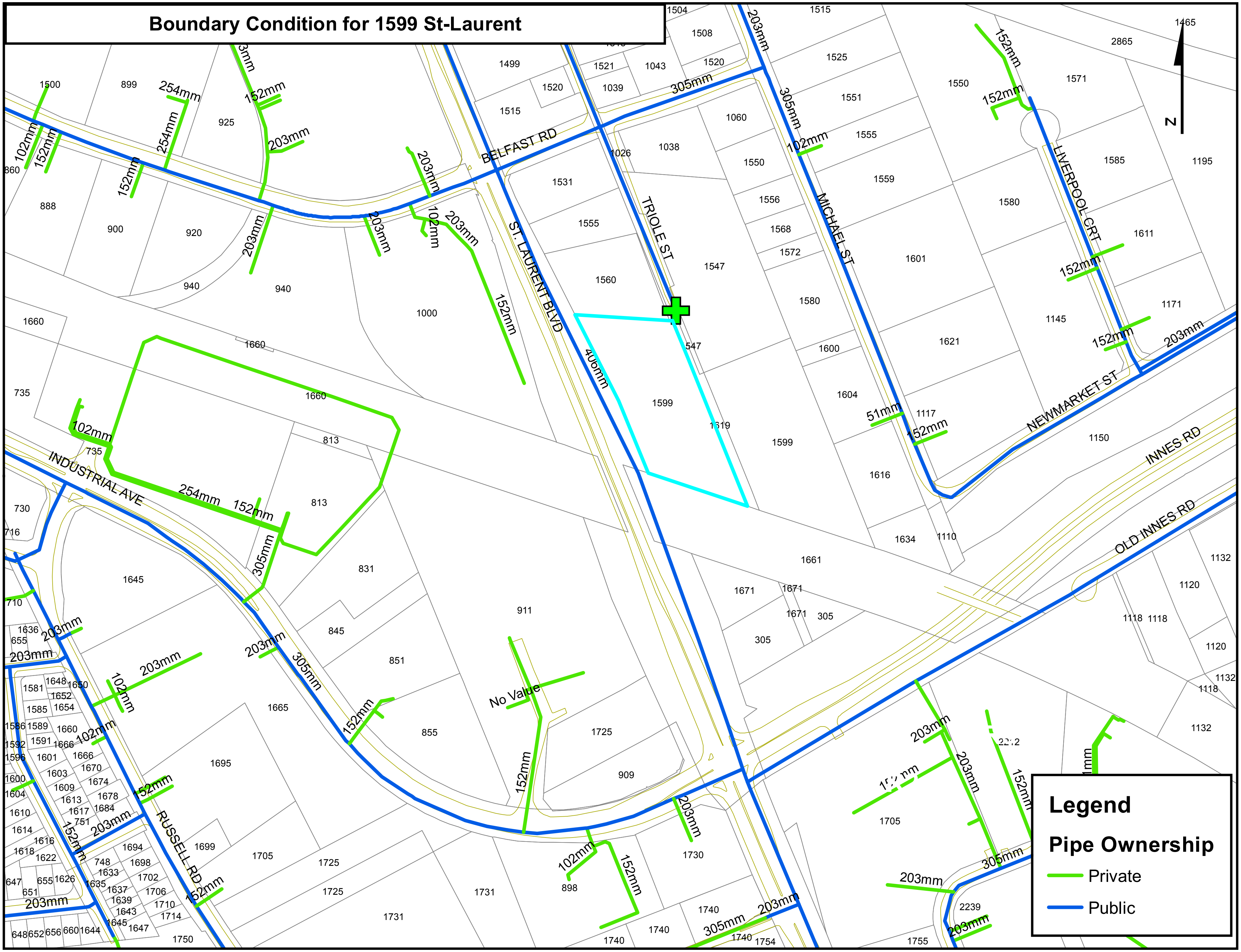
Boundary Condition for 1599 St-Laurent



LOCATION	MH FROM	MH TO	AREA (ha)	RUNOFF COEFF.	2.78CA INCR.	2.78CA ACCUM.	T of C (min)	INTENSITY (mm/hr)	PEAK FLOW (L/s)	LENGTH OF PIPE (m)	DIAM. OF PIPE (mm)	SLOPE %	PIPE CAPACITY	VELOCITY (m/s)	SECTION (min)
Triole Street	CB1	CBMH4	0.24	0.89	0.59	0.59	10	104	61.10	44	250	1.00	61.83	1.22	0.60
	CBMH4	CBMH3	0.24	0.87	0.59	1.17	11	99	116.46	56	375	0.41	116.72	1.03	0.91
	CBMH3	CBMH2	0.27	0.88	0.65	1.82	12	95	172.81	54	450	0.35	175.37	1.07	0.84
	CBMH2	CBMH1	0.24	0.88	0.58	2.41	13	91	218.15	77	450	0.55	219.83	1.34	0.96
	CB2	CBMH5	0.24	0.90	0.60	0.60	10	104	62.04	61	250	1.00	61.83	1.22	0.83
	CBMH5	STMH2	0.39	0.90	0.99	1.58	11	99	156.85	42	375	0.75	157.87	1.39	0.50
	STMH2	CBMH1	0.03	0.90	0.08	1.66	12	95	156.85	17	375	0.75	157.87	1.39	0.20
	CBMH1	STMH1	0.06	0.67	0.11	0.11	14	87	70**	67	375	0.25	91.14	0.80	1.39
	STMH1	EX. MH	0.00	0.20	0.00	0.11	14	87	70**	4	375	0.25	91.14	0.80	0.08
			1.71												

**** OUTFLOW RATE IS RESTRICTED to 70 L/S**

CONSULTANT : CAPITAL ENGINEERING GROUP LTD
PROJECT: APEX TRUCK TERMINAL
LOCATION :1599 ST. LAURENT BLVD.
OTTAWA, ONTARIO
DESIGNED BY : A. NAOUM
CHECKED BY :
DATE :DEC 4, 2014

STORM SEWER DESIGN SHEET
5 YEAR STORM EVENT

SHEET 1 OF 1

MEMO

Ottawa

Aug 8, 2014

To / Destinataire	Nina Maher, Planner
From / Expéditeur	Cody Oram, Project Manager, Infrastructure Approvals
Subject / Objet	**Pre-Application Consultation - 1599 St. Laurent Blvd.** *Truck Bay* — File No. PC2014-0184

Please note the following information regarding the engineering design submission for the above noted site:

1. The Servicing Study Guidelines for Development Applications are available at the following address: http://ottawa.ca/en/development-application-review-process-0/servicing-study-guidelines-development-applications

2. Servicing & site works shall be in accordance with the following documents:
   - ⇨ Ottawa Sewer Design Guidelines (2013)
   - ⇨ Ottawa Design Guidelines – Water Distribution (2010)
   - ⇨ Ottawa Standard Tender Documents (2013)
   - ⇨ Ontario Provincial Standards for Roads & Public Works (2013)

3. Record drawings and utility plans are also available for purchase from the City (Contact the City's Information Centre by email at InformationCentre@ottawa.ca or by phone at (613) 580-2424 x.44455).

4. Water Boundary condition requests must include the location of the service and the expected loads required by the proposed development. Please provide the following information:

   i. Location of service
   ii. Type of development and the amount of fire flow required.
   iii. Average daily demand: ___ l/s.
   iv. Maximum daily demand: ___l/s.
   v. Maximum hourly daily demand: ___ l/s.

5. The Stormwater Management Criteria, for the subject site, is to be based on the following:

   i. The 5-yr storm event using the IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997.
   ii. The pre-development runoff coefficient or a maximum equivalent 'C' of 0.5, whichever is less.
   iii. A calculated time of concentration (Cannot be less than 10 minutes).

iv. Flows to the storm sewer in excess of the 5-year storm release rate, up to and including the 100-year storm event, must be detained on site.

v. The City's downstream storm system outfalls to the Cyrville Drain and the subject site is located within the Greens Creek Study Area. Please contact Jocelyn Chandler, Planner, RVCA (jocelyn.chandler@rvca.ca) regarding water quality treatment.

6. Sanitary Sewer Constraints

- ⇨ The Consultant is to calculate the total anticipated sanitary flows from the proposed development, based on the City's Sewer Design Guidelines. This information will then be used by the City to determine if the downstream sanitary sewer system can accommodate the proposed development.

7. Ministry of Environment (MOE)

- ⇨ The Consultant is to contact the local MOE office to confirm if the site is subject to an Environmental Compliance Approval (ECA). Please contact Melissa Lee by e-mail Melissa.lee2@ontario.ca or by phone 613-521-34050.

Should you have any questions or require additional information, please contact me directly at (613) 580-2424, x 13422 or by email at cody.oram@ottawa.ca .

Andy Naoum

From: Jocelyn Chandler <jocelyn.chandler@rvca.ca>
Sent: November 28, 2014 10:18 AM
To: Andy Naoum
Subject: RE: Apex Truck Terminal / 1599 St. Laurent Blvd.

Hello Andy, I presume you will be connecting to the municipal storm sewer on Triole Street. The pipe travels approximately 750 metres to a direct outlet into the Cyrville Municipal Drain at MIchael Street. The Cyrville Drain requires standard quality control (70% TSS removal) treatment for stormwater.
Thank you for contacting me, let me know if you need anything further, Jocelyn

Jocelyn Chandler M.Pl. MCIP, RPP
Planner, RVCA
t) 613-692-3571 x1137
f) 613-692-0831
jocelyn.chandler@rvca.ca
www.rvca.ca
mail: Box 599 3889 Rideau Valley Dr., Manotick, ON K4M 1A5
courier: 3889 Rideau Valley Dr., Nepean, ON K2C 3H1

From: Andy Naoum [mailto:cegl@rogers.com]
Sent: Thursday, November 27, 2014 9:36 PM
To: Jocelyn Chandler
Cc: 'Oram, Cody'; 'Keith Riley'
Subject: Apex Truck Terminal / 1599 St. Laurent Blvd.

Hi Jocelyn,

This site is located on the east side of St. Laurent Boulevard at the end of Triole Street.

Can you please confirm the water quality requirements for the post development runoff?

I am aware of the normal requirements for the South Cyrville Drain, but I need specific directions for this site for the record.

Thanks,
Andy Naoum, P.Eng.
Capital Engineering Group Ltd.
(613) 739-0776

STORMWATER MANAGEMENT CALCULATIONS
APEX MOTOR EXPRESS TRUCK TERMINAL
1599 TRIOLE STREET
December 4 / 2014

ON SITE RETENTION FOR 5 YEAR STORM	AREA	RUNOFF	2.78 CA	DURATION	INTENSITY	PEAK FLOW	OUTFLOW	RETENTION	STORED
	(ha)	COEFF.		(min)	(mm/hr)	(L/s)	RATE(L/s)	RATE(L/s)	VOLUME(m3)
	1.650	0.89	4.08	5	141	576.35	47.00	529	158.81
	1.650	0.89	4.08	10	104	425.36	47.00	378	227.02
	1.650	0.89	4.08	15	84	341.12	47.00	294	264.70
	1.650	0.89	4.08	20	70	286.80	47.00	240	287.75
	1.650	0.89	4.08	25	61	248.60	47.00	202	302.41
	1.650	0.89	4.08	30	54	220.16	47.00	173	311.68
	1.650	0.89	4.08	60	33	134.49	47.00	87	**314.96**
	1.650	0.89	4.08	70	29	119.91	47.00	73	306.22
ON SITE RETENTION FOR 100 YEAR STORM	AREA	RUNOFF	2.78 CA	DURATION	INTENSITY	PEAK FLOW	OUTFLOW	RETENTION	STORED
	(ha)	COEFF.		(min)	(mm/hr)	(L/s)	RATE(L/s)	RATE(L/s)	VOLUME(m3)
	1.650	0.99	4.54	5	243	1102.15	47.00	1055	316.54
	1.650	0.99	4.54	10	179	810.86	47.00	764	458.32
	1.650	0.99	4.54	15	143	648.90	47.00	602	541.71
	1.650	0.99	4.54	20	120	544.71	47.00	498	597.25
	1.650	0.99	4.54	25	104	471.58	47.00	425	636.87
	1.650	0.99	4.54	30	92	417.19	47.00	370	666.33
	1.650	0.99	4.54	60	56	253.82	47.00	207	744.57
	1.650	0.99	4.54	90	41	186.69	47.00	140	**754.33**
	1.650	0.99	4.54	100	38	172.12	47.00	125	750.74

John Meunier - Hydrovex VHV ICD Curves

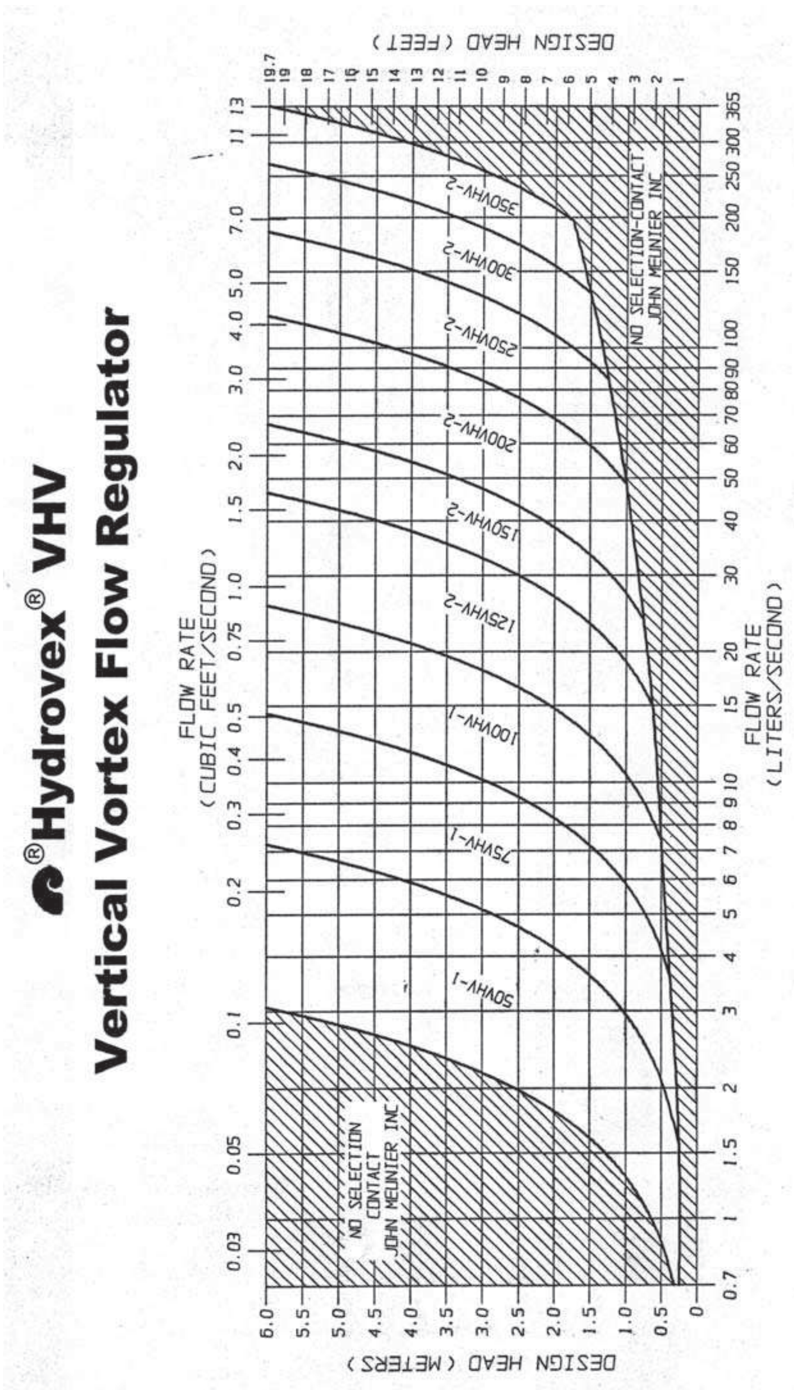


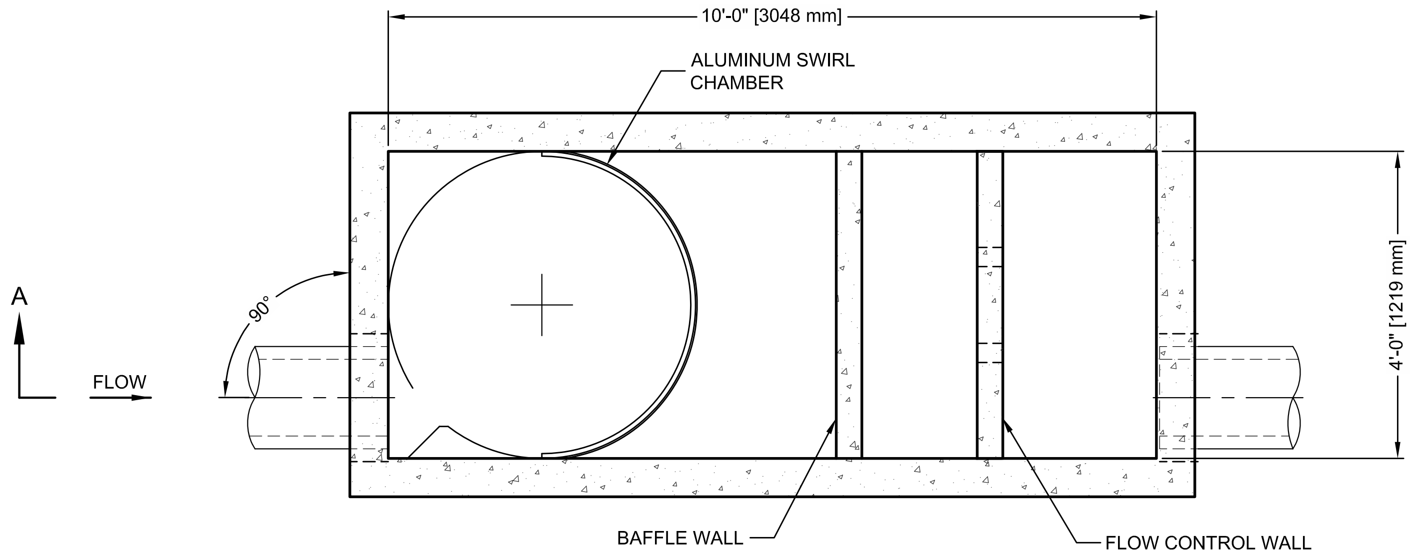
FIGURE 2 - VHV

JOHN MEUNIER

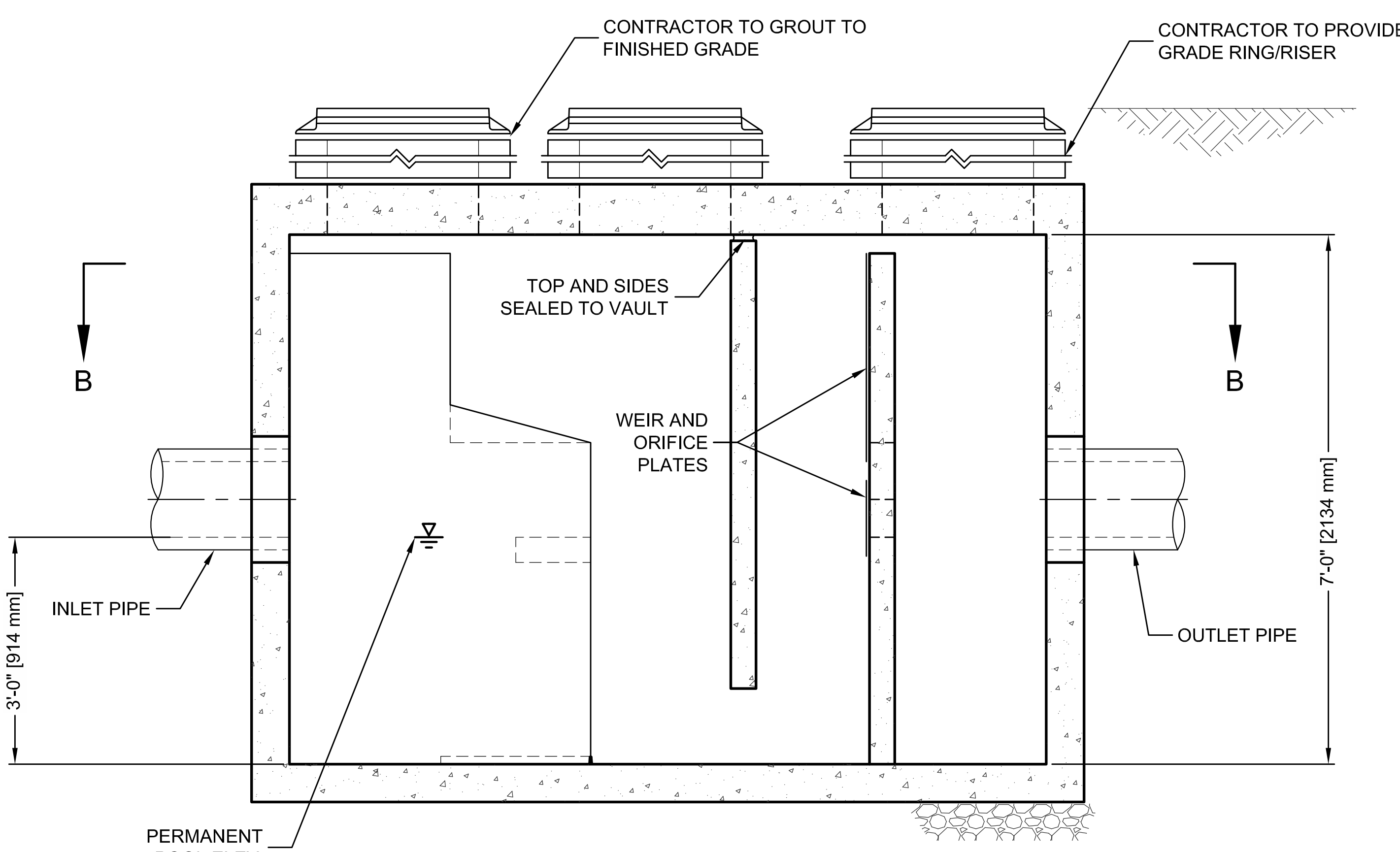
VORTECHS 2000 DESIGN NOTES

VORTECHS 2000 RATED TREATMENT CAPACITY IS 2.8 CFS, OR PER LOCAL REGULATIONS. IF THE SITE CONDITIONS EXCEED RATED TREATMENT CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

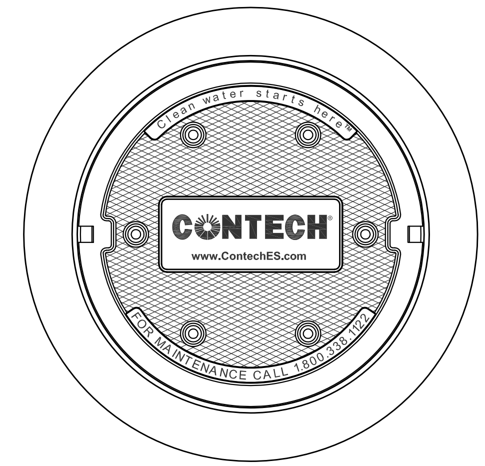
THE STANDARD INLET/OUTLET CONFIGURATION IS SHOWN. FOR OTHER CONFIGURATION OPTIONS , PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. www.ContechES.com



SECTION B-B



SECTION A-A



FRAME AND COVER

(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			*
WATER QUALITY FLOW RATE (CFS)			*
PEAK FLOW RATE (CFS)			*
RETURN PERIOD OF PEAK FLOW (YRS)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*
NOTES/SPECIAL REQUIREMENTS:			
* PER ENGINEER OF RECORD			

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. www.ContechES.com
4. VORTECHS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET AASHTO M306 LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. INLET PIPE(S) MUST BE PERPEDICULAR TO THE VAULT AND AT THE CORNER TO INTRODUCE THE FLOW TANGENTIALLY TO THE SWIRL CHAMBER. DUAL INLETS NOT TO HAVE OPPOSING TANGENTIAL FLOW DIRECTIONS.
7. OUTLET PIPE(S) MUST BE DOWN STREAM OF THE FLOW CONTROL BAFFLE AND MAY BE LOCATED ON THE SIDE OR END OF THE VAULT. THE FLOW CONTROL WALL MAY BE TURNED TO ACCOMODATE OUTLET PIPE KNOCKOUTS ON THE SIDE OF THE VAULT.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE VORTECHS STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

Vortechs®

THIS PRODUCT MAY BE PROTECTED BY THE FOLLOWING U.S. PATENT: 5,759,415; RELATED FOREIGN PATENTS.

CONTECH®
ENGINEERED SOLUTIONS LLC
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VORTECHS 2000
STANDARD DETAIL

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VORTECHS SYSTEM® ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON AN AVERAGE PARTICLE SIZE OF 75 MICRONS
APEX TRUCK TERMINAL
OTTAWA, ON
MODEL 2000 IN-LINE

CONTECH ENGINEERED SOLUTIONS

Design Ratio[1] = $\frac{\text{(1.8 hectares) x (0.9) x (2.775)}}{\text{(1.2 m2)}}$ **= 3.82**

Rainfall Intensity mm/hr	Operating Rate[2] % of capacity	Flow Treated (l/s)	% Total Rainfall Volume[3]	Rmvl. Effcy[4] (%)	Rel. Effcy (%)
0.5	2.8	2.2	9.2%	98.5%	9.0%
1.0	5.6	4.4	10.6%	96.3%	10.2%
1.5	8.4	6.7	9.9%	93.7%	9.3%
2.0	11.2	8.9	8.4%	91.0%	7.6%
2.5	14.0	11.1	7.7%	87.6%	6.7%
3.0	16.8	13.3	5.9%	85.4%	5.1%
3.5	19.6	15.6	4.4%	82.5%	3.6%
4.0	22.4	17.8	4.7%	79.5%	3.7%
4.5	25.2	20.0	3.3%	77.0%	2.6%
5.0	28.1	22.2	3.0%	74.8%	2.3%
6.0	33.7	26.7	5.4%	71.0%	3.8%
7.0	39.3	31.1	4.4%	67.1%	2.9%
8.0	44.9	35.6	3.5%	62.6%	2.2%
9.0	50.5	40.0	2.8%	55.2%	1.6%
10.0	56.1	44.5	2.2%	45.9%	1.0%
15.0	84.2	66.7	7.0%	18.1%	1.3%
20.0	88.3	70.0	4.5%	12.4%	0.6%
25.0	88.3	70.0	1.4%	12.4%	0.2%
30.0	88.3	70.0	0.7%	12.4%	0.1%
35.0	88.3	70.0	0.5%	12.4%	0.1%
40.0	88.3	70.0	0.5%	12.4%	0.1%
					73.8%

Predicted Annual Runoff Volume Treated =	95.0%
Assumed Removal Efficiency of remaining % =	0.0%
Removal Efficiency Adjustment[5] =	0.0%
Predicted Net Annual Load Removal Efficiency =	**74%**

1 - Design Ratio = (Total Drainage Area) x (Runoff Coefficient) x (Rational Method Conversion) / Grit Chamber Area
- The Total Drainage Area and Runoff Coefficient are specified by the site engineer.
- The rational method conversion based on the units in the above equation is 2.775.

2 - Operating Rate (% of capacity) = percentage of peak operating rate of 68 l/s/m^2.

3 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa, ON

4 - Based on Contech Construction Products laboratory verified removal of an average particle size of 75 microns (see Vortechs Guide).

5- Reduction not necessary based on 100 year storm of 70 L/s.

Calculated by:	JAK	12/1	Checked by:

CONTECH®
STORMWATER SOLUTIONS INC.

Vortechs® Guide
Operation, Design, Performance and Maintenance

Vortechs®

Vortechs®

The Vortechs system is a high-performance hydrodynamic separator that effectively removes finer sediment (e.g. 50-microns (μm), oil, and floating and sinking debris. The swirl concentration operation and flow controls work together to minimize turbulence and provide stable storage of captured pollutants. Precast models can treat peak design flows up to 30-cfs (850-L/s); cast-in-place models handle even greater flows. A typical system is sized to provide a specific removal efficiency of a predefined particle size distribution (PSD).

Operation Overview

Stormwater enters the swirl chamber inducing a gentle swirling flow pattern and enhancing gravitational separation. Sinking pollutants stay in the swirl chamber while floatables are stopped at the baffle wall. Vortechs systems are usually sized to efficiently treat the frequently occurring runoff events and are primarily controlled by the low flow control orifice. This orifice effectively reduces inflow velocity and turbulence by inducing a slight backwater that is appropriate to the site.

During larger storms, the water level rises above the low flow control orifice and begins to flow through the high flow control. Any layer of floating pollutants is elevated above the invert of the Floatables Baffle Wall, preventing release. Swirling action increases in relation to the storm intensity, while sediment pile remains stable. When the storm drain is flowing at peak capacity, the water surface in the system approaches the top of the high flow control. The Vortechs system will be sized large enough so that previously captured pollutants are retained in the system, even during these infrequent events.

As a storm subsides, treated runoff decants out of the Vortechs system at a controlled rate, restoring the water level to a dry-weather level equal to the invert of the inlet pipe. The low water level facilitates easier inspection and cleaning, and significantly reduces maintenance costs by reducing pump-out volume.

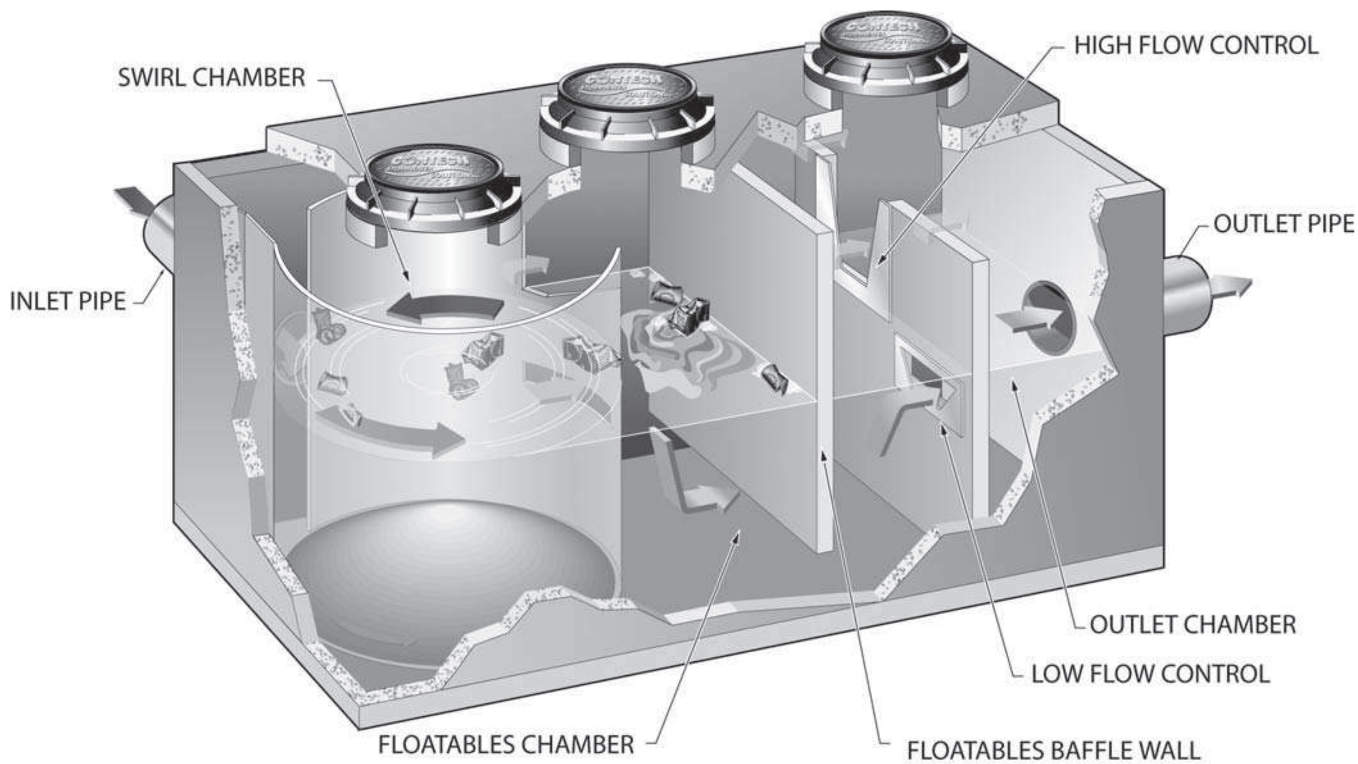
Design Basics

Each Vortechs system is custom designed based on site size, site runoff coefficient, regional precipitation intensity distribution, and anticipated pollutant characteristics. There are two primary methods of sizing a Vortechs system. The first is to determine which model size provides the desired removal efficiency at a given flow for a defined particle size or PSD. The second and more in depth method is the summation of Rational Rainfall Method™ which uses a summation process described below in detail and is used when a specific removal efficiency of the net annual sediment load is required.

Typically Vortechs systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for either 50-μm particles, or a particle gradation found in typical urban runoff (see performance section of this manual for more information).

The Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.



Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes or hourly and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed Vortechs system are determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Once a system size is established, the internal elements of the system are designed based on information provided by the site engineer. Flow control sizes and shapes, sump depth, oil spill storage capacity, sediment storage volume and inlet and outlet orientation are determined for each system. In addition, bypass weir calculations are made for off-line systems.

Flow Control Calculations

Low Flow Control

The low flow control, or orifice, is typically sized to submerge the inlet pipe when the Vortechs system is operating at 20% of its treatment capacity. The orifice is typically a Cippoletti shaped aperture defined by its flat crest and sides which incline outwardly at a slope of 1 horizontal to 4 vertical.

$$Q_{orfice} = C_d \bullet A \bullet \sqrt{2gh}$$

Where:

$Q_{orifice}$ = flow through orifice, cfs (L/s)

C_d = orifice coefficient of discharge = 0.56 (based on lab tests)

A = orifice flow area, ft^2 (m^2) (calculated by orifice geometry)

h = design head, ft (m) (equal to the inlet pipe diameter)

g = acceleration due to gravity (32.2-ft/s^2 (9.81-m/s^2)

The minimum orifice crest length is 3-in (76-mm) and the minimum orifice height is 4-in (102-mm). If flow must be restricted beyond what can be provided by this size aperture, a Fluidic-Amp™ HydroBrake flow control will be used. The HydroBrake allows the minimum flow constriction to remain at 3-in (76-mm) or greater while further reducing flow due to its unique throttling action.

High Flow Control

The high flow control, or weir, is sized to pass the peak system capacity minus the peak orifice flow when the water surface elevation is at the top of the weir. This flow control is also a Cippoletti type weir.

The weir flow control is sized by solving for the crest length and head in the following equation:

$$Q_{weir} = C_d \bullet L \bullet (h)^{3/2}$$

Where:

Q_{weir} = flow through weir, cfs (L/s)

C_d = Cippoletti weir coefficient = 3.37 (based on lab testing)

h = available head, ft (m) (height of weir)

L = design weir crest length, ft (m)

Bypass Calculations

In most all cases, pollutant removal goals can be met without treating peak flow rates and it is most feasible to use a smaller Vortechs system configured with an external bypass. In such cases, a bypass design is recommended by CONTECH Stormwater Solutions for each off-line system. To calculate the bypass capacity, first subtract the system's treatment capacity from the peak conveyance capacity of the collection system (minimum of 10-year recurrence interval). The result is the flow rate that must be bypassed to avoid surcharging the Vortechs system. Then use the following arrangement of the Francis formula to calculate the depth of flow over the bypass weir.

$$H = (Q_{bypass} / (C_d \bullet L))^{2/3}$$

Where:

H = depth of flow over bypass weir crest, ft (m)

Q_{bypass} = required bypass flow, cfs (L/s)

C_d = discharge coefficient = 3.3 for rectangular weir

L = length of bypass weir crest, ft

The bypass weir crest elevation is then calculated to be the elevation at the top of the Cippoletti weir minus the depth of flow.

Hydraulic Capacity

In the event that the peak design flow from the site is exceeded, it is important that the Vortechs system is not a constriction to runoff leaving the site. Therefore, each system is designed with enough hydraulic capacity to pass the 100-year flow rate. It is important to note that at operating rates above 100-gpm/ft^2 (68-Lps/m^2) of the swirl chamber area (peak treatment capacity), captured pollutants may be lost.

When the system is operating at peak hydraulic capacity, water will be flowing through the gap over the top of the flow control wall as well as the orifice and the weir.

Performance

Full Scale Laboratory Test Results

Laboratory testing was conducted on a full scale Vortechs model 2000. The 150-μm curve demonstrates the results of tests using particles that passed through a 60-mesh sieve and were retained on a 100-mesh sieve. The 50-μm curve is based on tests of particles passing through a 200-mesh sieve and retained on a 400-mesh sieve (38-μm). A gradation with an average particle size (d50) of 80-μm, containing particles ranging from 38–500-μm in diameter was used to represent typical stormwater solids. (Table 1)

Particle Size Distribution (μm)	Percentage of Sample Make-Up
<63	42%
63 - 75	4%
75 - 100	9%
100 - 150	7%
150 - 250	11%
>250	27%

Table 1: Particle gradation of typical urban runoff used for efficiency curve

As shown, the Vortechs system maintains positive total suspended solids (TSS), defined by the tested gradations, removal efficiencies over the full range of operating rates. This allows the system to effectively treat all runoff from large, infrequent design storms, as well as runoff from more frequent low-intensity storms.

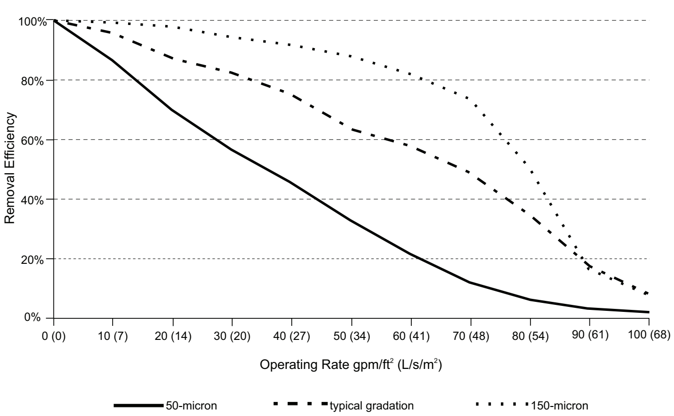


Figure 1: Vortechs model 2000 Removal Efficiencies

Typical Vortechs systems are designed to treat peak flows from 1.6-cfs (45-L/s) up to 30-cfs (850-L/s) online without the need for bypass. However, external bypasses can be configured to convey peak flows around the system if treatment capacity is exceeded. The system can also be configured to direct low flows from the last chamber of the system to polishing treatment when more stringent water quality standards are imposed. In all configurations, high removal efficiencies are achieved during the lower intensity storms, which constitute the majority of annual rainfall volume.

Full report available at www.contechstormwater.com.

Laboratory Testing

Full reports available at www.contechstormwater.com

Technical Bulletin 1: Removal Efficiencies for Selected Particle Gradations

Technical Bulletin 2: Particle Distribution of Sediments and the Effect on Heavy Metal Removal

Technical Bulletin 3: Sizing for Net Annual Sediment Removal

Technical Bulletin 3a: Determining Bypass Weir Elevation for Off-Line Systems

Technical Bulletin 4: Modeling Long Term Load Reduction: The Rational Rainfall Method

Technical Bulletin 5: Oil Removal Efficiency

Field Monitoring

Following are brief summaries of the field tests completed to date.

Full reports available at www.contechstormwater.com

DeLorme Mapping Company

Yarmouth, ME

CONTECH Stormwater Solutions

Prior to this premier field test of the Vortechs system, CONTECH developed an extensive body of laboratory data to document total suspended solids (TSS) removal efficiency. CONTECH performed this field study in order to compare the performance predicted using laboratory data to the performance of a correctly sized system in the field.

The study site was the headquarters of DeLorme Mapping in Yarmouth, Maine. The building, driveway, parking lot and ancillary facilities were constructed in 1996. A Vortechs model 11000 was installed to treat runoff from the 300-space, 4-acre (1.62-ha) parking lot.

Testing Period	May 1999 to Dec 1999
# of Storms Sampled	20
Mean Influent Concentration	328-mg/L
Mean Effluent Concentration	60-mg/L
Removal Efficiency	82%

The main purpose of the DeLorme study was to verify that the sizing methodology developed from our full-scale laboratory testing was valid and an accurate means of predicting field performance. The results of the study confirmed our sizing methodology.

Village Marine Drainage

Lake George, NY

New York State Department of Environmental Conservation, Division of Water

The New York State DEC used funds obtained in a Section 319 grant to initiate a study of the effectiveness of the Vortechs system to remove sediment and other pollutants transported by stormwater to Lake George, Lake George Village, New York. “Since the 1970s, when there was a rapid increase in the rate and concentration of development along the southwestern shores of Lake George, we have been concerned about the impact of stormwater discharges into the lake,” said Tracy West, co-author of the study.

Testing Period	Feb 2000 to Dec 2000
# of Storms Sampled	13
Mean Influent Concentration	801-mg/L
Mean Effluent Concentration	105-mg/L
Removal Efficiency	88%

The study concluded that the Village and Town of Lake George should consider installing additional Vortechs systems in areas where sedimentation and erosion have been identified as non-point source pollution problems.

Harding Township Rest Area
Harding Township, NJ
RTP Environmental Associates

This third party evaluation was performed under a U.S. Environmental Protection Agency grant, administered by the New Jersey Department of Environmental Protection. A. Roger Greenway, principal of RTP Environmental Associates, Inc., conducted the study in conjunction with Thonet Associates, which assisted with data analysis and helped develop best management practices (BMP) recommendations.

The Vortechs model 4000 was sized to handle a 100-year storm from the 3 acre (1.21 ha) paved parking area at the Harding Rest Stop, located off the northbound lane of I-287 in Harding Township, New Jersey.

Testing Period	May 1999 to Nov 2000
# of Storms Sampled	5
Mean Influent Concentration (TSS)	493-mg/L
Mean Effluent Concentration (TSS)	35-mg/L
Removal Efficiency (TSS)	93%
Mean Influent Concentration (TPH)	16-mg/L
Mean Effluent Concentration (TPH)	5-mg/L
Removal Efficiency (TPH)	67%

The study concluded that truck rest stops and similar parking areas would benefit from installing stormwater treatment systems to mitigate the water quality impacts associated with stormwater runoff from these sites.

Timothy Edwards Middle School
South Windsor, CT
UCONN Department of Civil & Environmental Engineering

This study of the Vortechs system was published as a thesis by Susan Mary Board, as part of the requirements for a Master of Science degree from the University of Connecticut. Her objective was to determine how well the Vortechs system retained pollutants from parking lot runoff, including total suspended solids (TSS), nutrients, metals, and petroleum hydrocarbons.

A Vortechs model 5000 was installed in 1998 to treat runoff from the 82-space parking lot of Timothy Edwards Middle School. The entire watershed was approximately 2 acres (0.81 ha), and was 80% impervious.

Testing Period	Jul 2000 to Apr 2001
# of Storms Sampled	weekly composite samples taken
Mean Influent Concentration	324-mg/L
Mean Effluent Concentration	73-mg/L
Removal Efficiency	77%

Additionally, the Vortechs system was particularly effective in removing zinc (85%), lead (46%), copper (56%), phosphorus (67%) and nitrate (54%).

The study concluded that the Vortechs system significantly reduced effluent concentrations of many pollutants in stormwater runoff.

Maintenance

The Vortechs system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit, e.g., unstable soils or heavy winter sanding will cause the swirl chamber to fill more quickly but regular sweeping will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant deposition and transport may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. Inspections should be performed twice per year (i.e. spring and fall) however more frequent inspections may be necessary in equipment washdown areas and in climates where winter sanding operations may lead to rapid accumulations. It is useful and often required as part of a permit to keep a record of each inspection. A simple inspection and maintenance log form for doing so is provided on the following page, and is also available on contechstormwater.com.

The Vortechs system should be cleaned when inspection reveals that the sediment depth has accumulated to within 12 to 18 inches (300 to 450 mm) of the dry-weather water surface elevation. This determination can be made by taking two measurements with a stadia rod or similar measuring device; one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. Note: To avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile. Finer, silty particles at the top of the pile typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.

Cleaning

Cleaning of the Vortechs system should be done during dry weather conditions when no flow is entering the system. Clean-out of the Vortechs system with a vacuum truck is generally the most effective and convenient method of excavating pollutants from the system. If such a truck is not available, a "clamshell" grab may be used, but it is difficult to remove all accumulated pollutants using a "clamshell".

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use adsorbent pads to solidify the oil since these pads are usually much easier to remove from the unit individually and less expensive to dispose of than the oil/water emulsion that may be created by vacuuming the oily layer. Floating trash can be netted out if you wish to separate it from the other pollutants.

Cleaning of a Vortechs system is typically done by inserting a vacuum hose into the swirl chamber and evacuating this chamber of water and pollutants. As water is evacuated, the water level outside of the swirl chamber will drop to a level roughly equal to the crest of the lower aperture of the swirl chamber. The water outside the swirl chamber should remain near this level throughout pumping as the bottom and sides of the swirl chamber are sealed to the tank floor and walls. This "water lock" feature prevents water from migrating into the swirl chamber, exposing the bottom of the baffle wall and creating excess pump-out volume. Floating pollutants will decant into the swirl chamber as the water level is drawn down. This allows most floating material to be withdrawn from the same access point above the swirl chamber. Floating material that does not decant into the swirl chamber during draw down should be skimmed from the baffle chamber. If maintenance is not performed as recommended, sediment may accumulate outside the swirl chamber. If this is the case, it may be necessary to pump out other chambers. It is advisable to check for sediment accumulation in all chambers during inspection and maintenance.

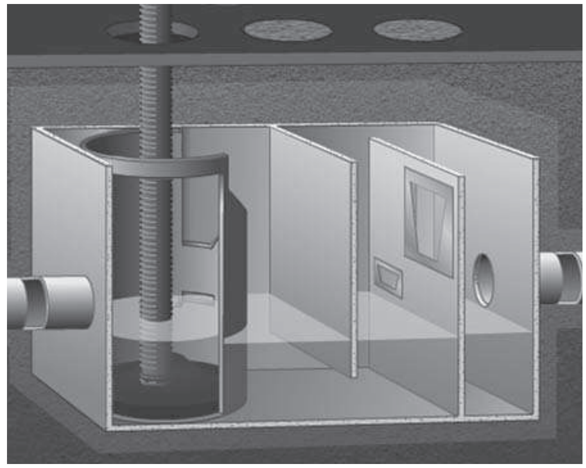
These maintenance recommendations apply to all Vortechs systems with the following exceptions:

1. It is strongly recommended that when cleaning systems larger than the Model 16000 the baffle chamber be drawn down to depth of three feet prior to beginning clean-out of the swirl chamber. Drawing down this chamber prior to the swirl chamber reduces adverse structural forces pushing upstream on the swirl chamber once that chamber is empty.
2. Entry into a Vortechs system is generally not required as cleaning can be done from the ground surface. However, if manned entry into a system is required the entire system should be evacuated of water prior to entry regardless of the system size.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure proper safety precautions. If anyone physically enters the unit, Confined Space Entry procedures need to be followed.

Disposal of all material removed from the Vortechs system should be done in accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

For assistance with maintaining your Vortechs system, contact us regarding the CONTECH Maintenance Compliance Certification Program.



Vortechs Inspection & Maintenance Log

Vortech Model: ______________________ Location: ______________________

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than eighteen inches the system should be cleaned out. **Note: To avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

RECYCLED PAPER

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Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

CONTECH Construction Products Inc. provides site solutions for the civil engineering industry. CONTECH's portfolio includes bridges, drainage, sanitary sewer, stormwater and earth stabilization products. For information on other CONTECH division offerings, visit contech-cpi.com or call 800.338.1122

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