MORRISON HERSHFIELD

REPORT

Victoria handyDART Transit Centre
Stormwater Management Plan

View Royal, BC

Prepared for:

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MORRISON HERSHFIELD

CORPORATE AUTHORIZATION

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The material in this report reflects the judgement of the Consultant based on the available information at the time of preparation of this report. Most of the background information was obtained from historical reports and drawings, provided by Client, and prepared by others over the years. Efforts were made to verify the available information where possible by obtaining input from the operating staff. However, the accuracy of the information in this report can't be guaranteed.

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APPENDICES

1. INTRODUCTION

Morrison Hershfield (MH) was retained by BC Transit to complete a stormwater management plan for the HandyDART Transit Centre to demonstrate the adequacy of the proposed storm system to convey runoff from the proposed development and provide suitable water quality prior to discharge.

1.1 Project Description

BC Transit is proposing the Victoria handyDART Transit Centre which will be used as an operations and maintenance facility for the handyDART electrical fleet, servicing the Greater Victoria Area (GVA). It consists of a gated secure area comprising of a main operations and maintenance building, a bus wash bay building, a cleaning bay building, and a bus fleet parking area; and a visitor parking lot outside of the secured facility. Site access will be provided off Burnside Road W near the existing paved entrance to the site.

1.2 Existing Site Conditions

The site is located at 2401 Burnside Road West, at the southeast quadrant of the Watkiss Way and Burnside Road intersection. The site is bounded Burnside Road W to the West, Watkiss Way to the North, Trans-Canada HWY off ramp to the south and by the Craigflower Creek Streamside Protection and Enhancement Area (SPEA) to the east, as shown in **Figure 1**.

Figure 1: Location Plan

The existing site is mostly undeveloped and contains various statutory rights-of-way (SRW) and easements including an easement for the Galloping Goose Regional Trail (GGRT), a CRD water SRW, and a BC Hydro transmission line easement. Most of the lands are heavily vegetated with portions cleared for the various utilities, including a 30m BC Hydro transmission tower with an adjacent Rogers' compound. A gravel access road and grass section near the centre of the site were maintained by a previous tenant. Two watercourses are running through the site conveying upstream flows. Watercourse #1 run West-East near the south property line and Watercourse #2 cuts through the middle of the site running North-South.

Site elevations range from 17.00m to 7.50m, falling generally Northwest-Southeast at grades between 4 and 12%. The site lies within the Craigflower Creek Watershed which is the ultimate drainage discharge point of the site.

1.3 Relevant Reference Documentation

The following documents have been reviewed in preparing this report and contain relevant information that pertains to the Stormwater Management Plan. Copies of these reports can be provided upon request.

Reports

- Phase I Environmental Site Assessment, WSP, September 14, 2017
- Phase II Environmental Site Assessment, Stantec, May 23, 2018
- Site Topographic Survey, WSP, September 13, 2017
- Archeological Impact Assessment, Stantec, April 30, 2018
- Habitat Assessment, Stantec, January 19, 2021
- Supplemental Geotechnical Subsurface Investigation and Development Design Considerations, Golder, February 4, 2021
- Construction Environmental Management Plan, Stantec, June 2, 2021
- Riparian Areas Protection Regulation: Assessment Report, Stantec, July 6, 2021

Guidelines and Regulations

- Town of View Royal Storm Sewer Bylaw No. 902, 2015
- Riparian Areas Protection Regulation, BC Reg. 178/2019
- Water Sustainability Act, Section 11: Changes In and about a Stream
- BC Approved Water Quality Guidelines for the Protection of Aquatic Life, 2019 Edition
- Fisheries Act (R.S.C., 1985, c. F-14)
- The Master Municipal Construction Documents (MMCD), Design Guidelines, 2014

1.4 Design Criteria

The proposed stormwater management plan is a collaboration between the design professionals (Civil Engineer, Arborist, Landscape Architect, Geotechnical Engineer), CRD (Parks, Water) and the Town of View Royal staff (Engineering, Planning). The approach taken will address and promote the following:

I. Detain post-development runoff to pre-development runoff rates using a storage chamber with a downstream orifice for flow control

II. Provide storm water systems that minimize the impact on storm water quality by installing rain gardens and an Oil Grit Separator (OGS) unit

III. The Town of View Royal requires that post development runoff from the proposed site is less than or equal to the pre-development rate of the 100-year event. BC Transit requires that the site be designed to 200-year event

IV. Minimize sedimentation and erosion, stabilize, and re-vegetate impacted areas

Rain gardens on this site will be designed for the 2-year, 24-hour storm event, and will act as first line filtration system for rain events. The storage detention tank and minor system will be sized to control the 200-year event. An OGS unit sized to the allowable site discharge will be installed to provide additional water quality treatment before releasing into the Criagflower Creek system. The system will be equipped with a shut-off valve to allow the system to be isolated in case of any deleterious substance spill.

A Type 1A SCS rain distribution will be applicable to this site and used to size the rain gardens and tanks. This rainfall distribution is common in the west coast.

1.5 Reporting

This report summarizes the impact of the proposed development on the existing downstream storm conveyance system. This stormwater management plan will:

- Review and analyze existing surface drainage conditions
- Describe the proposed stormwater management strategies
- Describe Erosion and Sediment Control (ESC) strategies

2. EXISTING DRAINAGE CONDITIONS

2.1 Upstream Basins

The site currently slopes in the direction of both watercourses as shown on **Figure 2** below. Both watercourses have a culvert just upstream under Burnside Road. Watercourse #1 conveys a small area (approx. 0.7 ha) from the highway intersection which is conveyed through a culvert under the Trans-Canada highway and Watercourse #2 conveys runoff from large upstream area (25.3 ha) that mainly consists of residential areas as shown on **Figure 3**. Both water courses ultimately discharge a total area of 26 ha to Craigflower Creek located at the east boundary of the site which flows in a south-northeast direction.

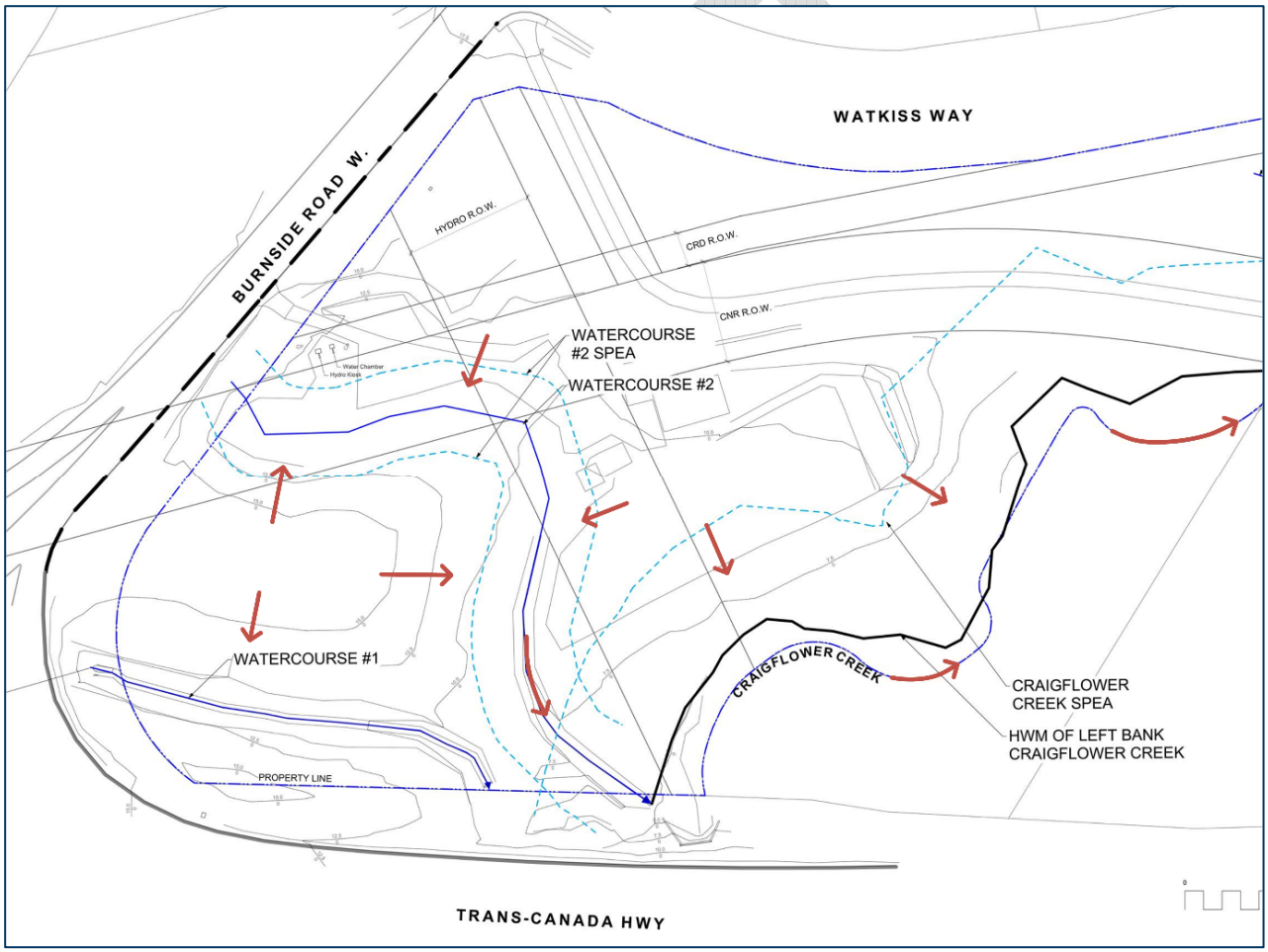


Figure 2: Existing Conditions

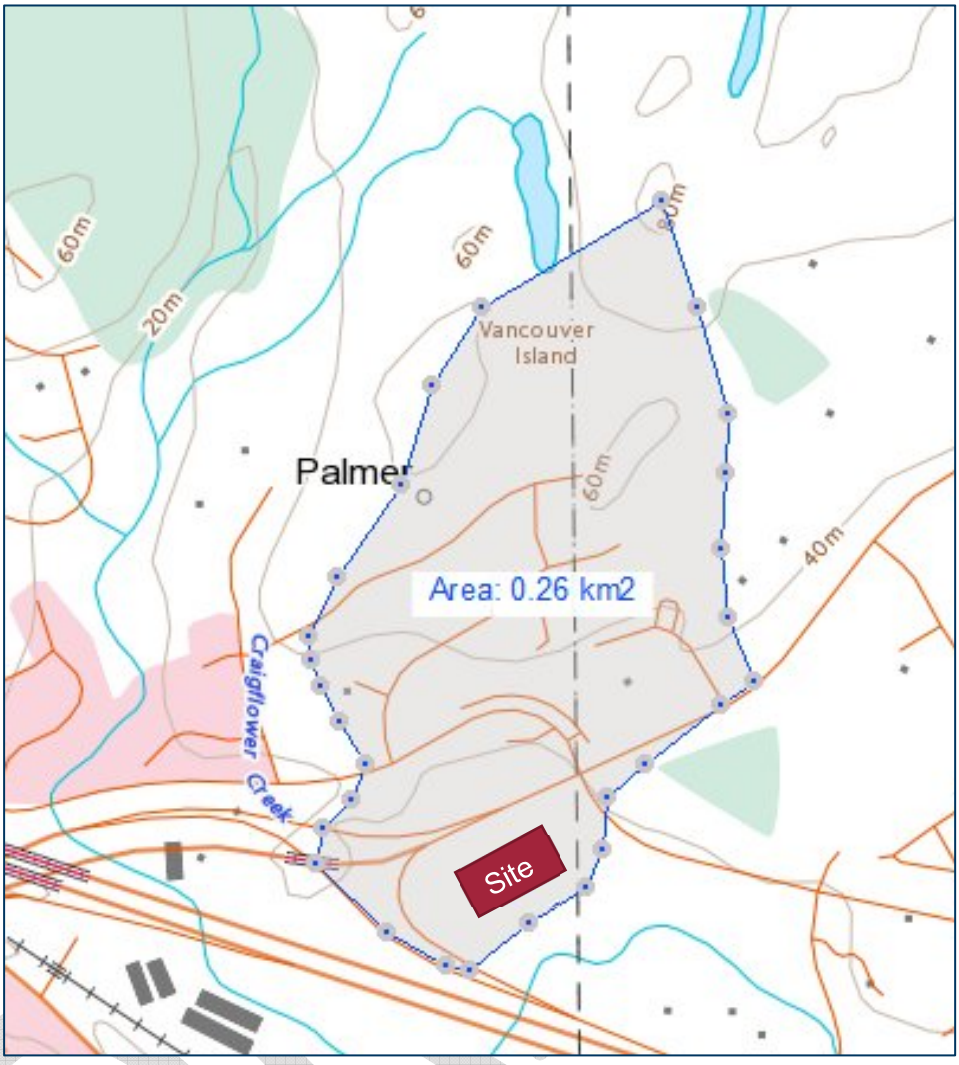


Figure 3: Upstream Drainage Basin (from Natural Resources Canada)

The upstream area of Watercourse #2 flows through a 600 mm diameter culvert under Burnside road and ultimately into Craigflower Creek. To develop the handyDART site, this upstream runoff and watercourse will need to be redirected away from the site and into a new realigned channel with Watercourse #1.

The Watercourse #1 upstream area runoff is conveyed through a 600 mm diameter culvert under the Trans-Canada Highway. The total area draining towards this culvert is approximately 0.7 ha, which is only 2.7% of the total upstream area (26 ha). This is very insignificant, or minor compared to the area draining towards Watercourse #2.

The runoff from the upstream area was determined using the rational method and the land area was assumed half as residential and the other half as undeveloped. **Table 1** below summarizes the runoff coefficients used for the upstream basin.

Table 1: Summary of Runoff Coefficients

Land Cover	Present Area (ha)	Runoff Coefficient (2 Year)	Runoff Coefficient (100 Year)	Runoff Coefficient (200 Year)
Undeveloped	13.0	0.25	0.31	0.33
Residential	13.0	0.70	0.88	0.91
Total Area	26.0			

Note: For 100 year and 200 year, respectively, 25% and 30%, were added to 2 Year C value

Using the Kirpach formula, the time of concentration was determined and then intensity was calculated based on the Victoria International Airport Intensity-Duration-Frequency (IDF) data. A summary of the calculated runoff using the rational method is shown below in **Table 2**.

Table 2: Upstream Basin Total Runoff for each Storm Event

Return Period (Years)	Runoff Coefficient	Rainfall Intensity (mm/hr)	Area (ha)	Runoff (m3/s)
2	0.48	26.8	26.0	0.9
25	0.52	49.3	26.0	1.9
50	0.57	55.0	26.0	2.3
100	0.59	60.4	26.0	2.6
200	0.62	66.9	26.0	3.0

The flows shown in **Table 2** assume no restriction from the 600 mm diameter culvert under Burnside Road.

After further examination of the CSP culvert under Burnside Road, the maximum headwater that could possibly occur based on the top of road elevation was approximated at 3.0 m. Due to the dense vegetation, a topographical survey of area did not provide conclusive data on the existing culvert invert elevation. Upon review of the available Lidar data a depression at the upstream end of this culvert is evident, so the probability of reaching a maximum headwater of 3.0m is low. However, based on an approximated culvert slope of 5%, and a maximum allowable head water of 3.0 m, the maximum flow that can possibly occur through this culvert is approximately 0.9 m^3/s which is equal to the 2-year natural runoff from the upstream basin. Culvert Master software calculations are provided in Appendix A.

2.2 Watercourse #2 Realignment

The Watercourse #2 stream and riparian habitat are in poor condition and will be realigned to be combined with Watercourse #1. The new realigned channel will be at the perimeter of the site as shown in **Figure 4**. The new channel will accommodate the combine flow of the upstream basins, and the aquatic and riparian habitat will be enhanced with a series of riffles and pools and a 10 m planted riparian area on each side of the stream. Work is proposed in two phases. Phase one includes all work outside of the existing protected Watercourse #2 and the

Craigflower Creek SPEA boundaries. Phase 2 includes work within the current SPEA areas to connect the channel upstream and create the downstream outlet. The lower section of the new channel will be a meandering low gradient channel and serve as off-channel habitat for salmonids. The benefits of the new channel are:

- Sediment removal/deposition
- Stream oxygenation
- Creates habitat for aquatic species, birds and small mammals
- Net gain of 432m² of instream habitat and 257m² of riparian habitat (accounts for the loss of existing Watercourse #2and the gain of from the realignment)
- Planting of over 250 trees
- Enhancing the urban forest

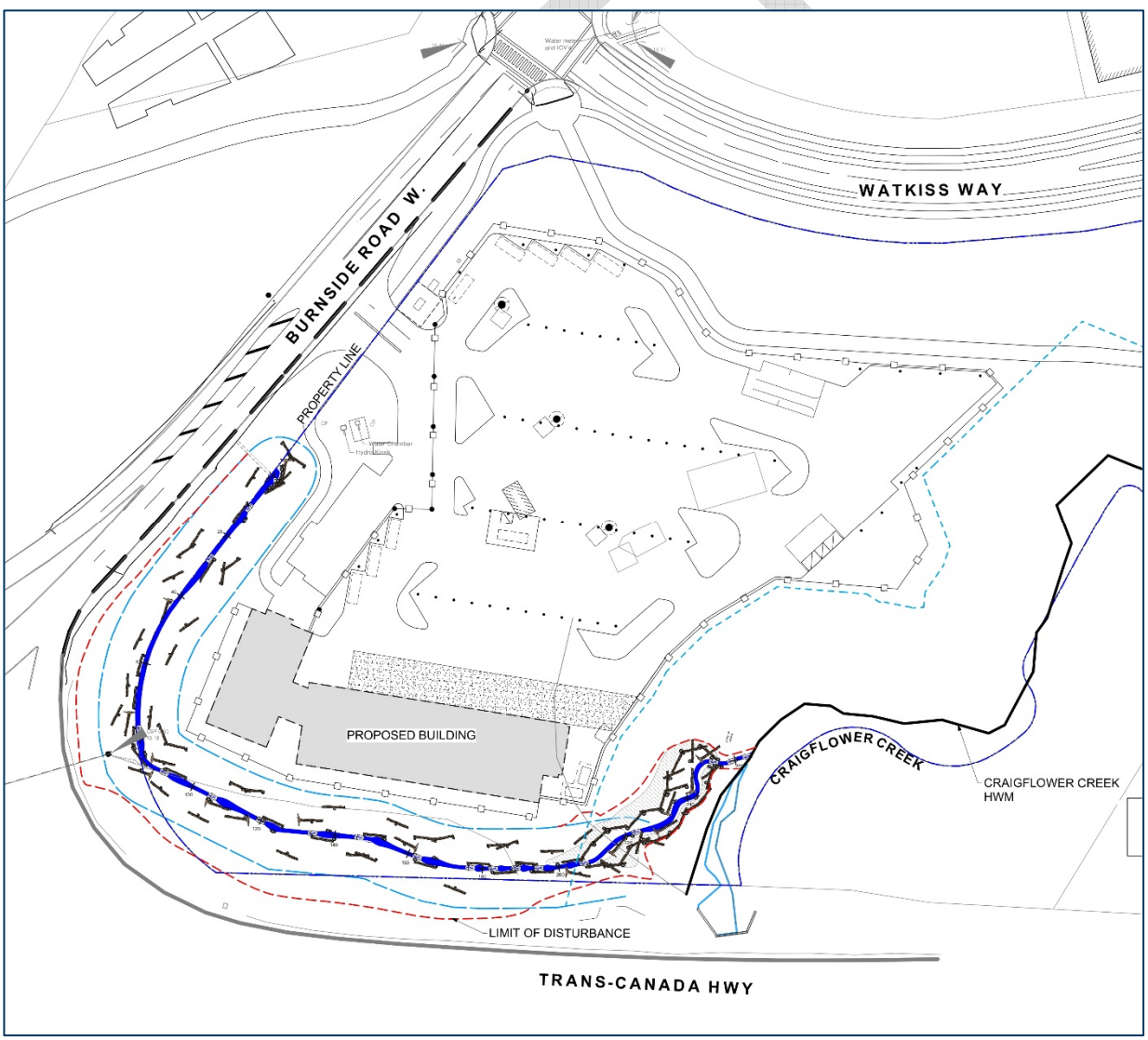


Figure 4: Proposed New Watercourse #2 Alignment

2.3 Existing Site Basins

The site is currently divided into 3 basins as shown on **Figure 5** below. Basin 1 consists mainly of asphalt walk path and landscaped surfaces and drains directly into Craigflower Creek. Basin 2 consists of gravel and landscaped surfaces, and Basin 3 is just a natural area draining into Watercourse #1. Table 3 summarizes the total land area and runoff coefficients for each area.

Table 3: Existing Drainage Area and Runoff Coefficient

	Paved	Landscaped	Gravel	Total Area (m^2)	Weighted Runoff Coefficient
Runoff Coefficient	0.9	0.3	0.5		
Basin	**Area (m^2)**				
1	359	1,596	0	1,955	0.41
2	0	17,009	1,137	18,146	0.31
3	0	6,266	0	6,266	0.30

Figure 5: Pre-Development Basin Boundary

Applying the rational method and the Victoria International Airport Intensity-Duration-Frequency (IDF) data, with a time of concentration of 5 minutes, the following pre-development 200 Year runoff rates were generated.

Table 4: Pre-Development Rates

Basin	Total Area (ha)	Weighted Runoff Coefficient	Intensity (mm/hr)			Runoff (L/s)		
			2 Year	100 Year	200 Year	2 Year	100 Year	200 Year
1	0.196	0.41	32.0	79.3	88.2	7.1	17.7	19.7
2	1.815	0.31				50.4	124.9	139.0
3	0.627	0.30				16.7	41.4	46.1
Total	**2.637**					**74.2**	**184.0**	**204.7**
Pre-Development Rate (L/s/ha)						**28.2**	**69.8**	**77.6**

The maximum allowable runoff from site based on the 200-year storm was 77.6 L/s/ha (204.7 L/s).

3. STORMWATER MANAGEMENT STRATEGY

3.1 Upstream Basins

The upstream basins will be directed into the realigned Watercourse #2 at a controlled rate based on the restricted flow from the 600mm culvert under Burnside Road. Reconfiguration and design of this watercourse was completed by meandering the watercourse and sizing it to convey the upstream runoff without flooding the site. The channel was designed with 3:1 (H:V) side slopes and a 1 m bottom. The rock weirs (check dams) were assumed to be 0.3m in height. Design details have been provided in Appendix B.

Assuming a maximum flow of 0.9 m^3/s, a PCSWMM model was created starting from the downstream end of culvert all the way to Craigflower Creek. Two scenarios were simulated, Scenario #1 included rock weirs (check dams) along the ditch channel and Scenario #2 excluded the check dams. Results of this simulation are shown in Table 5 below:

Table 5: PCSWMM Results of Watercourse #2

Station (m)	Ditch Invert (m)	100 Year - Q=0.9 m3/s						
		Slope (%)	HWL	Velocity (m/s)	Depth (m)	HWL	Velocity (m/s)	Depth (m)
			No Check Dams			With Check Dams		
0	10.57	0.50	11.01	1.51	0.45	11.53	1.18	0.96
35	10.39	0.50	10.86	1.07	0.47	11.52	0.80	1.13
85	10.14	2.10	10.46	1.45	0.32	11.25	0.89	1.11
99.2	9.84	2.10	10.16	1.45	0.32	10.95	0.89	1.11
113.4	9.54	2.10	9.86	1.45	0.32	10.65	0.89	1.11
127.6	9.24	2.10	9.56	1.45	0.32	10.35	0.89	1.11
141.8	8.94	2.10	9.26	1.45	0.32	10.05	0.89	1.11
156	8.64	2.10	8.96	1.45	0.32	9.75	0.89	1.11
170.2	8.34	2.10	8.66	1.45	0.32	9.45	0.89	1.11
184.4	8.04	2.10	8.30	1.68	0.26	9.15	0.86	1.11
190.4	7.74	5.00	8.00	1.98	0.26	8.85	0.77	1.11
196.4	7.44	5.00	7.70	1.98	0.26	8.54	0.92	1.10
202.4	7.14	5.00	7.40	1.98	0.26	8.24	0.92	1.10
208.4	6.84	5.00	7.10	1.98	0.26	7.94	0.94	1.10
214.4	6.54	5.00	6.80	1.98	0.26	7.62	0.94	1.08
220.4	6.24	5.00	6.50	1.98	0.26	7.29	0.94	1.05
226.4	5.94	5.00	6.18	1.98	0.24	6.92	0.95	0.98
253.8	4.12	6.66	4.36	2.19	0.24	4.36	0.89	0.24
Maximum				**2.19**	**0.47**		**1.18**	**1.13**
Minimum				**1.07**	**0.24**		**0.77**	**0.24**

As shown in Table 5, the velocities in the channel have significantly reduced because of the placement of check dams. For reference, a profile of the check dam scenario has been attached to Appendix B.

3.2 Onsite Area

The site is proposed to be graded in the west-east direction. Based on grading plan, the site will be divided into 8 basins as shown on **Figure 6**. The building roof is assumed to be clean water and will drain uncontrolled into realigned Watercourse #2 (most southern basin – i.e. Basin 7). Therefore, the roof and Basin 7 will remain uncontrolled for this site.

Basins 1 to 6 will each have a rain garden with an overflow that directs any excess runoff into the minor system, see section **3.2.1**. Stormwater will be conveyed through the minor system to a downstream storage chamber and be controlled downstream to realigned Watercourse #2. downstream. The pre-development control rate will be reduced to account for direct discharge from the building roof and Basin 7 runoff.

A summary of the 200-year runoff generated from each basin is shown below in Table 6.

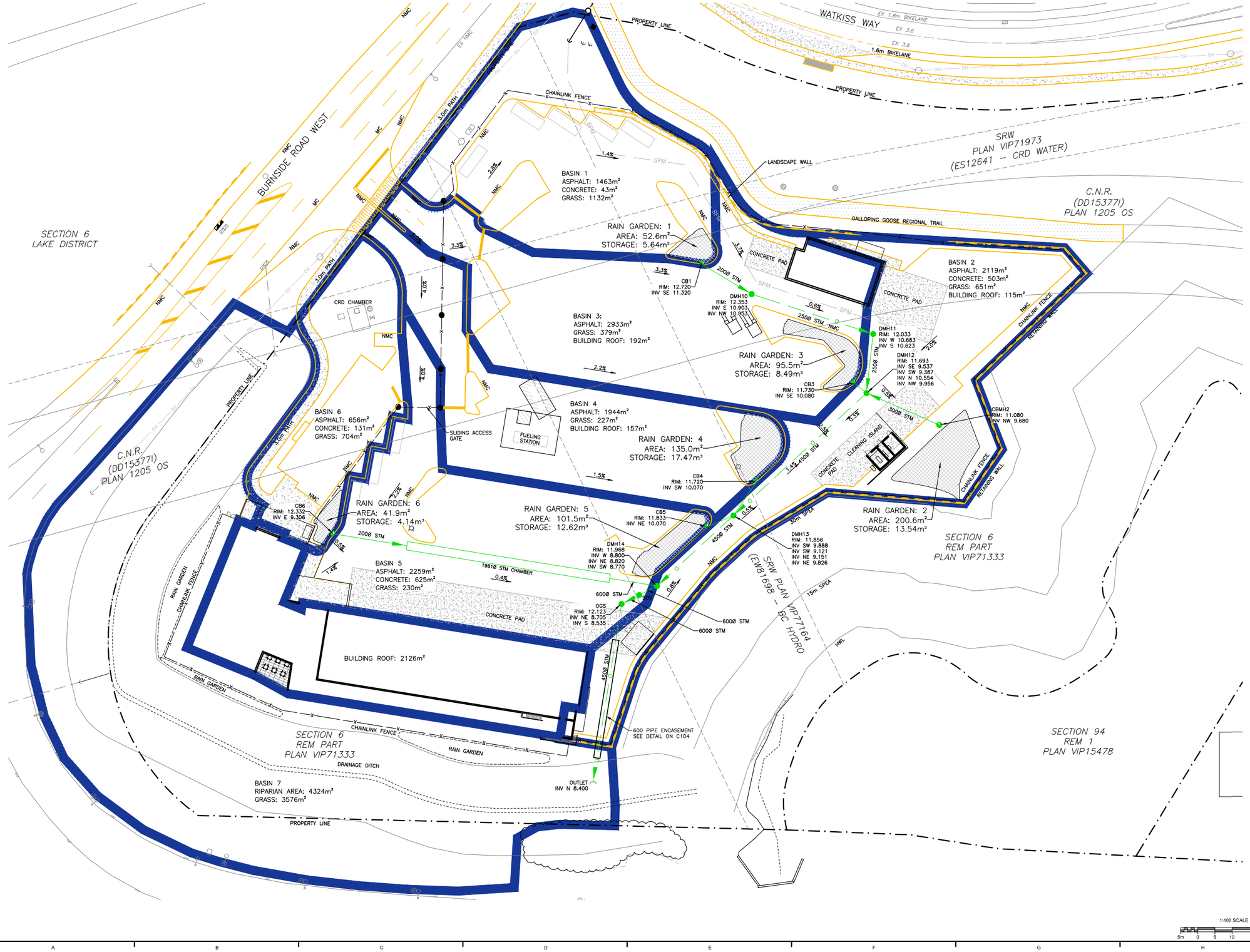
Table 6: Post-Development Flow Summary

	Roof	Paved	Landscaped	Gravel	Total Area (m^2)	Weighted Runoff Coefficient	200-Year Runoff (L/s)
Runoff Coefficient	1.0	0.9	0.3	0.5			
Basin	**Area (m^2)**						
1	0	1506	1132	0	2,638	0.64	41.53
2	115	2622	651	0	3,388	0.79	65.43
3	192	2933	379	0	3,504	0.84	72.17
4	157	1944	227	0	2,328	0.85	48.4
5	0	2884	230	0	3,114	0.86	65.3
6	0	787	704	0	1,491	0.62	22.5
(Building)	2126	0	0	0	2,126	1.00	52.1
7	0	0	7735	0	7,735	0.30	56.9
Total					**26,324**		**424**

The total runoff from post-development is approximately 424 L/s, almost double the amount at pre-development stage. As discussed in Section 2.2, the total pre-development flow rate was 204.7 L/s from the existing site. Since Basin 7 and the roof discharge directly into Watercourse #2, the new control rate has been reduced from 204.7 to 95.7 L/s (204.7 - (52.1+56.9)).

3.2.1 Minor System Design

The minor system has been sized for the subject area using the flows from Table 6. The minor system has been sized using 1 in 200-year rainfall intensity and the storm basin areas are illustrated on **Figure 6**. The proposed minor system design is summarized in Table 7 below.



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D'AMBROSIO
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GOLDER
MEMBER OF WSP

NOT FOR CONSTRUCTION

All dimensions in Metric

REV	DESCRIPTION	YYYY-MM-DD
C	Issued For Tender Package 2	2021-07-05
B	Issued For 50% Design Review	2021-04-27
A	Issued For 30% Design Review	2021-03-15

STAMPS

BCTransit

CLIENT:
BC TRANSIT

PROJECT:
VICTORIA handyDART CENTRE

STORMWATER MANAGMENT PLAN

SCALE:

PROJECT NO.
201919500

FIGURE 6

REV
C

DATE:
2021/07/26

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Last Saved: 07/2021 8:47 AM by NFitzpatrick

Table 7: Minor System Design

Manhole Number From	Manhole Number To	Area Number	Incremental Area (ha)	Cumulative Area (ha)	Release Rate (L/s/ha)	200 year Incremental Flow (L/s)	200 Year Cummulative Flow (L/s)	U/S Rim Elevation (m)	D/S Rim Elevation (m)	U/S Invert Elevation (m)	D/S Invert Elevation (m)	U/S Invert Elevation - adjusted for future settlement (m)	D/S Invert Elevation - adjusted for future settlement (m)	Drop (m)	Pipe Length (m)	Pipe Slope (%)	Std Pipe Diameter (mm)	Inside Pipe Diameter (m)	Pipe Roughness (Manning's n)	Pipe Velocity (m/s)	Pipe Capacity (L/s)	% Full	U/S Cover (m)	D/S Cover (m)
CB 1	DMH10	B1	0.26	0.26	N/A	41.5	41.5	12.720	12.353	11.320	10.953	11.320	10.953	0.050	13.678	2.68%	200	0.200	0.011	2.02	63.5	65%	1.2	1.2
DMH10	DMH11		0.00	0.26	N/A	0.0	41.5	12.353	12.033	10.903	10.733	10.903	10.683	0.010	29.903	0.74%	250	0.250	0.011	1.23	60.3	69%	1.2	1.1
DMH11	DMH12		0.00	0.26	N/A	0.0	41.5	12.033	11.693	10.673	10.554	10.673	10.554	1.167	13.884	0.86%	250	0.250	0.011	1.33	65.1	64%	1.1	0.9
CB3	DMH12	B3	0.35	0.35	N/A	72.2	72.2	11.730	11.693	10.080	10.006	10.080	9.956	0.569	3.707	3.35%	250	0.250	0.011	2.62	128.5	56%	1.4	1.5
CBMH2	DMH12	B2	0.34	0.34	N/A	65.4	65.4	11.080	11.693	9.680	9.587	9.680	9.537	0.150	18.570	0.77%	300	0.300	0.011	1.42	100.3	65%	1.1	1.9
DMH12	DMH13		0.00	0.95	N/A	0.0	179.1	11.693	11.856	9.387	9.201	9.387	9.151	0.030	42.263	0.56%	450	0.450	0.011	1.58	251.8	71%	1.9	2.3
CB4	DMH13	B4	0.23	0.23	N/A	48.4	48.4	11.720	11.856	10.070	9.876	10.070	9.826	0.705	9.705	2.51%	250	0.250	0.011	2.27	111.4	43%	1.4	1.8
CB5	DMH13	B5	0.31	0.31	N/A	65.3	65.3	11.833	11.856	10.070	9.938	10.070	9.888	0.767	6.595	2.76%	250	0.250	0.011	2.38	116.8	56%	1.5	1.7
DMH13	DMH14		0.00	1.50	N/A	0.0	292.8	11.856	11.968	9.121	8.870	9.121	8.820	0.050	24.294	1.24%	450	0.450	0.011	2.36	375.1	78%	2.3	2.7
CB6	Chamber (U/S)	B6	0.15	0.15	N/A	22.5	22.5	12.332	12.300	9.256	8.910	9.306	8.910	0.000	17.303	2.29%	200	0.200	0.011	1.87	58.6	38%	2.8	3.2
Chamber (US)	Chamber (D/S)		0.00	0.15	N/A	0.0	22.5	12.300	12.000	8.910	8.860	8.910	8.860	0.000	48.000	0.10%	Storage Chamber						3.4	3.1
Chamber (D/S)	DMH14		0.00	0.15	N/A	0.0	22.5	12.000	11.968	8.860	8.850	8.860	8.800	0.030	11.202	0.54%	600	0.600	0.011	1.88	531.1	4%	2.5	2.6
																							0.0	0.0
ONSITE ALLOWABLE RELEASE RATE TO MATCH PRE-DEVELOPMENT CONDITIONS IS CALCULATED TO BE 58.14 L/s. A 196mmØ ORIFICE PLATE ON DMH13 OUTLET IS REQUIRED. UNDERGROUND STORAGE = 50m³																								
DMH14	OGS		0.00	1.65	58.14	0.0	95.7	11.968	12.123	8.770	8.705	8.770	8.705	0.120	9.292	0.70%	600	0.600	0.011	2.15	606.9	16%	2.6	2.8
OGS	OUTFAL		0.00	1.65	58.14	0.0	95.7	12.123	9.345	8.535	8.400	8.585	8.400		42.078	0.44%	450	0.450	0.011	1.40	223.4	43%	3.1	0.5

3.2.2 Major System Design

Generally, the major drainage will be conveyed by the parking lot and ultimately discharge into the rain gardens. A total of 6 rain gardens are proposed on this site and the storage available at each is shown below.

Table 8: Post-Development Flow Summary

Rain Garden #	RG Elevation (m)	Spill Elevation (m)	Available Storage (m^3)
Basin 1	12.62	12.72	5.6
Basin 2	11.00	11.08	13.5
Basin 3	11.58	11.73	8.5
Basin 4	11.50	11.65	17.5
Basin 5	11.66	11.83	12.6
Basin 6	12.20	12.30	4.1
Total			**61.9**

When rain gardens are full, the runoff will then overflow to the minor system and ultimately to the storage chamber downstream. An inlet control orifice will be installed downstream of the storage chamber to control the flow from the site to the pre-development condition. A 196 mm diameter orifice is proposed and will control the flow to 95.7 L/s as discussed at the beginning of Section **3.2**. Assigning a control rate of 95.7 L/s and utilizing the Type 1A SCS Distribution, the total required storage to be detained on this site is 111.6 m^3. Some of this volume will be stored in the rain gardens (61.9 m^3) and the remaining will be stored in the storage chamber downstream (49.7 m^3). Storage and orifice sizing calculations are provided in Appendix C.

4. STORMWATER QUALITY

Stormwater from the hard surfaced areas will be conveyed and infiltrated into the rain gardens for water quality improvement. The raingardens are sized to provide capacity for the 2-year event treatment. During an event greater than the 2-year return period, the drainage will spill into the onsite catch basins which will convey it into the underground storage chamber which discharges to the Oil and Grit Separator before releasing to Craigflower Creek.

4.1 Rain Gardens

These will be designed with an organic rich growing medium and will biologically filter runoff. Each rain garden will include an under-drain that will collect water that infiltrates through the soil. The existing site conditions do not allow for a significant amount of groundwater recharge. The rain gardens will clean the runoff, cooling the water and slowing down the delivery of the water to Craigflower Creek. Overflow catch basin will be located adjacent to the rain gardens, so the under-drains are connected to the system and to collect overflow drainage. Rain garden and planting details will be provided by the Landscape Architect.

4.2 Oil And Grit Separator

The OGS will provide the required treatment for all rain events greater than the 2-year event. This unit will act as the final form of treatment for the drainage prior entering the watercourse.

As per MMDC design guidelines, oil and grit separators are required for sites with 50 or more parking stalls and OGS's are to be installed onsite.

Based on the site drainage area and hard surfaces, a CDS 2020-5 was recommended by Contech Eng. Solutions to meet the typical stormwater quality sediment removal requirements. The predicted Net Annual Load Removal Efficiency based on the Contech sizing report was approximately 82%. The report is attached to Appendix D. The proposed unit exceeds the minimum

5. EROSION AND SEDIMENT CONTROL

This section identifies potential erosion and sedimentation concerns that may arise during the construction stage. This report focuses on the construction activities for rough grading, advance ground settlement program, and the installation of onsite subgrade gravels and offsite landscape. Recommendations for controls of any problems in view of Best Management Practices regarding erosion control are to be provided.

5.1 Overview

The proposed earthworks program is divided in to two separate areas.

The first area includes all the offsite work which includes Watkiss Way improvements and the GGRT realignment and related landscape work. The extend of this work encroaches into the north part of the site. The total area for the offsite work 0.64 hectares.

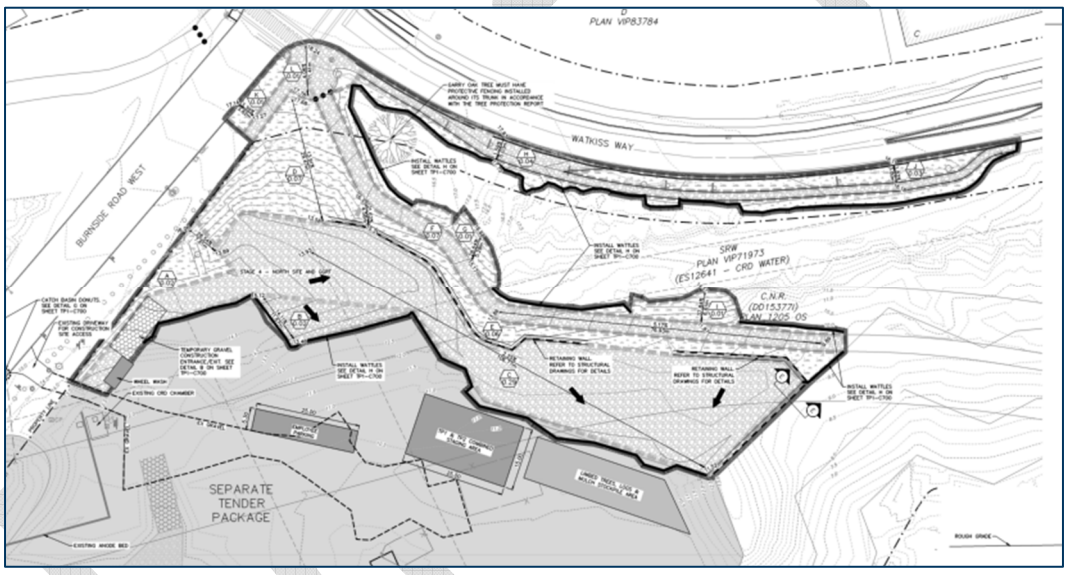


Figure 7: Offsite ESC Area

The second area includes the onsite work, it is comprised of the Watercourse #1 realignment, the advance soil settlement for the site stabilization and related landscape work. The total area for this work is 2.29 hectares. It is divided in three stages:

Stage 1: It includes the realignment of Watercourse #2, southwest area of the site earthworks and the temporary crossing of the existing Watercourse #2. Watercourse #2 drainage transition is to be completed in a specific sequence to allow for soil establishment. Stage 1 work is to be subdivided in 3 areas. These areas are identified in the rough grading and watercourse realignment drawings. Area 2 is the first step and includes the site access and most of the watercourse earthworks; Area 3 is the tie-to existing at the Craigflower Creek side and will be completed after Area 2 is done; the last area to be completed is Area 1, it includes the drainage transition from existing Watercourse #2 to the realigned channel, it requires to transition drainage on increments (e.g. 30%, 60%, 100%) to prevent any impact on the newly stabilized

watercourse bed. All work shall be completed under the direction of the Biologist and Landscape Architect and in accordance with provincial and federal permits and approvals.

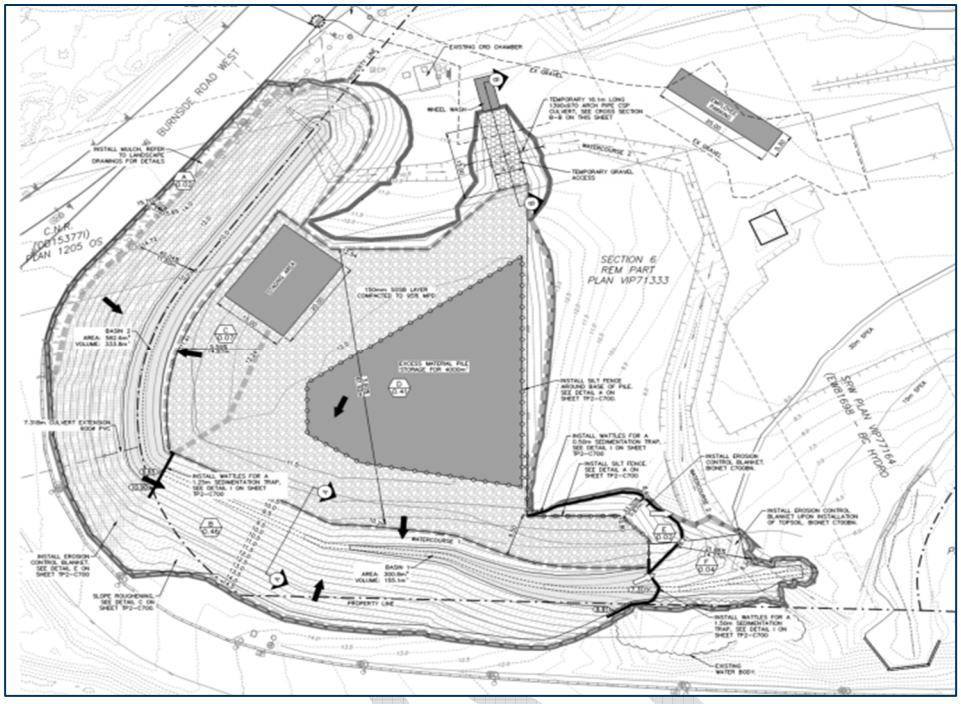


Figure 8: Onsite ESC Stage 1 Area

Stage 2: Includes the filling and decommissioning of the existing Watercourse #2, site leveling for the installation of the wick drain, and drainage layer installation for the advance soil settlement works.

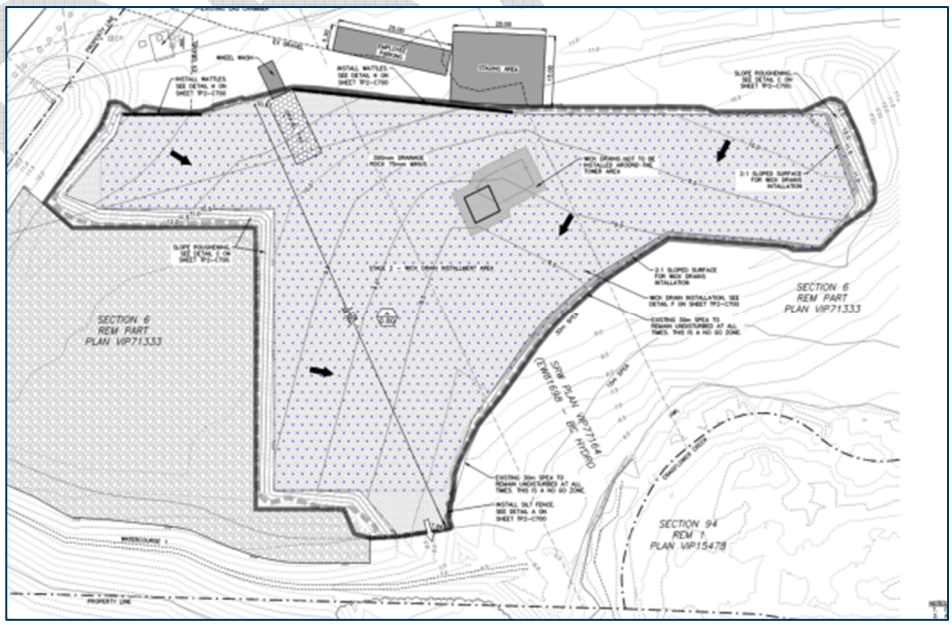


Figure 9: Onsite ESC Stage 2 Area

Stage 3: It includes the remaining portion of the site and the Stage 2 areas combined. On this stage the site will be raised to the proposed finished grade elevations and will be stabilized so it can remain undisturbed for a minimum of four months while preloading occurs. The contractor will be required to inspect and maintain the installed controls for the entire duration of the site preloading.

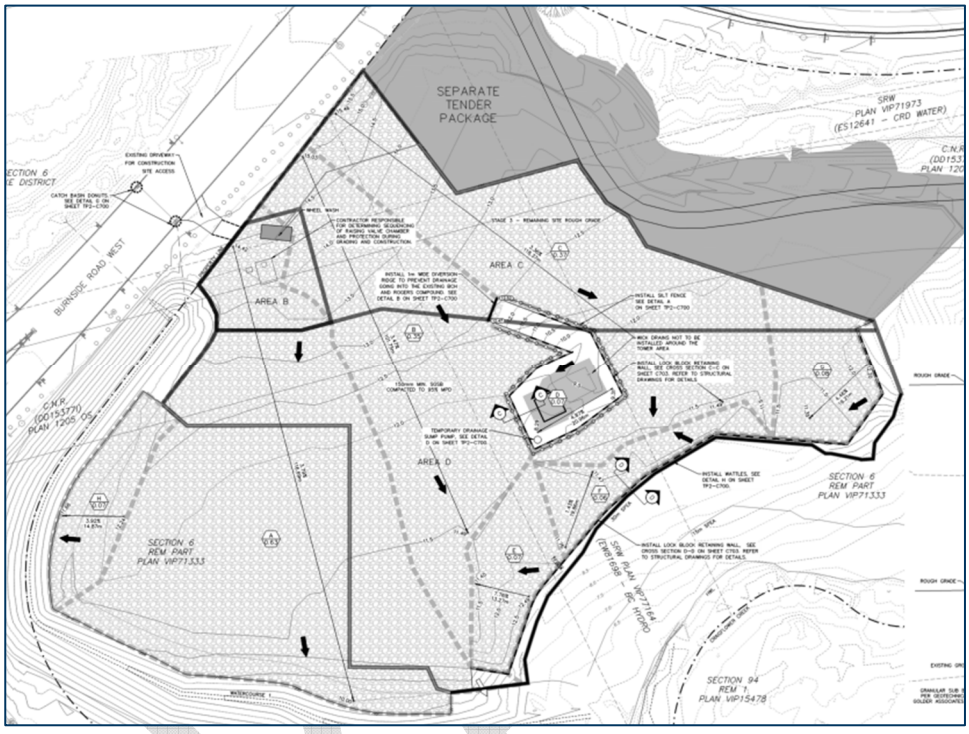


Figure 10: Onsite ESC Stage 3 Area

Future construction stages do not include extensive earthworks activities, therefore the application of standard best practices is anticipated to adequately address ESC concerns. ESC practices are to be maintained by the contractor during all stages, including application of good housekeeping practices identified in section **5.3**.

For additional information please refer to section 6.6 of the Construction Environmental Management Plan (CEMP), prepared by Stantec dated June 2, 2021.

5.2 Proposed Erosion and Sediment Controls

All proposed ESC are to be inspected and maintained regularly by the contactor and an environmental monitor. Proper documentation will be provided to the BC Transit representative as required.

5.2.1 Temporary Gravel Construction Entrance/Exit

The gravel entrance/exit will be installed in combination with a wheel wash to prevent mud tracking of flowing of sediment on to the adjacent municipal roads.

Temporary gravel construction entrance/exist shall be inspected for mud accumulation and reinstated as needed.

5.2.2 Wheel Wash

Wheel washes are primarily installed on muddy and potentially problematic sites to remove the dirt and mud from the truck tires prior to leaving site. This process helps to avoid tracking dirt and mud onto the adjacent roadways.

A mechanical unit shall be provided by the contractor at the site access/egress point for the construction trucks to drive through before to entering the municipal roads. Wheel Wash operation details shall be provided by the contractor identifying operation and maintenance requirements.

5.2.3 Catch Basin Donut

Catch basin donuts are a sediment control device that is installed on top of the catch basin to collect the silt and sediments, while allowing water to pass through freely. These are to be installed as ultimate line of defense to prevent any silt leaving the site to enter the existing municipal storm system.

These devices are to be installed on all existing CBs on the municipal roads adjacent to the site.

5.2.4 Silt Fence

Silt fence are effective to direct drainage into sediment control facilities and to prevent lose sediment to leave the construction site or enter waterways. These are also used to trap sediment around control devices, trapping sediment at the erosion source.

Silt fences are to be installed along the downstream edges of the construction activity, at lower property lines and within the site adjacent to SPEA zones. Adequate implementation of silt fences should be confirmed in the field, inspected and maintained regularly.

5.2.5 Surface Roughening

Surface roughening refers to the practice of roughening the surface of unestablished earth surface (bare soil) by tracking with construction equipment. This slows water runoff which does reduce erosion, but this tool on its own is not a full stabilization method and needs to be combined with others controls that provide soil cover.

Surface roughening is proposed for moderate slopes to a maximum gradient of 3:1. It is to be implemented as needed, in combination with other ESC methods and it shall be reinstated prior to the topsoil installation.

5.2.6 Sedimentation Trap

These traps are one of the most effective and reliable measures for treating sediment-laden runoff from construction sites. These structures are typically placed near the perimeter of the

site, where flows concentrate in swales, ditches, or other low areas. Sediment traps and basins should be constructed prior to disturbance of upslope areas and continue functioning until the contributing drainage area is fully stabilized.

Sedimentation traps will be implemented for the watercourse realignment work to prevent any sediment entering the Craigflower Creek and its SPEA.

5.2.7 Wattles

Wattles are materials designed and installed to control sediment at construction sites, thus preventing sediments from moving into waterbodies or waterways. Proper installation of wattles can reduce the rate of soil erosion, control sediment on site, reduce stormwater runoff velocity, and also promote water quality.

Wattles will be used to for sedimentation traps and to reduces run-off velocity on slopes ≥30%.

5.2.8 Erosion Control Blanket (ECB)

An erosion control blanket is a preformed protective blanket of plastic fibers, straw or other plant residue designed to protect soil from the impact of precipitation and overland flow and retain moisture to facilitate establishment of vegetation.

ECB shall be installed on slopes ≥30%, these shall be placed on top of the topsoil under the directions of the Landscape Architect.

5.2.9 Mulching

Mulching is a rapid stabilization technique to protect the soil surface from the forces of raindrop impact. It also conserves moisture, retains warmth, reduces run-off and erosion, prevents soil crusting and promotes vegetation establishment. Mulching for erosion control is a short to mid term treatment. It can be used in combination with a seed and fertilizer program.

Mulching is proposed for landscape areas with slopes ≤30%. On this development, all trees that are to be removed but not be used as logs on the proposed watercourse landscape, shall be sheared to be used as mulch. Mulching details and installation rates will be provided by the Landscape Architect.

5.3 ESC Requirements

Detailed Erosion and Sediment Control Plans are provided for Offsite and Onsite works, refer to Appendix E. Drawings included are:

- TP2-C700 ESC NOTES AND DETAILS
- TP2-C701 ESC STAGE 1 (ONSITE)
- TP2-C702 ESC STAGE 2 (ONSITE)
- TP2-C703 ESC STAGE 3 (ONSITE)
- ESC-TP1 (OFFSITE)

5.3.1 General ESC Requirements

- Erosion control measures are to be inspected every 7 days and following storm events (>10mm in 24hrs) and repaired or replaced, and cleaned as necessary.
- The contractor shall maintain existing public roads, temporary haul roads and ingress and egress from the site clean.
- The contractor must control dust and maintain road surfaces daily or at frequent intervals depending on the weather or traffic and as required by the town's engineer.
- The contractor is responsible for keeping all erosion and sedimentation control inspection records on site at all times.
- The contractor must contain hauled material in the vehicles, broom off loose debris from truck boxes and hitches, keep routes clear of mud, fallen rock and debris that are a result of the construction operations.
- All storm drainage and inlet devices adjacent to the construction site shall be equipped with silt trap features. Remove sediment after each storm event.
- If there is no development within 30 days after stripping and grading the areas shall be covered with a 150mm layer of SGSB to prevent erosion.
- Contractor will be responsible for removing all erosion control measures after the construction is complete.
- The contractor should not strip or expose soils or sub-soils in an unnecessary manner and should plan construction with consideration to avoid exposing soils and sub-soils to erosion.
- Potential clean run-on storm water from outside the construction boundary into the construction areas should be temporarily directed to non-disturbed areas by means of temporary berms, dikes or any other approved method.
- Due to relative low site gradient and construction phasing, the proposed main means of avoiding erosion of exposed soils is through the use of erosion control blankets on exposed soils during rain events or snow melt events. The contractor is responsible for adequately reviewing the weather forecast and enacting plans to avoid soil erosion.
- Silt fencing is the last protection resource to avoid sediment to leave the site. The contractor is responsible for applying all erosion prevention measures on this plan first and foremost.

5.3.2 Good Housekeeping Practices

- Proper placement and protection of stockpile soils and materials. Placement of materials on a municipal road or where wind/water could transport material off-site is prohibited.
- Stockpiles are to be properly placed and protected on site so material will not be eroded to off-site areas, including storm inlets and watercourses.
- Control of mud track out during construction, usually by means of a well-maintained construction entrance/exit on all access locations, supplemented with periodic street sweeping if required.
- Dust control must be implemented on site, when required.
- Down-gradient perimeter protection (such as silt fence, sediment traps or fiber rolls) to protect off-site areas from stormwater runoff and sedimentation during construction.

- Temporary sediment control at any storm inlets requires prior written approval from the town. For most sites, the only location where inlet protection would be approved is directly adjacent to a gravel pad or stockpile. Failure to obtain approval can lead to fines under local bylaws.

APPENDIX A: Culvert Master Calculations

Culvert Calculator Report
100 Year Event through Ex Culvert

Solve For: Discharge

Culvert Summary					
Allowable HW Elevation	3.00	m	Headwater Depth/Height	3.28	
Computed Headwater Eleva	3.00	m	Discharge	0.8897	m³/s
Inlet Control HW Elev.	3.00	m	Tailwater Elevation	0.30	m
Outlet Control HW Elev.	2.80	m	Control Type	Inlet Control	

Grades					
Upstream Invert	1.00	m	Downstream Invert	0.00	m
Length	20.00	m	Constructed Slope	0.050000	m/m

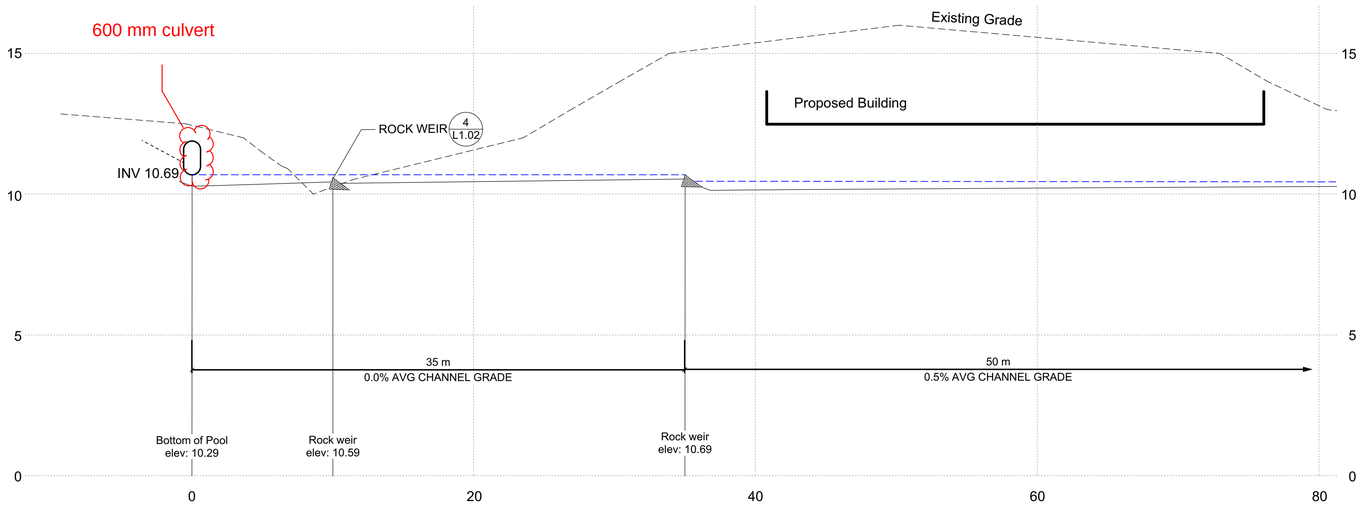
Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.57	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.57	m
Velocity Downstream	3.12	m/s	Critical Slope	0.056835	m/m

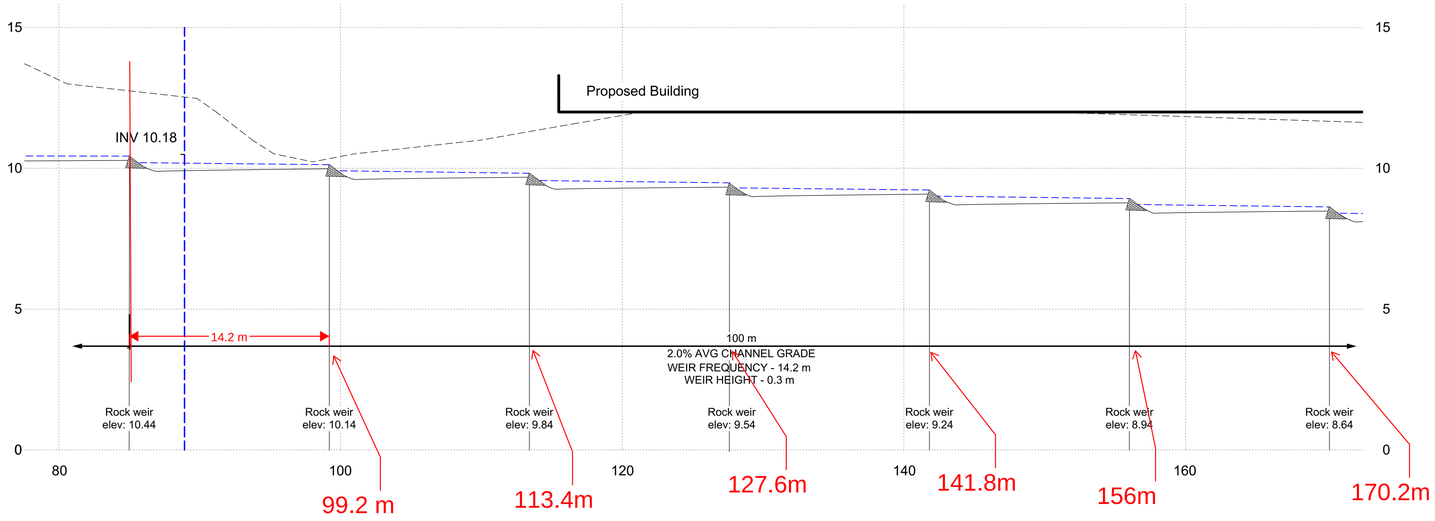
Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	Aluminum		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

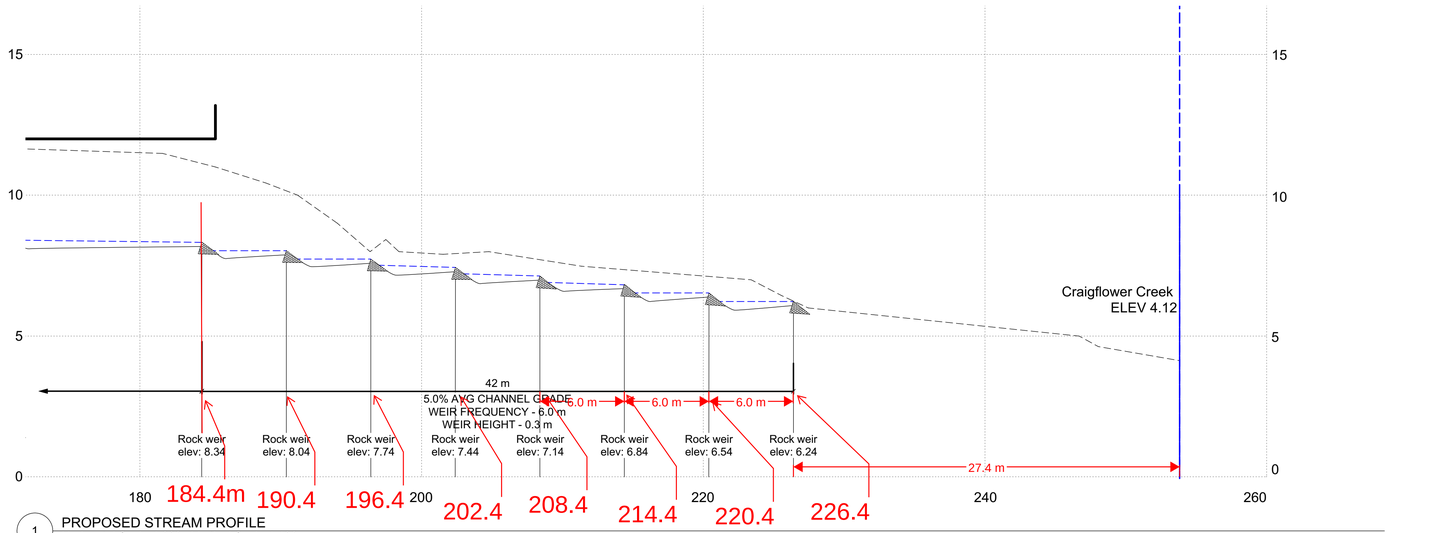
Outlet Control Properties					
Outlet Control HW Elev.	2.80	m	Upstream Velocity Head	0.47	m
Ke	0.90		Entrance Loss	0.43	m

Inlet Control Properties					
Inlet Control HW Elev.	3.00	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

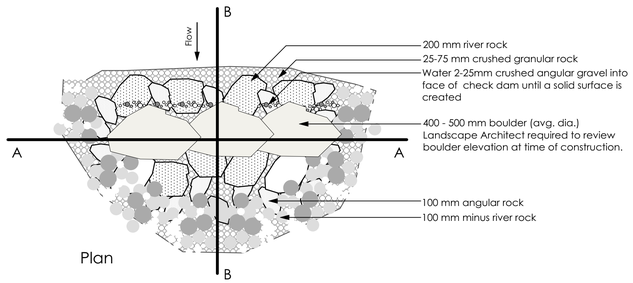
APPENDIX B: Watercourse #2 Design Details



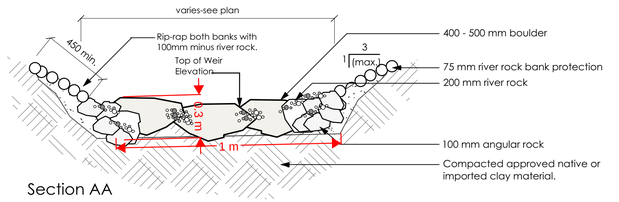




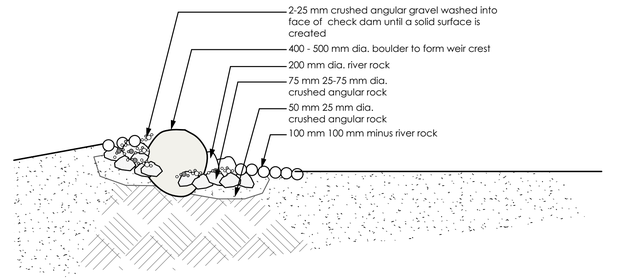
1 PROPOSED STREAM PROFILE
Horizontal Scale 1:200 Vertical Scale 1:100



Plan



Section AA



Section BB

4 ROCK WEIR DETAIL
Scale: 1:25

1	-	dd/mm/yyyy
rev no	description	date

Murdoch de Greeff INC
Landscape Planning & Design
200 - 524 Culduthel Road
Victoria, BC V8Z 1G1
Phone: 250.412-2891
Fax: 250.412-2892

12/1/2020

client
CLIENT
CLIENT ADDRESS
CITY, PROVINCE

project
PROJECT NAME
ADDRESS
CITY, PROVINCE

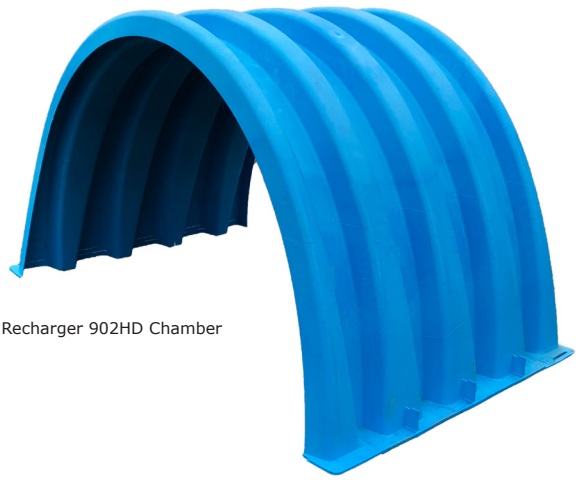
sheet title
Stream Profile

project no.	1##.##
scale	1:500 @ 24"x36"
drawn by	MDI
checked by	SM/PdG
revison no.	1
sheet no.	**L1.02**

APPENDIX C: Storage Chamber & Orifice Sizing Calculations

CULTEC Recharger® 902HD Stormwater Chamber

The Recharger® 902HD is a 48" (1219 mm) tall, high capacity chamber. Typically when using this model, fewer chambers are required resulting in less labor and a smaller installation area. The Recharger® 902HD has the side portal internal manifold feature. HVLV® FC-48 Feed Connectors are inserted into the side portals to create the internal manifold.



Recharger 902HD Chamber

Recharger 902HD End Cap

Recharger 902HD Chamber	
Size (L x W x H)	4.25' x 78" x 48" 1.30 m x 1981 mm x 1219 mm
Installed Length	3.67' 1.12 m
Length Adjustment per Row - with two end caps installed	1.03' 0.31 m
Length Adjustment per Row - when not using end caps	0.58' 0.18 m
Chamber Storage	17.31 ft^3/ft 1.61 m^3/m 63.47 ft^3/unit 1.80 m^3/unit
Min. Installed Storage	27.06 ft^3/ft 2.53 m^3/m 99.28 ft^3/unit 2.81 m^3/unit
Min. Area Required	26.58 ft^2 2.47 m^2
Chamber Weight	83.0 lbs 37.65 kg
Shipping	15 chambers/skid 1,370 lbs/skid 14 skids/48' flatbed
Min. Center-to-Center Spacing	7.25' 2.21 m
Max. Allowable Cover	8.3' 2.53 m
Max. Allowable O.D. in Side Portal	10" HDPE, 12" PVC 250 mm HDPE, 300 mm PVC
Compatible Feed Connector	HVLV FC-48 Feed Connector

Calculations are based on installed chamber length.
All above values are nominal.
Includes 12" (305 mm) stone above crown of chamber and typical stone surround at 7.25' (2.21 m) center-to-center spacing and stone foundation depth as listed in table.
Stone void calculated at 40%.

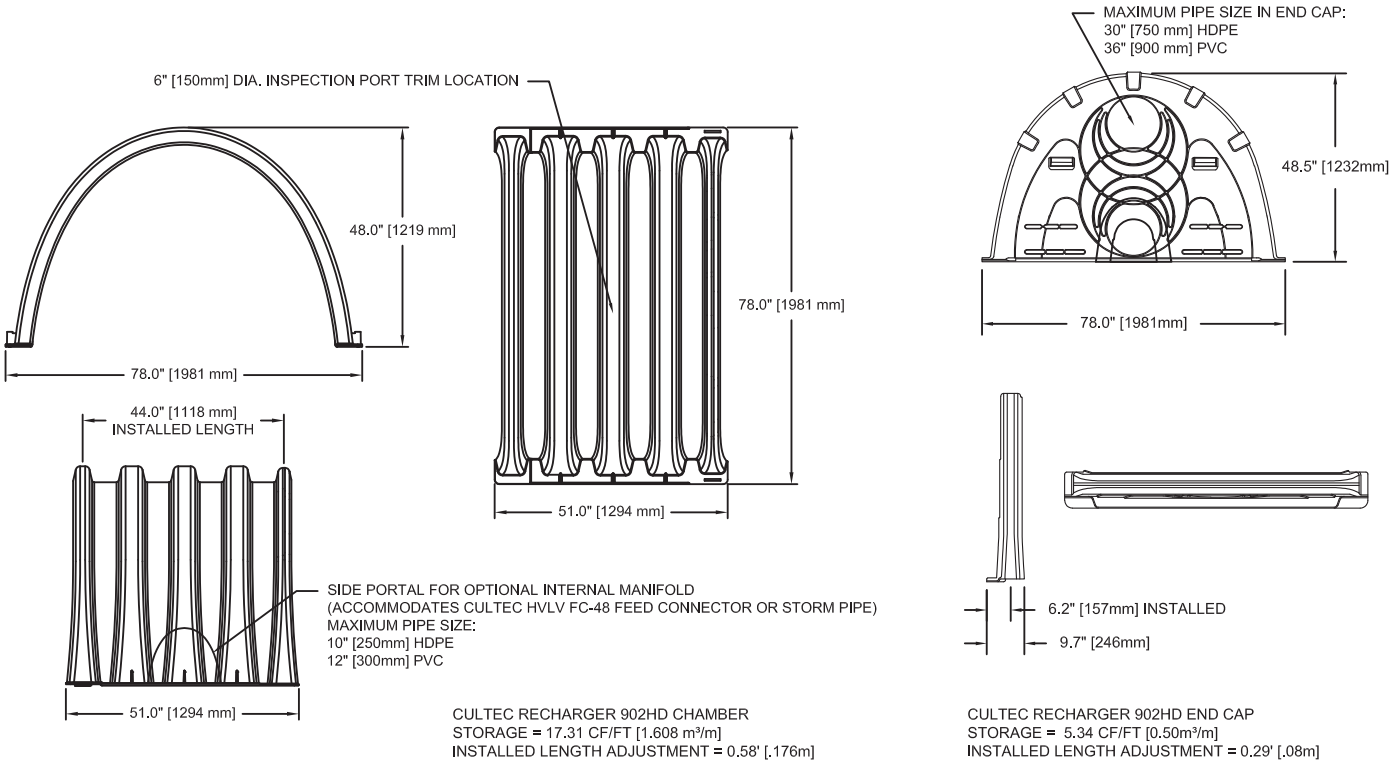
	Stone Foundation Depth		
	9" 229 mm	12" 305 mm	18" 457 mm
Chamber and Stone Storage Per Chamber	99.28 ft^3 2.81 m^3	101.94 ft^3 2.89 m^3	107.26 ft^3 3.04 m^3
Min. Effective Depth	5.75' 1.75 m	6.00' 1.83 m	6.5' 1.98 m
Stone Required Per Chamber	3.32 yd^3 2.54 m^3	3.56 yd^3 2.72 m^3	4.05 yd^3 3.06 m^3

Recharger 902HD End Cap	
Size (L x W x H)	9.7" x 78" x 48.5" 246 mm x 1982 mm x 1231 mm
Installed Length	6.2" 157 mm
End Cap Storage	5.34 ft^3/ft 0.50 m^3/m 2.76 ft^3/unit 0.08 m^3/unit
Min. Installed Storage	19.88 ft^3/ft 1.85 m^3/m 10.28 ft^3/unit 0.29 m^3/unit
End Cap Weight	52.0 lbs 23.59 kg
Shipping	15 end caps/skid 905 lbs/skid 14 skids/48' flatbed
Max. Inlet Opening in End Cap	30" HDPE, 36" PVC 750 mm HDPE, 900 mm PVC

Calculations are based on installed chamber length.
All above values are nominal.
Min. installed storage includes 9" (229 mm) stone base, 12" (305 mm) stone above crown of chamber and typical stone surround at 7.25' (2.21 m) center-to-center spacing.

For more information, contact CULTEC at (203) 775-4416 or visit www.cultec.com.

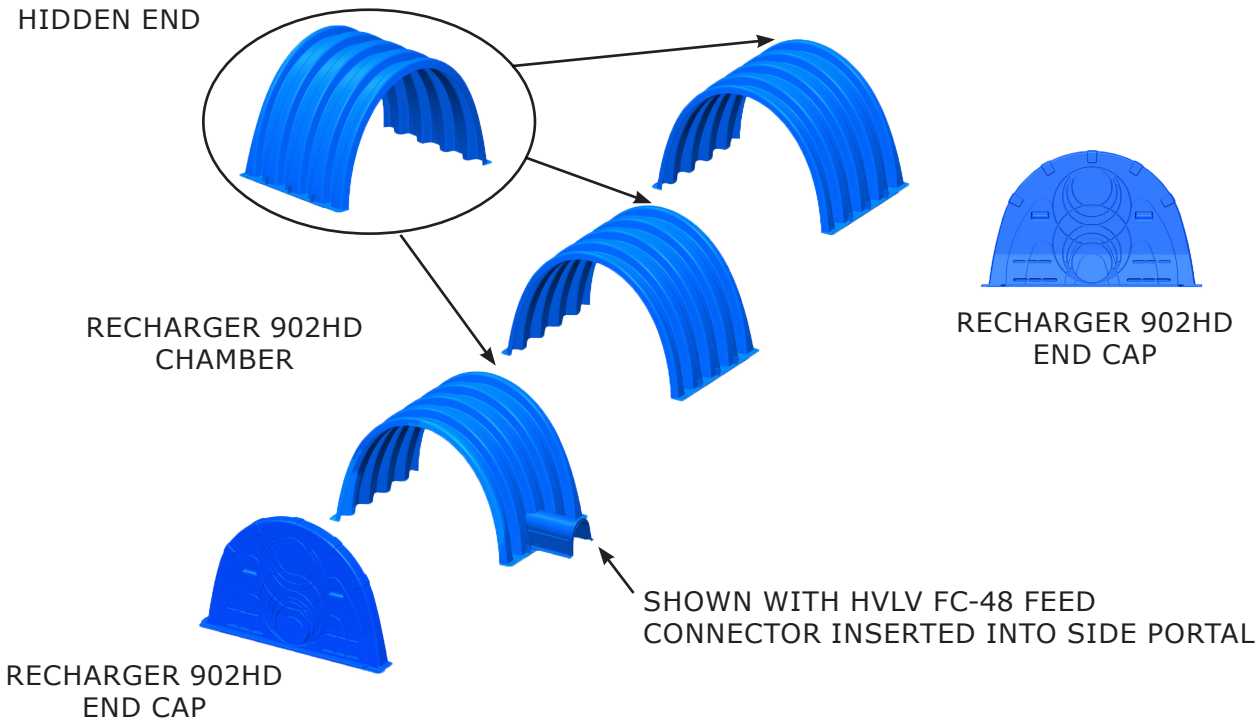
Three View Drawing



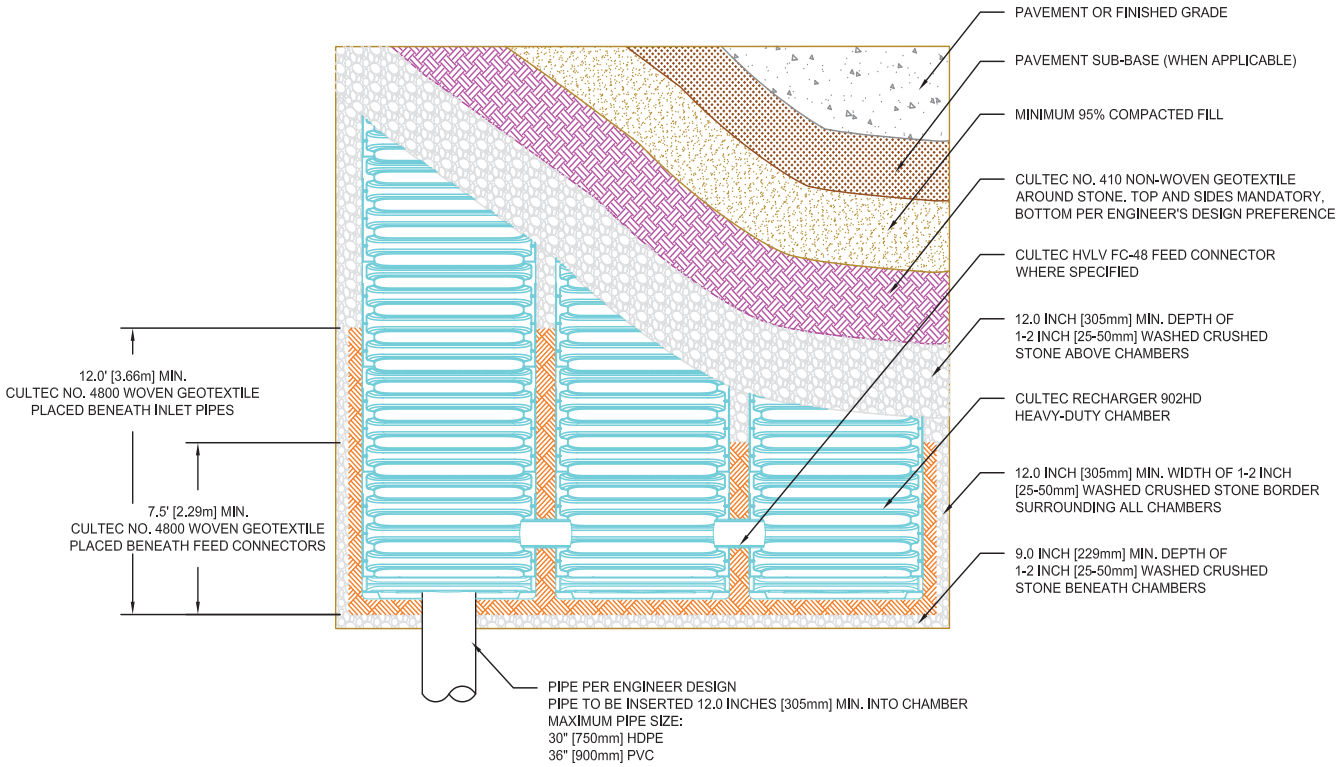
CULTEC RECHARGER 902HD CHAMBER
STORAGE = 17.31 CF/FT [1.608 m³/m]
INSTALLED LENGTH ADJUSTMENT = 0.58' [.176m]

CULTEC RECHARGER 902HD END CAP
STORAGE = 5.34 CF/FT [0.50m³/m]
INSTALLED LENGTH ADJUSTMENT = 0.29' [.08m]

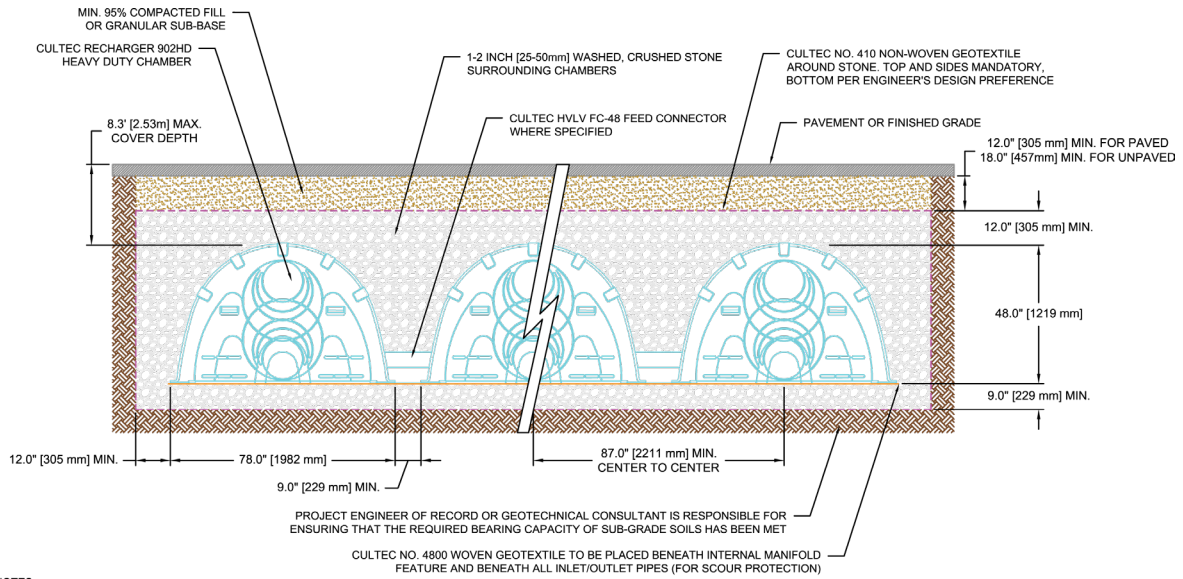
Typical Interlock Installation



Plan View Drawing



Typical Cross Section for Traffic Application



NOTES:

1. THE CHAMBERS SHALL BE DESIGNED AND TESTED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS." THE LOAD CONFIGURATION SHALL INCLUDE:
   - 1.a. INSTANTANEOUS AASHTO DESIGN TRUCK LIVE LOAD AT MINIMUM COVER
   - 1.b. MAXIMUM PERMANENT (50-YEAR) COVER LOAD
   - 1.c. 1-WEEK PARKED AASHTO DESIGN TRUCK LOAD
2. THE CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F3430-20 "STANDARD SPECIFICATION FOR CELLULAR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS"
3. THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE RESISTANCE TO THE LOADS AND LOAD FACTORS AS DEFINED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12, WHEN INSTALLED ACCORDING TO CULTEC'S RECOMMENDED INSTALLATION INSTRUCTIONS. THE STRUCTURAL DESIGN OF THE CHAMBERS SHALL INCLUDE THE FOLLOWING:
   - 3.a. THE CREEP MODULUS SHALL BE 50-YEAR AS SPECIFIED IN ASTM F3430
   - 3.b. THE MINIMUM SAFETY FACTOR FOR LIVE LOADS SHALL BE 1.75
   - 3.c. THE MINIMUM SAFETY FACTOR FOR DEAD LOADS SHALL BE 1.95

For more information, contact CULTEC at (203) 775-4416 or visit www.cultec.com.

Recharger® 902HD Bare Chamber Storage Volumes

Elevation		Incremental Storage Volume				Cumulative Storage	
in.	mm	ft³/ft	m³/m	ft³	m³	ft³	m³
48	1219	0.020	0.002	0.073	0.002	63.470	1.797
47	1194	0.050	0.005	0.183	0.005	63.397	1.795
46	1168	0.070	0.007	0.257	0.007	63.213	1.790
45	1143	0.120	0.011	0.440	0.012	62.957	1.783
44	1118	0.160	0.015	0.587	0.017	62.517	1.770
43	1092	0.200	0.019	0.733	0.021	61.930	1.754
42	1067	0.220	0.020	0.807	0.023	61.197	1.733
41	1041	0.240	0.022	0.880	0.025	60.390	1.710
40	1016	0.270	0.025	0.990	0.028	59.510	1.685
39	991	0.270	0.025	0.990	0.028	58.520	1.657
38	965	0.290	0.027	1.063	0.030	57.530	1.629
37	940	0.300	0.028	1.100	0.031	56.467	1.599
36	914	0.310	0.029	1.137	0.032	55.367	1.568
35	889	0.330	0.031	1.210	0.034	54.230	1.536
34	864	0.340	0.032	1.247	0.035	53.020	1.502
33	838	0.350	0.033	1.283	0.036	51.773	1.466
32	813	0.350	0.033	1.283	0.036	50.490	1.430
31	787	0.360	0.033	1.320	0.037	49.207	1.394
30	762	0.370	0.034	1.357	0.038	47.887	1.356
29	737	0.380	0.035	1.393	0.039	46.530	1.318
28	711	0.390	0.036	1.430	0.040	45.137	1.278
27	686	0.390	0.036	1.430	0.040	43.707	1.238
26	660	0.400	0.037	1.467	0.042	42.277	1.197
25	635	0.400	0.037	1.467	0.042	40.810	1.156
24	610	0.410	0.038	1.503	0.043	39.343	1.114
23	584	0.410	0.038	1.503	0.043	37.840	1.072
22	559	0.410	0.038	1.503	0.043	36.337	1.029
21	533	0.420	0.039	1.540	0.044	34.833	0.986
20	508	0.420	0.039	1.540	0.044	33.293	0.943
19	483	0.420	0.039	1.540	0.044	31.753	0.899
18	457	0.430	0.040	1.577	0.045	30.213	0.856
17	432	0.430	0.040	1.577	0.045	28.637	0.811
16	406	0.440	0.041	1.613	0.046	27.060	0.766
15	381	0.440	0.041	1.613	0.046	25.447	0.721
14	356	0.450	0.042	1.650	0.047	23.833	0.675
13	330	0.450	0.042	1.650	0.047	22.183	0.628
12	305	0.450	0.042	1.650	0.047	20.533	0.582
11	279	0.450	0.042	1.650	0.047	18.883	0.535
10	254	0.460	0.043	1.687	0.048	17.233	0.488
9	229	0.460	0.043	1.687	0.048	15.547	0.440
8	203	0.460	0.043	1.687	0.048	13.860	0.393
7	178	0.460	0.043	1.687	0.048	12.173	0.345
6	152	0.470	0.044	1.723	0.049	10.487	0.297
5	127	0.470	0.044	1.723	0.049	8.763	0.248
4	102	0.480	0.045	1.760	0.050	7.040	0.199
3	76	0.480	0.045	1.760	0.050	5.280	0.150
2	51	0.480	0.045	1.760	0.050	3.520	0.100
1	25	0.480	0.045	1.760	0.050	1.760	0.050
Total		**17.310**	**1.608**	**63.470**	**1.797**	**63.470**	**1.797**

Calculations are based on installed chamber length of 3.67' (1.12 m).

Recharger® 902HD Bare End Cap Storage Volumes

Elevation		Incremental Storage Volume				Cumulative Storage	
in.	mm	ft³/ft	m³/m	ft³	m³	ft³	m³
48	1219	0.039	0.004	0.020	0.0006	2.758	0.0781
47	1194	0.058	0.005	0.030	0.0008	2.738	0.0775
46	1168	0.058	0.005	0.030	0.0008	2.780	0.0767
45	1143	0.077	0.007	0.040	0.0011	2.678	0.0758
44	1118	0.097	0.009	0.050	0.0014	2.638	0.0747
43	1092	0.077	0.007	0.040	0.0011	2.588	0.0733
42	1067	0.097	0.009	0.050	0.0014	2.548	0.0722
41	1041	0.097	0.009	0.050	0.0014	2.498	0.0707
40	1016	0.097	0.009	0.050	0.0014	2.448	0.0693
39	991	0.097	0.009	0.050	0.0014	2.398	0.0679
38	965	0.097	0.009	0.050	0.0014	2.348	0.0665
37	940	0.116	0.011	0.060	0.0017	2.299	0.0651
36	914	0.097	0.009	0.050	0.0014	2.239	0.0634
35	889	0.097	0.009	0.050	0.0014	2.189	0.0620
34	864	0.116	0.011	0.060	0.0017	2.139	0.0606
33	838	0.097	0.009	0.050	0.0014	2.079	0.0589
32	813	0.097	0.009	0.050	0.0014	2.029	0.0574
31	787	0.116	0.011	0.060	0.0017	1.979	0.0560
30	762	0.097	0.009	0.050	0.0014	1.919	0.0543
29	737	0.135	0.013	0.070	0.0020	1.869	0.0529
28	711	0.097	0.009	0.050	0.0014	1.799	0.0509
27	686	0.116	0.011	0.060	0.0017	1.749	0.0495
26	660	0.116	0.011	0.060	0.0017	1.689	0.0478
25	635	0.097	0.009	0.050	0.0014	1.629	0.0461
24	609	0.116	0.011	0.060	0.0017	1.579	0.0447
23	584	0.116	0.011	0.060	0.0017	1.519	0.0430
22	559	0.135	0.013	0.070	0.0020	1.459	0.0413
21	533	0.116	0.011	0.060	0.0017	1.389	0.0393
20	508	0.116	0.011	0.060	0.0017	1.329	0.0376
19	483	0.116	0.011	0.060	0.0017	1.269	0.0359
18	457	0.116	0.011	0.060	0.0017	1.209	0.0342
17	432	0.116	0.011	0.060	0.0017	1.149	0.0325
16	406	0.135	0.013	0.070	0.0020	1.089	0.0308
15	381	0.116	0.011	0.060	0.0017	1.019	0.0289
14	356	0.116	0.011	0.060	0.0017	0.959	0.0272
13	330	0.116	0.011	0.060	0.0017	0.899	0.0255
12	305	0.135	0.013	0.070	0.0020	0.839	0.0238
11	279	0.116	0.011	0.060	0.0017	0.770	0.0218
10	254	0.135	0.013	0.070	0.0020	0.710	0.0201
9	229	0.135	0.013	0.070	0.0020	0.640	0.0181
8	203	0.135	0.013	0.070	0.0020	0.570	0.0161
7	178	0.135	0.013	0.070	0.0020	0.500	0.0141
6	152	0.116	0.011	0.060	0.0017	0.430	0.0122
5	127	0.135	0.013	0.070	0.0020	0.370	0.0105
4	102	0.135	0.013	0.070	0.0020	0.300	0.0085
3	76	0.155	0.014	0.080	0.0023	0.230	0.0065
2	51	0.135	0.013	0.070	0.0020	0.150	0.0042
1	25	0.155	0.014	0.080	0.0023	0.080	0.0023
Total		**5.338**	**0.496**	**2.758**	**0.0781**	**2.758**	**0.0781**

Calculations are based on installed chamber length of 6.2" (157 mm).

CULTEC Recharger® 902HD Specifications

GENERAL

CULTEC Recharger® 902HD chambers are designed for underground stormwater management. The chambers may be used for retention, recharging, detention or controlling the flow of on-site stormwater runoff.

CHAMBER PARAMETERS

1. The chambers shall be manufactured in the U.S.A. or Canada by CULTEC, Inc. of Brookfield, CT (cultec.com, 203-775-4416).
2. The chambers shall be designed and tested in accordance with ASTM F2787 "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers". The load configuration shall include:
    a. Instantaneous AASHTO Design Truck live load at minimum cover
    b. Maximum permanent (50-year) cover load
    c. 1-week parked AASHTO design truck load
3. The chambers shall meet the requirements of ASTM F3430-20 "Standard Specification for Cellular Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers".
4. The installed chamber system shall provide resistance to the loads and load factors as defined in the AASHTO LRFD Bridge Design Specifications Section 12.12, when installed according to CULTEC's recommended installation instructions. The structural design of the chambers shall include the following:
    a. The Creep Modulus shall be 50-year as specified in ASTM F3430
    b. The minimum safety factor for live loads shall be 1.75
    c. The minimum safety factor for dead loads shall be 1.95
5. The chamber shall be structural foam injection molded of blue virgin high molecular weight impact-modified polypropylene.
6. The chamber shall be arched in shape.
7. The chamber shall be open-bottomed.
8. The chamber shall be joined using an interlocking overlapping rib method. Connections must be fully shouldered overlapping ribs, having no separate couplings.
9. The nominal chamber dimensions of the CULTEC Recharger® 902HD shall be 48 inches (1219 mm) tall, 78 inches (1981 mm) wide and 4.25 feet (1.30 m) long. The installed length of a joined Recharger 902HD shall be 3.67 feet (1.12 m).
10. Multiple chambers may be connected to form different length rows. Each row shall begin and end with a separately formed CULTEC Recharger® 902HD End Cap. Maximum inlet opening on the end cap is 30 inches (750 mm) HDPE or 36 inches (900 mm) PVC.
11. The chamber shall have two side portals to accept CULTEC HVLV™ FC-48 Feed Connectors to create an internal manifold. Maximum allowable pipe size in the side portal is 10 inches (250 mm) HDPE and 12 inches (300 mm) PVC.
12. The nominal chamber dimensions of the CULTEC HVLV™ FC-48 Feed Connector shall be 12 inches (305 mm) tall, 16 inches (406 mm) wide and 49 inches (1245 mm) long.
13. The nominal storage volume of the Recharger 902HD chamber shall be 17.31 ft^3 / ft (1.61 m^3 / m) - without stone. The nominal storage volume of a joined Recharger 902HD shall be 63.47 ft^3 / unit (1.80 m^3 / unit) - without stone.
14. The nominal storage volume of the HVLV™ FC-48 Feed Connector shall be 0.913 ft^3 / ft (0.085 m^3 / m) - without stone.
15. The Recharger 902HD chamber shall have 5 corrugations.
16. The chamber shall be capable of accepting a 6 inch (150 mm) inspection port opening at the top center of each chamber, centered on the corrugation crest.
17. The units may be trimmed to custom lengths by cutting back to any corrugation.
18. The chamber shall be manufactured in a facility employing CULTEC's Quality Control and Assurance Procedures.
19. Maximum allowable cover over the top of the chamber shall be 8.3 feet (2.53 m).

END CAP PARAMETERS

1. The CULTEC Recharger® 902HD End Cap (referred to as 'end cap') shall be manufactured in the U.S.A. by CULTEC, Inc. of Brookfield, CT (cultec.com, 203-775-4416).
2. The end cap shall be twin-sheet thermoformed of virgin high molecular weight polyethylene.
3. The end cap shall be joined at the beginning and end of each row of chambers using an interlocking overlapping rib method. Connections must be fully shouldered overlapping ribs, having no separate couplings.
4. The nominal dimensions of the end cap shall be 48.5 inches (1231 mm) tall, 78 inches (1982 mm) wide and 9.7 inches (246 mm) long. When joined with a Recharger 902HD Chamber, the installed length of the end cap shall be 6.2 inches (157 mm).
5. The nominal storage volume of the end cap shall be 5.34 ft^3 / ft (0.50 m^3 / m) - without stone. The nominal storage volume of an interlocked end cap shall be 2.76 ft^3 / unit (0.08 m^3 / unit) - without stone.
6. Maximum inlet opening on the end cap is 30 inches (750 mm) HDPE or 36 inches (900 mm) PVC.
7. The end cap shall provide resistance to the loads and load factors as defined in the AASHTO LRFD Bridge Design Specifications Section 12.12.

Orifice Calculator at DMH14

	Input Cell
	Output cell

Data

Highest Water Level (m) -HWL	10.22
Invert of outlet pipe(m)	8.97
Pipe Diameter	0.45
H = Head from HWL to Orifice Centerline (m)	**1.02**
Site Area (ha)	1.6
Maximum Allowable Rate (L/s/ha)	58.14
Q = Orifice Flow Rate (m^3/s)	**0.093**
C = Discharge Coefficient	**0.65**
g = Gravitaional Constant (m/s^2)	9.81

Orifice Diameter (mm)	**196**

Assumed Radius (m)	Center line Head H (m)	Area of Orifice A (m2)	Calculated Radius (m)	Assumed-Calculated
0.097902752	**1.151097248**	**0.030114534**	**0.097906863**	**4.11123E-06**

APPENDIX D: Oil Grit Separator (OGS) Unit Report

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON AN AVERAGE PARTICLE SIZE OF 50 MICRONS
Craigflower Creek
View Royal,BC

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

Area	1.6	ha	Rainfall Station #	21	
Weighted C	0.78		(select from Rainfall Data column D)		
Tc	6	minutes (assumed)	Particle size	50	microns
CDS Model	2020	(select from pulldown)	CDS Treatment Capacity	31.2	l/s
			CDS Hydraulic Capacity	396.5	l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	16.2%	16.2%	1.7	1.7	5.6	95.3	15.4
1.0	17.2%	33.4%	3.5	3.5	11.1	93.4	16.1
1.5	14.8%	48.2%	5.2	5.2	16.7	91.5	13.6
2.0	12.3%	60.5%	6.9	6.9	22.3	89.6	11.0
2.5	9.5%	70.0%	8.7	8.7	27.8	87.7	8.3
3.0	7.4%	77.4%	10.4	10.4	33.4	85.8	6.4
3.5	4.8%	82.3%	12.1	12.1	39.0	83.9	4.1
4.0	4.5%	86.8%	13.9	13.9	44.5	82.0	3.7
4.5	3.4%	90.2%	15.6	15.6	50.1	80.1	2.7
5.0	2.4%	92.6%	17.3	17.3	55.7	78.3	1.9
6.0	3.5%	96.1%	20.8	20.8	66.8	74.5	2.6
7.0	2.0%	98.1%	24.3	24.3	78.0	70.7	1.4
8.0	1.0%	99.1%	27.8	27.8	89.1	66.9	0.7
9.0	0.4%	99.5%	31.2	31.2	100.0	63.0	0.2
10.0	0.2%	99.7%	34.7	31.2	100.0	56.7	0.1
15.0	0.3%	100.0%	52.0	31.2	100.0	37.8	0.1
20.0	0.0%	100.0%	69.4	31.2	100.0	28.4	0.0
0.0	0.0%	100.0%	0.0	0.0	0.0	#DIV/0!	0.0
0.0	0.0%	100.0%	0.0	0.0	0.0	#DIV/0!	0.0
0.0	0.0%	100.0%	0.0	0.0	0.0	#DIV/0!	0.0
							88.3
						Removal Efficiency Adjustment[2] =	6.5%
						Predicted % Annual Rainfall Treated =	93.4%
						Predicted Net Annual Load Removal Efficiency =	**81.9%**

1 - Based on 42 years of hourly rainfall data from Canadian Station 1018620, Victoria BC (Airport)
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

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QUOTATION 20236

Quote Date 06-Jul-21
Expiry Date 05-Aug-21
Salesperson BR

Quoted to:

MORRISON HERSFIELD

Ship to:

VIEW ROYAL, B.C.
VANCOUVER ISLAND

Cust No.	Terms	Ship Via	F.O.B.	PO Number	Customer Phone
26322	Net 30 Days		Kon Kast		

Qty Ordered	Item	Description	Weight (lb)	Unit	Tax	Price	Total
1	9998	CDS Oil/Grit Separator CDS 2020-5 c/w fiberglass & stainless steel internals, tabs & inserts, all precast, castings & cores * Note: Unit does not include any sorbent pac packs.		Each	P	23900.000	23900.00
1	4142	DELIVERY - COMMON CARRIER NOTE: Please allow up to 4 weeks lead time for manufacture of internals * NOTE: We pre-asemble the CDS units, paint on match lines & number each piece & disassemble prior to shipping. We pre-drill the holes for the inserts & the inserts & tabs are installed on site, after the internals are in place * ** Freight rate is included & is based on truck & trailer load access to site. Off loaded by customer ** Customer is responsible to verify that type & quantity of material on quote meets job requirements ** All taxes are extra			P	2575.000	2575.00

PST Number:

Order Weight(lbs):

Total Quote 26475.00

CONTECH ENGINEERED SOLUTIONS

Parameter Brief

The CDS® Unit for Removal of Oil and Grease

The CDS system is a hydrodynamic separator which uses patented continuous deflective separation (CDS) technology to separate and trap debris, sediment and oil and grease from stormwater runoff. Indirect screening allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls separate captured solids and minimize resuspension of previously captured pollutants.

Oil and grease (O&G) are commonly found in stormwater runoff from automobiles and associated anthropogenic activities. O&G appear in many different forms in stormwater runoff: free, dissolved, emulsified, and attached to sediments. Total Petroleum Hydrocarbons (TPH) is the usual analytical measure of fuels, oil and grease (O&G) for stormwater. Typically the concentrations of TPH associated with runoff from streets and parking lots range from 2.7 to 27 mg/l (FHWA, 1996). The Oregon Association of Clean Water Agencies (ACWA) reports O&G levels for runoff from different land uses for the period of 1991 – 1996, as shown in Table 1.

Table 1. O&G levels from different land uses.

Land Use	Median (mg/L)	Range (mg/L)
Residential	1.2	ND - 12.6
Commercial	2.4	ND – 18
Industrial	2.0	ND – 107.6 (12 mg/l next highest)
Mixed	1.0	ND –28

CDS units can be equipped with a conventional oil baffle to capture and retain oil, grease, and other TPH pollutant as they are transported through the storm drain system during wet weather (stormwater) and dry weather (spills) flows. In addition, CDS units with the addition of oil sorbents can ensure the permanent removal of the free oil and grease from stormwater runoff. Laboratory investigations into the CDS unit's removal of oils and greases are summarized below.

Laboratory Studies – CDS Unit at Portland State University, 2003

In 2003, Slominski and Wells at Portland State University conducted tests on a CDS Model 20_20 unit equipped with a 2400 micron screen and oil baffle. Tests were conducted at 25, 50 and 75 percent of the unit's hydraulic capacity (500 gpm) for the removal of used motor oil with influent concentrations of 10, 25 and 50 mg/L. A summary of the test is shown in Table 2 (Slominski and Wells, 2003).

Table 2. Summary of oil and grease tests (Slominski and Wells, 2003).

Flow Rate (gpm)	Influent Conc. (mg/L)	Average Effluent Conc. (mg/L)	Removal Efficiency (%)
125	7.2	3.5	51
125	18.3	1.5	92
125	46.2	3.5	92
250	9.9	2	80
250	22.8	5	78
250	45.6	7.5	84
375	10.5	7.5	29
375	21.9	16	27
375	46.9	27	42

Laboratory Studies – CDS Unit Oil Spill Test at Portland State University, 2003

In addition to the regular capture test performed to measure the removal of free oil and grease from stormwater, Slominski and Wells (2003) also performed an oil spill test. The unit performed extremely well in the oil spill test, with the peak oil concentration in the effluent occurring right as the addition of oil to the unit stopped. This showed a capture rate of more than 99.75% of the oil dumped into the unit (82,000 mg/L). This demonstrates that a CDS unit would be a very effective means of containing an oil spill. An oil storage capacity chart for the CDS unit is available on request.

Laboratory Study – CDS Unit with Sorbents at University of California, Los Angeles (UCLA)

Studies by Stenstrom and Lau (1998) at UCLA demonstrated that the CDS unit with sorbents can achieve 80 to 90 percent removal of oil and grease at influent concentrations ranging from 13.6 mg/L to 41.1 mg/L. Test results showed that the effluent oil and grease concentrations were less than 10 mg/L.

A series of nine laboratory experiments were performed on a CDS unit (Model PMSU20_15) to determine its ability to remove free oil and grease using sorbents (Stenstrom and Lau, 1998). One control experiment was performed without sorbents. The focus of this study was to evaluate the effectiveness of various sorbent materials to control the typically low concentrations of free oil and grease found in urban stormwater runoff when applied within the separation chamber of a CDS unit. The conventional oil baffle was not installed within the CDS unit during this evaluation. The sorbents were allowed to float on the surface of the separation chamber of the CDS device. Different amounts of each sorbent were used because of the varying properties of the sorbents (density and surface area).

Tests were performed using a 2400-micron screen over 30 minutes at 125 gpm (approximately 40% of the CDS unit's nominal flow capacity). Used motor oil (Specific Gravity = 0.86) was introduced into the feed of the CDS at approximately 25 mg/L, which is generally the upper limit of oil and grease concentrations found in stormwater runoff. Oil and grease were measured at various times (influent/effluent) to determine the

removal efficiency. Background oil and grease was measured as well as oil and grease released from the sorbents after the influent oil and grease was reduced to zero.

Five commercially available sorbents were evaluated. Two sorbents were found particularly effective and they are:

- OARS™ (AbTech Industries, 4110N. Scottsdale Rd., Suite 235, Scottsdale, AZ 85251)
- Rubberizer™ (Haz-Mat Response Technologies, Inc., 4626 Santa Fe Street, San Diego, CA 92109)

Results from the sorbent laboratory study (Stenstrom and Lau, 1998) are shown in Table 3.

Table 3. Performance of Oil and Grease Removal of CDS Units.

Test No.	Sorbent Type	Sorbent Mass (g)	Influent (mg/L)	Effluent (mg/L)	Percent Removal	Flow (gpm)
2	OARS	2600	19.6	2.7	86	125
3	OARS	2600	24.0	4.3	82	190
4	OARS	2600	30.7	1.7	94	75
5	OARS	2600	21.0	3.5	83	125
6	Rubberizer	1030	27.2	3.9	86	125

Effluent concentration of oil using the OARS™ sorbent was less than 1.0 mg/L. Effluent concentration of oil using the Rubberizer™ sorbent was 1.96 mg/L.

References:

Federal Highway Association. (1996). Evaluation and Management of Highway Runoff Water Quality. Publication No. FHWA-PD-96-032.

Slominski and Wells. (2003). Oil and Grease Removal using Continuous Deflection Separation with and Oil Baffle. Portland, Oregon: Author.

Stenstrom, M. K. and Sim-Lin Lau. (1998). Oil and Grease Removal by Floating Sorbent in a CDS Device. Los Angeles.

Technical Manual

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Introduction

ClearTec Rubberizer® Overview

ClearTec Global is the manufacturer and distributor of the Rubberizer® Product Line, the Only Fully Sorbent Solidifier™ that transforms spilled hydrocarbons into a rubber-like solid on contact. Rubberizer® is EPA approved as a sorbent due to ClearTec Global's Trade Secret and non-chemical sorption and solidification process. It is used throughout the world and is patented in 22 countries.

ClearTec's revolutionary line of products have been used in oil spill clean-up and storm-water filtration operations around the world for 25 years. Our unique Rubberizer sorbent is formulated from modern non-toxic, non-hazardous polymers capable of high sorption efficiencies and will transform hydrocarbons into a rubber-like solid on contact, including:

- Gasoline
- Diesel Fuels
- Lube Oils
- Jet Fuel
- Transformer Oils
- Chlorinated Solvents
- Aromatic Solvents
- Hydraulic Oils
- Light Crudes

Product Highlights

- Works on land and water borne spills
- Does not release solidified oils under pressure
- Does not leach
- Remains buoyant
- Reduces clean-up time and overall costs
- Incinerates with less than .1% residual ash

Industry Applications:

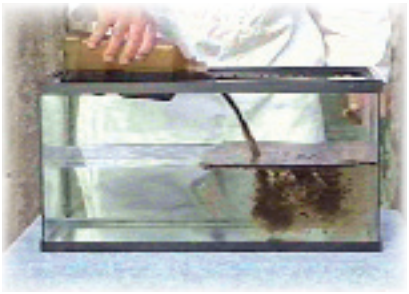
- Oil Spill Response
- Storm Water Filtration
- Marinas & Shipyards
- Heavy Industry & Manufacturing
- Secondary Containment
- Power Generation
- Transportation
- Airports
- Custom Filtration Applications

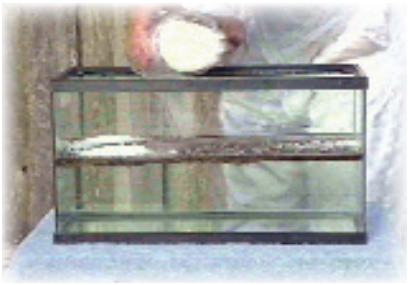
Product Overview

ClearTec Rubberizer® Particulate

ClearTec Rubberizer® Particulate is a mixture of hydrocarbon polymers plus additives resulting in a grainy material used primarily for cleanup operations where sweeping and shoveling are involved. It can also be used for clarification of various emulsions or solidification and removal of various petroleum-based slicks from the surface of water which is in a controlled state. One pound of this product will solidify into a rubber-like material up to 2/3 gallon of jet fuel, diesel, gasoline, transformer oil, hydraulic oils, light crudes and many other hydrocarbons. This product, (and the booms, pillows, and mats in which it is the filler), exhibit characteristics that include:

- **Light weight:** ClearTec Rubberizer® Particulate is made of a light weight polymer that enables rapid deployment and retrieval. It's apparent specific gravity is approximately 0.4.
- **Hydrophobic:** Rubberizer® has no affinity for water and will therefore not absorb it.
- **Permanently buoyant:** Rubberizer® remains buoyant both before and after sorption.
- **Leach Resistant:** Rubberizer® Particulate will not release sorbed and solidified liquids even under landfill pressures and will not leach solidified liquids upon aqueous contact.
- **Efficient:** ClearTec Rubberizer® has low volume increases of sorbed liquids (15% in lab tests, 25% in field applications).





Product Overview

ClearTec Rubberizer® Booms

ClearTec Rubberizer® Booms use the ClearTec Rubberizer® Particulate as a filler and have a 100% polypropylene tubular fabric encasement. Boom connectors are also provided for boom-to-boom linking and response for larger spills requiring multiple booms for containment and collection. ClearTec Rubberizer® Booms are multifunctional and can be used for mitigation on water while sorbing the spill. Once fully saturated, they continue to function as containment barriers and remain significantly above water level for maximum effectiveness. ClearTec Rubberizer® Booms are soft and conform well to textured surfaces enabling them to act as containment barriers on airport runways or vehicle roadways. Booms can also be used for bulk cleanup operations. ClearTec Rubberizer® Booms exhibit characteristics that include:

- **Single Waste Stream:** ClearTec Rubberizer® Booms contain, absorb, and solidify for easy disposal.
- **No Waste:** ClearTec Rubberizer® Booms saturate to the core and are the only Fully Sorbent Solidifier™ booms on the market.
- **Permanently Buoyant:** ClearTec Rubberizer® Booms remain buoyant even once fully sorbed and solidified.
- **Leach Resistant:** Once the booms sorb and solidify hydrocarbons (typically within 20 minutes), they are retrievable without loss of their contents caused by handling and the consequent dripping associated with other products on the market.
- **Versatile:** ClearTec Rubberizer® Booms are equally effective on land or water borne spills, and they are extremely effective at removing sheen from the surface of the water.

ClearTec Rubberizer® Boom Diameter	Hydrocarbon Sorbtion Capacity
1.5″	.15 gallons per linear foot
2.25″	1/4 gallons per linear foot
3.25″	2/3 gallons per linear foot
5″	1 gallon per linear foot

Product Overview

ClearTec Rubberizer® Pillows

ClearTec Rubberizer® Pillows are made with particulate as a filler and a 100% polypropylene fabric encasement. They can be used to catch drips and leaks, clean up large spill areas, or be placed in sumps for emulsion clarification. Standard size pillows are 12" by 12" and will sorb and solidify up to one gallon each. They exhibit characteristics that include:

- **Single Waste Stream:** ClearTec Rubberizer® Pillows contain, absorb and solidify which allows for easy disposal.
- **Permanently Buoyant:** ClearTec Rubberizer® Pillows remain buoyant even once hydrocarbons are fully sorbed and solidified.
- **Leach Resistant:** ClearTec Rubberizer® Pillows are retrievable without loss of their contents caused by handling and consequent dripping.
- **Versatile:** ClearTec Rubberizer® Pillows are equally effective on land or water borne spills.

ClearTec Rubberizer® Mats

The advantage of the ClearTec Rubberizer® Mat over a boom or pillow is the large surface areas which the mat covers. They can be used as sweeps for fuel pits or on puddles, lakes, rivers, bays, and other areas of pooling water with oil contamination problems. They are designed to absorb and solidify up to 3/4 gallon of hydrocarbons per square foot. They are constructed from high-strength fiberglass mesh screen and contain ClearTec Rubberizer® Filter Media as a filler. They are available in a variety of sizes and can be customized to fit virtually any situation. They exhibit characteristics that include:

- **Single Waste Stream:** ClearTec Rubberizer® Mats contain, absorb and solidify which allows for easy disposal.
- **Permanently Buoyant:** ClearTec Rubberizer® Mats remain buoyant even once hydrocarbons are fully sorbed and solidified.
- **Versatile:** ClearTec Rubberizer® Mats have ribbon loops so multiple mats can be tethered together to cover virtually any spill area.
- **Leach Resistant:** ClearTec Rubberizer® Mats are retrievable without loss of their contents caused by handling and consequent dripping.

ClearTec Rubberizer® Spill Kits

ClearTec Rubberizer® Spill Kits are designed to provide the oil spill response professional with the tools they need in an emergency. From a minor spill to a spill of 12 barrels or more, you can be assured that our kits will be fast, effective, and easy to deploy. Our spill kits typically include a combination of ClearTec Rubberizer® Booms, Mats and Particulate.

ClearTec Rubberizer® Tanker Spill Kits

These spill kits are packaged in large drums and are designed to help both crude and product tankers stay in compliance with OPA '90 regulations which are as follows:

Vessels UNDER 400 Feet LOA
- Required to have enough materials on board to clean up at least 7 barrels of hydrocarbons

Vessels OVER 400 Feet LOA
- Required to have enough materials on board to clean up at least 12 barrels of hydrocarbons

ClearTec Rubberizer® Emergency Spill Kits

We also offer a wide range of spill kits packaged in small plastic pails and collapsible bags in order to suit the following types of applications:

- Airport & Marina fueling stations
- Utility & transportation vehicles
- Industrial/manufacturing shop spills
- Bilge clean-up
- Construction sites
- Wrecking & ship yards

Customized Spill Kits To Fit Virtually Any Application

Rubberizer® Filter Media

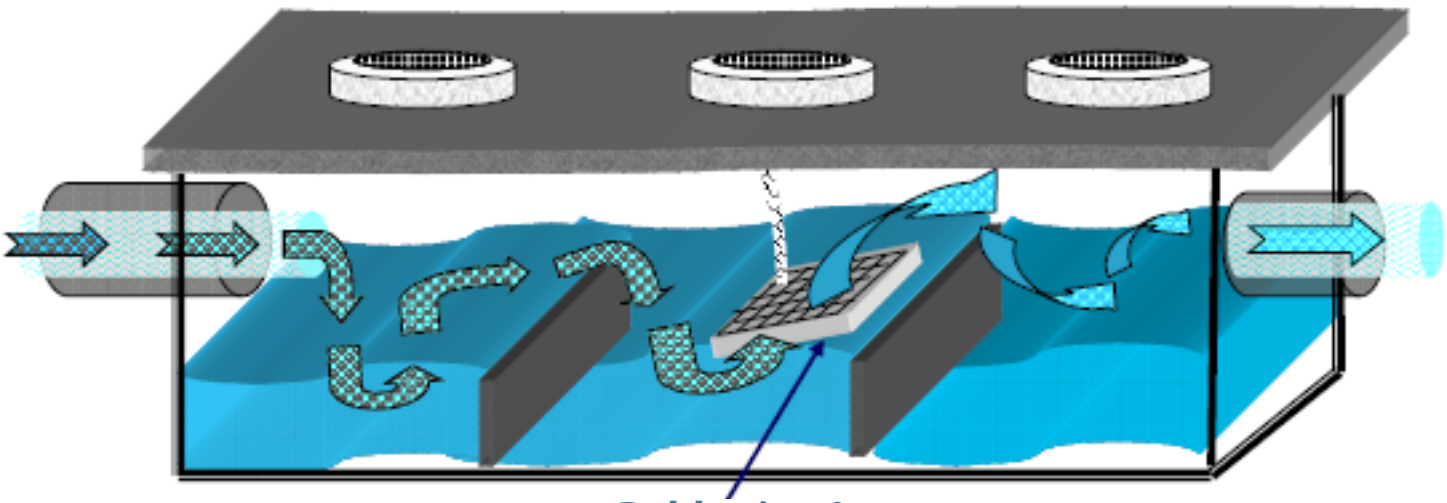
Overview

ClearTec Rubberizer® patented products are available in a variety of water treatment and filtration medias. They are making headway in filtration applications saving material costs, labor and disposal volume by as much as 75%. They are formulated from modern, non-toxic, non-hazardous polymers capable of very high sorption efficiencies. These products absorb and solidify a wide variety of fuels, oils, and chlorinated solvents including paraffins, BTEX, TCE, and PCBs.

Rubberizer® is exempt from CFR regulatory certification for spill response and licensing and can be placed in any California state waters. This illustrates Rubberizer's environmentally friendly nature. Much of this can be attributed to the relatively inert characteristics of the polymers and non-chemical nature of the solidification process. Laboratory sorption efficiencies of 500% (5 grams pollutant to 1 gram of Rubberizer®) are common for spill response type applications.

Filter media is available in fine (32-8), medium (8-4), and coarse (4-2) grades

Example Storm Vault Application



Rubberizer® Filter Media Performance Test

Test Background

A four inch diameter by four foot length tube with a fine screen across one end was erected vertically. The tube was placed above a catch basin which was filled with tap water. A small pump was used to circulate water from the catch basin to the top of the tube. A 500 ml separator funnel was erected above the top of the tube. The separator funnel was filled with napthenic lubricating oil 30.1/cSt at 40°C viscosity. The tube was filled on each run with Rubberizer® Filter Media to a depth of 42 inches. The initial water flow rate was set at approximately 6 liters/minute. The tests were run until the flow rate had been reduced to approximately 2 liters/minute. The input pressure at cessation was approximately .25 psi. The oil input rate was set at 4-5 drops per second (approximately 1/2 liter/hour.)

Results

The following table summarizers the results.

Media Size	Core Saturation Depth	Weight of Media	Volume of Oil Absorption	Weight of Oil Absorbed	% Efficiency
4 to 2 Mesh	16″	793 g	1160 mL	1056 g	133%
8 to 4 Mesh	10″	528 g	702 mL	640 g	121%
32 to 8 Mesh	8″	452 g	538 mL	490 g	108%

ClearTec's medium grade (8 to 4) filter media is the most popular as its uniform size allows water to pass through quickly as it absorbs hydrocarbons.

Solidification Capacity of ClearTec Rubberizer® Particulate

Experimental Procedure

The purpose of this experiment was to determine what quantity of ClearTec Rubberizer® Particulate was needed to solidify various fuels and industrial liquids to the point at which they would pass the EPA 50 PSI landfill pressure test. 8.1 ml, 12.2 ml, and 16.3 ml volumes of the liquids to be tested were transferred by pipette to a 50 ml Erienmeyer flask and stoppered with neoprene stoppers. These test samples were allowed to come to thermal equilibrium at 65° F. To each test sample, a weighed 3.0 gram sample of ClearTec Rubberizer® Particulate was added and agitated. The samples were allowed to stand for 21 hours at 65° F . The samples were than subjected to a pressure test in excess of 100 PSI. The results of this work are summarized in Table I below.

Table I
Pounds of Rubberizer® Particulate to Gallons of Test Liquids

Fuels	Results
Bunkers	1 pound sorbent to 2/3 gallon range
Jet Fuel	1 pound sorbent to 2/3 gallon range
Diesel	1 pound sorbent to 2/3 gallon range
Gasoline	1 pound sorbent to 2/3 gallon range
Oils	**Results**
Light Crudes	1 pound sorbent to 2/3 gallon range
Alphatic	1 pound sorbent to 1/2 gallon range
Aromatic	1 pound sorbent to 2/3 gallon range
Napthenic	1 pound sorbent to 1/2 gallon range
Cutting	1 pound sorbent to 2/3 gallon range
Transformer	1 pound sorbent to 2/3 gallon range
Motor (10w/40 unused)	1 pound sorbent to 1/2 gallon range
Chlorated Liquids	**Results**
Carbon Tetrachloride	1 pound sorbent to 2/3 gallon range
Chloroform	1 pound sorbent to 2/3 gallon range
Trichloroethane	1 pound sorbent to 2/3 gallon range
Tetrachloroethane	1 pound sorbent to 2/3 gallon range
Trichloroethelene	1 pound sorbent to 2/3 gallon range
Miscellaneous Liquids	**Results**
Benzene	1 pound sorbent to 2/3 gallon range
Toluene	1 pound sorbent to 2/3 gallon range
Xylene	1 pound sorbent to 2/3 gallon range
Hexane's (Mixture)	1 pound sorbent to 2/3 gallon range
Petroleum Ether	1 pound sorbent to 1/2 gallon range
Turpentine	1 pound sorbent to 2/3 gallon range

Leach & Extraction Laboratory Report

Leach Test

A solidified sample of diesel fuel representing one pound of ClearTec Rubberizer® Particulate to 2/3 gallon of diesel fuel was prepared by transferring 18.3 ml of diesel fuel by pipette into a 50 ml Erienmeyer flask and adding a weighed 3.0 gram sample of ClearTec Rubberizer® Particulate. This sample was allowed to stand for four days at 65° F. Twenty-five ml of tap water was then added and the ppm hydrocarbon in the leachate was periodically determined. The results of this work are presented in Table I.

Table I
Leachate PPM Hydrocarbon

1 Day	<5 ppm
7 Days	<5 ppm
14 Days	<5 ppm

Emulsion Clarification Test

An approximate 1,000 PPM emulsion of diesel fuel and water was prepared by transferring by pipette 0.55 ml of diesel to 500 ml of tap water that was being agitated in a blender. 40 ml of the emulsion was then transferred to a 50 ml Erienmeyer flask and 2.0 grams of ClearTec Rubberizer® Particulate was added. The sample was briefly agitated three times daily and maintained at 65° F. The ppm hydrocarbon remaining in the emulsion was periodically determined and the results are presented in Table II.

Table II
Emulsion Phase PPM Hydrocarbon

1 Day	100 ppm > emulsion > 50 ppm
2 Days	50 ppm > emulsion > 25 ppm
3 Days	10 ppm > emulsion > 5 ppm
4 Days	5 ppm > emulsion > 0 ppm

PCB/TCB Solidification, Emulsion Extraction, and Leach Tests

Tests using the active ingredient polymer of the ClearTec Rubberizer® products on PCB and TCB mixtures have indicated solidification ratios of one pound ClearTec Rubberizer® Particulate to one gallon PCB/TCB mixtures. Furthermore, two week leach tests using the aforementioned equivalent ratio indicated less than 2 ppm PCB/TCB in the aqueous phase. Additionally, extraction tests from an aqueous emulsion of PCB using the ClearTec Rubberizer® products active ingredient polymer have indicated clarification of the emulsion to less than 2 ppm PCB remaining.

Temperature Stabilization Laboratory Report

Introduction

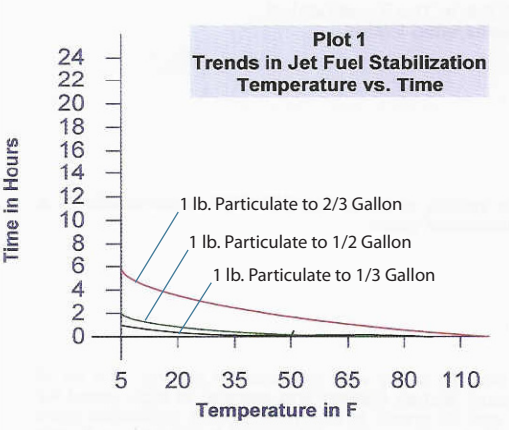
The purpose of this experiment was to evaluate the effect of temperature on the stabilization rates of ClearTec Rubberizer® Particulate on jet fuel (JP4 and JP5), diesel fuel, gasoline, transformer oil and hydraulic oil. Three experimental temperatures (5° F, 55° F, and 105° F) and three experimental ratios of ClearTec Rubberizer® Particulate to test liquid (1 lb. ClearTec Rubberizer® Particulate to 1/3 gallon, 1/2 gallon and 2/3 gallon) were chosen. The samples were examined periodically, observations recorded and the data evaluated. The results of this work are presented herein. For the purpose of this experiment, stabilization is defined as that point which retrieval of the tested liquids in a real cleanup operation could be effected without the release of the same.

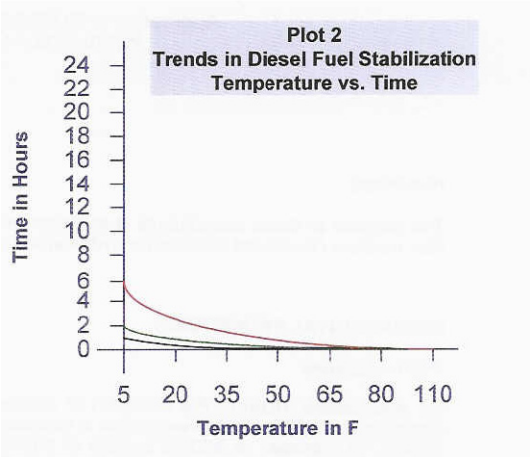
Experimental Procedure

8.1 ml, 12.2 ml and 16.3 ml volumes of the liquids to be tested were transferred by pipette to 50 ml Erienmeyer flasks and stoppered with neoprene stoppers. One collection of each of the test liquid's volume series was then brought to thermal equilibrium at 5° F, 55° F, and 105° F. To each test liquid sample a weighed 3.0 gram sample of ClearTec Rubberizer® Particulate was added and agitated. An initial observation at 3 minutes and successive observations at 30 minutes, 2 hours, 4 hours, 6 hours, 8 hours, 16 hours, and 24 hours were made on each sample with the samples being maintained at their respective temperatures between observation periods. The data acquired were analyzed and the resultant analysis presented herein.

Jet Fuel (JP4 and JP5)

Stabilization of both JP4 and JP5 was complete within the 24 hour observation period at all test temperatures and all ratios of ClearTec Rubberizer® Particulate to liquid. Only minor temperature effects on stabilization were observed, with the rates being slightly slower with decreasing temperature. (See Plot 1.) As a result of these tests it has been concluded that a ratio of 1 lb. of ClearTec Rubberizer® Particulate to 2/3 gallon of jet fuel is appropriate for most cleanup operations within the test temperature range.





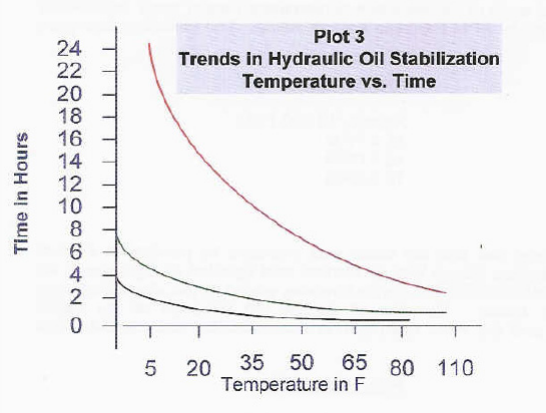
Diesel Fuel

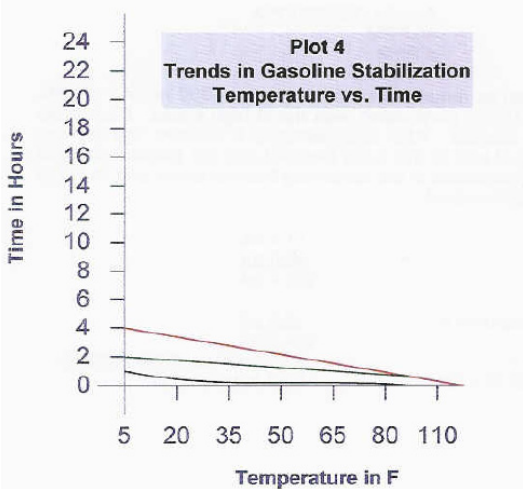
Stabilization of diesel fuel was complete within the 24 hour observation period at all test temperatures and all test ratios of ClearTec Rubberizer® Particulate to liquid. Only minor temperature effects on stabilization rates were observed, with the rates being slightly slower with decreasing temperature (See Plot 2.) As a result of these tests it has been concluded that a ratio of 1 lb. of ClearTec Rubberizer® Particulate to 2/3 gallon of diesel fuel is appropriate for most cleanup operations within the test temperature range.

Temperature Stabilization Laboratory Report, cont.

Hydraulic Oil

Stabilization rates of hydraulic oil were found to be influenced by temperature, with high temperature (105° F) being rapid in ratios up to 1 lb. of ClearTec Rubberizer® Particulate to 2/3 gallon hydraulic oil. At 55° F rapid stabilization required ratios of 1 lb. of ClearTec Rubberizer® Particulate to 1/2 gallon hydraulic oil. At 5°F stabilization was inhibited for the 1 lb. ClearTec Rubberizer® Particulate to 2/3 gallon hydraulic oil ratio within the testing period (See Plot 3).



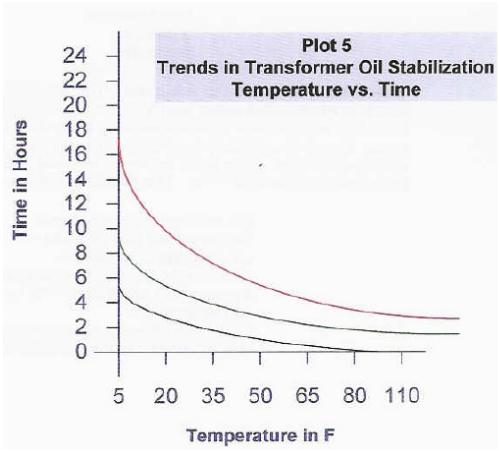


Gasoline

Stabilization of gasoline was complete within the 24 hour test period for all temperatures tested at all ClearTec Rubberizer® Particulate to gasoline ratios tested. Only minor temperature effects on stabilization rates were observed, with the rates being slightly slower with decreasing temperature (See Plot IV). As a result of these tests it has been concluded that a ratio of 1 lb. of ClearTec Rubberizer® Particulate to 2/3 gallon of gasoline is appropriate for most cleanup operations within the test temperature range.

Transformer Oil

Stabilization rates of transformer oil were found to be influenced by temperature, with the rates being slightly slower with decreasing temperature. The rate was rapid and complete at 105° F and 55° F within the test period at ratios up to 1 lb. of ClearTec Rubberizer® Particulate to 2/3 gallon transformer oil. The stabilization rate was significantly inhibited at the ratio of 1 lb. of ClearTec Rubberizer® Particulate to 2/3 gallon transformer oil at the 5° F test temperature (See Plot 5.)



Hydrocarbon Contaminated Water Test

Purpose

The purpose of these experiments is to determine the viability of using ClearTec Rubberizer® Particulate as a filter medium/treatment medium for hydrocarbon contaminated water.

Experimental Procedure

Part I - Benzene

An approximate 10,000 ppm emulsion of Benzene and tap water was prepared by placing 11.4 ml of Benzene and 990 ml of tap water into a Hamilton Beach kitchen blender and agitated at high speed for approximately 10 minutes. A 250 ml sample of emulsion and 65 grams of ClearTec Rubberizer® Particulate were placed in a 600 ml beaker. The beaker contents were then agitated with a hand held Sunbeam egg beater set on high speed. Samples of approximately 50 ml each of the Benzene contaminated water were periodically taken and sent to Quality Assurance Laboratory for ppm Benzene determination. The following data was recorded:

Residence Time I	PPM Benzene
Initial Sample	Approx. 10,000 ppm
1 minute	31.4 ppm
3 minutes	19.7 ppm
5 minutes	12.3 ppm

Part II - Diesel Fuel

An approximate 10,000 ppm emulsion of diesel fuel and tap water was prepared by placing 11.4 ml of diesel fuel and 990 ml of tap water into a Hamilton Beach kitchen blender and agitated at high speed for approximately 10 minutes. A 100 gram sample of ClearTec Rubberizer® Particulate was added to the aforementioned emulsion and the blender agitated at high speed. Samples of approximately 50 ml each of the diesel contaminated water were periodically taken and the ppm hydrocarbon contamination determined. The following data was recorded:

Residence Time I	PPM Hydrocarbon
Initial Sample	Approx. 10,000 ppm
3 minutes	40 ppm
5 minutes	4 ppm

Diesel fuel was placed in a burette. The blender, with its remaining contents (approximately 900 ml of > 4 ppm diesel contaminated water and 100 grams ClearTec Rubberizer® Particulate was run at high speed. Diesel fuel from the burette was then allowed to drain into the blender. After approximately 5 minutes, the blender motor began to seriously overload. The draining diesel was at this point stopped an the blender stopped shortly thereafter.

Hydrocarbon Contaminated Water Test, cont.

Results

The ppm hydrocarbon was then determined in the remaining blender water and found to be approximately 250 ppm. The following data was recorded:

Diesel from initial sample =	11.4 ml
Diesel added from burette =	95.0 ml
Ml sub-total in blender =	107.4 ml
LESS diesel remaining in solution (approx. 900 ml @ 250 ppm hydrocarbon =	-2.6 ml
Net absorbed =	104.8 ml
Density of Diesel (.88) x (ml diesel) =	92.2 (approx. grams diesel)
Grams diesel / grams ClearTec Rubberizer® x 100 =	92.2 % by weight

Discussion

A review of the data acquired in Part I shows a significant reduction in the ppm Benzene contamination (99.7%) during the first minute of treatment. Reduction in ppm Benzene contamination thereafter, while significant, was substantially reduced. Similar results were observed in Part II while 99.6% of the contaminants were removed in the first sample taken at the 3 minute point. The overload of the blender motor in Part II caused an early sensation of agitation, thereby interfering with the active treatment process, resulting in a 250 ppm hydrocarbon contamination level in the remaining sample. It is unknown at this time as to what the hydrocarbon level might have been had the process gone on uninterrupted.

Conclusion

The experiment established that ClearTec Rubberizer® Particulate may be a very effective replacement for treatment or pretreatment of hydrocarbon contaminated water in place of conventional treatment materials and/or processes (i.e. activated carbon). Further experimentation with potential applications is warranted.

Oil Leachate Test

Introduction

Various sorption media are available on the market today for the removal of hydrocarbons from storm water. Many of these materials can subsequently degrade and release hydrocarbons after capture because they don't permanently encapsulate. ClearTec Rubberizer® however does not deteriorate with long-term exposure to oil-contaminated water and will not release captured oil.

Leach Test Method

This method consists of saturating the media in a hydrocarbon mixture of 50% diesel and 50% used motor oil for approximately 20 hours. Then clear water is passed through the media at about 1/2 gallon per minute (gpm) flow rate with live discrete samples for oil and grease collected at two-minute intervals. A media will pass this test if the leachate water samples contain less than 10 mg/L oil and grease.

The 1/2 gpm water flow used to produce the leachate samples was generated with a small submersible pump in a 5-gallon water reservoir. The flow was moderated with a PVC ball valve attached to the discharge tubing of the pump and the flow was calibrated by observing the time required to fill a 1/2 gallon volume.

All aspects of the leach test methodology were performed by John Mac Pherson (professional analytical chemist) for Foss Environmental Services (Now SeaCor) of Seattle, Washington. All procedures performed were done in strict accordance with the King County Oil Leach Test Method.

Weight of ClearTec Rubberizer® Media:	421 grams
Volume of Media:	1 Liter
Volume of Oil Used:	300 mL
Volume of Oil Retained in Media:	244 mL
Oil/Media Ratio:	1.10 mL/gm
Observation While Adding Oil Mixture:	Oil flowed through media at a moderate rate but absorbed rapidly. Oil dripped into receiver in 68 seconds.

Oil Leachate Test, cont.

Results

The results of the testing are recorded in the following table.

Sample 1 Water flow rate through the media was .5 gpm. No reduction of flow due to reduced media transmissivity was observed throughout the entire test with both media types. Both medias could have supported higher flow rates.	**FES-A1** No oil sheen observed on leachate sample. Leachate clear and colorless. Leachate oil = < 1.0 mg/L
Sample 2 Water flow rate through the media was .5 gpm. No reduction of flow due to reduced media transmissivity was observed throughout the entire test with both media types. Both medias could have supported higher flow rates.	**FES-A2** No oil sheen observed on leachate sample. Leachate clear and colorless. Leachate oil = < 1.0 mg/L
Sample 3 Water flow rate through the media was .5 gpm. No reduction of flow due to reduced media transmissivity was observed throughout the entire test with both media types. Both medias could have supported higher flow rates.	**FES-A3** No oil sheen observed on leachate sample. Leachate clear and colorless. Leachate oil = < 1.0 mg/L
Sample 4 Water flow rate through the media was .5 gpm. No reduction of flow due to reduced media transmissivity was observed throughout the entire test with both media types. Both medias could have supported higher flow rates.	**FES-A4** No oil sheen observed on leachate sample. Leachate clear and colorless. Leachate oil = < 1.2 mg/L
Sample 5 Water flow rate through the media was .5 gpm. No reduction of flow due to reduced media transmissivity was observed throughout the entire test with both media types. Both medias could have supported higher flow rates.	**FES-A5** No oil sheen observed on leachate sample. Leachate clear and colorless. Leachate oil = < 1.0 mg/L

Abalone Larval Development Short-Term Toxicity Test

Test Summary

Species: Haliotis rufescens
Protocol: CSWRCB
Test Type: Static
Test Chamber: Dispo. culture dishes
Temperature: 15 +/- 1° C
Number of Embryos Per Chamber: Approx. 400
QA/QC Batch No.: RT-960117 (ran concurrently)

Source: Pacific Mariculture
Dilution Water: Lab seawater
End Points: NOEC at 48 hours
Test Volume: 50 ml
Aeration: None.
Number of replicates: 5

Results Summary

Test Concentration (Nominal)	Percent of Abalone Larvae with Normal Development
Blank	98.1%
Control	96.7%
0.1%	97.1%
1%	98.1%
5%	97.1%
10%	98.1%
20%	98.2%
40%	97.6%
60%	97.3%
80%	96.4%
100%	96.1%

Note:

A 1:100 sample extract was made by placing 8 grams of sample into 800 mL of filtered sea water in a one liter extraction vessel and continuously shaken for 24 hours. Sample mixture was then allowed to settle for three hours. Sample extract was then filtered through a Whatman #1 filter. Test dilutions were made with lab sea water. An extract blank was made by following the same protocol (but without the sample).

Nominal test concentrations are serial dilutions of the sea water extract.

* Denotes values significantly less than control at P = 0.05%.

Note: No test concentration significantly less than control.

Chronic Toxicity

NOEC	100% extract
LOEC	> 100% extract

Aquatic Testing Laboratory Report

LABORATORY REPORT

Aquatic Testing Laboratories
"dedicated to providing quality aquatic toxicity test
4350 Transport Street, Unit 107
Ventura, CA 93003
(805) 650-0546 FAX (805) 650-07

Date: January 22, 1996

Client: HAZ-MAT Response Technologies
5841 Box Canyon Road
La Jolla, CA 92037
Attn: Philip Stagg

Laboratory No.: A-96011201-001
Sample I.D.: Rubberizer TSB

Sample Control:

The sample was received by ATL on 01/12/96.

Sample Analysis:

The following analyses were performed on your sample:

Oil Spill Clean-Up Agent - Abalone Development Test.

Attached are the test data generated from the analysis of your sample.

Result Summary:

ATL Lab No.	Sample ID.	Test	Results
A-96011201-001	Rubberizer TSB	Abalone	NOEC = 100% LOEC = >100%

pH of extract: 8.0

Quality Control: Reviewed and approved by:

Joseph A. LeMay, Laboratory Director

Thank you for your business!

Material Safety Data Sheet (MSDS)

Material Safety Data Sheet May be used to comply with OSHA's Hazard Communication Standard 29 CFR 1910 1200 Standard Must be consulted for specific requirements		**US Department of Labor** Occupational Safety and Health Administration (Non-Mandatory Form) Form Approved OMB NO. 1218-0072	
Section I - Identity Information			
IDENTITY: ClearTec Rubberizer® Booms, Mats, Pillows, and Particulate		EMERGENCY PHONE NUMBER: 1-800-542-3036	
MANUFACTURER'S NAME: ClearTec Global, LLC		ADDRESS: 4626 Santa Fe Street., San Diego, CA 92109	
Section II - Hazardous Ingredients			
HAZARDOUS COMPONENTS (Specific Chemical Identity, Common Name(s)) N/A - There are no chemicals present in this product at a concentration of 0.1% or more classified as a carcinogenic by IARC, NYP, or OSHA. This product is not considered a hazardous substance by the EPA.			
Section III - Physical/Chemical Characteristics			
BOILING POINT:	N/A	SPECIFIC GRAVITY:	Apparent - 0.4 Real - 0.8
VAPOR PRESSURE:	N/A	MELTING POINT:	N/A
VAPOR DENSITY:	N/A	EVAPORATION RATE:	N/A
SOLUBILITY IN WATER: Insoluble			
APPEARANCE AND ODOR: White grainy material, mild sweet odor			
Section IV - Fire and Explosion Hazard Data			
FLASH POINT METHOD USED: ASTM D 92 325° Cleveland open cup		FLAMMABLE LIMITS: Not yet established	LEL: No data UEL: No data
EXTINGUISHING MEDIA: CO2, water, foam, and dry chemical			
SPECIAL FIRE FIGHTING PROCEDURES: Protect against inhalation of combustion products			
UNUSUAL FIRE AND EXPLOSION HAZARDS: None known			
Section V - Reactivity Data			
STABILITY: Stable		CONDITIONS TO AVOID: Ignition sources, excessive heat. Do not allow contact with strong oxidization agents.	
INCOMPATIBILITY (Materials to Avoid): Strong oxidizing agents (i.e, concentrated nitric acid)			
HAZARDOUS DECOMPOSITION OR BYPRODUCTS: Thermal decomposition/combustion may release hydrocarbons, aldehydes, keystones, alcohols, carboxylic acids, carbon monoxide and unidentified organic compounds			
HAZARDOUS POLYMERIZATION: _____ May Occur __X__ May Not Occur			

Material Safety Data Sheet (MSDS), cont.

Section VI - Health Hazard Data			
ROUTES OF ENTRY:	Inhalation: Primary	Skin: N/A	Ingestion: Possible
HEALTH HAZARDS (Acute & Chronic): None that are known			
CARCINOGENICITY: No	NTP: No	IARC MONOGRAPHS: No	OSHA REGULATED: No
SIGNS & SYMPTOMS OF EXPOSURE: Respiratory conditions and eye irritation are possible and skin irritation with exposure to any fine or grainy material			
MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Preexisting eye, skin, and respiratory disorders may be aggravated by exposure to this product.			
EMERGENCY & FIRST AID PROCEDURES: Flush affected areas thoroughly with water and consult physician if irritation persists.			
Section VII - Precautions for Safe Handling and Use			
STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: If material has not been contaminated it may be swept up and returned to its container. If material is contaminated, dispose accordingly.			
WASTE DISPOSAL METHOD: Incinerate or landfill according to government waste disposal regulations (Local, State, and Federal)			
PRECAUTIONS TO BE TAKEN IN HANDLING & STORING: Product should be stored away from excessive heat and/or ignition source, preferable long term storage should be below 125° F			
OTHER PRECAUTIONS: None.			
Section VIII - Control Measures			
RESPIRATORY PROTECTION (Specify Type): Dust mask for airborne particulate			
VENTILATION:	Local Exhaust: Sufficient	Mechanical (General): None	Special/Other: None
PROTECTIVE GLOVES: Optional		EYE PROTECTION: Goggles for dust protection	
OTHER PROTECTIVE CLOTHING OR EQUIPMENT: None			
WORK/HYGIENIC PRACTICES: Working procedures should minimize airborne particles.			

Brunei Shell Rubberizer® Test Report

Background

ClearTec Rubberizer® Booms have been proposed as a line of defense against leakage of condensates, Oil Based Muds, and other hydrocarbons from various BSP facilities. To test the effectiveness of the product for BSPs requirements, tests were conducted in house. This note describes the results of the tests.

Test Procedure

In the absence of any standard test procedures, HSE/5 developed its own tests which demonstrate the efficiency of the product for the purposes to which it is intended in BSP.

A) Condensate
The ClearTec Rubberizer® Boom was inserted inside a 1 L measuring cylinder. Condensate-Water, mixture of varying initial concentrates were poured down through the boom and the filtrate was collected at the bottom (See Pictures 1 and 2). The concentrate of hydrocarbons was measured in the filtrate.

B) Oil Based Mud Cuttings
Testing of the boom for OBM was done by taking fresh OBM in a 2 Liter beaker and dipping the boom in it for 2 minutes. The flow time of the 500 ml OBM through a standard orifice at the bottom of the cone was measured before and after passing it through the boom.

Results

A) Condensate
The results are presented in Production Chemistry Report #97E3SRB of 15-04-97. The results indicate that the ClearTec Rubberizer® Boom is extremely effective to absorb hydrocarbons, providing absorption of 99.8% to 99.99 % when influent concentration was ranging from 1,000 to 100,000 ppm.

B) Oil Based Mud Cuttings
The flow time for 500 ml changed from 55 seconds (before passing through the boom) to 110 seconds (after passing through the boom).

Conclusion

The ClearTec Rubberizer® Boom is an appropriate defense mechanism to absorb hydrocarbons from concentrate-water mixtures and oil based muds.

Brunei Shell Rubberizer® Test Report, Cont.

TO: HSE/51
FROM: DRO/4
DATE RECEIVED: 04-14-97
DATE TESTED: 04-14-97

REF. I.D.: 97E35RB
DATE: 04-15-97
PAGE: 1 OF 1

Shell Oil's Production Chemistry Lab Results

Method I.D.		P047
Sample	**Sampling Date**	**Total Petroleum Hydrocarbon PPM**
1,000 ppm condensate in tap water (1st run)	04-14-97	2
1,000 ppm condensate in tap water (2nd run)	04-14-97	<1
10,000 ppm condensate in tap water (1st run)	04-14-97	14
100,000 ppm condensate in tap water (1st run)	04-14-97	78

Test performed by Shell Oil, Brunei

Rubberizer® Certifications & Awards

Classified as a Sorbent by the United States Environmental Protection Agency

Licensed as an Oil Spill Clean Up Agent by the State of California Department of Fish & Game

Classified as a non-toxic, food-grade polymer by the Federal Drug Administration

Approved for use in oil spill emergencies by the Federal Emergency Management Agency

Pre-approved for use on California highways by the California Department of Transportation

Six-time recipient of the Defense Supply Center Best Value Gold Medal

Client Testimonials

Hear What Our Clients Are Saying...

"The material you provided was a real lifesaver for us and all those involved with the cleanup of approximately 800 gallons of diesel fuel that was spilled during onload of fuel on the Ex-Davidson. In this day and age, it is a real treat when you find someone that sells something that does what it is supposed to do. I'm sold on Rubberizer®!"

Matthew C., California Marine Cleaning, Inc.

"Obviously I need your boom to effectively remove sheen, because the other materials just do not work. I have used your product on spills ranging from heavy bunker fuel to rainbow sheen cleanups. I feel that we could effectively use your booms for all the remaining cleanup and save Chevron a lot of money in the process especially in the area of disposal since your product can either go to the landfill or to H-power."

DeWayne H., AAA Island Environmental Inc.

"We have found that toward the end of a spill, Rubberizer® is the only product that is effective in the removal of light ends or sheen. Our customers have been very pleased with the results of the Rubberizer® product because it removed the final product and reduced the overall clean-up time and costs."

Harry B., Foss Environmental (Now SeaCor)

"This Marine Safety Office has found the Rubberizer® product to be very effective in the cleanup of oil spills of lighter end products such as diesel fuel and gasoline. Specific use of the product by this office includes pleasure crafts which sink in their slip leaking either diesel or gasoline, where the Rubberizer® is placed in the slip, thus cleaning up the fuel from the water and preventing spread of sheen."

J.A. W. IV, US Coast Guard

"Recently MPC conducted a large scale spill response following a release of PCB-contaminated mineral oil into a drainage ditch running through farmland. Rubberizer® was used to perform a variety of containment and recovery processes on the site. When the project was over and the filter box removed for disposal, the culvert was revealed to have been kept free of contamination."

Michael P., Marine Pollution Control

Waste Water Treatment - Marseilles, France

Background

Approximately 700 Liters of diesel fuel spilled into a microbiological waste water treatment pond near Marseilles, France. Initial sampling established an emulsified pollution level of 1790 PPM hydrocarbons. This contamination level was high enough to cause the cessation of discharging treated wastewater for a month or more.

Results

The waste water treatment ponds were treated with approximately 250 lbs of ClearTec Rubberizer® Particulate and one ClearTec Rubberizer® Boom. With the addition of both of these products, the hydrocarbon contamination was rapidly reduced thereby facilitating a reduction in foaming and the re-opening of discharge outlets in less than 21 hours.

Storm Water Treatment, Port of Seattle, WA, USA

Background

In an effort to reduce the amount of oil, grease, and sediment in storm water runoff, the Port of Seattle installed catch basin inserts filled with ClearTec Rubberizer® filter media in several storm drains located in the passenger pick up area at the Seattle/Tacoma International Airport. Prior to installation of the catch basins, the average total oil and grease concentration in the storm water was 42 mg/L, and the average total suspended solids were 126 mg/L.

Results

The treated water was sampled for two years at a point downstream from the catch basins. The results showed that with the addition of Rubberizer®, the average oil and grease concentration decreased from 42 mg/L to 2.6 mg/L, and the average total suspended solids decreased from 128 mg/L to 24.7 mg/L.

Pine River Oil Spill - Chetwynd, BC, Canada

Background

A crude oil pipeline ruptured spilling an estimated 6,289 liters of black crude oil into the Pine River located about 21 miles south of Chetwynd, BC. Initially, the response crews tried to clean up the spill using polypropylene pads and barrier booms. However, after a few days of using these products, it became clear that they needed a product that would not only contain the oil but also solidify it so that it would not be re-released into the water. One of the contractors that was called to the scene, Foss Environmental (now SeaCor) had previously used our ClearTec Rubberizer ® products and knew they could do just that. They contacted us and ordered 1,200 feet of our 3.25" diameter ClearTec Rubberizer ® Booms which were rushed to the site and deployed immediately.

Results

The ClearTec Rubberizer® Booms performed as promised, and no sheen ever reached the town of Chetwynd. The booms remained in place for a few months and continued to contain and solidify oil as it leached from log jams where it had collected with debris.

Storm Water Treatment - Wayne County, MI, USA

Background

The Rouge River and its watershed are a primary source of pollution to the Great Lakes. In an effort to make these waterways "fishable and swimmable" as intended by the Clean Water Act of 1972, the Cities of Livonia and Westland, Michigan tested 4 different filter device inserts to sift sediments and absorb hydrocarbons from storm water runoff. Two of the four inserts tested, Hydro-Cartridge® and StreamGuard™ , were filled with our ClearTec Rubberizer® filter media.

Results

The oil collected at each catch basin was analyzed once a week for a period of 19 months. Of the four devices tested, the Hydro-Cartridge® and StreamGuard™, which were both filled with ClearTec Rubberizer® filter media, removed the most oil per gallon of storm water. These results indicate that the two devices absorbed anywhere from 3 to 13 times more oil than the other two devices.

Ship Spill - San Diego, CA, USA

Background

A ship in San Diego Bay spilled approximately 800 gallons of diesel into a containment area around the ship. ClearTec Rubberizer® Booms were used to span gaps in the existing containment boom. Additional ClearTec Rubberizer® Booms (5" X 10') were thrown into the spill area.

Results

While some of this spill had already been retrieved with vac-trucks, the remainder was pushed into the booms using spray from fire hoses. Just hours later, the booms were swollen with solidified diesel and were retrieved. There was no remaining sheen on the surface of the water.

Ship Spill - Kodiak, AK, USA

Background

A ship in Kodiak, Alaska spilled approximately 150 gallons of lube oil. This water borne spill was contained with a series of 3.25" X 20' ClearTec Rubberizer® Booms that were tied together. ClearTec Rubberizer® Pillows were tossed into the spill containment area, and polypropylene pads were used until daylight ceased.

Results

The booms and pillows remained buoyant and continued to sorb and solidify the remaining lube oil until the following morning, at which time the booms and pillows, swollen with solidified lube oil, were removed. It was reported that all the lube oil had been sorbed and solidified with no remaining sheen.

Highway Spill - San Diego, CA, USA

Background

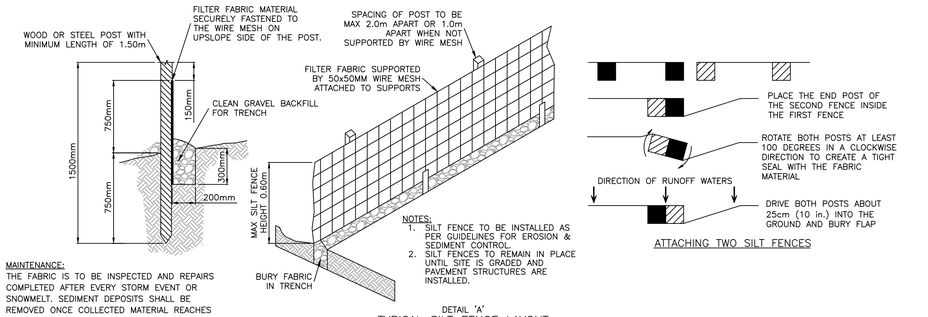
A tanker truck collided with another vehicle and spilled 30 gallons of diesel fuel on the highway. Because it was raining heavily that day, the fire department set up a berm to contain the fuel and large quantities of water.

Results

The berm that the fire department set up was not capable of solidifying the oil so they deployed two of our 2.25" X 20' ClearTec Rubberizer® Booms. All 30 gallons of the diesel was sorbed, solidified, and retrieved within 20 minutes.

ClearTec Global
4626 Santa Fe Street
San Diego, CA 92109
800.542.3036
619.399.7217 (Fax)
www.cleartecglobal.com

APPENDIX E: Erosion and Sediment Control Plans



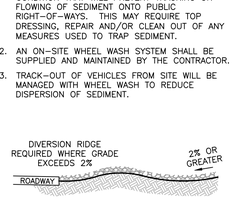
MAINTENANCE:
THE FABRIC IS TO BE INSPECTED AND REPAIRS COMPLETED AFTER EVERY STORM EVENT OR SNOWMELT. SEDIMENT DEPOSITS SHALL BE REMOVED ONCE COLLECTED MATERIAL REACHES A DEPTH OF ONE-THIRD THE FENCE HEIGHT.

NOTES:
1. SILT FENCE TO BE INSTALLED AS PER GUIDELINES FOR EROSION & SEDIMENT CONTROL.
2. SILT FENCES TO REMAIN IN PLACE UNTIL SITE IS GRADED AND PAVEMENT STRUCTURES ARE INSTALLED.

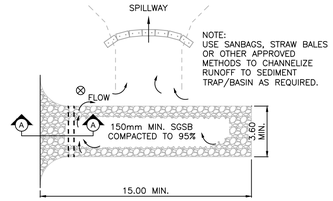
DETAIL 'A'
TYPICAL SILT FENCE LAYOUT
NOT TO SCALE

ATTACHING TWO SILT FENCES

NOTES:
1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. AN ON-SITE WHEEL WASH SYSTEM SHALL BE SUPPLIED AND MAINTAINED BY THE CONTRACTOR.
3. TRACK-OUT OF VEHICLES FROM SITE WILL BE MANAGED WITH WHEEL WASH TO REDUCE DISPERSION OF SEDIMENT.

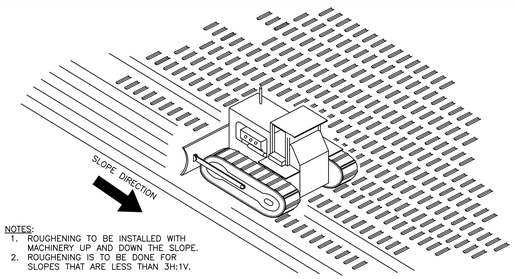


SECTION A-A



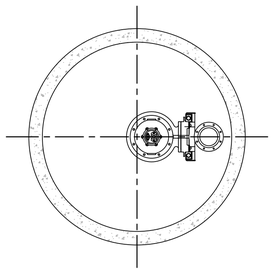
PLAN

DETAIL 'B'
TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT
NOT TO SCALE

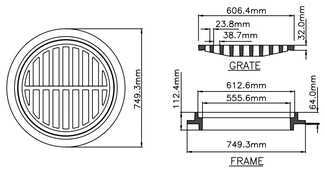


NOTES:
1. ROUGHENING TO BE INSTALLED WITH MACHINERY UP AND DOWN THE SLOPE.
2. ROUGHENING IS TO BE DONE FOR SLOPES THAT ARE LESS THAN 3H:1V.

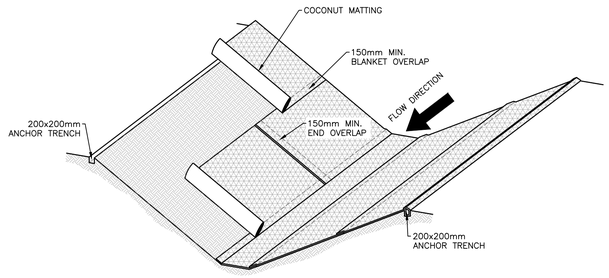
DETAIL 'C'
SURFACE ROUGHENING
NOT TO SCALE



PLAN
SCALE: NTS

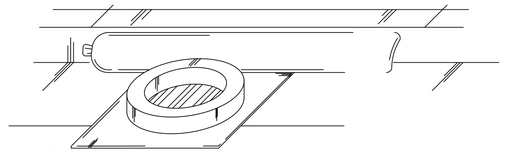


DRAIN GRATE & FRAME DETAIL
SCALE: NTS



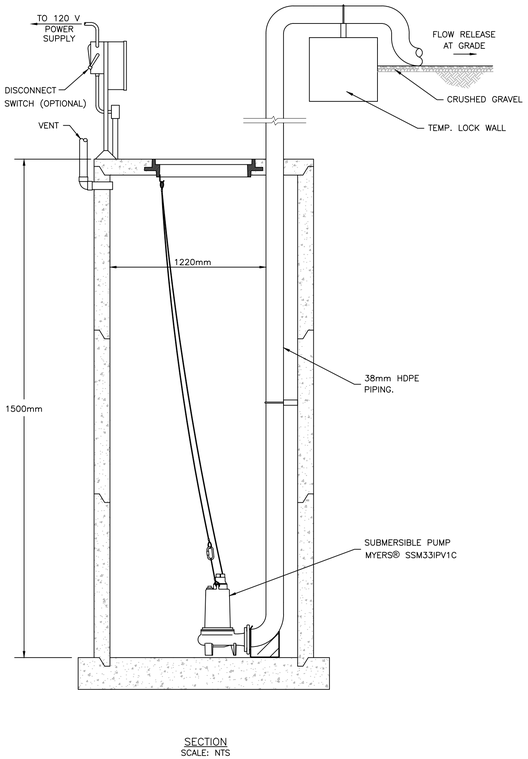
DETAIL 'E'
EROSION CONTROL BLANKET DETAIL
NOT TO SCALE

MAINTENANCE:
INLET PROTECTION MEASURES WILL BE INSPECTED EVERY 7 DAYS AND AFTER EVERY STORM EVENT OR SNOW MELT. ANY DAMAGED MATERIAL WILL BE REPAIRED OR REPLACED IMMEDIATELY. SEDIMENT WILL BE REMOVED AFTER EVERY STORM OR SNOW MELT EVENT.



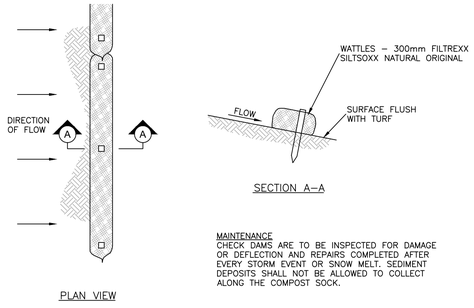
NOTE:
INSTALLED WITH FILTER FABRIC TIED TO GRATE AND THEN REINSERTED INTO FRAME. DONUT BACKER SOCK MUST BE INSTALLED FOR CATCH BASINS PLACED ALONG CURB.

DETAIL 'G'
CATCH BASIN DONUT SEDIMENTATION BARRIER
NOT TO SCALE



SECTION
SCALE: NTS

DETAIL 'D'
TEMPORARY DRAINAGE SUMP PUMP
NOT TO SCALE

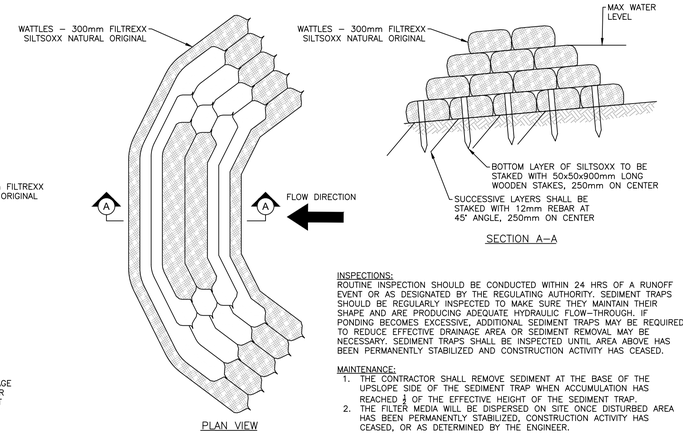


PLAN VIEW

SECTION A-A

MAINTENANCE
CHECK DAMS ARE TO BE INSPECTED FOR DAMAGE OR DEFLECTION AND REPAIRS COMPLETED AFTER EVERY STORM EVENT OR SNOW MELT. SEDIMENT DEPOSITS SHALL NOT BE ALLOWED TO COLLECT ALONG THE COMPOST SOCK.

DETAIL 'H'
WATTLES - 300mm FILTREXX SILTSOXX NATURAL ORIGINAL
NOT TO SCALE



PLAN VIEW

SECTION A-A

INSPECTIONS:
ROUTINE INSPECTION SHOULD BE CONDUCTED WITHIN 24 HRS OF A RUNOFF EVENT OR AS DESIGNATED BY THE REGULATING AUTHORITY. SEDIMENT TRAPS SHOULD BE REGULARLY INSPECTED TO MAKE SURE THEY MAINTAIN THEIR SHAPE AND ARE PRODUCING ADEQUATE HYDRAULIC FLOW-THROUGH. IF PONDING BECOMES EXCESSIVE, ADDITIONAL SEDIMENT TRAPS MAY BE REQUIRED TO REDUCE EFFECTIVE DRAINAGE AREA OR SEDIMENT REMOVAL MAY BE NECESSARY. SEDIMENT TRAPS SHALL BE INSPECTED UNTIL AREA ABOVE HAS BEEN PERMANENTLY STABILIZED AND CONSTRUCTION ACTIVITY HAS CEASED.

MAINTENANCE:
1. THE CONTRACTOR SHALL REMOVE SEDIMENT AT THE BASE OF THE UPSLOPE SIDE OF THE SEDIMENT TRAP WHEN ACCUMULATION HAS REACHED ½ OF THE EFFECTIVE HEIGHT OF THE SEDIMENT TRAP.
2. THE FILTER MEDIA WILL BE DISPERSED ON SITE ONCE DISTURBED AREA HAS BEEN PERMANENTLY STABILIZED, CONSTRUCTION ACTIVITY HAS CEASED, OR AS DETERMINED BY THE ENGINEER.

DETAIL 'I'
FILTREXX SILTSOXX NATURAL ORIGINAL SEDIMENTATION TRAP DETAIL
NOT TO SCALE

MORRISON HERSHFIELD
Suite 310, 4321 Still Creek Drive
Burnaby, British Columbia, V5C 6S7
Tel: 604 454 0402 Fax: 604 454 0403
www.morrisonhershfield.com

D'AMBROSIO architecture + urbanism

Murdoch de Greeff INC

GOLDER
MEMBER OF WSP

NOT FOR CONSTRUCTION

All dimensions in Metric

C	Issued For Tender Package 2	2021-07-05
B	Issued For 50% Design Review	2021-04-27
A	Issued For 30% Design Review	2021-03-15
REV	DESCRIPTION	YYYY-MM-DD

STAMPS

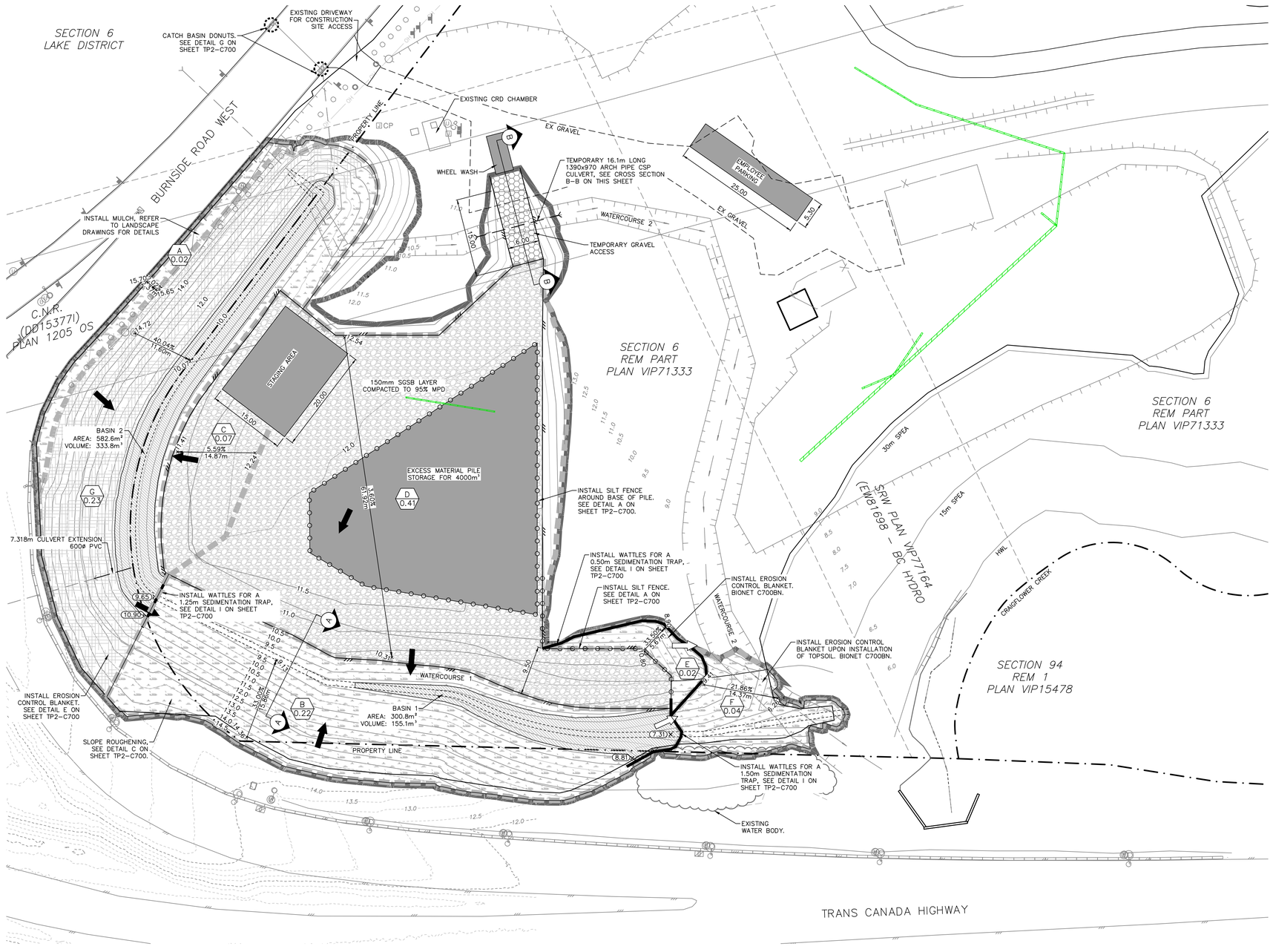
BCTransit

CLIENT:
BC TRANSIT

PROJECT:
VICTORIA handyDART CENTRE

ESC NOTES & DETAILS

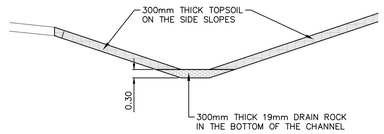
SCALE:	PROJECT NO.	
NTS	201919500	
DWG.#	REV	DATE:
TP2-C700	C	2021/07/26



LEGEND

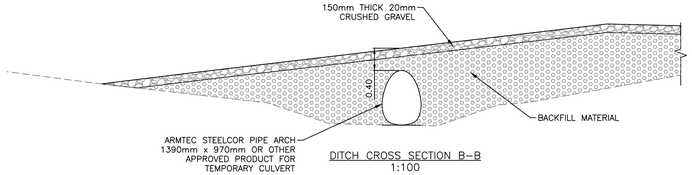
- CONSTRUCTION BOUNDARY
- DRAINAGE DIVIDES
- 15.0 — ROUGH GRADE CONTOUR
- 14.0 — EXISTING GRADE CONTOUR
- 1.00% — DIRECTION OF DRAINAGE FLOW
- EXISTING SEDIMENTATION FACILITY
- OVERLAND FLOW DIRECTION
- RUN-ON / RUN-OFF LOCATIONS
- SILT FENCE
- WATTLES - 300mm FILTREXX SILTSOXX NATURAL ORIGINAL
- A 0.04 — DRAINAGE DIVIDE LABEL / DRAINAGE DIVIDE AREA IN ha
- STABILIZED GRAVEL ACCESS
- 150mm SGSB LAYER COMPACTED TO 95% MPD
- EROSION CONTROL BLANKET
- SEEDING AREA
- SURFACE ROUGHENING
- CATCH BASIN DONUT

NOTES:
1. CONTOURS SHOWN ARE FOR ROUGH GRADING.
2. 300mm OF TOPSOIL IS REQUIRED ON LANDSCAPE AREAS TO ACHIEVE FINISHED GRADE ELEVATIONS. SURFACE ROUGHENING IS REQUIRED PRIOR THE TOPSOIL PLACEMENT.
3. EROSION CONTROL BLANKET IS TO BE INSTALLED ON TOP OF TOP SOIL FOR FINAL STABILIZATION ON SLOPES ≥ 3:1.
4. FOR BOTTOM OF THE DITCH STABILIZATION AND CHECK DAM INSTALLATION REFER TO LANDSCAPE DRAWINGS.



DITCH CROSS SECTION A–A
1:100

NOTE: FOR MORE DETAILS ON DITCH STRUCTURE SEE LANDSCAPE DRAWINGS



DITCH CROSS SECTION B–B
1:100

RUSLEFAC CALCULATIONS

Catchment	R	K	Length (m)	Slope (%)	LS Table LS-3	Description of Controls and Practices	C	P	Area (ha)	A-Value (tonnes/ha)	Erosion Potential	
											Soil Loss With Contros	Soil Loss Without Contros
A	1700	0.034	2.00	2.02	0.13	Surface Roughening+Mulching	0.0200	0.900	0.02	0.136	0.003	0.15
B	1700	0.034	11.60	40.04	3.39	Sed. Pond+Surface Roughening+ECB+Wattles	0.0000	0.288	0.46	0.002	0.001	90.15
C	1700	0.034	14.87	5.59	0.50	SGSB Agregate+Sedimentation Trap	0.0040	1.000	0.07	0.117	0.008	2.04
D	1700	0.034	61.92	3.60	0.70	SGSB Agregate+Sedimentation Trap	0.0040	1.000	0.41	0.163	0.067	16.67
E	1700	0.034	5.67	33.50	1.61	Surface Roughening+Mulching+Wattles	0.0200	0.288	0.02	0.536	0.011	1.86
F	1700	0.034	14.37	21.81	2.21	Surface Roughening+Mulching+Wattles	0.0200	0.288	0.04	0.736	0.029	5.11
G	1700	0.034	14.37	33.00	3.36	Surface Roughening+Mulching+Wattles	1.0200	0.288	1.04	57.064	59.346	202.02
								Total Area	2.06			

MORRISON HERSHFIELD
Suite 310, 4321 Still Creek Drive
Burnaby, British Columbia, V5C 6S7
Tel: 604 454 0402 Fax: 604 454 0403
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D'AMBROSIO architecture + urbanism

Murdoch de Greeff INC

GOLDER
MEMBER OF WSP

NOT FOR CONSTRUCTION

All dimensions in Metric

	Issue 7	
C	Issued For Tender Package 2	2021-07-05
B	Issued For 50% Design Review	2021-04-27
A	Issued For 30% Design Review	2021-03-15
REV	DESCRIPTION	YYYY-MM-DD

STAMPS

BCTransit

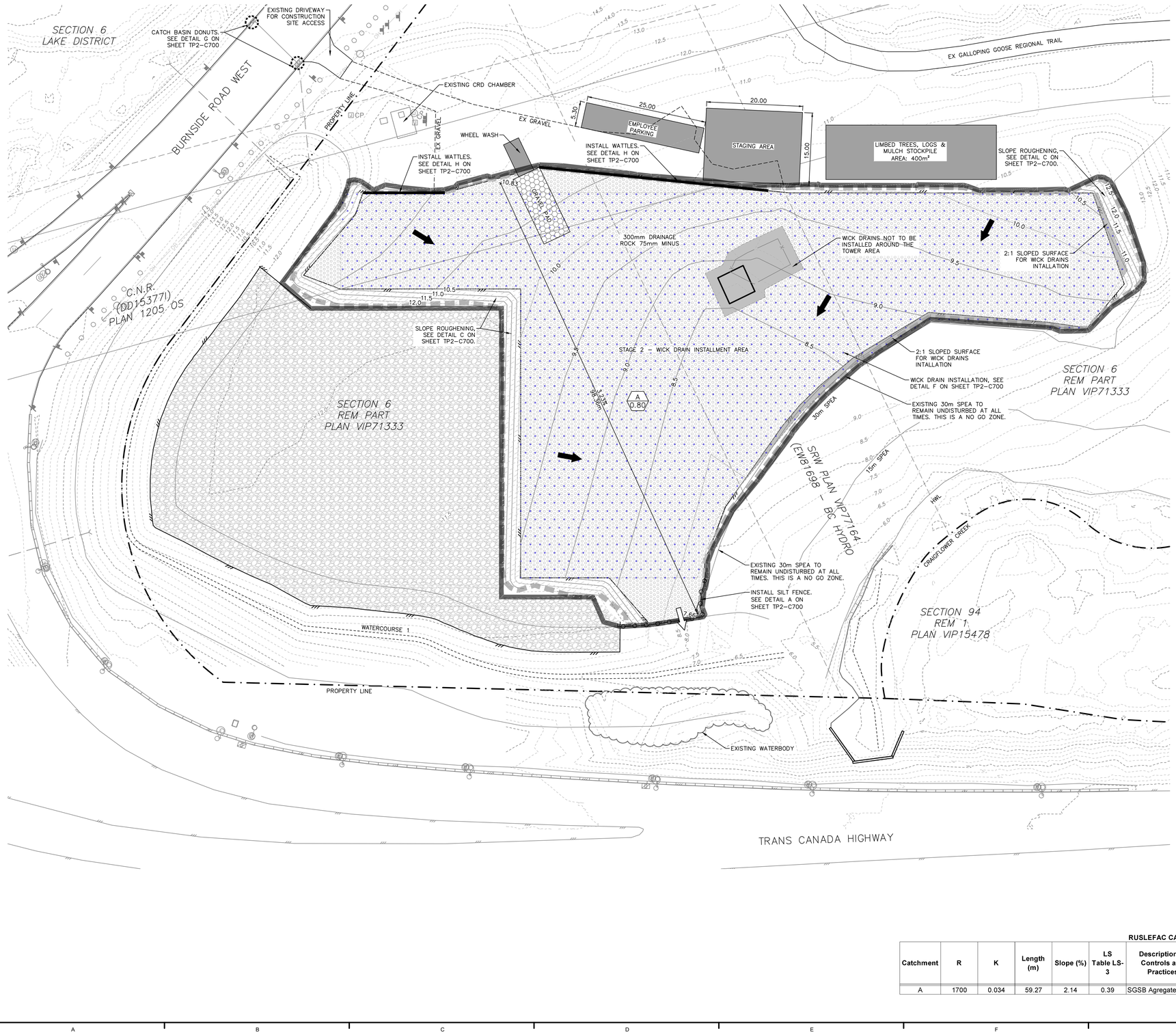
CLIENT: BC TRANSIT

PROJECT: VICTORIA handyDART CENTRE

ESC STAGE 1

SCALE:	PROJECT NO.	
1:400	201919500	
DWG.#	REV	DATE:
TP2-C701	C	2021/07/26

X:\Proj\2020\201919500-handyDART Transit Centre - OM Fac\05_CAD\07 Sheets\C701 ESC STAGE 1.dwg Last Saved: 7/26/2021 5:55 PM by NFitzpatrick Plotted: 7/26/2021 7:02 PM by Sergio Rueda-Guevara



LEGEND

- CONSTRUCTION BOUNDARY
- DRAINAGE DIVIDES
- 15.0 ROUGH GRADE CONTOUR
- 14.0 EXISTING GRADE CONTOUR
- 1.00% DIRECTION OF DRAINAGE FLOW
- EXISTING SEDIMENTATION FACILITY
- OVERLAND FLOW DIRECTION
- RUN-ON / RUN-OFF LOCATIONS
- SILT FENCE
- WATTLES – 300mm FILTREXX SILTSOXX NATURAL ORIGINAL
- A 0.04 DRAINAGE DIVIDE LABEL / DRAINAGE DIVIDE AREA IN ha
- STABILIZED GRAVEL ACCESS
- 150mm SGSB LAYER COMPACTED TO 95% MPD
- 300mm DRAINAGE ROCK 75mm MINUS
- WICK DRAINS
- SURFACE ROUGHENING
- CATCH BASIN DONUT

NOTES:
1. CONTOURS SHOWN ARE FOR ROUGH GRADING.
2. A 300mm DRAINAGE ROCK 75mm MINUS SHOULD BE INSTALLED IN TOP OF THE PROPOSED GRADES TO ALLOW WICK DRAINAGE DURING AVANCE SETTLEMENT PRE-LOADING PERIOD (150 DAYS).
3. SURFACE ROUGHENING IS REQUIRED PRIOR THE TOPSOIL PLACEMENT.
4. EROSION CONTROL BLANKET SHALL BE INSTALLED ON TOP OF TOP SOIL FOR FINAL STABILIZATION ON SLOPES ≥ 3:1.

RUSLEFAC CALCULATIONS

Catchment	R	K	Length (m)	Slope (%)	LS Table LS-3	Description of Controls and Practices	C	P	Area (ha)	A-Value (tonnes/ha)	Erosion Potential	
											Soil Loss With Contros	Soil Loss Without Contros
A	1700	0.034	59.27	2.14	0.39	SGSB Agregate	0.010	1.000	0.80	0.225	0.180	18.04
								Total Area	0.80			
								Weighted Average A for the site (tonnes/ha)		0.28		

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All dimensions in Metric

REV	DESCRIPTION	YYYY-MM-DD
	Issue 7	
C	Issued For Tender Package 2	2021-07-05
B	Issued For 50% Design Review	2021-04-27
A	Issued For 30% Design Review	2021-03-15

STAMPS

BCTransit

CLIENT: BC TRANSIT

PROJECT: VICTORIA handyDART CENTRE

ESC STAGE 2

SCALE:	PROJECT NO.
1:400	201919500
DWG.# TP2-C702	REV C / DATE: 2021/07/26

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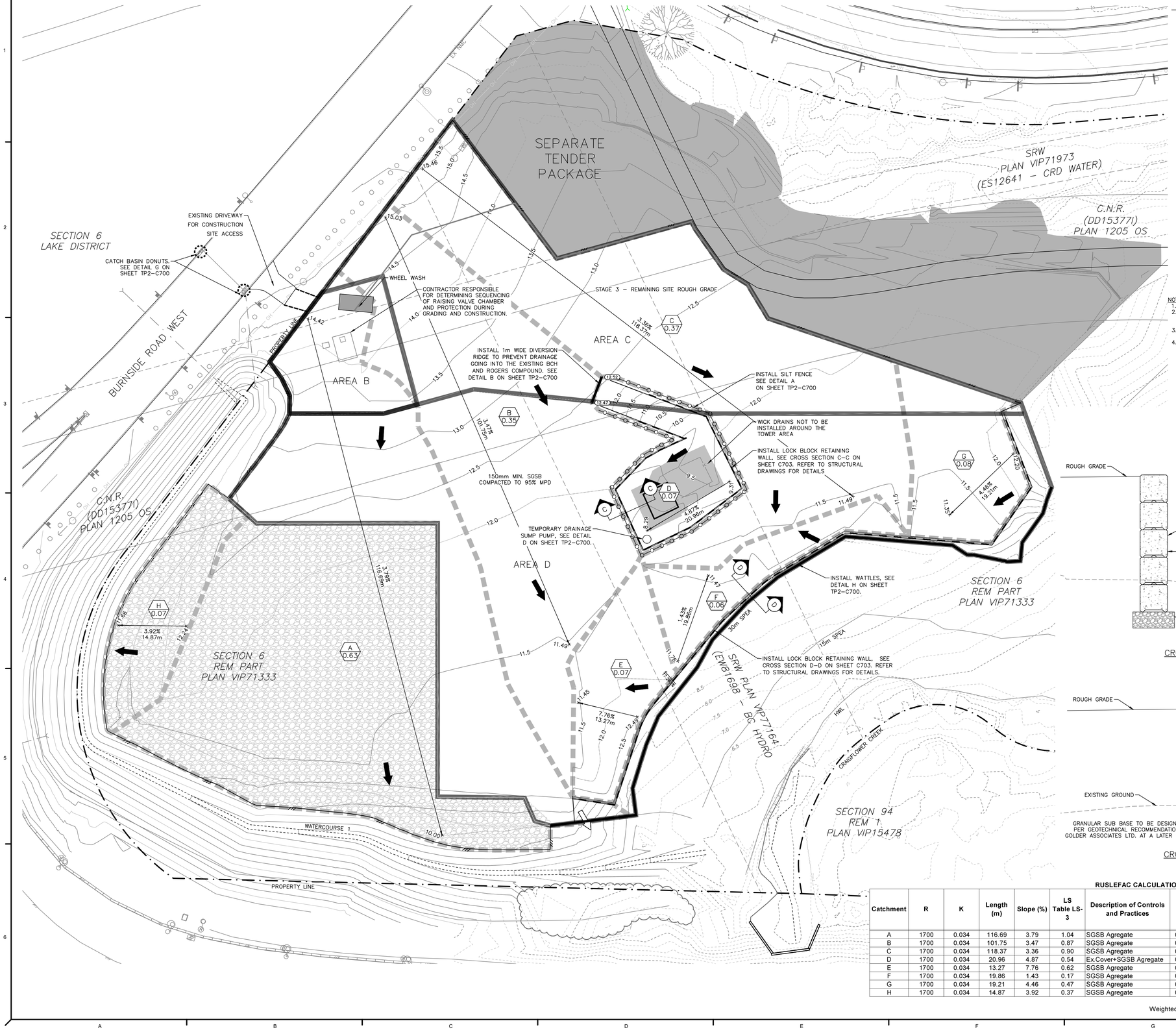
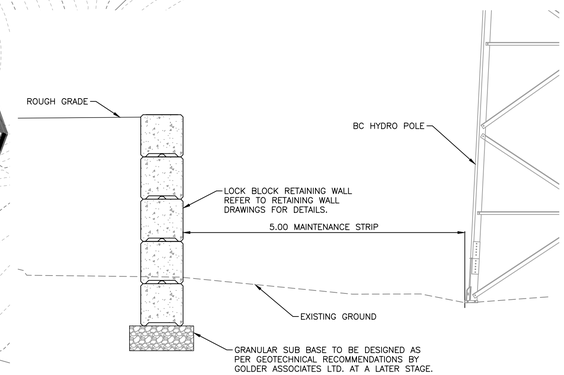


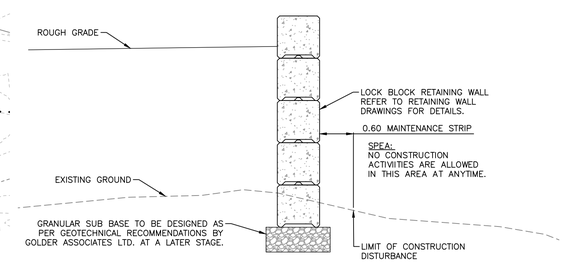
LEGEND

- CONSTRUCTION BOUNDARY
- DRAINAGE DIVIDES
- 15.0 — ROUGH GRADE CONTOUR
- 14.0 — EXISTING GRADE CONTOUR
- 1.00% — DIRECTION OF DRAINAGE FLOW
- OVERLAND FLOW DIRECTION
- RUN–ON / RUN–OFF LOCATIONS
- SILT FENCE
- WATTLES – 300mm FILTREXX SILTSOXX NATURAL ORIGINAL
- A / 0.04 — DRAINAGE DIVIDE LABEL / DRAINAGE DIVIDE AREA IN ha
- 150mm MIN. SGSB COMPACTED TO 95% MPD
- CATCH BASIN DONUT

NOTES:
1. CONTOURS SHOWN ARE FOR ROUGH GRADING.
2. 300mm OF TOPSOIL IS REQUIRED ON LANDSCAPE AREAS TO ACHIEVE FINISHED GRADE ELEVATIONS. SURFACE ROUGHENING IS REQUIRED PRIOR THE TOPSOIL PLACEMENT.
3. EROSION CONTROL BLANKET IS TO BE INSTALLED ON TOP OF TOP SOIL FOR FINAL STABILIZATION ON SLOPES ≥ 3:1.
4. FOR BOTTOM OF THE DITCH STABILIZATION AND CHECK DAM INSTALLATION REFER TO LANDSCAPE DRAWINGS.



CROSS SECTION C–C
1:50



CROSS SECTION D–D
1:50

RUSLEFAC CALCULATIONS

Catchment	R	K	Length (m)	Slope (%)	LS Table LS-3	Description of Controls and Practices	C	P	Area (ha)	A-Value (tonnes/ha)	Erosion Potential	
											Soil Loss With Contros	Soil Loss Without Contros
A	1700	0.034	116.69	3.79	1.04	SGSB Agregate	0.0100	1.000	0.63	0.602	0.379	37.94
B	1700	0.034	101.75	3.47	0.87	SGSB Agregate	0.0100	1.000	0.35	0.504	0.177	17.66
C	1700	0.034	118.37	3.36	0.90	SGSB Agregate	0.0100	1.000	0.37	0.522	0.193	19.30
D	1700	0.034	20.96	4.87	0.54	Ex Cover+SGSB Agregate	0.0000	1.000	0.07	0.000	0.000	2.17
E	1700	0.034	13.27	7.76	0.62	SGSB Agregate	0.0100	1.000	0.07	0.357	0.025	2.50
F	1700	0.034	19.86	1.43	0.17	SGSB Agregate	0.0100	1.000	0.06	0.101	0.006	0.61
G	1700	0.034	19.21	4.46	0.47	SGSB Agregate	0.0100	1.000	0.08	0.272	0.022	2.18
H	1700	0.034	14.87	3.92	0.37	SGSB Agregate	0.0100	1.000	0.07	0.214	0.015	1.50
								Total Area		1.70		
								Weighted Average A for the site (tonnes/ha)		1.51		

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REV	DESCRIPTION	YYYY-MM-DD
C	Issued For Tender Package 2	2021-07-05
B	Issued For 50% Design Review	2021-04-27
A	Issued For 30% Design Review	2021-03-15

STAMPS

BCTransit

CLIENT: BC TRANSIT

PROJECT: VICTORIA handyDART CENTRE

ESC STAGE 3

SCALE: 1:400 | PROJECT NO. 201919500

DWG.# TP2-C703 | REV C | DATE: 2021/07/26

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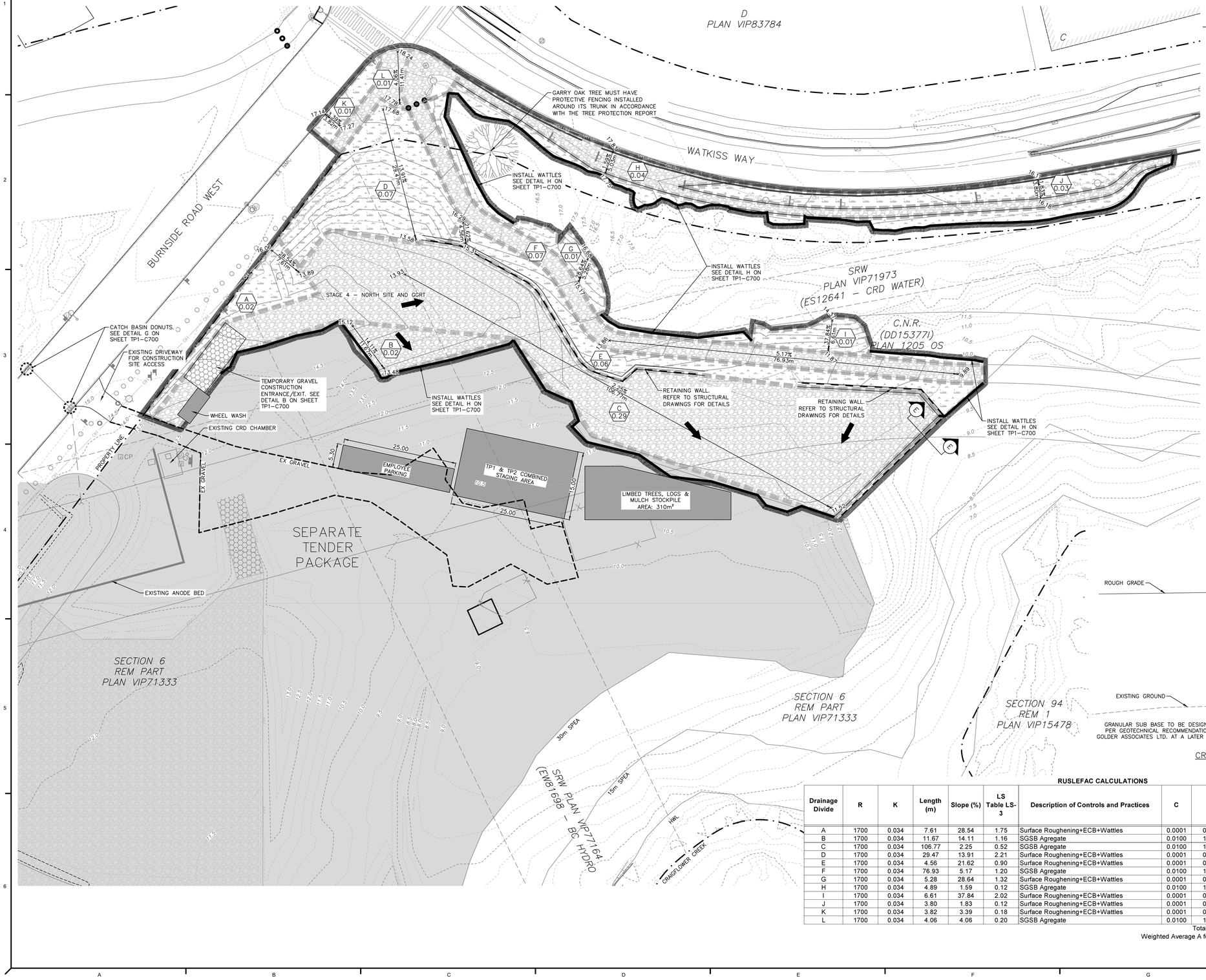
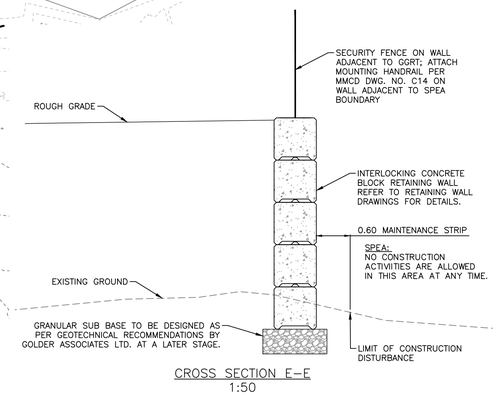


LEGEND

- CONSTRUCTION BOUNDARY
- DRAINAGE DIVIDES
- 15.0 ROUGH GRADE CONTOUR
- 14.0 EXISTING GRADE CONTOUR
- 1.00% DIRECTION OF DRAINAGE FLOW
- EXISTING SEDIMENTATION FACILITY
- OVERLAND FLOW DIRECTION
- RUN–ON / RUN–OFF LOCATIONS
- SILT FENCE
- WATTLES – 300mm FILTREXX SILTSOXX NATURAL ORIGINAL
- A 0.04 DRAINAGE DIVIDE LABEL / DRAINAGE DIVIDE AREA IN ha
- STABILIZED GRAVEL ACCESS
- CRUSHED GRAVEL BASE COURSE
- SEEDING AREA
- CATCH BASIN DONUT



CROSS SECTION E–E
1:50

RUSLEFAC CALCULATIONS

Drainage Divide	R	K	Length (m)	Slope (%)	LS Table LS-3	Description of Controls and Practices	C	P	Area (ha)	A-Value (tonnes/ha)	Erosion Potential	
											Soil Loss With Contros	Soil Loss Without Contros
A	1700	0.034	7.61	28.54	1.75	Surface Roughening+ECB+Wattles	0.0001	0.288	0.02	0.003	0.000	2.02
B	1700	0.034	11.67	14.11	1.16	SGSB Agregate	0.0100	1.000	0.02	0.669	0.013	1.34
C	1700	0.034	106.77	2.25	0.52	SGSB Agregate	0.0100	1.000	0.29	0.303	0.088	8.78
D	1700	0.034	29.47	13.91	2.21	Surface Roughening+ECB+Wattles	0.0001	0.288	0.07	0.004	0.000	8.96
E	1700	0.034	4.56	21.62	0.90	Surface Roughening+ECB+Wattles	0.0001	0.288	0.06	0.002	0.000	3.13
F	1700	0.034	76.93	5.17	1.20	SGSB Agregate	0.0100	1.000	0.07	0.696	0.049	4.87
G	1700	0.034	5.28	28.64	1.32	Surface Roughening+ECB+Wattles	0.0001	0.288	0.01	0.002	0.000	0.77
H	1700	0.034	4.89	1.59	0.12	SGSB Agregate	0.0100	1.000	0.04	0.068	0.003	0.27
I	1700	0.034	6.61	37.84	2.02	Surface Roughening+ECB+Wattles	0.0001	0.288	0.01	0.003	0.000	1.17
J	1700	0.034	3.80	1.83	0.12	Surface Roughening+ECB+Wattles	0.0001	0.288	0.03	0.000	0.000	0.21
K	1700	0.034	3.82	3.39	0.18	Surface Roughening+ECB+Wattles	0.0001	0.288	0.01	0.000	0.000	0.11
L	1700	0.034	4.06	4.06	0.20	SGSB Agregate	0.0100	1.000	0.01	0.117	0.001	0.12
								Total Area	0.64			
								Weighted Average A for the site (tonnes/ha)		2.92		

1:400 SCALE
4m 0 4 8 20m

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REV	DESCRIPTION	YYYY-MM-DD
E	Issued For Tender Package 1 (TP1)	2021-07-23
D	Draft Issued For Tender Package 1 (TP1)	2021-07-05
C	Draft Issued For Tender Package 1 (TP1)	2021-06-22
B	Issued For 50% Design Review	2021-04-27
A	Issued For 30% Design Review	2021-03-15

STAMPS

BCTransit

CLIENT: BC TRANSIT

PROJECT: VICTORIA handyDART CENTRE

ESC - TP1

SCALE: 1:400 | PROJECT NO. 201919500

DWG.# TP1-C704 | REV E | DATE: 2021/07/26

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