

1. DEVELOPMENT DESCRIPTION

1.1 PROJECT OVERVIEW

The project consists of the development of Lot 7 of the previously approved Forefront at Thompson's Point Subdivision Plan at Thompsons' Point. The Lot 7 development fulfills the long-term goal of providing a location for a Cultural Center within a mixed-use development as shown on the Master Development Plan. In this case, the Children's Museum & Theatre of Maine is seeking to relocate from their existing location on Free Street, whereby they can address pressing needs for additional space and programming including exhibit and Theatrical performance space. As evidenced by the multiple past reviews and approvals granted by the Portland Planning Board for the Forefront site, we believe the current application will be welcomed and embraced by the community and continue the dynamic growth and excitement associated with the Thompson's Point redevelopment.

1.2 PROJECT PURPOSE AND NEED

The existing site (Lot 7) is currently an unimproved, open area that has been used for parking, trailer storage and related industrial uses. The site area has been mostly gravel within the recent past. The site presents an opportunity for the Children's Museum to relocate to a new facility to meet growing attendance and programming needs which would allow more accessibility to local and out of state visitors. The project presents a continuation of the Thompson's Point property redevelopment to provide an attractive and viable destination with linkage to the City's multi-modal transportation hub, nearby highways and good pedestrian, bicycle, and vehicular connectivity. A new multi-story building and the addition of landscape and hardscape features will improve the aesthetics of the site from the highway and from within the site, and contribute to the improving vitality of the area. The community benefits provided by the project include the following:

- Contribute to the redevelopment and revitalization of the area.
- Provide a quality cultural use destination to complement other mixed use activities on the site.
- Incorporate exterior site enhancements for child play, outside exhibits, general recreation.

1.3 EXISTING CONDITIONS

The CMTM project parcel is described as Lot 7 on the approved Subdivision Plan¹. The total site area is 48,958 SF (1.12 acres) and there is a small single story masonry block building partially located on the south end of the site that will require demolition prior to construction. The project site is currently owned by Forefront Partners I, LP (Forefront) which is currently under contract with the Children's Museum & Theatre of Maine (CMTM) who will purchase the property. The site is bounded to the north by a parking lot associated with the Brick North building. Brick South and future development (Lot 6) is

¹ See CCRD Book 216, Page 438

located to the west of the site. The depot and concert grounds are located to the south. The proposed loop road, parking, yard area and the tidal flat to the Fore River are located to the site's east side.

Existing Lot 7 utilities are limited to a few stormwater catch basins with small conveyance systems discharging to a tidal flat associated with the Fore River. There are also overhead power and communication lines feeding the south end of the peninsula running through the site area. These will be rerouted as part of the project. There are new nearby utilities previously constructed as part of the Brick North and Brick South development activities and these will remain unchanged except for the drainage system, which will require additional improvements.

The limited amount of infrastructure within Lot 7 is anticipated to be removed and/or abandoned as part of the development of the site. Aside from abandoning the existing utilities and removal of the small building, general site preparation is anticipated to be straightforward to include site grading, new utilities, drainage, building construction and site surface improvements for parking and landscaping. A temporary soil surcharge preload program is currently contemplated as part of foundation preparation program. However, the exact details of this effort remain to be determined.

Existing topography is relatively flat with elevations ranging from approximately 14.5 to 16.25 based on NGVD 1929 vertical Datum. The lot is internally draining, meaning the lowest portion of the site is towards the center of the site and the higher grades are around the perimeter. The site improvements will involve ground disturbance over the entire site. Haley & Aldrich has been engaged to assist with a geotechnical investigation. Their initial findings include identifying soft marine clay soils underlying the site. The preliminary recommendations include the use of a preload to aid with addressing long term settlement potential. The details of the preload program remain under discussion and are to be clarified over the next few months. A 6-month soil preload may be part of the construction process.

The site is within the Thompson's Point peninsula which extends into and is generally surrounded by the Fore River. This portion of the Fore River is tidally influenced and has a mean annual high tide elevation of 7.4 (NGVD 1929) and a 100-year FEMA flood elevation of 10.0 (NGVD1929). Tidal information as determined by Sebago Technics, Inc., land surveyor is defined as follows:

Mean High Water is Elevation 4.95

Mean Low Water is Elevation is -4.95

Groundwater is anticipated to be encountered in excavations for foundations, utilities, and stormwater management systems. The site has been previously included within the Maine Voluntary Response Action Program (VRAP).² Site activities including earthwork, soils management and groundwater handling will require compliance with the recommended actions contained within a work plan developed by Credere Associates.

Photographs of the existing site conditions have been previously submitted with the Masterplan Submission.

² See No Action Assurance Letter dated March 6, 2013 to Forefront Partners I, LP

1.4 PROPOSED DEVELOPMENT

The development program includes the following components:

1.4.1 ON-SITE (PHASE 2)

The proposed CMTM development will include improvements to the entire parcel which is approximately 49,000 SF in size. The proposed land cover is anticipated to be comprised of a 9,682 SF± multi-story building footprint, paved parking for 18 parking spaces, at-grade loading at an overhead door, various sidewalks/pedestrian hardscape, lawn, planted landscape, and possibly ground level exterior play or exhibit areas. The building's main entrance will be positioned on the south end, facing the depot building. Patrons may park within the 18 onsite parking spaces located to the northeast corner of the site or within additional parking that will be located along the new access road that will be extended from between Brick South and the Depot and connecting to the Brick North parking lot. There will be two ADA compliant spaces onsite and an ADA compliant access route will be provided to the front entry.

The south end of the CMTM site is currently envisioned as a landscape area containing both hard and landscaped surfaces. The hard surfaces may consist of patterned concrete or paver blocks while the landscaped areas are likely to contain various themes including plantings, fixed and non-fixed site measures including, but not limited to, benches, fencing, exhibits, etc. The north end of the site will include mostly hard surfaces consisting of concrete, pavers, or similar measures along with a less amount of vegetative landscaping. The co-applicants realize the importance of continuity and connectivity to the Brick North and Brick South uses, parking, and pedestrian designs and they are working closely to assure the CMTM site is well integrated to the long-term vision of the site.

Multiple bicycle racks will be positioned nearby the CMTM entrance. The exact styling and positioning of these site improvements including benches and related measures are being discussed and refined between the team members. Additional information on these site features will be supplied to the City as the design is refined.

The applicants continue to discuss the provisions for Solid Waste Handling and how/where these measures may be handled on the overall site. Currently, the site plan indicates an enclosure to be located on the north end of the site.

1.4.2 OFF-SITE (PHASE 1)

The co-applicant, Forefront Partners I, LP will complete additional improvements to the overall site as part of or in advance of the CMTM development. This will involve the extension of the access loop road from basically between Brick South and the Depot, around and over to the access drive serving the parking just to the south and east of Brick North. This work will complete a looped access within the site whereby site visitors will have access to defined parking areas and uses. This access and circulation pattern has been basically in existence during these earlier phases of the site's redevelopment, albeit within undefined gravel areas around the site. The proposed work will now provide a continuation of both paved vehicular routes and the pedestrian sidewalks and related

site amenities. Defined parking along the access loop will also be created as part of this work as was contemplated in the Master Plan. The current plans identify the access drive loop and show a layout of traditional perpendicular parking on the CMTM side of the drive as well as on the south side of the loop, basically up against the peninsula's south end concert area. Previous Master plan documents relied on parallel parking on both sides of the access drive. As the site designs have advanced, the team is now interested in pursuing a perpendicular parking arrangement as this will provide a greater number of spaces available. The team looks forward to explaining these proposed site operations to staff and the Planning Board at upcoming meetings.

The co-applicants are also continuing to discuss and refine the pedestrian alley that will be between Brick South and the CMTM building. This north-south pedestrian access spine has always been considered a vital core element to pedestrian connectivity on the site. It will extend from the Brick North parking lot ultimately to the Depot building. The team continues to discuss the use of different ground surface treatments including concrete, pavers or similar, vegetative landscaping, site improvements and lighting. Ultimately, this alley will be the primary pedestrian link between the majority of uses in the core of the property, so all team members are interested in making this space contain aesthetic appeal and interest for all those using the site, including workers and visitors.

1.5 LAND ORDINANCE REVIEW

1.5.1 OVERVIEW

The project is located in the B-5 Zone. The proposed uses include:

- Museums and art galleries;
- Indoor recreation and family amusement establishments; and
- Theaters and places of public assembly.

These uses are all allowed by right in the zone.

The space and bulk criteria for the B-5 Zoning District are not overly restrictive. There is no minimum lot size, minimum frontage, minimum front yard, side yard, rear yard, or street setbacks in the B-5 Zone. Lot development for Lot 7 has been previously presented as part of earlier overall permitting submissions³ for the Thompson's Point Development. The current proposal remains within all of the previously approved design parameters and no zoning relieve is required.

1.5.2 SHORELAND ZONING

The site is located within the Shoreland Zoning District, however, there are no specific restrictions related to vegetative clearing or resource setbacks, given the nature of the site's historic developed conditions.

³ See Overall Site Plan dated 06.16.2016 as part of Final Subdivision plan submission

1.6 STATE AND FEDERAL PERMITS

The project as presented does not require any additional Federal or State level site permits. Construction activities will require compliance with the previously approved VRAP Work Plan.

1.7 EASEMENTS OR OTHER BURDENS

There are no existing easements or encumbrances that impact the current site development proposal across Lot 7. Cross access and utility easement agreements will be part of the land transfer between Forefront Partners I, LP and CMTM.

1.8 TRAFFIC

The Thompson's Point development has involved multiple submissions and traffic reviews over time. The development was granted a Traffic Movement Permit from the MaineDOT and this permit remains valid and applicable to the current CMTM proposal. The overall project has benefited from off-site traffic improvements including substantial improvements to the Thompsons Point Connector road and the public rail crossing accessing the property. These improvements will continue to satisfactorily address the site's access needs into the foreseeable future. Trip Generation for the CMTM project was forecast at 29 trips for the am and pm peak hours⁴ based on a 40,000 SF facility. The proposed facility is now at approximately 29,000 SF. The estimated trip generation is expected to remain unchanged.

1.9 PARKING DEMAND

The predicted peak parking demand is estimated to be approximately 50-60 vehicles as identified in the previously submitted Parking Summary⁵ by Gorrill-Palmer Consulting Engineers. Their study outlined peak parking demand to the full development and it accounted for variable parking demand for CMTM (Building I in the Study) from 6:00 AM to 10:30 PM. The Co-applicants are pursuing a parking agreement whereby parking supply to meet the peak demand of 50-60 vehicles will be available on the site. This includes 18 spaces on Lot 7 as well as additional spaces near the site. As has always been proposed, the management of parking encompasses all the site uses and there will continue to be a reliance of shared parking throughout the site.

1.10 SOILS/GEOTECHNICAL REVIEW

A geotechnical investigation is being prepared by Haley & Aldrich. It is anticipated the subsurface soils will consist of urban fill, marine clay, and sand. Some level of onsite soils may contain contaminants that require the material to remain onsite and covered in an approved manner consistent with the MaineDEP VRAP Work Plan. Generally, this involves the placement of a minimum layer (12" usually) of clean material and/or pavement/hardscape surface, in order to minimize exposure. The applicants are currently working with Credere Associates, the site environmental firm, on the environmental analysis and work plan to address Lot 7 site conditions.

⁴ See *The Forefront at Thompsons Point Trip Generation for the Master Plan* dated August 31, 2015 by Gorrill Palmer.

⁵ See *Memorandum – Forefront at Thompson's Point Parking Summary* by Gorrill Palmer dated August 31, 2015

1.11 NATURAL FEATURES

The development is designated to maintain a 25' foot buffer from the annual mean high tide to all impervious and building structures. Phase I grading and stormwater quality improvements are proposed inside of this setback or has always been proposed and previously approved. The project will avoid impacts to the wetland of special significance around the perimeter of the site. The development will improve water quality of stormwater runoff entering the Fore River.

1.12 UTILITIES AND STORMWATER

The water, sewer, and electrical services on the site will need to be updated to serve the proposed development. Further details of planned utility upgrades are included in Section 3 of this narrative.

A supplemental stormwater management report has been prepared (Attachment A) and is intended to describe the improvements included with the CMTM plan and demonstrate the integration of stormwater treatment and conveyance design with the approved Master Plan Stormwater Management Strategy. The accompanying computations show that this phase of the project has been designed to meet the Portland Stormwater Management Standards adopted July 19, 2010 and General Stormwater Standards of MaineDEP (revised October 2010) and are consistent with the overall goals presented in previous Stormwater Reports.

A detailed soil erosion and sediment control plan and a brief narrative has been produced for the project and this is included as Attachment B.

1.13 ATTACHMENTS

Attachment A – Supplemental Stormwater Management Report

Attachment B – Erosion & Sediment Control Plan

ATTACHMENT A

Supplemental Stormwater Management Report

**SUPPLEMENTAL STORMWATER MANAGEMENT REPORT FOR
CHILDREN'S MUSEUM AND THEATRE OF MAINE
PRELIMINARY SITE PLAN APPLICATION
(GENERAL STANDARDS)**

**LOT 7
CHILDREN'S MUSEUM & THEATRE OF MAINE SITE
THE FOREFRONT AT THOMPSON'S POINT
PORTLAND, MAINE**

PREPARED FOR:

**CHILDREN'S MUSEUM & THEATRE OF MAINE
142 FREE STREET
P.O. BOX 4041
PORTLAND, MAINE 04101
(207) 828-1234**

PREPARED BY:

**STANTEC CONSULTING SERVICES, INC
482 PAYNE ROAD SCARBOROUGH COURT
SCARBOROUGH, MAINE 04106
(207) 883-3355**

March 2017

TABLE OF CONTENTS

Section	Description	Page
1.0	INTRODUCTION.....	1
2.0	JELLYFISH FISH FILTER UNITS.....	1
3.0	STORMWATER MANAGEMENT REVISIONS	2
4.0	CONCLUSION	3
5.0	APPENDICES	3

List of Appendices

Appendix A – Jellyfish™ Treatment System Computations (Provided for Final Submission)

Appendix B – Rational Method 25-Yr Event Stormdrain Pipe Sizing Computations

Appendix C – StormTech® Chamber Sizing Computation

Appendix D – Summary of Water Quality Treatment – “Zone F”

Appendix E – Operations & Maintenance Manual (Lot 7 – Only)

SUPPLEMENTAL STORMWATER MANAGEMENT REPORT

1.0 INTRODUCTION

Stantec Consulting Services, Inc. (Stantec) was retained by Children's Museum & Theatre of Maine (CMTM) for preparation of the proposed development of Lot 7 within the Forefront at Thompson's Point development in Portland, Maine.

This supplemental report is intended to describe the improvements included with the development of Lot 7 and demonstrates the integration of stormwater treatment and conveyance design with the approved Master Plan Stormwater Management Strategy. The enclosed computations show that this development has been designed to meet the Portland Stormwater Management Standards adopted July 19, 2010 and General Stormwater Standards of MaineDEP (revised October 2010) and are consistent with the overall goals presented in previous Stormwater Reports. The intent of the stormwater management design, erosion and sediment control, and Inspection and Maintenance Manual have remained the same as approved in June 5, 2012. This project will have a cumulative developed area of 1.12 acres of which 0.70 acres (30,492 SF) are newly constructed impervious area. Revisions to how the development of Lot 7 was presented in the Master Plan and how it relates to Stormwater Management Discharge Zone F is outlined below and tabulated in the attached computations.

2.0 JELLYFISH FISH FILTER UNITS

As of January 21, 2015, MaineDEP has approved the use of a Jellyfish™ filter unit as an acceptable BMP for stormwater treatment. Jellyfish™ units have been integrated into the overall stormwater management strategy and are designed to treat zones that were previously treated by StormTreat™ units. MaineDEP approves the use of the Jellyfish™ units when sized, installed, and maintained in accordance with the following provisions:

- Each treatment cartridge is approved for a maximum flow rate of 80 GPM for each 54-inch long membrane cartridge and 40 GPM for each drawdown cartridge.
- Upstream water quality volume equal to 1.0 inch of runoff from impervious surfaces and 0.4 inch of runoff from landscaped areas to be stored and hydraulically isolated from any other storage on site. Water quality volume must also be drained in 24-48 hours.
- All systems must provide means to maintain the system.
- System must be inspected every 6 months.
- Review and approval by the manufacturer for the proposed use and sizing of the Jellyfish™ to ensure conformance with the manufacturer's design specifications.

Jellyfish™ units for this project have been designed by the manufacturer's engineers and checked thoroughly by Stantec. See Jellyfish™ unit details on Sheet C-7.0 Detail A. Also see Appendix A for attached Jellyfish™ unit computations.

3.0 STORMWATER MANAGEMENT REVISIONS

Zone F (Lot 7-CMTM Site, Brick North Building, Brick South Building and Associated Parking Areas):

Stormwater Management Zone F continues to include approximately half of the existing Brick South building, the existing Brick North building, and the associated developed area in between including landscaping, walkways, and parking areas. However, Zone F has been updated to now include all of Lot 7 (CMTM Site). The stormwater management strategy remains the same for Zone F, but has been resized based on the revised site plan for the CMTM site.

Zone F water quality treatment will be comprised of two treatment measures:

- A collection of Filterra® (or approved equal) tree box filters sized for the specific tributary area to each filter. All Tree-Box Filters have been designed to meet new sizing requirements as of January 21, 2015. (Designed by Others)
- Contech Jellyfish™ Treatment Units (CMTM Site):

Jellyfish™ units are manholes that utilize membrane filtration treatment cartridges. Flow enters the Jellyfish™ from an upstream storage chamber and flows down into a settling tank portion of the unit. Once the settling tank is filled, flow from the bottom of the tank is forced up through hi-flow cartridges and routes to the outlet. A baffle wall is located between the inlet and outlet compartments to ensure that un-treated flow is not mixed with treated flow. When the hi-flow treatment cartridge has filled, a drain down cartridge is activated treating the remaining water quality volume. Horizontal orifices are located on top of the cartridges to control the outflow of the system. Each Jellyfish™ unit is designed to discharge the water quality volume within 24-48 hours.

To meet Chapter 500, the Water Quality Volume provided within a Jellyfish™ System must be equal to or greater than the following:

- $1''/12 \times \text{impervious area} + 0.4''/12 \times \text{landscaped area} = \text{Water Quality Volume (cubic feet)}$

Computations of Water Quality Volume for Zone F can be found in Appendix D.

The water quality volume is provided in a subsurface arched chambers storage system. This portion of the design is consistent with the previously design storage for the StormTreat™ systems.

Jellyfish™ units are designed based on a mass sediment loading calculation. Each treatment hi-flow cartridge has a mass capacity of 125 lbs and each low-flow (draindown) cartridge has a capacity of 63 lbs. The mass loading for each zone was determined by Maine DEP sediment loading standards, assuming a 50% sediment removal from a designed pretreatment StormTech® Isolator row.

Discharge from larger storm events are controlled over a broad crested weir housed in a precast concrete outlet control structure set above the water quality volume. The overflow piping network is sized to handle runoff from a 25-year storm event.

Pretreatment for flow entering from all inlet pipes to the storage area will be provided via the installation of a StormTech® Isolator row(s).

Therefore, water quality goals for the Jellyfish™ Proprietary Systems meet the General Stormwater Standards of the November 2005 Chapter 500 Rules of MaineDEP (rev. January 2015).

The Jellyfish™ treatment system is considered adequate to meet the Chapter 500 General Standards.

4.0 CONCLUSION

The stormwater management strategy for this project presented herein allows for treatment of 100% of the developed area and 100% of the impervious area within Lot 7, the Children's Museum & Theatre of Maine site. The individual systems have been adjusted to accommodate layout revisions but ultimately the detailed design remains the same and meets or exceeds the City of Portland Stormwater Management Requirements.

5.0 APPENDICES

Appendix A – Jellyfish™ Treatment System Computations

Appendix B – Rational Method 25-Yr Event Stormdrain Pipe Sizing Computations

Appendix C – StormTech® Chamber Sizing Computation

Appendix D – Summary of Water Quality Treatment – “Zone F”

V:\1953\active\195350337\civil\admin\permitting\local\stormwater\stormwater_supplemental_childrens_museum20170313.docx

APPENDIX A

**JELLYFISH™ TREATMENT SYSTEM COMPUTATIONS
(TO BE PROVIDED SEPARATELY)**

APPENDIX B

RATIONAL METHOD 25-YR EVENT STORMDRAIN PIPE SIZING COMPUTATIONS

ATTACHMENT B

**Rational Method Flow Computation - 25-Yr Storm Event
Children's Museum & Theatre of Maine
Forefront Thompson's Point - Portland, ME**

Storm Water Management Zone	Area Trib To Discharge	Total Developed Area (sf)	Total Impervious Area (sf)	Total Pervious Area (sf)	Total Area (acres)	Weighted C	25 Year Flow (CFS)
Zone F	702 (CMTM SITE)	34,080.03	14,946.24	19,133.79	0.78	0.53	2.70
	702A	8,276.47	2,517.07	5,759.40	0.19	0.43	0.53
	702B1	7,826.31	2,781.96	5,044.35	0.18	0.47	0.55
	702B2	1,768.77	0.00	1,768.77	0.04	0.20	0.05
	702C	732.08	0.00	732.08	0.02	0.20	0.02
	702D	1,500.12	81.97	1,418.15	0.03	0.24	0.05
	702E	1,385.82	76.22	1,309.60	0.03	0.24	0.05
	702F1	9,091.23	7,445.88	1,645.35	0.21	0.81	1.11
	702F2	2,057.80	1,601.71	456.09	0.05	0.78	0.24
	702G	1,441.43	441.43	1,000.00	0.03	0.43	0.09
	703 (CMTM BUILDING)	9,632.10	9,602.10	30.00	0.22	0.95	1.37
	CMTM Subtotal	43,712.13	24,548.34	19,163.79	1.00	0.48	4.06
	CB F-3	4,476.35	2,203.47	2,272.88	0.10	0.57	0.38
	CB F-5	5,211.51	2,336.19	2,875.32	0.12	0.54	0.42
	CB F-6	2,907.41	1,336.65	1,570.76	0.07	0.54	0.24
	CB F-8	5,571.53	4,925.59	645.94	0.13	0.86	0.72
	CB F-7	19,466.31	17,661.14	1,805.17	0.45	0.88	2.57
	701	21,172.99	17,635.58	3,537.41	0.49	0.82	2.61
	704	8,858.74	7,701.29	1,157.45	0.20	0.85	1.13
	Brick South North Side* (706)	16,464.53	16,464.53	0.00	0.38	0.95	2.34
	Brick North (Treated)* (705)	33,340.00	33,340.00	0.00	0.77	0.95	4.74
	Remained of Zone F Subtotal	117,469.37	103,604.44	13,864.93	2.70	0.77	15.15
	Totals	161,181.50	128,152.78	33,028.72	3.70	1.25	19.21

Assumptions	
Pervious C	0.2
Impervious C	0.95
I-25 Year Storm ¹	6.52 In/Hr
RATIONAL FLOW = C*I*A	
Notes:	
1. Rainfall intensity based on Thompson's Point IDF curve using a TC of 5 min.	

Computed By: AMS
 Checked By: SRB
 Date: 3/21/2017

Pipe Capacity Computations 25-Yr Storm Event Children's Museum & Theatre of Maine at the Forefront at Thompson's Point		
Inlet ID	702A (CB9)	
Peak Runoff	0.53	(cfs)
Pipe Diameter	8	(in)
Cross Sectional Area	0.35	(sf)
Slope	0.0050	(ft/ft)
Mannings 'n'	0.012	
Flow Velocity	2.66	(ft/s)
Maximum Capacity	0.93	(cfs)
Inlet ID	702B1 (CB7)	
Peak Runoff	0.55	(cfs)
Pipe Diameter	8	(in)
Cross Sectional Area	0.35	(sf)
Slope	0.0102	(ft/ft)
Mannings 'n'	0.012	
Flow Velocity	3.80	(ft/s)
Maximum Capacity	1.33	(cfs)
Inlet ID	702B2 (CB5)	
Peak Runoff	0.05	(cfs)
Pipe Diameter	8	(in)
Cross Sectional Area	0.35	(sf)
Slope	0.0350	(ft/ft)
Mannings 'n'	0.012	
Flow Velocity	7.04	(ft/s)
Maximum Capacity	2.46	(cfs)
Inlet ID	702C (CB8)	
Peak Runoff	0.02	(cfs)
Add Flow from 702A	0.53	(cfs)
Total	0.55	(cfs)
Pipe Diameter	12	(in)
Cross Sectional Area	0.79	(sf)
Slope	0.0051	(ft/ft)
Mannings 'n'	0.012	
Flow Velocity	3.52	(ft/s)
Maximum Capacity	2.76	(cfs)
Inlet ID	702D (CB6)	
Peak Runoff	0.05	(cfs)
Add Flow from 702B1	0.55	
Add Flow from 702C	0.55	(cfs)
Total	1.15	(cfs)
Pipe Diameter	12	(in)
Cross Sectional Area	0.79	(sf)
Slope	0.0051	(ft/ft)
Mannings 'n'	0.012	
Flow Velocity	3.52	(ft/s)
Maximum Capacity	2.76	(cfs)
Inlet ID	702E (CB4)	
Peak Runoff	0.05	(cfs)
Add Flow from 702B2	0.05	
Add Flow from 702D	1.15	(cfs)
Total	1.26	(cfs)
Pipe Diameter	12	(in)
Cross Sectional Area	0.79	(sf)
Slope	0.0039	(ft/ft)
Mannings 'n'	0.012	
Flow Velocity	3.08	(ft/s)
Maximum Capacity	2.42	(cfs)
Inlet ID	702F1 (CB1)	
Peak Runoff	1.11	(cfs)
Add Flow from 702F2	0.33	(cfs)
Total	1.44	(cfs)
Pipe Diameter	12	(in)
Cross Sectional Area	0.79	(sf)
Slope	0.0050	(ft/ft)
Mannings 'n'	0.012	
Flow Velocity	3.48	(ft/s)

Maximum Capacity	2.74	(cfs)
Inlet ID	702F2 (CB2)	
Peak Runoff	0.24	(cfs)
Add Flow from 702G	0.09	(cfs)
Total	0.33	(cfs)
Pipe Diameter	12	(in)
Cross Sectional Area	0.79	(sf)
Slope	0.0059	(ft/ft)
Mannings 'n'	0.012	
Flow Velocity	3.78	(ft/s)
Maximum Capacity	2.97	(cfs)
Inlet ID	702G (CB3)	
Peak Runoff	0.09	(cfs)
Pipe Diameter	8	(in)
Cross Sectional Area	0.35	(sf)
Slope	0.0053	(ft/ft)
Mannings 'n'	0.012	
Flow Velocity	2.74	(ft/s)
Maximum Capacity	0.96	(cfs)
Inlet ID	703 (Roof Drain)	
Peak Runoff	1.37	(cfs)
Pipe Diameter	6	(in)
Cross Sectional Area	0.20	(sf)
Slope	0.0731	(ft/ft)
Mannings 'n'	0.012	
Flow Velocity	8.39	(ft/s)
Maximum Capacity	1.65	(cfs)

APPENDIX C

STORMTECH CHAMBER SIZING COMPUTATION

**ATTACHMENT C
STORMTECH CHAMBER SIZING**

Zone F Chamber Storage

Weir Height	13.63 EL	
Bottom of Chamber Elevation	11.13 EL	
Total Chamber Height	30 Inches	30 (max chamber height)
Total Crushed Stone Height	6 Inches	
Total Storage Height	30 * Inches	(chamber only, no stone storage)
Total Storage per chamber	61.38 * CF	
Total WQV Required for Zone F	7,416.05 CF	
Total WQV Provided for Zone F	7,856.64 CF	
Total Chambers Required	121.0 Chambers	
Total WQV Required for Zone F (CMTM Site)	2,686.06 CF	
Total WQV Provided for Zone F (CMTM Site)	2,700.72 CF	
Total Chambers Required (CMTM Site)	44.0 Chambers	
Total WQV Required for Zone F (Remainder of Zone F)	4,729.99 CF	
Total WQV Provided for Zone F (Remainder of Zone F)	4,787.64 CF	
Total Chambers Required (Remainder of Zone F)	78.0 Chambers	

* Storage per chamber of 61.38 cf taken from the StormTech design manual for an SC-740 chamber with 36" depth of water is the system minus the storage of 6" of stone as the outlet pipe invert is at the top of stone elevation, therefore the stone volume is not used as storage.

APPENDIX D

SUMMARY OF WATER QUALITY TREATMENT – “ZONE F”

ATTACHMENT D Summary of Water Quality Treatment

Storm Water Management Zone	Inlet Subcatchment	Total Developed Area (sf)	Total Impervious Area (sf)	Total Pervious Area (sf)	Total New Developed Area (Acres)	Required Water Quality Volume (cf) ²	Existing Roof Mitigation Credit (sf) ⁹	Treatment Approach	1 Yr 24-hr Storm Event Peak Flow Rate (cfs) ³	Stormtech Isolator Row Chambers Required (EA) ⁴	Jelly Fish Treatment Unit Required(Where Applicable) ^{5,11}	Jelly Fish Units Provided (EA)	Provided Water Quality Volume (cf) ^{6,7}	
Zone F	702 (CMTM SITE)	34,080.03	14,946.24	19,133.79	0.78	1,883	0	Jelly Fish Unit	1.27	6.33	JF6-4-1	JF6-4-1	2,700.72	
	703 (CMTM BUILDING)	9,633.00	9,633.00	0.00	0.22	803	0	Jelly Fish Unit	0.64	3.21				
	Sub-Total CMTM Site	43,713.03	24,579.24	19,133.79	1.00	2,686.06	0	Jelly Fish Unit	-	10.00				
	CB F-3	4,476.35	2,203.47	2,272.88	0.10	259	0	Jelly Fish Unit	0.18	0.89	JF6-4-1	JF6-4-1	4,787.64	
	CB F-5	5,211.51	2,336.19	2,875.32	0.12	291	0	Jelly Fish Unit	0.20	0.98				
	CB F-6	2,907.41	1,336.65	1,570.76	0.07	164	0	Jelly Fish Unit	0.11	0.56				
	CB F-8	5,571.53	4,925.59	645.94	0.13	432	0	Jelly Fish Unit	0.34	1.69				
	CB F-7	19,466.31	17,661.14	1,805.17	0.45	1,532	0	Jelly Fish Unit	1.20	6.02				
	704	8,858.74	7,701.29	1,157.45	0.20	680	0	Jelly Fish Unit	0.53	2.65				
	701	21,172.99	17,635.58	3,537.41	0.49	1,588	0	Filterra	1.23	0.00	-	-	-	
	Sub-Total Remainder of Zone F	67,664.84	53,799.91	13,864.93	1.55	3,358	0	-			12.79			
	Sub-Total Zone F New Treated Area	111,377.87	78,379.15	32,998.72	2.56	6,044.01	0.00	-	-	22.79	JF6-4-1	JF6-4-1	7,488.36	
	Brick South North Side* (706)	16,464.53	16,464.53	0.00	0.38	1,372	9,879	Jelly Fish Unit	1.10	5.49	JF6-4-1	JF6-4-1	1360	
	Brick North (Treated)* (705)	33,340.00	33,340.00	0.00	0.77	2,778	20,004	Gravel Drip Strip	-	0.00	-	-	2,920	
	Sub-Total Zone F Existing Treated Roof Area	49,804.53	49,804.53	0.00	1.14	4150.38	29882.72	-	-	5.49	JF6-4-1	JF6-4-1	4,280.00	
	Zone F New Untreated Area - Perimeter Grades	0.00	0.00	0.00	0.00			0	None	-	NA	N/A	N/A	0
Zone F Total Area Discharge	161,182.40	128,183.68	32,998.72	3.70	10,194	29,883	-	-	28.29	JF6-4-1	JF6-4-1	11,768		

APPENDIX E

OPERATIONS & MAINTENANCE MANUAL (LOT 7 – ONLY)

**INSPECTION AND MAINTENANCE MANUAL
FOR STORMWATER MANAGEMENT AND
RELATED STORMWATER FACILITIES**

**LOT 7
CHILDREN'S MUSEUM & THEATRE OF MAINE SITE
THE FOREFRONT AT THOMPSON'S POINT
PORTLAND, MAINE**

PREPARED FOR:

**CHILDREN'S MUSEUM & THEATRE OF MAINE
142 FREE STREET
P.O. BOX 4041
PORTLAND, MAINE 04101
(207) 828-1234**

PREPARED BY:

**STANTEC CONSULTING SERVICES INC.
482 PAYNE ROAD
SCARBOROUGH, MAINE 04074
(207) 883-3355**

MARCH 2017

TABLE OF CONTENTS

<u>SECTION</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
I.	INTRODUCTION.....	1
	A. Guidelines Overview	2
II.	PROJECT OVERVIEW	2
III.	STANDARD INSPECTION/MAINTENANCE DESCRIPTIONS	4
	A. Pond Overflow	4
	B. Control Structures	5
	C. Stormwater Inlets	6
	D. Tributary Drainage System.....	7
	E. Jellyfish® Filter.....	9
	F. Pretreatment Solids Removal (Water Quality Units).....	15
	G. In-line Storage (Underground Detention)	16
	H. Sorbent Booms	18
	I. Parking Lot Cleaning.....	18
	J. Litter	18
	K. Summary Checklist	18
IV.	PROGRAM ADMINISTRATION.....	18
	A. General	18
	B. Record Keeping.....	19
	C. Contract Services	19

APPENDICES

Appendix A – Sample Inspection Logs

Appendix B – Permits for Project

Appendix C – Summary Checklist for Inspection and Maintenance

I. INTRODUCTION

Relatively complex stormwater management facilities are commonly installed in development projects including, commercial facilities, and many other developments. The complexity and goals of these systems vary with the nature of the receiving water, as well as the type of development. Runoff from developed areas of the project, including rooftops, paved or lawn areas, typically contain materials that can impact the receiving waters. Source control and the installation of wet ponds, infiltration galleries, and water quality units, often combined with pretreatment measures or followed by vegetated buffer strips and other best management practices, can significantly reduce the non-point pollution discharge from the developed area. These measures are particularly important to projects in the watersheds of sensitive water bodies, or projects with potential impacts to groundwater. With the increased cost of land and development, there is an increased tendency to construct portions of the stormwater management systems underground.

The effectiveness of water quality management provisions and other components of the stormwater management system are dependent on their design, upkeep, and maintenance to assure they meet their intended function over an extended period of years. It is critical that the stormwater management facilities are regularly inspected, and that maintenance is performed on an as-needed basis. It must also be recognized that the effectiveness of these facilities, and their maintenance requirements, are related to the stormwater drainage facilities that collect and transport the flow to the ponds, infiltration galleries, and other treatment measures. Thus, maintenance should be directed to the total system, not just the pond or primary stormwater management facility.

The purpose of this document is to define, in detail, the inspection and maintenance requirements deemed necessary to assure that the stormwater management facilities function as intended when they were designed. Subsequent sections identify individual maintenance items, give a brief commentary of the function, and need for the item, a description of the work required, and a suggested frequency of accomplishment. While the suggested programs and schedules must be adapted to projects, the material presented should provide guidance for a successful long-term program for operation and maintenance. A supplemental section provides guidance for construction monitoring of the facilities during their installation and more detailed checklists. Certain facilities, specifically the groundwater recharge and infiltration beds are not intended to be placed in service until the tributary catchment area has the permanent cover in place and any contributing turf areas have achieved a 90% catch of vegetation (i.e. established).



A. GUIDELINES OVERVIEW

A summary of the individual components of stormwater management facilities has been prepared. The format used in the summary is as follows:

Preface: A general description of what function/benefit the element is intended to provide. This is a short summary and not intended to provide the design basis which can be found in other sources.

Inspection: This section provides the inspection requirements for the individual component.

Maintenance: The section provides general information on the routine maintenance requirements of this element.

Frequency: This section outlines the best judgment of the designer on the system to the frequency of maintenance.

Comments: This section provides any particular comment on the site-specific features of this element. This is a summary only. The owner/operator should review the design drawings and documents carefully to understand the particular elements of the project. The end of this section should allow for the owner/operator to make notes on the specific program. This may include the selected maintenance procedure, cross-references to applicable design drawings, etc.

A list of the individual inspection/maintenance elements is provided in the table of contents. The guidelines are proposed for initial use with adjustments made as appropriate based upon specific project experience.

II. PROJECT OVERVIEW

Key permits issued (or applied for) on the project include:

- MaineDEP Site Location of Development (City of Portland Delegated Review Authority)
- City of Portland Site Plan Review

The permit applications pending for the project include the design information for the stormwater system.

A copy of the permits and Stormwater Management Report should be appended to this manual as Appendix B. The Owner/Operator of the stormwater management system should review these permits for a general description and background of the project, as well as any specific permit conditions or requirements of the project.

The applicant the Children's Museum & Theatre of Maine (CMTM) has retained Stantec Consulting Services Inc. for civil engineering for the proposed Children's

Museum & Theatre of Maine at the Forefront at Thompsons's Point in Portland, Maine. Stantec Consulting Services Inc. has prepared the design for the stormwater management facilities and may be contacted at:

Stantec Consulting Services Inc.
482 Payne Road
Scarborough, Maine 04074
(207) 883-3355

It is recommended the preparer of the plan be contacted with any particular questions on the design intent or similar issues.

The applicable plans/design documents which apply to the project are:

1. Civil Site Plans/Permit Applications Prepared by Stantec Consulting Services Inc.
2. The Erosion Control/Sedimentation Control Plan for the project.
3. The Stormwater Management Plan for the project.

A copy of these documents should be retained with the manual.

The site is tributary to the Fore River watershed.

The proposed design will include deep sump catch basins, oil absorbent sorbent booms, underground detention including the use of an arched chamber system, Jellyfish® filter, and collection, conveyance, and discharge systems.

The project is subject to the requirements of the City of Portland Code of Ordinances, Chapter 32. Specifically, the post construction stormwater management plan. The City requirements have been reiterated for ease of reference; however, the owner shall be responsible to meet the current City code.

“Any person owning, operating or otherwise having control over a BMP required by a post construction stormwater management plan shall maintain the BMP's in accordance with the approved plan and shall demonstrate compliance with that plan as follows:

(a) Inspections. The owner or operator of a BMP shall hire a qualified post-construction stormwater inspector to at least annually, inspect the BMP's, including but not limited to any parking areas, catch basins, drainage swales, detention basins and ponds, pipes and related structures, in accordance with all municipal and state inspection, cleaning and maintenance requirements of the approved post-construction stormwater management plan.

(b) Maintenance and repair. If the BMP requires maintenance, repair or replacement to function as intended by the approved post-construction stormwater management plan, the owner or operator of the BMP shall take corrective action (s) to address the deficiency or deficiencies as soon as

possible after the deficiency is discovered and shall provide a record of the deficiency and corrective action (s) to the department of public services ("DPS") in the annual report.

(c) *Annual report.* The owner or operator of a BMP or a qualified post-construction stormwater inspector hired by that person, shall, on or by June 30 of each year, provide a completed and signed certification to DPS in a form provided by DPS, certifying that the person has inspected the BMP (s) and that they are adequately maintained and functioning as intended by the approved post-construction stormwater management plan, or that they require maintenance or repair, including the record of the deficiency and corrective action (s) taken.

(d) *Filing fee.* Any persons required to file an annual certification under this section shall include with the annual certification a filing fee established by DPS to pay the administrative and technical costs of review of the annual certification.

(e) *Right of entry.* In order to determine compliance with this article and with the post-construction stormwater management plan, DPS may enter upon property at reasonable hours with the consent of the owner, occupant or agent to inspect the BMP's."

III. STANDARD INSPECTION/MAINTENANCE DESCRIPTIONS

The following narratives describe the inspection/maintenance provisions for the Stormwater Management area. These O&M procedures will complement scheduled sweeping of the pavement areas anticipated to occur at least twice per year. The MaineDEP will require the stormwater system be certified to meet the basis of design at five year increments. Proper O&M is necessary to make sure the system can be certified.

A. POND OVERFLOW

Preface: The stormwater detention facilities proposed for the project includes underground detention systems under the paved parking areas. The underground units are a proprietary system called StormTech® SC-740 Chambers. The storage portion of the 30-inch high chambers will travel to the Jellyfish® filter. The upper storage portion will bypass the treatment system for major storm events. If the detention storage volume were exceeded, water would spill over the overflows of the underground systems and flow to the next inlet or sheet flow over the curb line and down the perimeter slope to the Fore River.

Inspection: There are inspection ports that should be checked semiannually to make sure that water is not ponded due to blockage.

Maintenance: The upstream measures are intended to reduce and presumably eliminate maintenance cleanings. Major cleaning would likely require excavation of the system although some success has been reported with fire flow flushing.

B. CONTROL STRUCTURES

Preface: The proposed underground storage systems will serve as a detention pond controlled by the hydraulic outlet control structure. The outlet control structure will be designed to detain the water quality volume with a slow release through the treatment measure (Jellyfish®) and discharge runoff for storm events larger than 1". Therefore, flow is anticipated to be released during and after every major storm event. Minor events will likely pass through the Jellyfish® filter. The Jellyfish® filters have a controlled low flow discharge of 0.066 cfs per unit. The control structure will be designed to be inspected by removing the manhole covers and inspection of the valve, orifice, weir, and channels. Debris should be removed whenever observed and reported to key maintenance personnel since any debris would indicate lack of proper system O&M in the collection and conveyance system. Entry may require CONFINED SPACE ENTRY procedures and appropriately trained personnel.

Inspection: The outlet control structures must be inspected to assure it maintains its intended hydraulic characteristics. The inspection would note any debris or sediment which may accumulate in the structure and in the inlet and outlet pipes. It is noted that it does not take much debris or silt to alter the hydraulic characteristics of the discharge. The inlet should be inspected to assure it is not blocked or restricted or there is sediment to the extent that its flow characteristics may be altered.

Maintenance: Maintenance of the control structure will consist primarily of removing debris which may accumulate and sealing the bulkhead if leakage occurs.

Frequency: The control structure should be inspected quarterly and after a high intensity rainfall event (in excess of 3 inches in a 24-hour period).

Maintenance/Inspection Responsibility:

Inspection Personnel: The maintenance personnel will be an outside agent hired by CMTM and will perform the scheduled maintenance/inspection.

Dates of inspections, maintenance performed, and any observed problems should be noted in the logs/records maintained by the outside agent.

Outside Contract Services: The outlet structure should be opened/inspected by the outside agent of CMTM on a quarterly basis. The logs and records of inspections and maintenance of the control structures should be maintained during each 5-year re-certification interval.

Replacement Parts/Repairs: No normal replacement parts are required. Inspection personnel should have a bucket to remove debris from the

structure. If leakage of the bulkhead occurs, it is recommended that repairs be made by a professional contractor familiar with hydraulic grouts.

C. STORMWATER INLETS

Preface: The success of any stormwater facility relies on the ability to intercept stormwater runoff at the design locations. Stormwater inlets may include catch basins, open culverts, culverts with bar screens, and field inlets. Inlets exist throughout the system at the points of collection as well as at the outlet of many ponds. Bar racks are common on many inlet locations which intercept an open channel. This section is directed at maintenance of the actual inlet point. A later section addresses more substantive maintenance of the structures and conveyance facilities. The inlets contain oil absorbent sorbent booms to retain oils and avoid discharge to downgradient areas. These will become saturated with oil over time and require replacement.

Inspection: The inspection of inlet points will need to be coordinated with other maintenance items, these include:

- Roadway/parking lot maintenance areas
- Building maintenance areas
- Grounds maintenance

The key elements of the inspection are to assure the inlet entry point is clear of debris and will allow the intended water entry.

Maintenance: The key maintenance is the removal of any blockage which restricts the entry of stormwater to the inlet. The removed material should be taken out of the area of the inlet and placed where it will not reenter the runoff collection system. Snow should be removed from inlets in parking lots/roadway areas. Grass clippings and leaves should be bagged and removed particularly near the yard inlets near the building.

Frequency: All inlets should be inspected on a monthly basis, and after/during significant storm events. A windshield survey is suitable for most inlets but off road inlets and pond structures require more rigorous inspection.

Maintenance/Inspection Responsibility:

Maintenance Personnel: The outside agent will perform the normal maintenance/inspections of the inlets and culvert crossings.

Comments: Maintenance of inlets is critical on this project.



POORLY STABILIZED INLET ALLOWS ENTRANCE OF DEBRIS AND REDUCED CAPACITY



STABILIZED INLETS REDUCE DEBRIS ACCUMULATION AND MAINTAIN DESIGN CAPACITY

D. TRIBUTARY DRAINAGE SYSTEM

Preface: Stormwater from the project will be directed through a conveyance system which transports the flow to water quality units (underground storage) and to a Jellyfish® filter. This conveyance system will be principally overland flow discharging to piped drain systems. Most of the sediment carried by the drainage system is intended to be trapped in the catch basins, isolator rows or water quality units. Maintenance of this system can play a major role in the long-term maintenance costs and the effectiveness of the treatment systems.

Inspection: The tributary drainage system should be periodically inspected to assure that it is operating as intended, and that its carrying capacity has not been diminished by accumulations of debris and sediment or other hydraulic impediments. On piped systems the inlets must be inspected to ensure the rims are set at the proper elevation to optimize flow entry and are not clogged with leaves or other debris. The inlet basins are normally equipped with sumps which will remove large sediment particles from the flow stream with hooded outlets. The inlet basins may be equipped with oil absorbent sorbent booms which should be inspected for saturation. Once the boom becomes saturated it will appear brown or black in color and will be ineffective at removing oils.

The level of sediment in the sumps should be checked to assure their effectiveness. Pipelines connecting the inlets should be checked to determine if siltation is occurring. This will be most critical on drain lines laid at minimal slopes. This can usually be accomplished by a light and mirror procedure.

In some projects most of the stormwater is carried in open swales, channels, or ditches. These conveyance channels may be rip rapped or vegetated, depending on the gradient and expected flow velocities. These facilities must be inspected to insure debris or sedimentation does not reduce their carrying capacity. Excess vegetative growth must also be noted. The surface protection for the channels, either stone or vegetation, must be inspected to insure its integrity. Any areas subject to erosion should be noted.

Maintenance: Maintenance of the storm drainage system must assure that it continues to serve its design function on a long term basis, and that its operation does not transport excessive sedimentation to any downstream detention pond, or the receiving waters. Elevations on the rim of catch basins should be adjusted as needed to assure optimal water entry. Depending on the frost susceptibility of the soil, the rims may become elevated over time causing flow to circumvent the inlet. When the sump in an inlet restricts capacity and is half full with silt or other deleterious materials, the catch basin cleaning would normally be accomplished with vacuum trucks contracted as a maintenance service for the development center. The removed material must be disposed of at an approved site for such materials. The removed and replaced sorbent boom shall be disposed of in accordance with local and state regulations.

If sediment in the pipeline exceeds 20% of the diameter of the pipe, it should be removed. This may be accomplished by hydraulic flushing, or by mechanical means. If hydraulic flushing is used the downstream conditions should be analyzed. In general, a sump or sediment trap should be used where it can be flushed into the underground detention pond, since it will reduce pond volume and hasten the time when it must be cleaned.

Frequency: The piped drainage system should be inspected on an annual basis. Adjustment of inlet rim elevations should be on an as needed basis. Cleaning catch basin sumps and pipelines will depend on the rate of accumulation.

Maintenance/Inspection Responsibility:

Maintenance Personnel: Outside agent appointed by CMTM.

Special Services: The owner will elect to contract with an independent agent for cleaning catch basins, sumps, pipelines, and replacement of sorbent booms. Remedial source control measures may be performed by the owner or an outside service depending upon the nature of the particular situation.

Comments: Maintenance of inlets is critical on this project.



A WELL STABILIZED VEGETATED SWALE SHOWS LITTLE SIGNS OF EROSION VELOCITIES OR FLOWS. THIS SWALE ALSO FUNCTIONS AS A POND SPILLWAY

E. JELLYFISH® FILTER

Preface: The primary purpose of the Jellyfish Filter is to capture and remove pollutants from stormwater runoff. As with any filtration system, these pollutants must be removed to maintain the filter's maximum treatment performance. Regular inspection and maintenance are required to insure proper functioning of the system.

It is recommended that Jellyfish Filter inspection and maintenance be performed by professionally trained individuals, with experience in stormwater maintenance and disposal services. Maintenance procedures may require manned entry into the Jellyfish structure. Only professional maintenance service providers trained in confined space entry procedures should enter the vessel. Procedures, safety and damage prevention precautions, and other information, included in these guidelines, should be reviewed and observed prior to all inspection and maintenance activities.

Inspection: Inspection of the Jellyfish Filter is key in determining the maintenance requirements for, and to develop a history of the site's pollutant loading characteristics. In general, inspections should be performed at the times indicated below; or per the approved project stormwater quality documents (if applicable), whichever is more frequent.

- Post-construction inspection is required prior to putting the Jellyfish Filter into service. All construction debris or construction-related sediment within the device must be removed, and any damage to system components repaired.
- A minimum of two inspections during the first year of operation to assess the sediment and floatable pollutant accumulation, and to ensure proper functioning of the system.
- Inspection frequency in subsequent years is based on the inspection and maintenance plan developed in the first year of operation. Minimum frequency should be once per year. Inspection is recommended after each major storm event.
- Immediately after an upstream oil, fuel or other chemical spill.

Inspection activities are typically conducted from surface observations and include:

- Observe if standing water is present
- Observe if there is any physical damage to the deck or cartridge lids
- Observe the amount of debris in the Maintenance Access Wall (MAW)

The following procedure is recommended when performing inspections:

- Provide traffic control measures as necessary.
- Inspect the MAW for floatable pollutants such as trash, debris, and oil sheen.
- Measure oil and sediment depth by lowering a sediment probe through the MAW opening until contact is made with the floor of the structure. Retrieve the probe, record sediment depth, and presences of any oil layers and repeat in multiple locations within the MAW opening. Sediment depth of 12 inches or greater indicates maintenance is required.
- Inspect cartridge lids. Missing or damaged cartridge lids to be replaced.
- Inspect the MAW, cartridge deck, and backwash pool weir, for cracks or broken components. If damaged, repair is required.
- Dry weather inspections: inspect the cartridge deck for standing water.
 - o No standing water under normal operating condition.

- o Standing water inside the backwash pool, but not outside the backwash pool, this condition indicates that the filter cartridges need to be rinsed.
- o Standing water outside the backwash pool may indicate a backwater condition caused by high water elevation in the receiving water body, or possibly a blockage in downstream infrastructure.
- Wet weather inspections: observe the rate and movement of water in the unit. Note the depth of water above deck elevation within the MAW.
 - o Less than 6 inches, flow should be exiting the cartridge lids of each of the draindown cartridges (i.e. cartridges located outside the backwash pool).
 - o Greater than 6 inches, flow should be exiting the cartridge lids of each of the draindown cartridges and each of the hi-flow cartridges (i.e. cartridges located inside the backwash pool), and water should be overflowing the backwash pool weir.
 - o 18 inches or greater and relatively little flow is exiting the cartridge lids and outlet pipe, this condition indicates that the filter cartridges are occluded with sediment and need to be rinsed.

Maintenance: Maintenance frequencies and requirements are site specific and vary depending on pollutant loading. Maintenance activities may be required in the event of an upstream chemical spill or due to excessive sediment loading from site erosion or extreme runoff events. It is a good practice to inspect the system after major storm events. Recommended maintenance activities typically include:

- Removal of oil, floatable trash and debris.
- Removal of collected sediments.
- Rinsing and re-installing the filter cartridges.
- Replace filter cartridge tentacles, as needed.

Required maintenance for the Jellyfish Filter is based upon results of the most recent inspection, historical maintenance records, or the site specific water quality management plan; whichever is more frequent. In general, maintenance requires some combination of the following:

- Sediment removal for depths reaching 12 inches or greater, or within 3 years of the most recent sediment cleaning, whichever occurs sooner.
- Floatable trash, debris, and oil must be removal.
- Filter cartridges rinsed and re-installed as required by the most recent inspection results, or within 12 months of the most recent filter rinsing, whichever occurs sooner.

- Replace filter cartridge if rinsing does not remove accumulated sediment from the tentacles, or if tentacles are damaged or missing. It is recommended that tentacles should remain in service no longer than 5 years before replacement.
- Damaged or missing cartridge deck components must be repaired or replaced as indicated by results of the most recent inspection.
- The unit must be cleaned out and filter cartridges inspected immediately after an upstream oil, fuel, or chemical spill. Filter cartridge tentacles should be replaced if damaged by the spill.

The following procedures are recommended when maintaining the Jellyfish Filter:

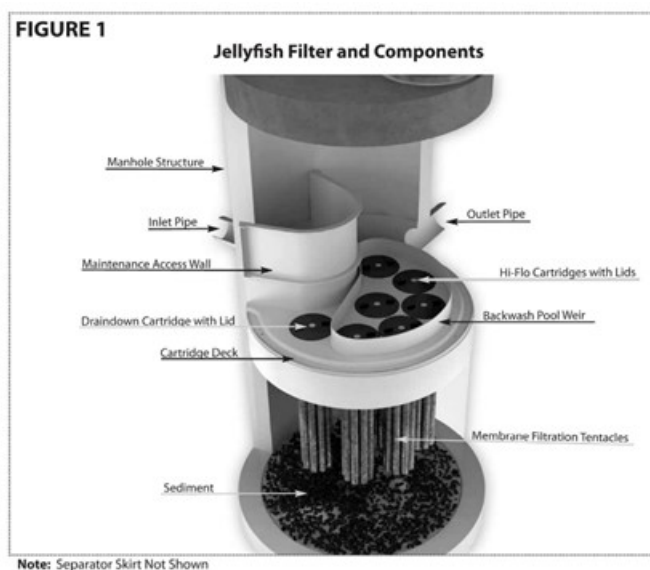
- Provide traffic control measures as necessary.
- Open all covers and hatches. Use ventilation equipment as required, according to confined space entry procedures.
- Caution: Dropping objects onto the cartridge deck may cause damage. Perform Inspection Procedure prior to maintenance activity.
- To access the cartridge deck for filter cartridge service, descend the ladder and step directly onto the deck. Caution: Do not step onto the maintenance access wall (MAW) or backwash pool weir, as damage may result. Note that the cartridge deck may be slippery.
- Filter Cartridge Rinsing Procedure
 - Remove a cartridge lid.
 - Remove the cartridge from the receptacle using the lifting loops in the cartridge head plate. Caution: Should a snag occur, do not force the cartridge upward as damage to the tentacles may result. Rotate the cartridge with a slight sideways motion to clear the snag and continue removing the cartridge.
 - Thread a rope or cord through the lifting loops and lift the filter cartridge from the cartridge deck to the top surface outside the structure.
 - Caution: Immediately replace and secure the lid on the exposed empty receptacle as a safety precaution. Never expose more than one empty cartridge receptacle.
 - Repeat the filter cartridge removal procedure until all of the cartridges are located at the top surface outside the structure.
 - Disassemble the tentacles from each filter cartridge by rotating counter-clockwise. Remove the tentacles from the cartridge head plate.
 - Position a receptacle in a plastic tub or garbage can such that the rinse water is captured. Using a low-pressure garden hose sprayer, direct a wide-angle water spray at a downward 45° angle

onto the tentacle membrane, sweeping from top to bottom along the length of the tentacle. Rinse until all sediment is removed from the membrane. Caution: Do not use a high pressure sprayer or focused stream of water on the membrane. Excessive water pressure may damage the membrane.

- o Remove rinse water from rinse tub or garbage can using a vacuum hose as needed.
- o Slip the O-ring over the pipe nipple on the top end of the tentacle and reassemble onto the cartridge head plate; hand tighten.
- o If rinsing is ineffective in removing sediment from the tentacles, or if tentacles are damaged, provisions must be made to replace the spent or damaged tentacles with new tentacles. Contact Contech to order replacement tentacles.
- o Lower a rinsed filter cartridge to the cartridge deck. Remove the cartridge lid on a receptacle and carefully lower the filter cartridge into the receptacle until the head plate gasket is seated squarely on the lip of the receptacle. Caution: Should a snag occur when lowering the cartridge into the receptacle, do not force the cartridge downward; damage may occur. Rotate the cartridge with a slight sideways motion to clear the snag and complete the installation.
- o Replace the cartridge lid on the exposed receptacle. Check the fit before completing rotation to a firm hand-tight attachment. Rinse away any accumulated grit from the receptacle threads if needed to get a proper fit.
- o Repeat cartridge installation until all cartridges are installed.
- Vacuum Cleaning Procedure
 - o Caution: Perform vacuum cleaning of the Jellyfish Filter only after filter cartridges have been removed from the system. Access the lower chamber for vacuum cleaning only through the maintenance access wall (MAW) opening, being careful not to damage the flexible plastic separator skirt that is attached to the underside of the deck. The separator skirt surrounds the filter cartridge zone, and could be torn if contacted by the wand. Do not lower the vacuum wand through a cartridge receptacle, as damage to the receptacle will result.
 - o to remove floatable trash, debris, and oil, lower the vacuum hose into the MAW opening and vacuum floatable pollutants off the surface of the water. Alternatively, floatable solids may be removed by a net or skimmer.
 - o Using a vacuum hose, remove the water from the lower chamber to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank.

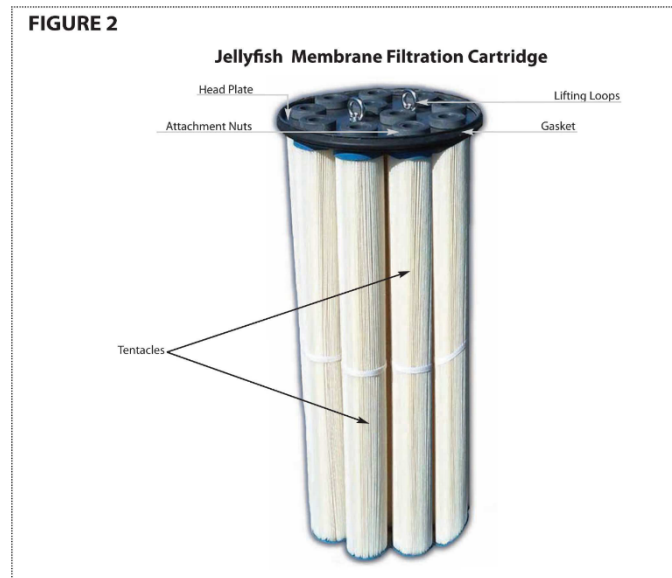
- o Remove the sediment from the bottom of the unit through the MAW opening.
- o For larger diameter Jellyfish Filter manholes (8-ft, 10-ft, 12-ft diameter), complete sediment removal may be facilitated by removing a cartridge lid from an empty receptacle and inserting a jetting wand (not a vacuum wand) through the receptacle. Use the sprayer to rinse loosened sediment toward the vacuum hose in the MAW opening, being careful not to damage the receptacle.
- o After the unit is clean, re-fill the lower chamber with water if required by the local jurisdiction, and re-install filter cartridges.
- o Dispose of sediment, floatable trash and debris, oil, spent tentacles, and water according to local regulatory requirements.
- Chemical Spills
 - o Caution: If a chemical spill has been captured by the Jellyfish Filter, do not attempt maintenance. Immediately contact the local hazard response agency, and contact Contech Engineered Services.

Below is a cut-away schematic of the Jellyfish Filter manhole with key components identified (6-ft. diameter manhole is depicted):



The Jellyfish Filter has no moving parts to wear out and therefore maintenance activities are generally focused on pollutant removal and filter cartridge service.

Below is a schematic of a Jellyfish Filter membrane filtration cartridge. Tentacles can be easily removed from the head plate and rinsed or replaced as needed.



Frequency: The Jellyfish Filter should be inspected a minimum of 2 times during the first year of operation and a minimum of once per year in subsequent years. Inspection is also recommended after each major storm event or immediately after an upstream oil, fuel or other chemical spill.

Maintenance/Inspection Responsibility:

Inspection Personnel: It is recommended that Jellyfish Filter inspection and maintenance be performed by professionally trained individuals, with experience in stormwater maintenance and disposal services. Maintenance procedures may require manned entry into the Jellyfish structure. Only professional maintenance service providers trained in confined space entry procedures should enter the vessel. Procedures, safety and damage prevention precautions, and other information, included in these guidelines, should be reviewed and observed prior to all inspection and maintenance activities.

Replacement Parts/Repairs: Jellyfish Filter cartridges, replacement tentacles, cartridge lids, and other system components can be ordered by contacting: Contech Engineered Solutions, 1-800-548-4667.

Comments: The benefits of regular inspection and maintenance are many from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways and provide the key to the Jellyfish Filter's long and effective service life.

F. PRETREATMENT SOLIDS REMOVAL (WATER QUALITY UNITS)

Preface: Certain vendors provide pre-manufactured systems which are effective in removal of suspended sediment particularly sand used for

winter maintenance. Some of the units operate on a vortex principal with the sediment being swept from the stormwater stream and stored in the base of the unit. Other units are long linear units designed in accordance with Stokes Law. The units are constructed of durable materials requiring little maintenance of the physical component and typically are accessible via an at grade manhole cover.

The vendor of the unit should provide information on suggested maintenance which should be appended to this manual.

These units typically do not remove nutrients, metals, and dissolved materials.

Inspection: Most water quality units have an access manhole cover for inspection. The sediment storage zone is the bottom of the system and lies below the vortex in this type of unit or along the bottom. Because of the depth, a pole staff, or sludge judge is helpful in determining the depth of the sediment. Inspection should comply with applicable confined space regulations and vendor recommendations. Oil and floatables are also trapped in certain devices and should be removed.

Maintenance: The typical unit maintenance is the removal of sediment. Stantec Consulting Services Inc. typically recommends the units be inspected in the spring and late fall with adjustments based on historic operating experience.

The vendor may have specific scheduled maintenance schedules which should be followed.

The structural components of the system are principally stainless steel, concrete, and or climate resistant plastics.

Frequency: Twice per year or as outlined above.

Applicability: This system has three water quality units. The three linear units are in Zone A upstream of the underground sand filter.

Special Notes: These units are designed for a specific flow and catchment area. If the contributing watershed is increased, the need for design modifications or supplements to the water quality units should be examined.

G. IN-LINE STORAGE (UNDERGROUND DETENTION)

Preface: In-line storage may be used for storage of water ahead of treatment systems, or for buried underdrained filters. Because of the difficulty in access for inspection and maintenance, the units will be preceded with pretreatment to remove sediment.

The underground storage systems for this project include StormTech® chamber system for detention ahead of water quality treatment units or underground sand filter.

In-line storage systems typically have a restrictive outlet when used for detention. This outlet is a separate downstream appurtenance with orifices, weirs, and overflows.

Specific design cautions should be considered if in-line storage is used as part of a stormwater management system. In-line storage systems have multiple inspection ports. The locations should consider the need for confined space entry.

Inspection: Inspection of in-line storage systems should follow all protocols for confined space entry. Inspections should include:

- Observations of standing water and monitoring drainage to make sure drainage is achieved 72 hours after a rainfall of 1 inches or greater (annually) for Jellyfish® filter systems and 48 hours for underground sand filters.
- Sedimentation
- Outlet Controls
- Inlets
- Inspection of each isolated tank series, run of pipe, distribution of manhole, and header pipe

Maintenance: Maintenance of in-line storage systems will vary depending upon the extent of pretreatment, the nature of the receiving bodies, and the design. Leakage, accumulated sediment, and repairs of any damaged portion of the system should be performed immediately upon discovery.

Maintaining Responsibility: A contract for third party maintenance needs to be established before occupancy.

Frequency: After successful operation of the in-line storage system for one year or two major storms (whichever is longer), quarterly inspections are recommended except the drawdown test after a one-inch rain may be annually only. Maintenance repairs should be performed as soon as possible. The Site Location of Development Permit will require recertification on a periodic basis as stipulated by the permit conditions.

Applicability: Underground detention will be employed on this project

H. SORBENT BOOMS

Preface: During construction, sorbent booms will be installed in the catch basins which have pavement areas. The intent of these is to absorb oil and runoff from new pavement surfaces. These will be removed and replaced when construction of the project is complete and should be inspected quarterly for the first year and annually thereafter.

Inspection: The sorbent boom should be raised out of the inlet, inspected, and replaced if necessary. Inspection should occur for the first year and annually thereafter concurrent with the catch basin cleaning.

Recommendation: It is recommended this project have additional sorbent booms or pillows onsite in the event of an unexpected spill or if oil sheen is observed frequently on any inlet.

Maintenance: The inspection and replacement should be conducted as part of a third party O&M contract and require disposal of used sorbent booms as "special wastes".

I. PARKING LOT CLEANING

To protect the catch basin sediment sumps, underground storage, tree box, and Jellyfish® filter, it is recommended the parking lot be swept at mid winter and spring and that power washing with an appropriate vacuum/power wash vehicle be done once a year.

Maintenance: It is recommended this service be contract with the firm that maintains lawns and landscaping.

J. LITTER

Litter should be removed as a matter of course by workers and a part of the grounds maintenance contract.

K. SUMMARY CHECKLIST

The above described inspection and maintenance items have been summarized on a checklist appended hereto as Appendix C.

IV. PROGRAM ADMINISTRATION

A. GENERAL

A reliable administrative structure must be established to assure implementation of the maintenance programs described in the foregoing section. Key factors that must be considered in establishing a responsive administrative structure include:

1. Administrative body must be responsible for long-term operation and maintenance of the facilities.

2. Administrative body must have the financial resources to accomplish the inspection and maintenance program over the life of the facility.
3. The administrative body must have a responsible administrator to manage the inspection and maintenance programs.
4. The administrative body must have the staff to accomplish the inspection and maintenance programs, or must have authority to contract for the required services.
5. The administrative body must have a management information system sufficient to file, retain, and retrieve all inspection and maintenance records associated with the inspection and maintenance programs.

If any of the above criteria cannot be met by the entity assigned inspection and maintenance responsibilities, it is likely that the system will fail to meet its water quality objectives at some point during its life. While each of the above criteria may be met by a variety of formats, it is critical to clearly establish the assigned administrative body in a responsible and sustainable manner.

B. RECORD KEEPING

Records of all inspections and maintenance work accomplished must be kept and maintained to document facility operations. These records should be filed and retained for a minimum 5-year time span. The filing system should be capable of ready retrieval of data for periodic reviews by appropriate regulatory bodies. Where possible, copies of such records should also be filed with the designated primary regulatory agency for their review for compliance with permit conditions. Typical inspection and maintenance record forms are attached hereto as Appendix B.

C. CONTRACT SERVICES

In some instances or at specific times, the Maintenance Personnel may not have the staff to conduct the required inspection and/or maintenance programs as outlined in this document. In such cases the work should be accomplished on a contractual basis with a firm or organization that has the staff and equipment to accomplish the required work.

The service contract for inspection and maintenance should be formal, well written legal document which clearly defines the services to be provided, the contractual conditions that will apply, and detailed payment schedules. Liability insurance should be required in all contracts.

APPENDIX A

Sample Inspection Logs

**THE FORERONT AT THOMPSON'S POINT
PORTLAND, MAINE**

STORMWATER MANAGEMENT
IN-LINE STORAGE
ANNUAL INSPECTION & MAINTENANCE LOG

FACILITY:		YEAR:	
LOCATION:		CONTRACTOR:	
FUNCTION:		INSPECTOR:	
DATE OF INSPECTION:			
ITEM IDENTIFICATION	DESCRIPTION OF CONDITIONS	MAINTENANCE ACCOMPLISHED	DATE OF MAINTENANCE
GENERAL COMMENTS:			

CHILDREN'S MUSEUM & THEATRE OF MAINE
PORTLAND, MAINE
 STORMWATER MANAGEMENT
 IN-LINE STORAGE
 MONTHLY INSPECTION & MAINTENANCE LOG

FACILITY:			YEAR:			
LOCATION:			CONTRACTOR:			
FUNCTION:						
MONTH	DAY	INSPECTOR	WATER DEPTH	OVERFLOW WEIR		WEIR CONDITION
				CLEAR	DEBRIS	
JANUARY						
FEBRUARY						
MARCH						
APRIL						
MAY						
JUNE						
JULY						
AUGUST						
SEPTEMBER						
OCTOBER						
NOVEMBER						
DECEMBER						
LIST SPECIAL MAINTENANCE UNDERTAKEN:						

**CHILDREN'S MUSEUM & THEATRE OF MAINE
PORTLAND, MAINE**

STORMWATER MANAGEMENT
IN-LINE STORAGE
SEMI-ANNUAL INSPECTION & MAINTENANCE LOG

SEMI-ANNUAL INSPECT 1.2	FACILITY:
DATE:	LOCATION:
INSPECTOR:	FUNCTION:
WEIR CONDITION:	
OUTLET CONDITION	

FORE BAY SUMP	EST. DEPTH SED.	REMOVED? Y/N	EST. VOL. CY	WHERE DISPOSED OF	STRUCTURAL CONDITION

CONTROL STRUCTURE:
DESCRIBE CONDITIONS FOUND & MAINTENANCE ACCOMPLISHED:

APPENDIX B

Permits for Project

(To be Added at a Subsequent Time)

APPENDIX C

Summary Checklist Inspection and Maintenance

**Stormwater Management System
Maintenance Program
Summary Checklist**

Item	Commentary	Frequency				
		Monthly	Quarterly	Semi-Annual	Annual	Long Term
Control Structure	Inspect outlet control to assure it maintains its hydraulic characteristics. Inspect after high intensity rain (excess of 3"/24 hr.) Inspect inlets for blockage.		X			
Stormwater Inlets in Series	Stormwater inlets allow flow entry from a surface swale to a piped system. Entry may or may not be equipped with a bar rack. Inspect entry for debris accumulation. Remove debris to allow unimpeded entry. Lawn clippings and leaves should be removed from yard areas.	X			X Clearing	
Tributary Drainage	Inspect to assure that the carrying capacity has not been diminished by debris, sediment or other hydraulic impediments.				X	
Jellyfish® Filter	The operation and maintenance of the Jellyfish® filter system is limited to annual inspections and solids removal on an as-needed basis.			X First year only	X	X
In-Line Storage (Underground detention)	Inspect for standing water not anticipated, sedimentation, outlet control, inlets. Jet Stream sediment removal from Isolator Row				X	X
Sorbent Booms	Sorbent boom should be raised out of the inlet, inspected, and replaced if necessary.		X For first 12 months		X After first year	
Parking Lot Cleaning	Parking lot be swept at mid-winter and spring. Power washing with an appropriate vacuum/power wash vehicle be done once a year.			X	X	
Litter	Litter should be removed daily.					

ATTACHMENT B

Erosion & Sediment Control Report

**SUPPLEMENTAL
EROSION & SEDIMENTATION CONTROL NARRATIVE**

**LOT 7
CHILDREN'S MUSEUM & THEATRE OF MAINE SITE
THE FOREFRONT AT THOMPSON'S POINT
PORTLAND, MAINE**

PREPARED FOR:

**CHILDREN'S MUSEUM & THEATRE OF MAINE
142 FREE STREET
P.O. BOX 4041
PORTLAND, MAINE 04101
(207) 828-1234**

PREPARED BY:

**STANTEC CONSULTING SERVICES, INC
482 PAYNE ROAD SCARBOROUGH COURT
SCARBOROUGH, MAINE 04106
(207) 883-3355**

March 2017

TABLE OF CONTENTS

Section	Description	Page
1.0	INTRODUCTION.....	1
2.0	EROSION & SEDIMENTATION CONTROL DEVICES	1
3.0	CONCLUSION	1
4.0	ATTACHMENTS	1

List of Attachments

Attachment A – Plan sheet C-6.0 Erosion Control Plan

SUPPLEMENTAL EROSION & SEDIMENTATION CONTROL REPORT

1.0 INTRODUCTION

Stantec Consulting Services, Inc. (Stantec) was retained by Children's Museum & Theatre of Maine (CMTM) for preparation of the proposed development of Lot 7 within the Forefront at Thompson's Point development in Portland, ME.

This supplemental report is intended to describe the Erosion & Sedimentation Control Plan and associated BMP's customarily used in Maine and which are applicable to this project.

2.0 EROSION & SEDIMENTATION CONTROL DEVICES

- Siltation fence and/or sediment barrier shall be installed down slope of any disturbed areas to trap runoff borne sediments until the site is constructed and vegetation is reestablished. The silt fence and/or sediment barrier shall be installed per the details provided in the plan set and inspected immediately after each rainfall and at least daily during prolonged rainfall. The Contractor shall make repairs immediately if there are any signs of erosion or sedimentation below the erosion control fence line. If such erosion is observed the Contractor shall take proactive action to identify the cause of the erosion and act to avoid its recurrence. Typically, this requires that stabilization measures be undertaken.
- A construction entrance will be constructed at all access points onto the site to prevent tracking of soil onto adjacent streets. It may be necessary to wash the wheels of vehicles exiting the site to avoid tracking mud or material that will generate dust during certain periods of construction.
- Sorbent booms are intended to capture oils and the asphalt sheen from paved surfaces and shall be installed in all catch basins before pavement is installed.
- Catch basin sediment barrier inlet protection will be installed around all catch basin inlets during construction to prevent erosion and sediment build up in the storm drain conveyance system prior to reestablishing vegetation on site.

3.0 CONCLUSION

The Contractor shall be responsible for ensuring all erosion and sedimentation control devices be installed properly and maintained when needed. Installation and maintenance of erosion and sediment control BMP's is dependent on the weather and time of construction and may change as the project advances.

4.0 ATTACHMENTS

Appendix A – Plan Sheet C-6.0 Erosion Control Plan

APPENDIX A

**PLAN SHEET C-6.0 EROSION
CONTROL PLAN
(PLEASE SEE CIVIL PLAN SET)**