Southeast False Creek Private Lands

AUGUST 2009

PUBLIC REALM ENRICHMENT GUIDE

Final

CITY OF VANCOUVER

PWL partnership

PREPARED FOR THE CITY OF VANCOUVER BY PWL PARTNERSHIP LANDSCAPE ARCHITECTS INC.

AUGUST 2009

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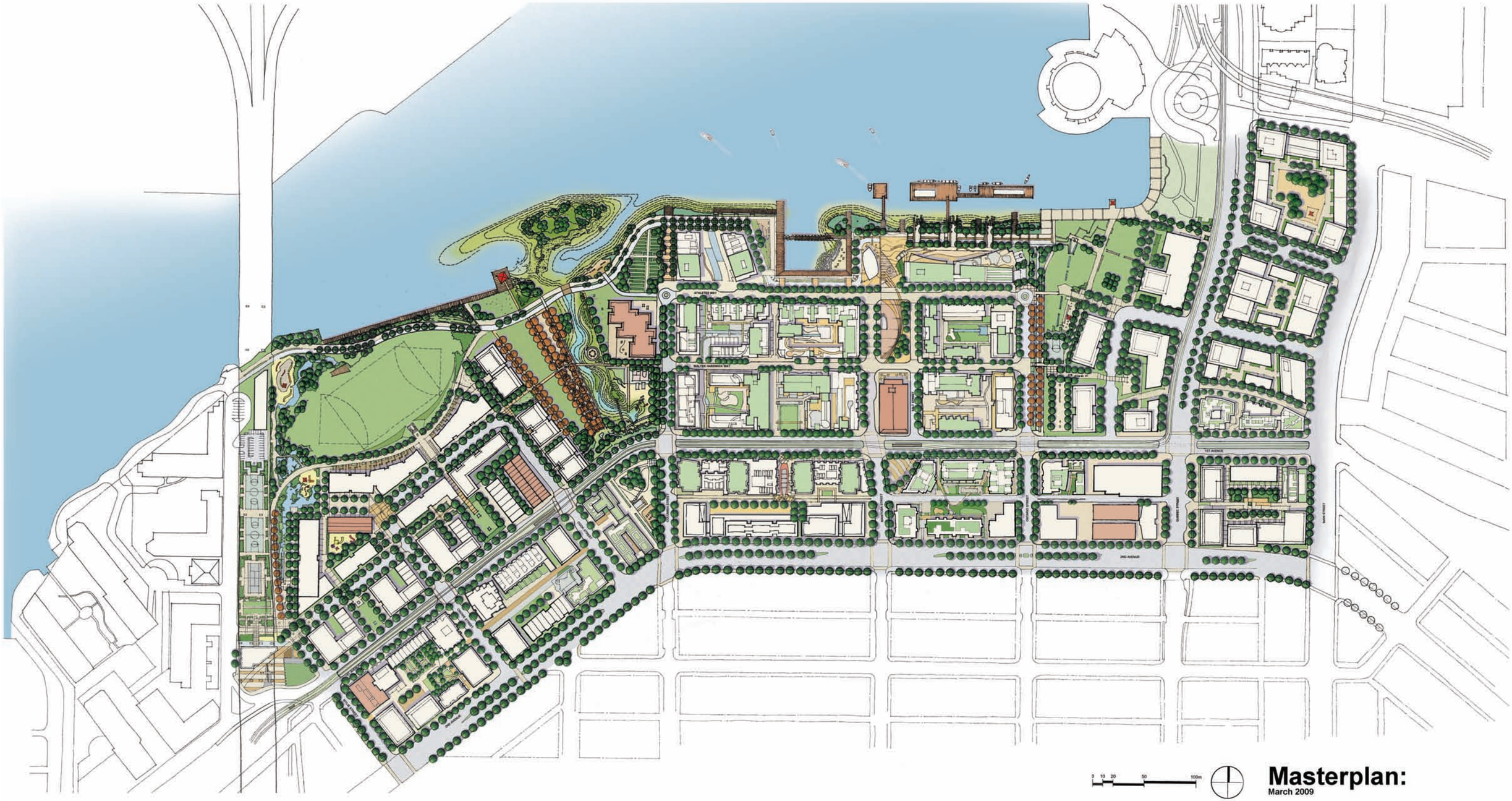
CONTENTS



Masterplan:

March 2009

1.0 INTRODUCTION

Southeast False Creek (SEFC) represents one of Canada's most unique urban redevelopment projects. Through the transformation of former industrial land into an innovative community, it will eventually be home to approximately 10,000 – 12,000 people. Amongst the key planning and design documents are the SEFC Official Development Plan (ODP) and SEFC Public Realm Plan that establish a comprehensive set of planning and design principles and strategies that guide development in the area. These principles and strategies address a range of topics including: determining the character of neighbourhoods, the density and massing of buildings, the objectives for parks, open spaces and plazas, the experience of streetscapes and overarching sustainability objectives.

The purpose of the Public Realm Enrichment Guide (PREG) for Southeast False Creek is to complement the ODP and Public Realm Plan by providing property owners, developers, and the city with design guidelines for the enhancement of streets and lanes consistent with the aesthetic, educational and sustainability objectives of the ODP and the Public Realm Plan, and the design directions established for the public lands in SEFC. The objectives of the Public Realm Enrichment Guide ("the Guide") are as follows:

a. *Specify the design of public realm features (e.g. sidewalk and lane pavement treatment, street bulges, benches, bollards, bike racks, etc.) for private lands in SEFC.*
b. *Identify general and specific guidelines for the location and placement of public realm features.*
c. *Serve as a design manual for staff, for applicants and the public in completing the SEFC public realm.*

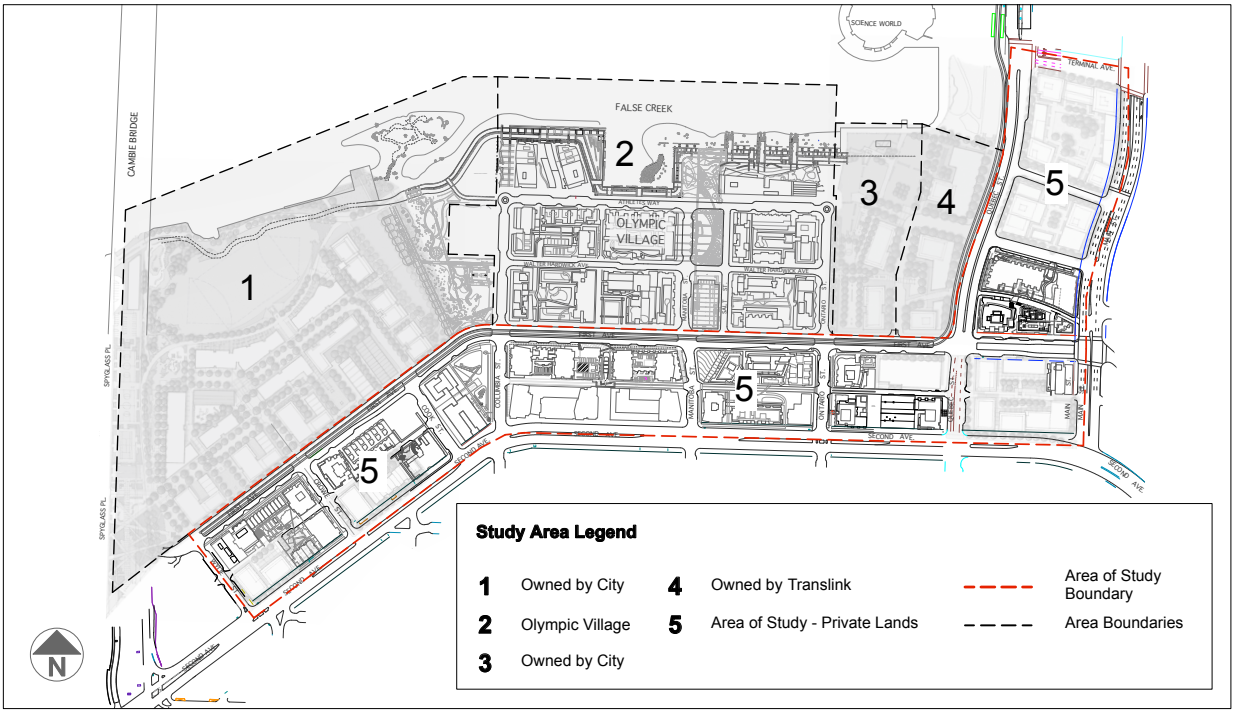
The Guide builds on opportunities presented through the redevelopment of private lands in SEFC. It celebrates the site's industrial and ecological heritage, enhances way-finding throughout the area, ensures that a distinctive and high quality public realm emerges, and references the SEFC sustainability objectives. The Guide provides design guidance for the following six design elements:

1. **Boulevards/Rain Garden** – Boulevards and street trees, rain gardens and street bulge planting, and urban agriculture.
2. **Structural Soil Cells**
3. **Paving Materials** – Sidewalks, boulevards, street corners, lanes and mews, edge restraint treatments, historic shoreline treatments, and tree surrounds.
4. **Lighting**
5. **Site Furnishings** – Benches, trash and recycling receptacles, bike racks and lockers, drinking fountains, bollards and granite blocks.
6. **Artistic Elements** – Vision and principles, sidewalk medallions, utility covers and lids

The Guide recognizes that although the developer of individual sites will be required to enrich the public realm components of their sites, the enrichment should not impose excessively expensive costs on them.

1.1 STUDY AREA

The study area includes all private land parcels within area 5, as shown, which includes the streetscape design on the south side of First Ave., north and south side of Second Ave., east and west side of Main Street and Quebec Street.



SEFC ENRICHMENT STUDY AREA

1.2 NEIGHBOURHOOD CHARACTER

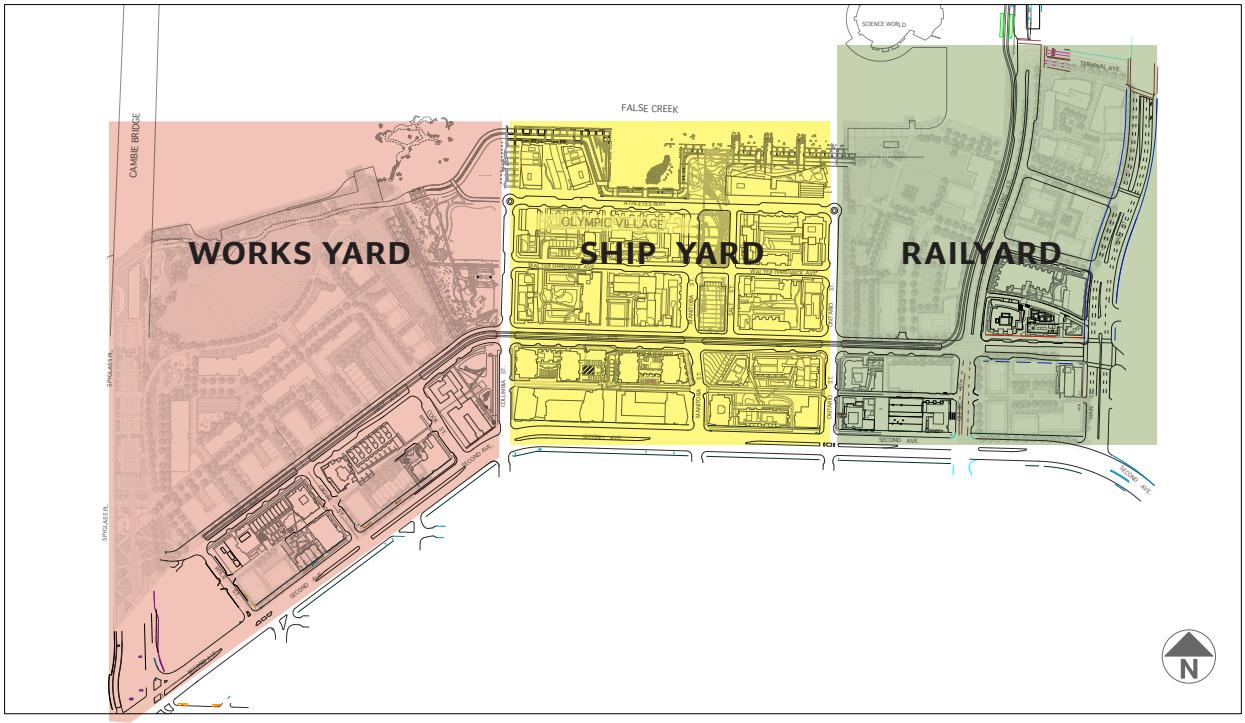
The Southeast False Creek ODP and Public Realm Plan describe a number of 'area-wide' and neighbourhood specific design guidelines and strategies to enable a coherent urban form to emerge across this new community. Building upon the ODP/Public Realm Plan guidelines, the Public Realm Enrichment Guide provides design direction for private land in SEFC to ensure there is design continuity between the development of SEFC's public and private lands. Like the ODP and Public Realm Plan, the Guide's recommendations can apply across the entire area, as well as within each of the distinct neighbourhoods identified in the ODP: the "Worksyard", in the western portion of the community; the "Shipyard", in the central portion; and the "Railyard", in the eastern portion. As each neighbourhood draws design inspiration from the historic activities specific to each area, so too do some of the hard landscape elements. The combination of 'area-wide' and 'neighbourhood' specific features and elements will help maintain design consistency across SEFC while allowing the character unique to each neighbourhood to surface.

The overarching design directions apply to standard neighbourhood elements and features found throughout the public realm in SEFC that do not change from neighbourhood to neighbourhood. These include:

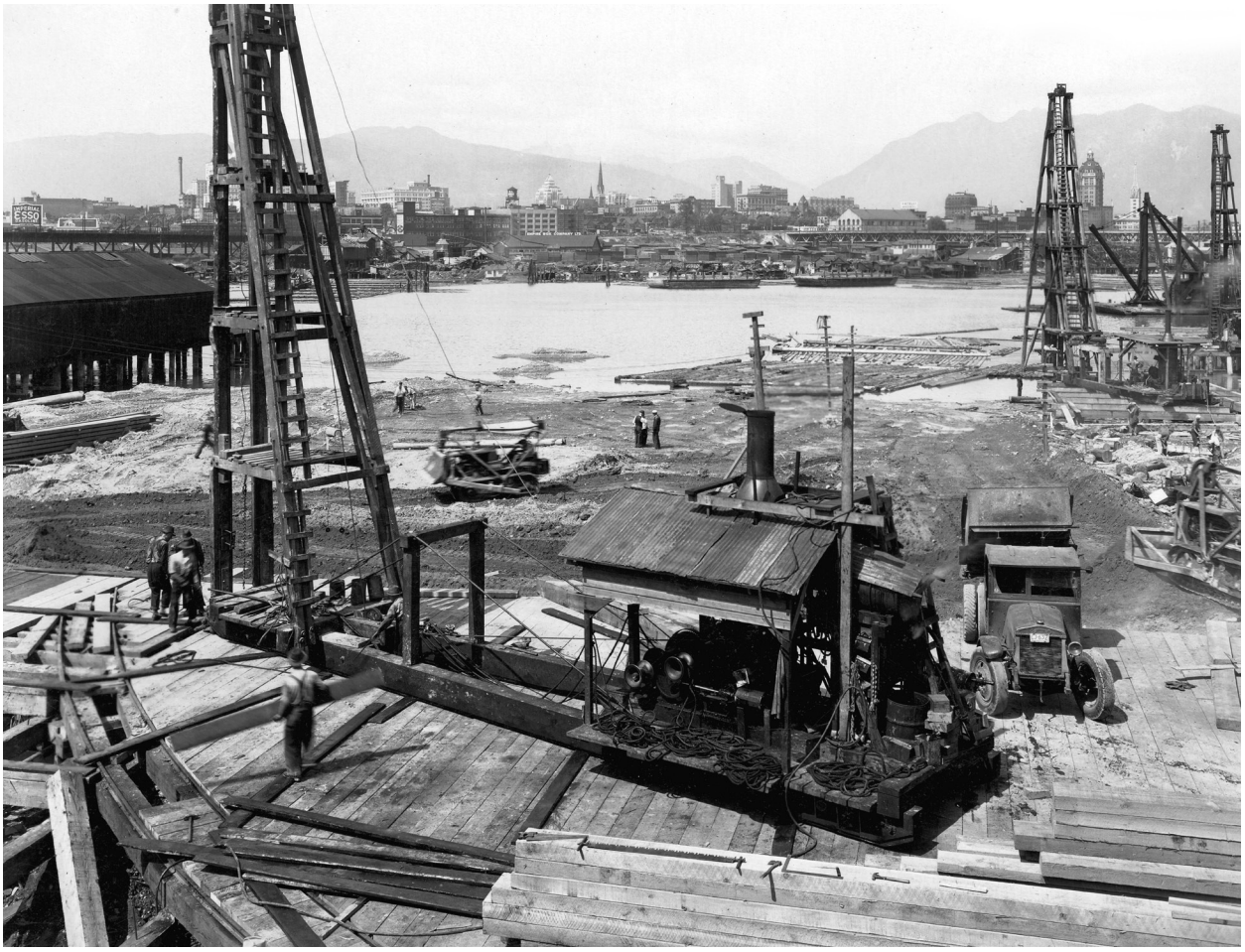
- The marking of the original 1889 shoreline and other shoreline progressions noted in the Public Realm Plan.
- Lane/Sidewalk Treatments and Bulges.
- Catch basin covers, sewer/water, and manhole lids.
- Site Furnishings, Bollards and granite blocks.

In addition to the standard features there are custom neighbourhood elements and features that vary in response to each neighbourhood's design theme. These include:

- Vista switch lids and hydro kiosks
- Medallions and other reused artifacts that can be embedded into the landscape (eg. sidewalks, lanes, bulges and walls, etc) .



SEFC NEIGHBOURHOOD HISTORIC ZONES



HISTORIC SOUTHEAST FALSE CREEK WATERFRONT

2.0 RELATED REPORTS / STUDIES

There are a number of studies that have influenced this work, including:

- **Southeast False Creek Policy Statement**, City of Vancouver
  Adopted by Vancouver City Council, October 1999
  http://vancouver.ca/commsvcs/guidelines/sefc/index.htm

- **Southeast False Creek Official Development Plan (ODP)**, 2005, City of Vancouver
  Adopted by Vancouver City Council July 19, 2005.
  http://vancouver.ca/commsvcs/southeast/documents/index.htm#odp

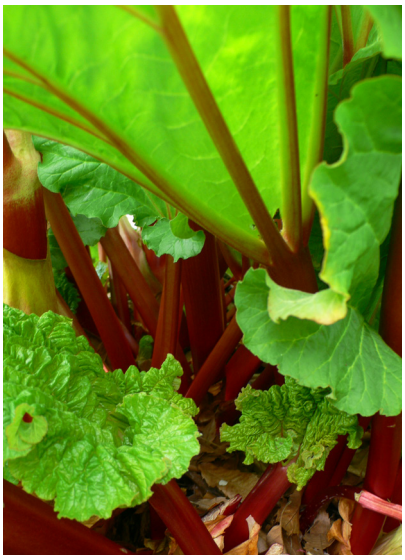
- **Southeast False Creek Public Realm Plan**, 2006, prepared by Stantec, PWL Landscape Architects and Commonwealth. Approved by Council on July 20, 2006
  http://vancouver.ca/commsvcs/southeast/documents/index.htm#realm

- **Southeast False Creek Art Master Plan**, March 2007, by 4 Culture & Buster Simpson
  http://vancouver.ca/commsvcs/southeast/documents/index.htm#artmasterplan

- **Southeast False Creek Heritage Study**, September 2004, Commonwealth Heritage
  http://vancouver.ca/commsvcs/southeast/documents/index.htm#heritage

- **Private Lands Design Guidelines**
  http://vancouver.ca/commsvcs/southeast/documents/index.htm#private

All above reports and studies are to be considered and read in context with this study.



URBAN AGRICULTURE

STREET TREES - ACER RUBRUM

STREET TREES - CERCIDIPHYLLUM JAPONICUM

3.0 BOULEVARDS / RAIN GARDENS / STREET BULGES

The boulevards and street bulges provide green and unique character for the private lands. Manicured lawn should not be planted on any boulevards.

In boulevards areas where there is no parking and/or people crossing the boulevards to access retail, commercial and or residential development, the boulevards should be planted with the recommended plant list or City approved alternatives.

In areas where pedestrians are crossing boulevards from parking zones to access residential and commercial development, planting should be minimized and concentrated adjacent to or near the street trees.

Annual plant material should not be planted in the boulevard areas. The continual replanting of annuals will disturb the existing/established plant material and street trees. Perennials are encouraged in the boulevards.

3.1 URBAN AGRICULTURE

Urban agriculture is encouraged in the private lands and where appropriate on the public realm areas within the private lands.

3.2 STREET TREES

The Street Tree framework and structure for Southeast False Creek has been established in the Public Realm Plan. Healthy and majestic street trees are an important environmental feature/element in the precinct. The street tree requirements and selection applies to the public streets as well as the public lanes and public mews. The street trees proposed in the SEFC Public Realm Plan have been updated based on new information and direction from Engineering, Vancouver Parks Board, and the City Arborist.

3.3 BOULEVARD STREET TREE REQUIREMENTS

1. Minimum caliper of 7cm
2. All trees must follow BCLNTA and BCSLA Standards
3. Structural soil cells in conjunction with structural soil must be installed as per Section 4.0 of this guide.
4. Trees along the street are to be continuous and not more than 10m o.c.
5. Final selection and approval of street trees to be done by the City of Vancouver.
6. Street Trees are to be uniform in shape and form and of the highest quality

3.3.1 RECOMMENDED STREET / LANE / MEWS TREE LIST

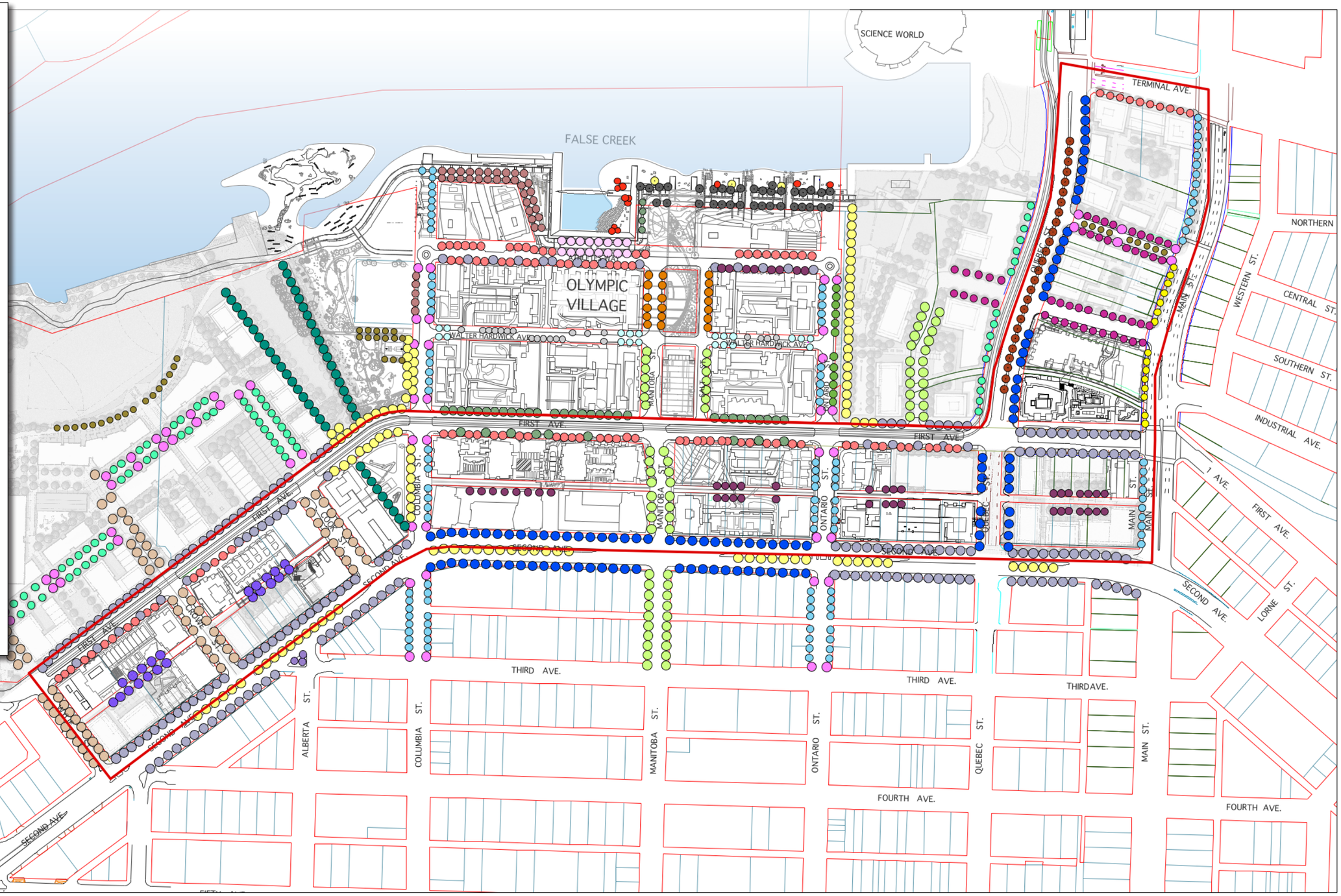
Trees

Botanical name	Common name
Acer cappadocicum ‘ Rubrum’	Colliseum Maple
Acer rubrum ‘Armstrong’	Armstrong Red Maple
Acer rubrum ‘Morgan’	Morgan Red Maple
Acer rubrum ‘Scarlet Sentinal’	Scarlet Sentinal Red Maple
Acer platanoides ‘Cleveland’	Cleveland Norway Maple
Acer platanoides ‘Columnare’	Columnare King Maple
Acer platanoides ‘ Easy Street’	Easy Street Norway Maple
Acer platanoides ‘ Emerald Queen’	Emerald Queen Maple
Carpinus betulus ‘ Fastigiata’	European Hornbeam
Cercidiphyllum japonicum	Katsura Tree
Davidia involucrata	Dove Tree
Liquidamber styraciflua ‘ Worplesdon’	Worplesdon Sweet Gum
Liriodendron chinensis	Chinese Tulip Tree
Oxydendrum arboreum	Sour Wood
Platanus acerifolia ‘Bloodgood’	Plane Trees (for medians and along park edges
Parrotia persica	Persian Ironwood
Quercus accutissima	Sawtooth Oak
Quercus frainetto	Forest Green Italian Oak
Tilia tomentosa	Silver Linden
Zelkova serrata	Japanese Zelkova Tree

Street Tree Legend

- Acer cappadocicum 'Rubrum' — Cappadocian Maple Magnolia
- Acer macrophyllum — Big Leaf Maple
- Acer platanoides 'Cleveland' — Cleveland Norway Maple
- Acer platanoides 'Columnar' — Columnar Norway Maple
- Acer platanoides 'Easy Street' — Easy Street Norway Maple
- Acer platanoides 'Emerald Queen' — Emerald Queen Norway Maple
- Acer rubrum 'Armstrong' — Armstrong Red Maple
- Acer rubrum 'Karpick' — Karpick Red Maple
- Acer rubrum 'Morgan' — Morgan Red Maple
- Acer rubrum 'Scarlet Sentinal' — Scarlet Sentinal Red Maple
- Acer truncatum 'Norwegian Sunset' — Shantung Maple
- Acer x freemanii 'Autumn Blaze' — Freeman Maple
- Carpinus betulus 'Fastigiata' — European Hornbeam
- Carpinus caroliniana — American Hornbeam
- Cercidiphyllum japicum — Katsura Tree
- Davidia involucrata — Dove Tree
- Fraxinus ornus — Flowering Ash
- Fraxinus oxycarpa 'Raywood' — Raywood Ash
- Metasequoia glyptostroboides — Dawn Redwood
- Perrotia persica 'Ignes Ruby Vase' — Persian Ironwood
- Platanus acerifolia 'Bloodgood' — London Plane Tree
- Quercus acutissima — Sawtooth Oak
- Quercus frainetto 'Schmidt' — Forest Green Italian Oak
- Stewartia koreana — Korean Stewartia
- Zelkova Serrata 'Green Vase' — Green Vase Japanese Zelkova

Study Area Boundary

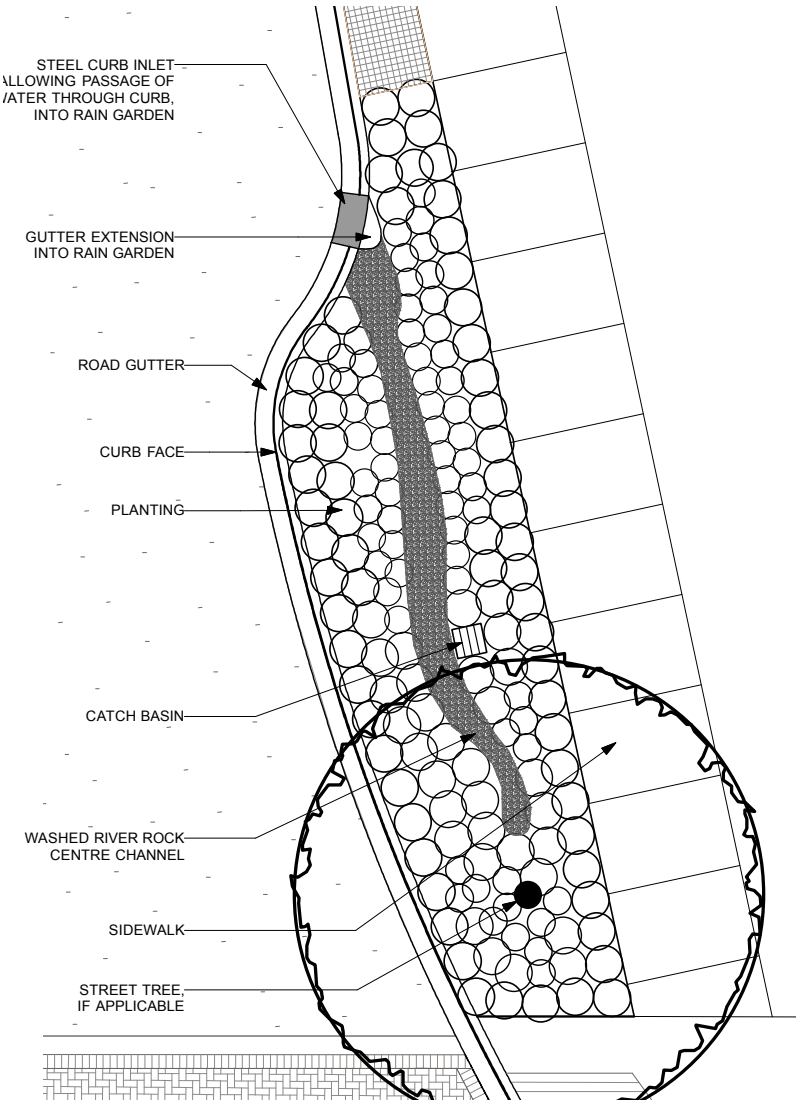


3.5 RAIN GARDEN PLANTING

Where possible, rain garden planting is proposed for curb bulges to intercept stormwater runoff and help improve water quality.

In considering shrub and tree planting ensure there is sufficient room for mature plant growth, and that sightlines for pedestrians and vehicles will not be compromised.

Consult the Vancouver Streets Restoration Manual for City of Vancouver Standards regarding Rain Garden Bulge Construction



STREET CORNER RAIN GARDEN (TYPICAL LAYOUT)

3.5.1 RECOMMENDED RAIN GARDEN PLANT LIST

Bottom Channel		Exposure	Size
Emeregent Plants			
Carex aquatilis var dives(sitchensis)	Sitka Sedge	Full Sun/Part Shade	0.6-1.2m
Carex obnupta	Slough Sedge	Full Sun/Part Shade	0.3-1.2m
Carex rostrata	Beaked Sedge	Full Sun	0.3 - 1 m
Carex stipata	Sawbeak Sedge	Full Sun	0.6-1.2m
Carex tumulicola	Berkeley Sedge	Full Sun/Part Shade	0.6-1.2m
Deschampsia cespitosa	Tufted Hair Grass	Full Sun/Part Shade	0.6-1.2m
Eleocharis palustris	Creeping spikerush	Full Sun/Part Shade	0.3 - 1 m
Iris douglasiana	Douglas Iris	Full Sun	0.3 - 0.6m
Iris missouriensis	Western Blue Iris	Full Sun	0.3 - 0.6m
Juncus acuminatus	Tapered Rush	Full Sun/Part Shade	0.3 - 1 m
Juncus effusus	Common Rush	Full Sun	0.3 - 1 m
Juncus tenuis	Slender Rush	Full Sun	0.3 - 1 m
Scirpus lacustris	Hard Stemmed Bullrush	Full Sun	1 - 2m
Scirpus microcarpus	Small Fruited Bullrush	Full Sun/Part Shade	0.6 - 1 m
Shrubs - Evergreen			
Blechnum spicant	Deer fern	Part Sun/Shade	0.3 - 0.6m
Ledum groenlandicum	Labrador Tea	Full Sun	0.6-1.2m
Polystichum munitum	Western Swordfern	Part Sun/Shade	0.6-1.2m

Side Slopes

Groundcovers			
Gaultheria shallon	Salal	Full Sun/Part Shade	0.3 - 0.5m
Mahonia nervosa	Creeping Oregon Grape	Full Sun/Part Shade	0.3 - 0.5m
Mahonia repens	Creeping Mahonia	Full Sun/Part Shade	0.1 - 0.2m
Shrubs - Deciduous			
Ribes lacustre	Black Gooseberry	Full Sun/Part Shade	1 - 2m
Symphoricarpus albus	Snowberry	Full Sun/Part Shade	1 - 1.2m
Shrubs - Evergreen			
Ledum groenlandicum	Labrador Tea	Full Sun	0.6-1.2m
Mahonia nervosa	Creeping Oregon Grape	Full Sun/Part Shade	0.3 - 0.5m
Polystichum munitum	Western Swordfern	Part Sun/Shade	0.6-1.0m
Perennials/Grasses			
Aquilegia formosa	Red Columbine	Full Sun/Part Shade	0.5 - 1.0m
Aster subspicatus	Douglas Aster	Full Sun	0.3 - 0.6m
Festuca rubra	Red Fescue	Full Sun	0.4 - 0.6m
Helictotrichon sempervirens	Blue Oat Grass	Full Sun	0.3 - 0.6m
Hemerocallis var.	Day Lily	Full Sun	0.3 - 0.6m
Lupinus polyphyllus	Large Leaved Lupine	Full Sun/Part shade	0.6 - 1.0m
Pennisetum alopercuroides 'Hameln'	Dwarf Fountain Grass	Full Sun/Part Shade	0.5 - 1.0m

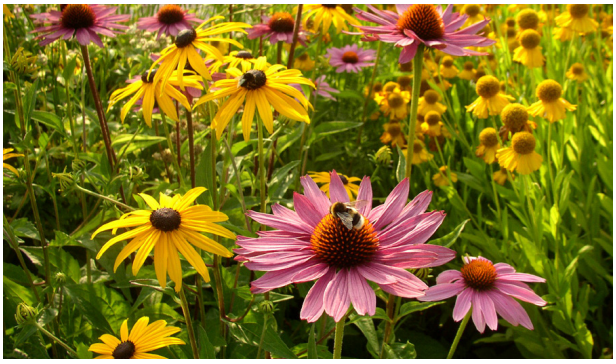
3.6 STREET BULGE PLANTING

Street bulges both on street corners and mid-blocks serve a variety of purposes including traffic calming, and enhancing the pedestrian realm experience. Located at street corners and along the length of the street, they function to define parallel parking, while physically reducing the width of the street at particular locations. Bulges located opposite to one another on each side of the street allow shorter distances for pedestrian crossings. They also provide larger areas for planting beyond the typical street boulevard for street tree and shrub planting and, in particular locations, rain gardens. Below is a typical list of plants that have been selected for their use in street bulges. Ensure plant material does not block sightlines from vehicles.

3.6.1 RECOMMENDED TYPICAL STREET BULGE PLANT LIST

Shrubs		Exposure	Size ht x spread
Botanical name	**Common name**		
Cornus sericea 'Kelseyii'	Kelseyii Dogwood	Full Sun/Part Shade	2.5 x 2.5m
Hebe buxifolia	Boxwood Hebe	Full Sun	0.8 x 1m
Microbiota decussata	Siberian Cypress	Full Sun/Part Shade	0.3 x 1.2m
Rosa 'Gourmet Popcorn'	Rose 'Gourmet Popcorn'	Part Sun	0.8 x 0.45 m
Sarcaccocca hookeriana humilius	Himalayan Sweet Box	Part Shade	0.6 x 2m
Senecio greyii	Senecio	Full Sun/Part Shade	0.9 x 1.2m
Symphoricarpos chenaultii 'Hancock'	Hancock Trailing Snowberry	Full Sun/Part Shade	0.6 x 0.6m
Vaccinium ovatum 'Thunderbird'	Thunderbird Evergreen Huckleberry	Full Sun/Part Shade	1.2 x 1.2m
Ground Covers		Exposure	Size ht x spread
Arctostaphylos uva ursi	Bearberry	Full Sun/Part Shade	0.4 x 0.4m
Erica carnea 'Springwood Pink'	Spring Pink Winter Heather	Full Sun/Part Shade	0.15 x 0.7m
Erica carnea 'Springwood White'	Dwarf White Heather	Full Sun/Part Shade	0.15 x 0.7m
Gaultheria shallon	Salal	Full Sun/Part Shade	0.3 x 0.5m
Lonicera pileata	Privet Honeysuckle	Full Sun/Part Shade	0.6 x 1.2m
Mahonia nervosa	Dwarf Oregon Grape	Full Sun/Part Shade	1.2 x 0.9m
Rubus calcynoides 'Emerald Carpet'	Emerald Carpet Oriental Raspberry	Full Sun	0.3 x 1.8m
Paxistima canbyi	Cliff-green	Full Sun/Part Shade	1.2 x 1.2m
Salvia argentea	Silver Sage	Full Sun	0.40 x 0.6m
Waldsteinia ternata	Barren Strawberry	Shade/Part Shade	0.15 x 0.4m

Perrenials, Ferns, and Ornamental Grasses		Exposure	Size ht x spread
Carex flagellifera 'Kiwi'	'Kiwi' Weeping Brown Sedge		
Carex morrowii 'Ice Dance'	Variegated Sedge	Shade/Part Shade	0.3 x 0.45m
Carex pendula	Great Drooping Sedge	Full Sun/Part Shade	1.0 x 0.50m
Echinecea pupurea	Purple Cone Flower	Full Sun/Part Shade	1.0 x 0.50m
Epimedium pinnatum ssp. colchicum	Epimedium Barrenwort	Full Sun/Part Shade	0.3 x 0.45m
Epimedium x perralchimcum 'Frohnleiten'	Epimedium Barrenwort	Full Sun/Part Shade	0.3 x 0.50m
Festuca glauca 'Elijah Blue'	Elijah's Blue Fescue	Full Sun/Part Shade	0.25 x 0.25m
Festuca valesiaca 'Glaucantha'	Wallis Fescue	Full Sun/Part Shade	0.4 x 0.6m
Hosta 'Frances Williams'	Frances Williams Hosta	Full Shade/Pt Shade	1.2 x 1.5m
Hosta 'Gold Standard'	Gold Standard Hosta	Full Shade/Pt Shade	0.9 x 1.2m
Iris missouriensis	Western Blue Iris	Full Sun/Part Sun	0.3 x 0.4m
Juncus effusus 'Goldstrike'	'Goldstrike' Rush	Full Sun/Part Shade	0.8 x 0.4m
Juncus inflexus 'Lovesick Blues'	'Lovesick Blues' Weeping Rush	Full Sun/Part Shade	0.4 x 0.8m
Juncus effusus	Common Rush	Full Sun/Part Shade	0.8 x 0.6m
Luzula sylvatica	Greater Wood Rush	Full Shade/Pt Shade	0.5 x 0.5m
Polystichum munitum	Western Swordfern	Full Shade/Pt Shade	1.0 x 1.0m
Rudbeckia fulgida var. fulgida	Black-eyed Susan	Full Sun/Part Shade	0.7 x 0.5m
Scirpus microcarpus	Small Flowered Bullrush	Full Sun/Part Shade	1.0 x 0.25m
Sedum 'Purple Emperor'	Purple Emperor Sedum	Full Sun	0.4 x 0.5m
Sedum x telphium 'Autumn Joy'	Autumn Joy Sedum	Full Sun/Part Shade	0.4 x 0.6m



ECHINECEA PUPUREA & RUDBECKIA FULGIDA

SEDUM X TELPHIUM 'AUTUMN JOY'

SARCACCOCA

POLYSTICUM MUNITUM

FESTUCA GLAUCA

GAULTHERIA SHALLON

RAIN GARDENS & ROUGH ROAD GRADING LEGEND

- Rain Gardens
- Rough Road Grade Direction
- Study Area Boundary

FALSE CREEK

SCIENCE WORLD

OLYMPIC VILLAGE

ATHLETES WAY

WALTER HARDWICK AVE

MANITOBA ST.

SALT ST.

ONTARIO ST.

QUEBEC ST.

TERMINAL AVE.

MAIN ST.

WESTERN ST.

NORTHERN

CENTRAL ST.

SOUTHERN ST.

INDUSTRIAL AVE.

1 AVE.

FIRST AVE.

SECOND AVE.

THIRD AVE.

FOURTH AVE.

LORNE ST.

COLUMBIA ST.

ALBERTA ST.

COOK ST.

CROWE ST.

WYATT ST.

FIFTH AVE.

SPYGLASS PL.

WHEELHOUSE SQUARE

COMMODORE RD.

PWL partnership

Southeast False Creek Private Lands

RAIN GARDEN LOCATIONS & ROUGH ROAD GRADING

FINAL AUGUST 2009

3.8

3.7 MAINTENANCE OF BOULEVARDS AND RAIN GARDENS

It is recommended that landscape maintenance of the boulevards and rain gardens occur for a period of two years prior to being turned over to the City.

It is the responsibility of the adjacent landowner / strata to maintain the boulevards by:

- watering the street trees
- watering the boulevard plant material

Any pruning, thinning, or maintenance required on the street trees must be completed only by the City of Vancouver.

4.0 SOIL CELLS + STRUCTURAL SOIL

Healthy street trees are an important element of the overall landscape framework for Southeast False Creek. To ensure the trees will be healthy, assist in cooling the urban heat island, capture rain water, and provide the other aesthetic and environmental benefits, a significant growing medium is needed. "The current recommendation for urban trees is a minimum of 1000 - 1200 cubic feet (28.3 -34.0 cubic meters) of soil to support a tree of 16-20 inches (40.6 - 50.8 cm) DBH with larger volumes needed to support even larger trees." (1) Soil cells should be installed under all sidewalk pavement and paver areas recognizing that it is not always practical to install soil cells in the same corridor as utilities. The City will evaluate whether soil cells should be installed proximate to utilities by taking into account:

- the need to protect/buffer existing or planned utilities (but not unplanned utilities),
- the scheduling order of installations,
- and the availability of qualified inspection staff to oversee the installation. Double depth soil cells are to be used where applicable.

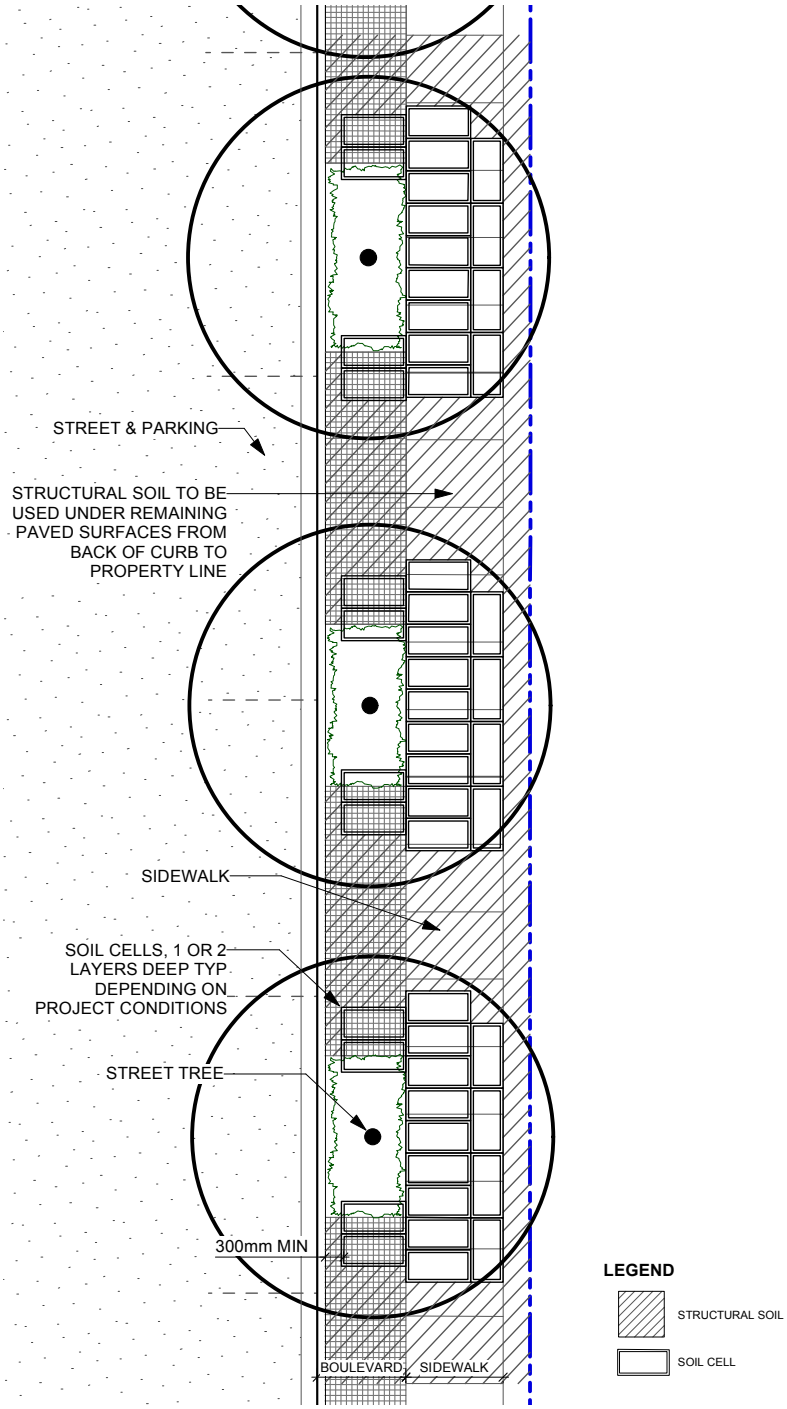
Where soil cells are not used, structural soils should be used. Structural soils should be used for all laneway trees.

(1) James Urban, ASLA ISA

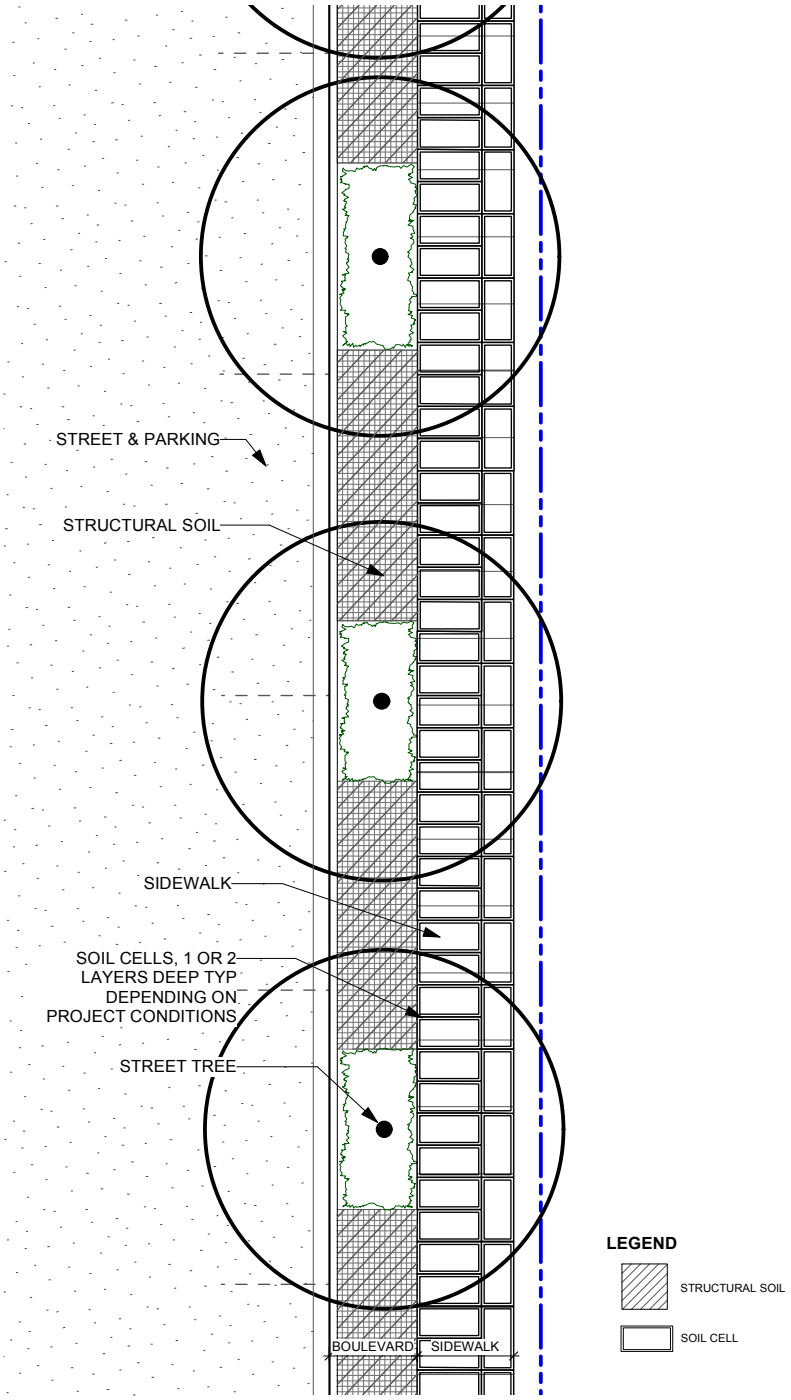
The diagrams that follow demonstrate two soil cell configurations, but not necessarily the only possible ones.

- Arrangement 1 would promote more uniform root growth around the base of the tree, in addition this separated layout allows soil cells to be used under curved sections of the public realm.
- Arrangement 2 would allow tree roots to travel further distances due to the continuous nature of the layout. This layout would also be quicker to install, but would not work in curved or irregularly shaped sections of the public realm.

4.1 SOIL CELL ARRANGEMENT 01



4.2 SOIL CELL ARRANGEMENT 02



5.0 PAVING MATERIALS

Paving materials were established in the original SEFC Public Realm Plan and are being updated for the private lands by this document. The paving materials have been selected to create a unique and special character for the public realm while at the same time addressing durability, maintenance, accessibility, and life cycle costs.

The paving material plans identify paving for the various areas, streets, and lanes in the SEFC Private Lands.

5.1 SIDEWALKS

5.1.1 CONCRETE

Concrete sidewalks are proposed for the majority of the sidewalks in the SEFC Private Lands Precinct. Locations are noted on the Paving Key Plan, section 5.8 of this document. To ensure the concrete sidewalks have a distinct character in the precinct, they are to be broom finished, without tooling, and with expansion joints and saw cut control joints.

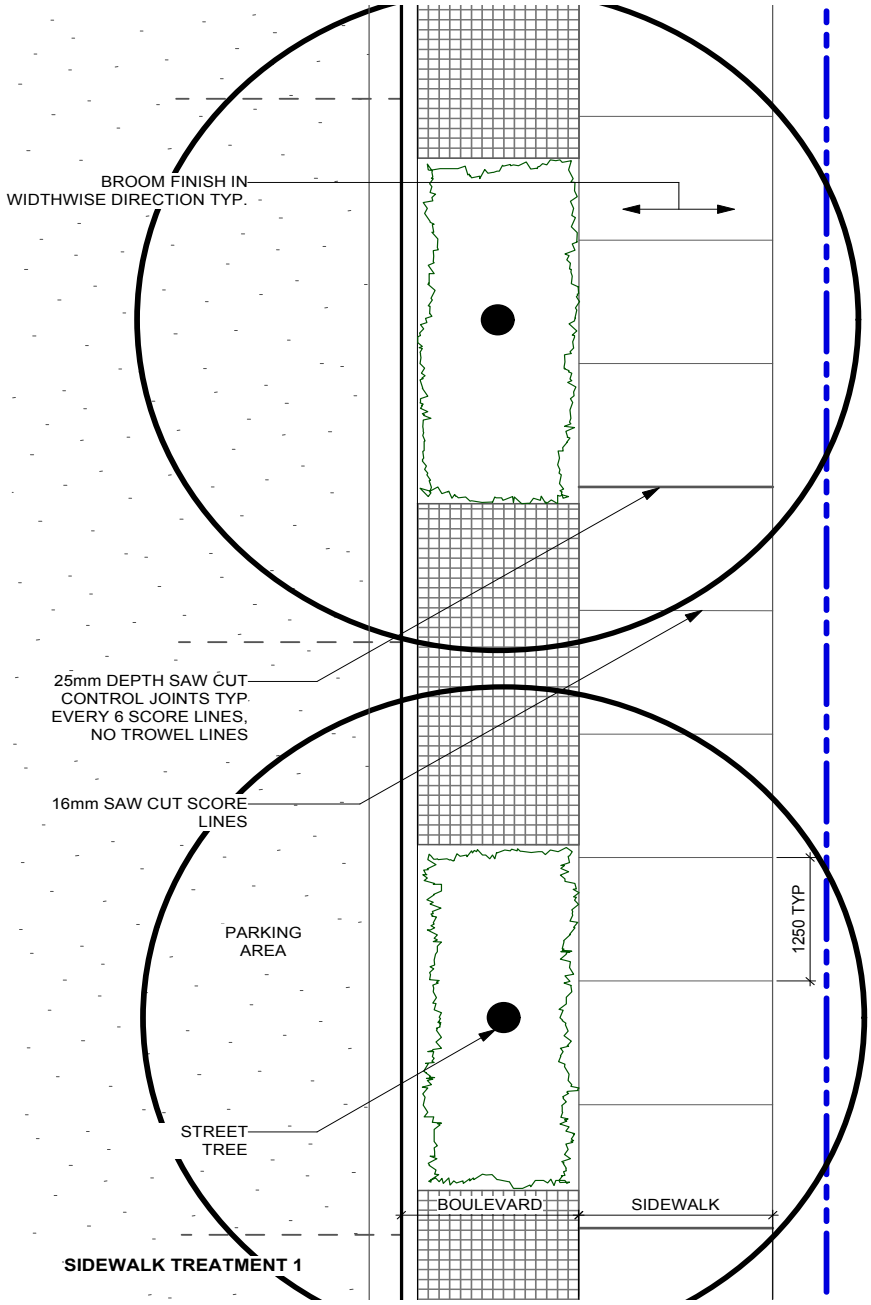
5.1.2 CONCRETE UNIT PAVERS

Concrete unit pavers are proposed in a variety of locations to identify unique and special areas of Southeast False Creek.

California pavers should be laid in a running bond pattern perpendicular to the sidewalk. Colours and finish are noted on the plan details. All paving specifications should follow the ICPI Paving Specifications and the consultant should ensure that construction methods are held at the highest levels.

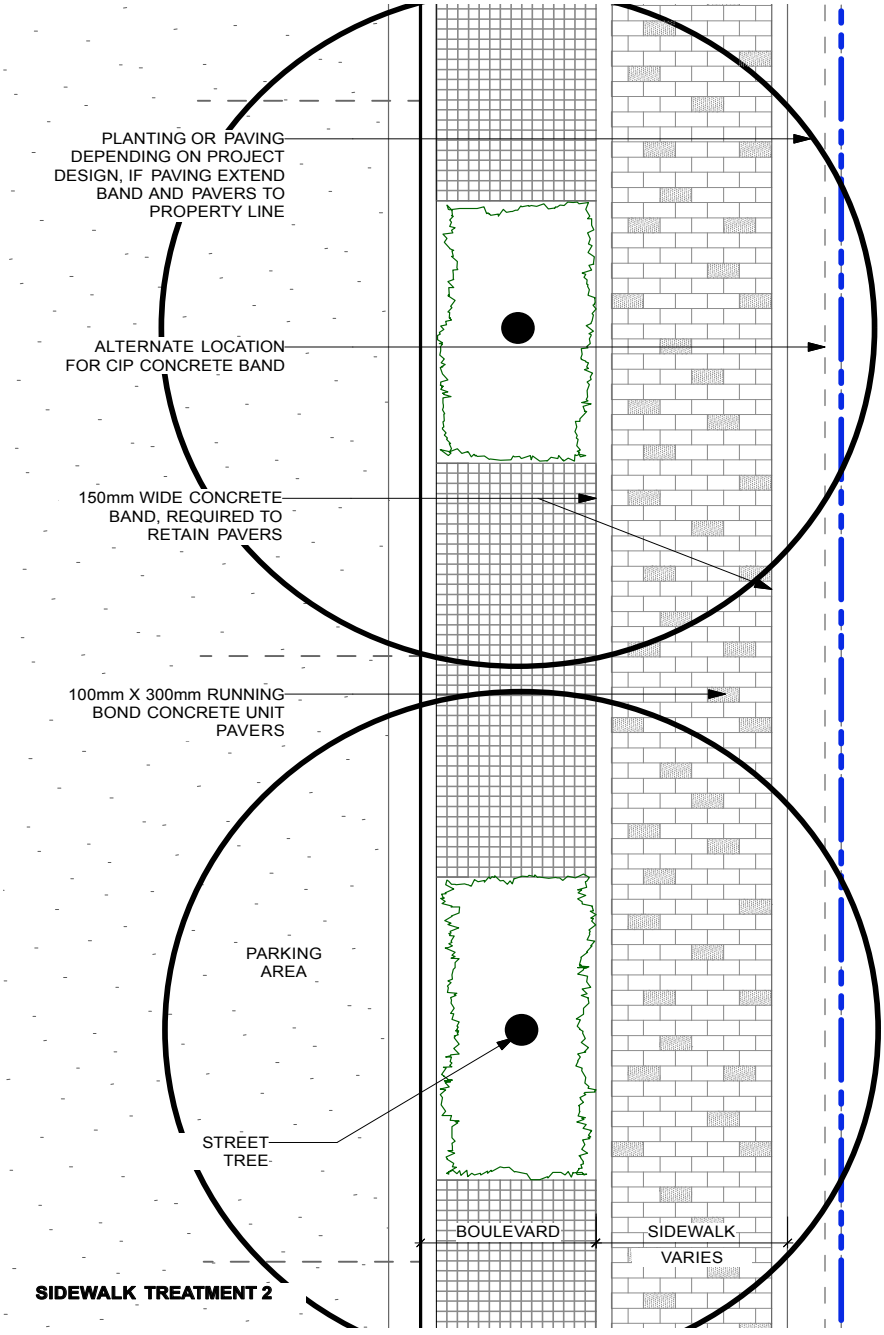
See diagrams that follow.

5.1.1 CONCRETE



Note: Ensure no troweling

5.1.2 CONCRETE UNIT PAVERS



5.2 BOULEVARDS

There are three boulevard treatments that vary according to the land adjacent, the land use and street conditions. Edge restraint should be reinforced with concrete.

Treatment 1: Street trees with generous planting beds and granite setts without gaps is applied to commercial boulevards with low to medium pedestrian traffic. This granite sett layout provides a 'formal' appearance while allowing people to access street parking.

Used in mixed-use residential areas

Treatment 2: Street trees and granite setts with either planting or crushed granite granular paving at the base of trees is applied to commercial boulevards with high pedestrian traffic. This granite sett layout provides a 'formal' appearance while allowing people to access street parking.

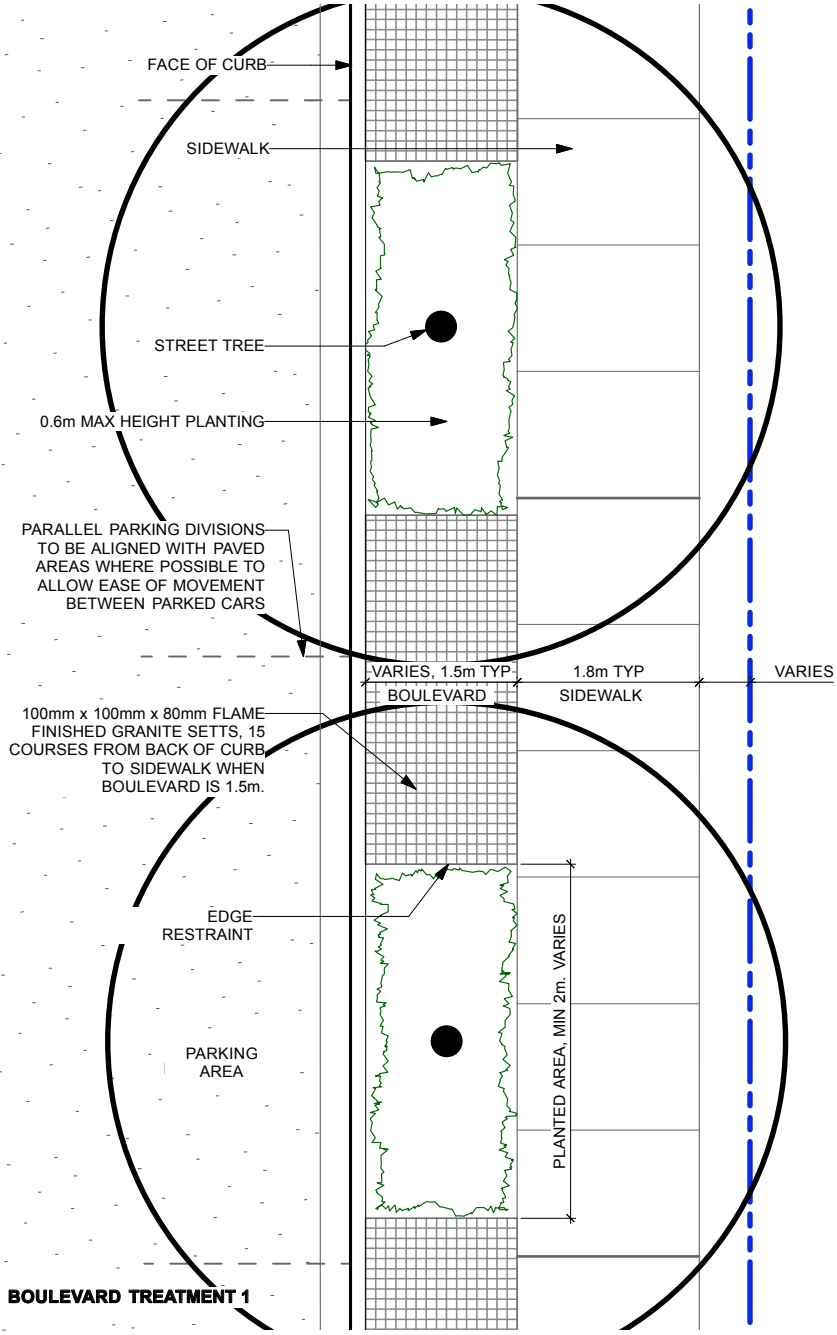
Used in commercial areas

Treatment 3: Street trees with low planting is applied to high traffic streets. This fully planted boulevard is suitable where there is no street parking.

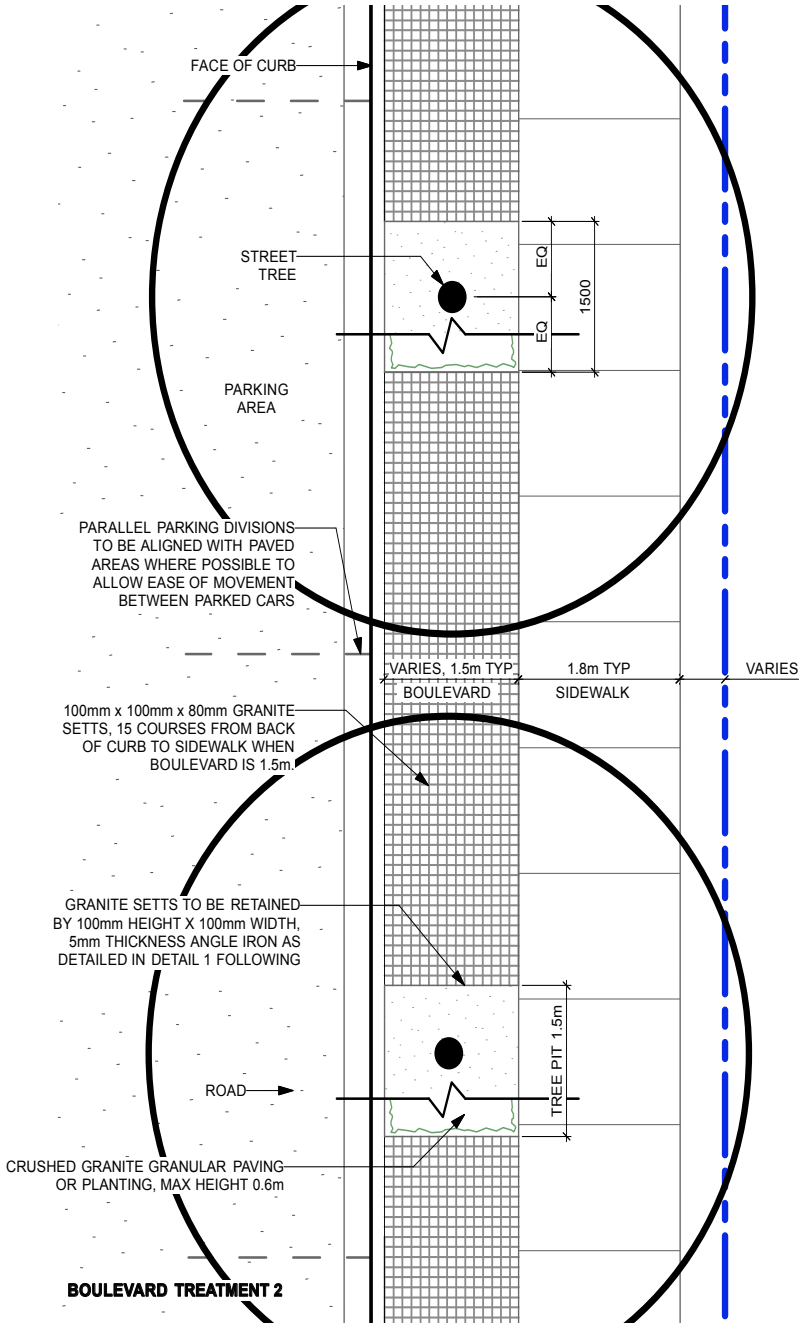
Example Image of Flame Finished Granite Setts

See treatment plans that follow.

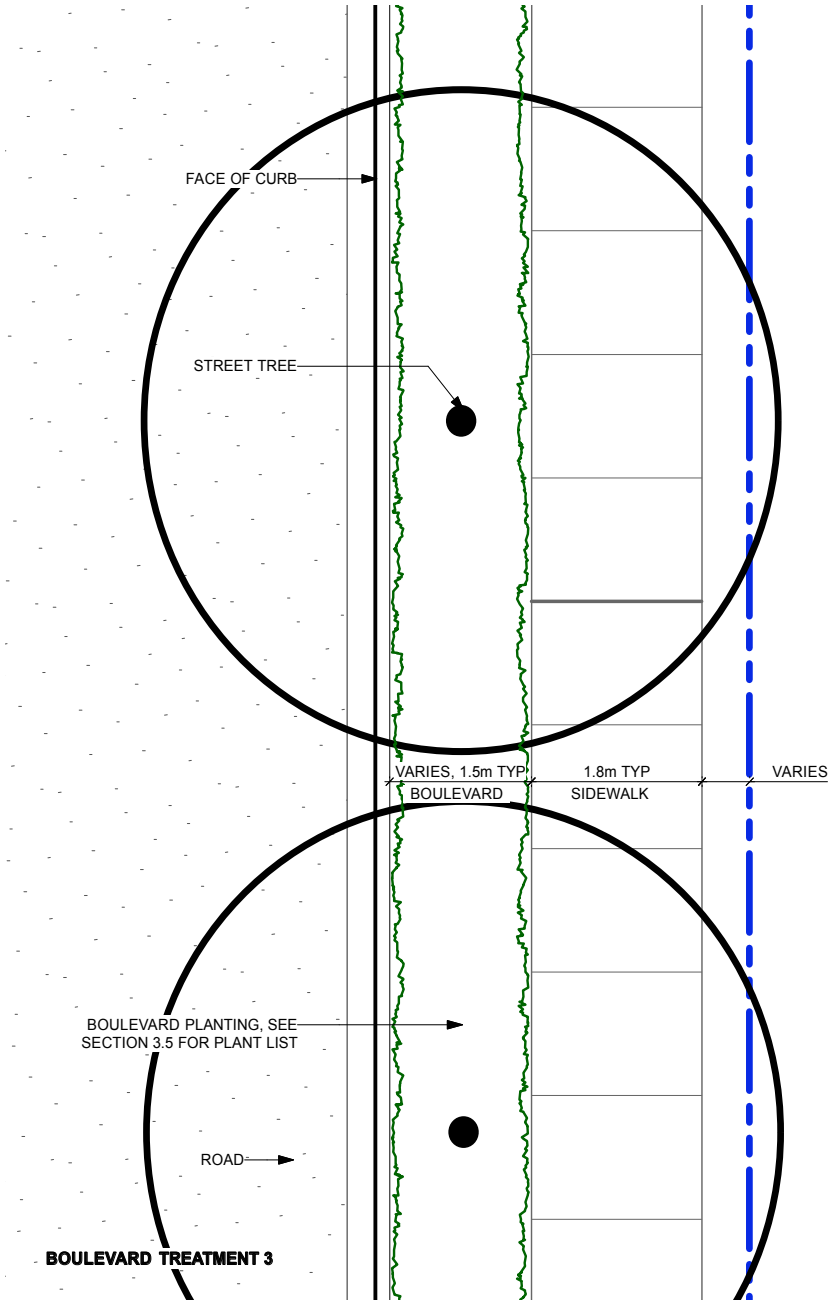
TREATMENT 1 PLAN - STREET TREES W/ PLANTING AND GRANITE SETTS



TREATMENT 2 PLAN - STREET TREES W/ GRANITE SETTS AND CRUSHED GRANITE GRANULAR PAVING PLAN

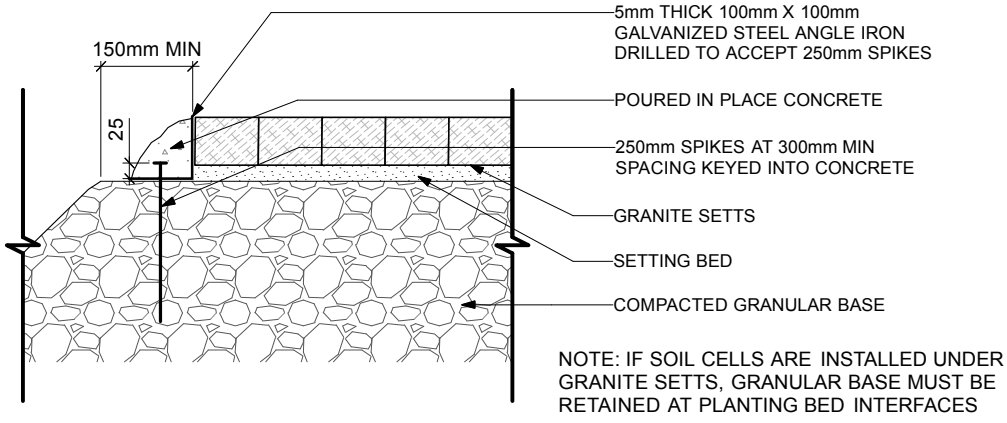


TREATMENT 3 PLAN - STREET TREES W/ LOW PLANTING



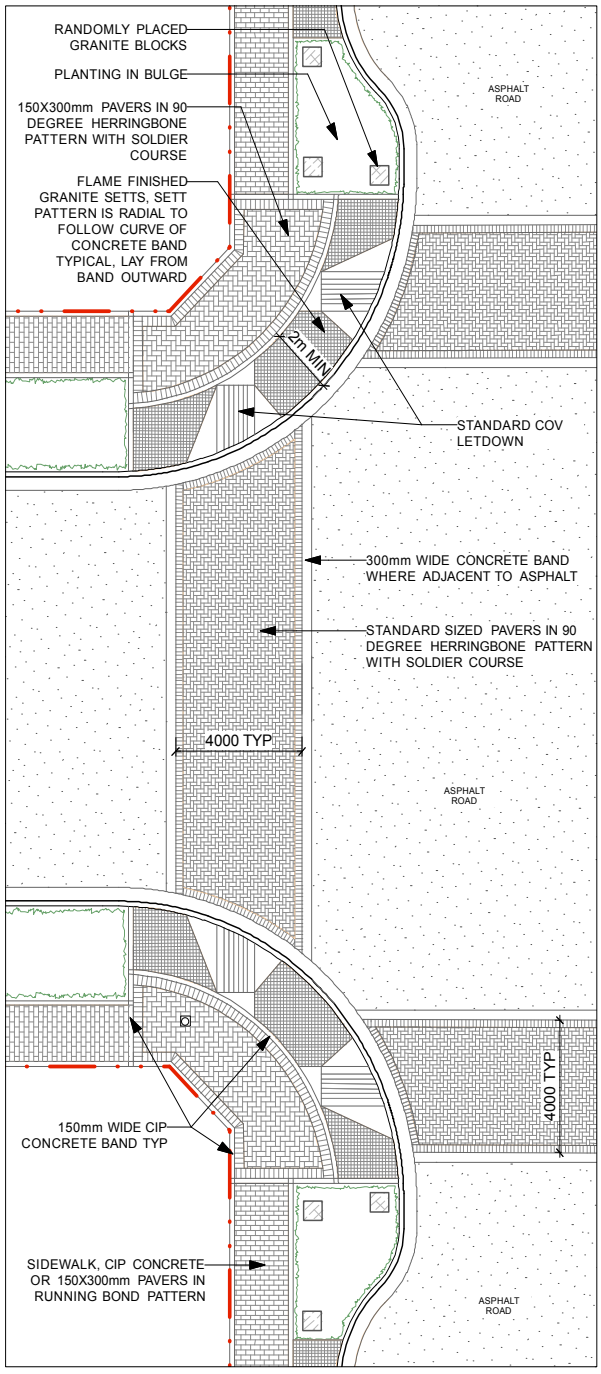
DETAIL 1 - GRANITE SETTS EDGE RETAINING DETAIL

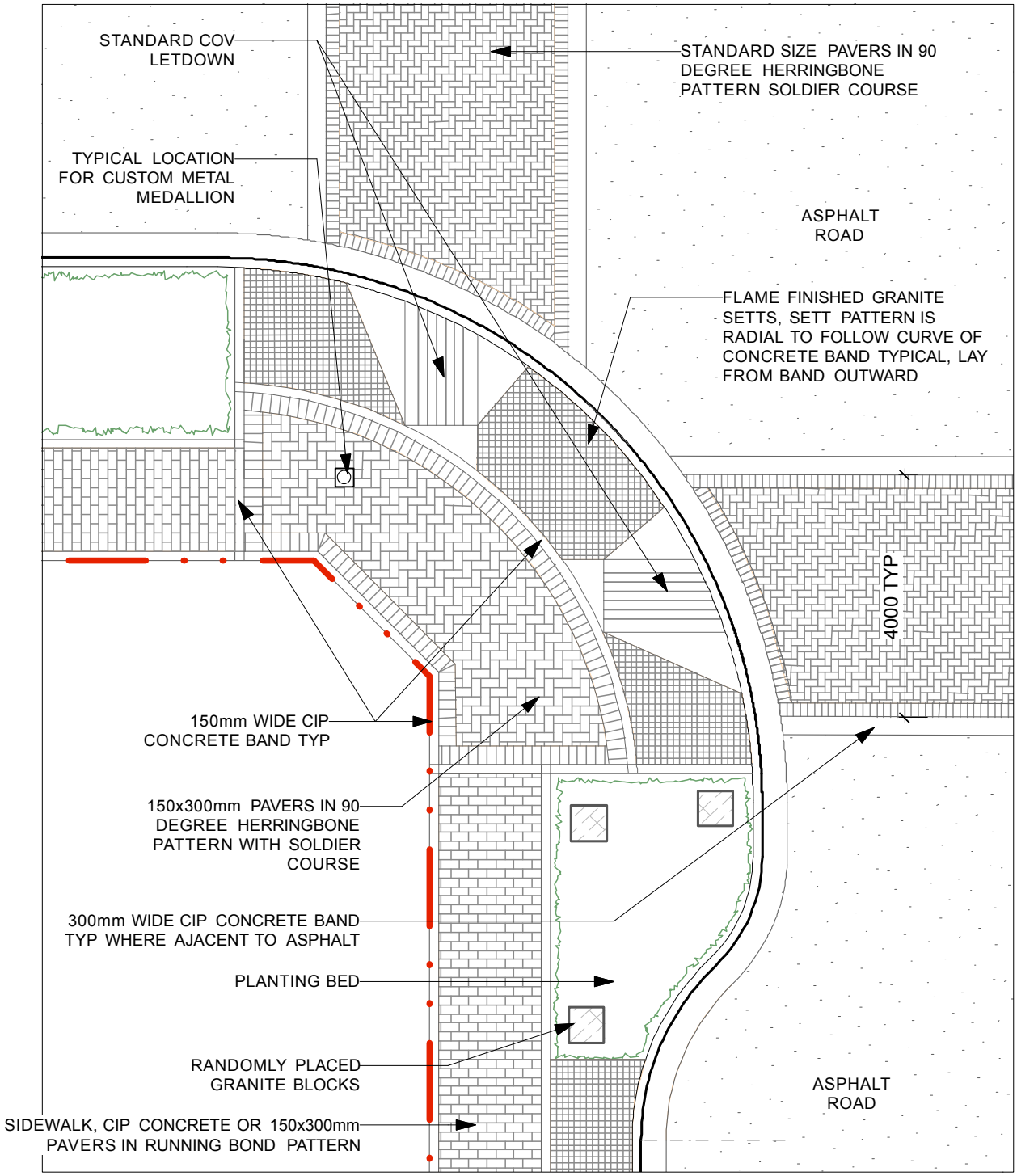
The Following is an edge retaining detail for granite setts which would be the minimum required where no concrete banding exists. As stated, if soil cells are installed below the granite setts or adjacent sidewalk, the granular base material must be retained from falling into the planting bed/tree pit where these edge conditions occur.



5.3 STREET CORNERS

The street corners in the SEFC precinct will all have a consistent character, which identifies the overall area and reinforces the gateway ideas noted in the previous Public Realm Plan. The following plan identifies the character and paving materials for all typical corners. Consult the Vancouver Streets Restoration Manual for City of Vancouver Standards regarding Letdowns.

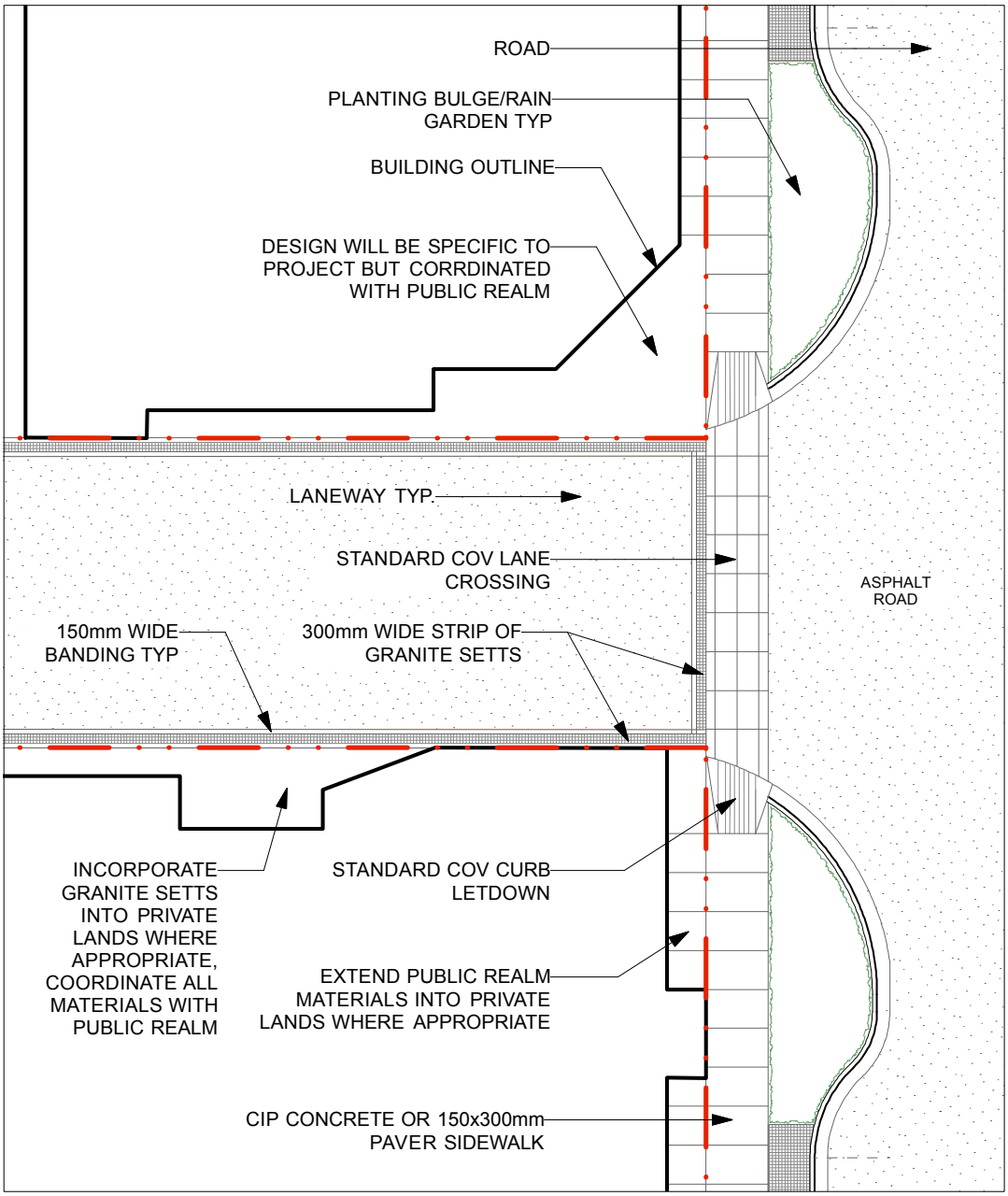




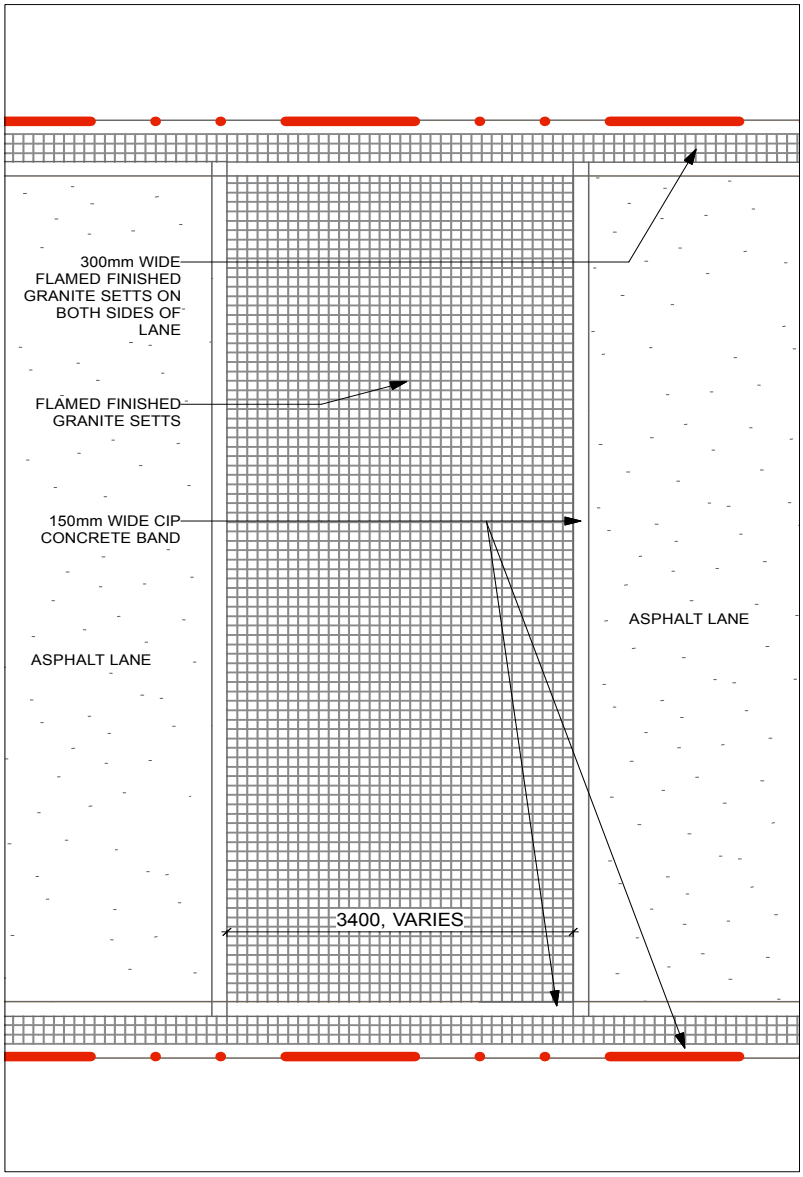
STREET CORNER BLOW-UP DIAGRAM

5.4 LANES / MEWS

The street corners in the SEFC precinct will all have a consistent character, which identifies the overall area and reinforces the gateway ideas noted in the previous Public Realm Plan. The following plan identifies the character and paving materials for all typical corners. Consult the Vancouver Streets Restoration Manual for City of Vancouver Standards regarding Lane Crossings.



SEFC LANEWAY ENTRY TREATMENT

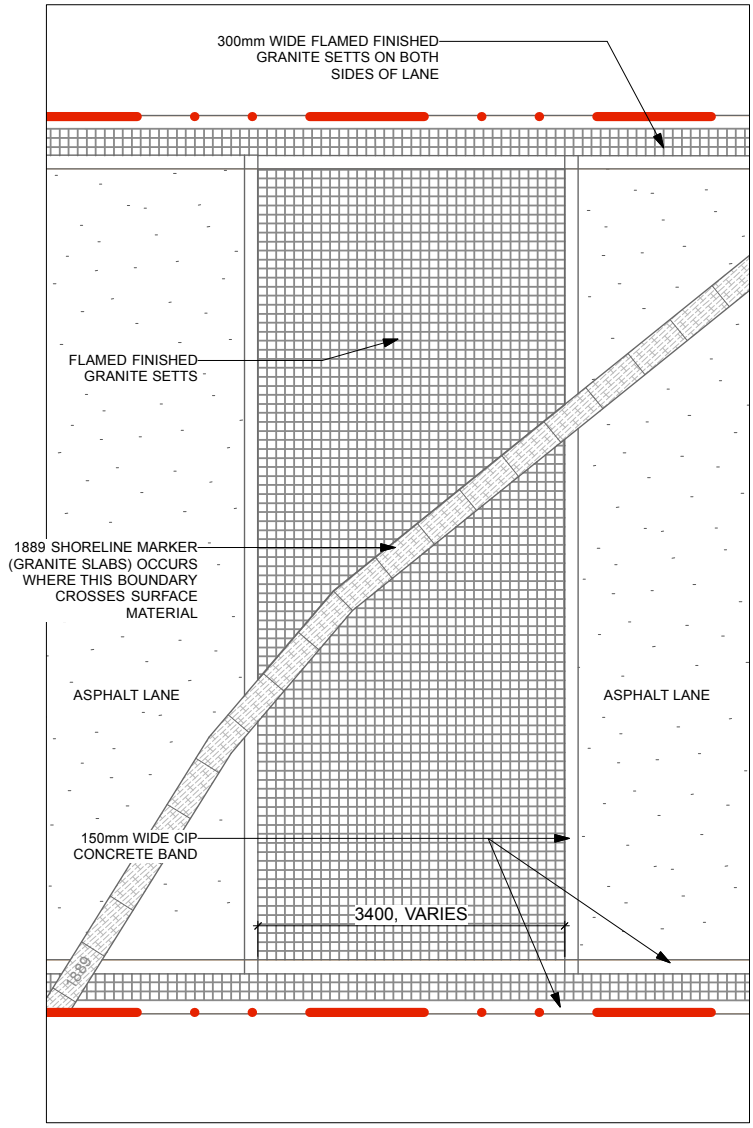


SEFC LANEWAY MID BLOCK TREATMENT

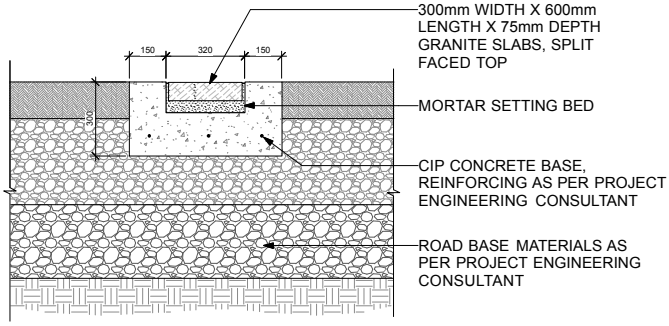
5.5 ORIGINAL 1889 SHORELINE

The location of the original 1889 shoreline of False Creek crosses all of the historic neighbourhoods providing legibility, interpretation, and commemoration of the original False Creek waterway. The shoreline should be reflected in all public realm areas wherever possible. The public realm areas where the shoreline is evident is in the streets, boulevards, sidewalk paving, lanes, and mews. The following details demonstrate how the original shoreline should be integrated into the public realm. Consult project engineer regarding concrete reinforcement requirements.

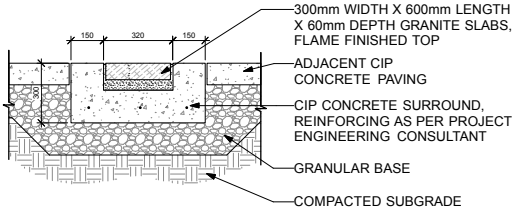
In addition to the public realm, the shoreline should be reflected, where possible and appropriate, in the private realm through landscape design.



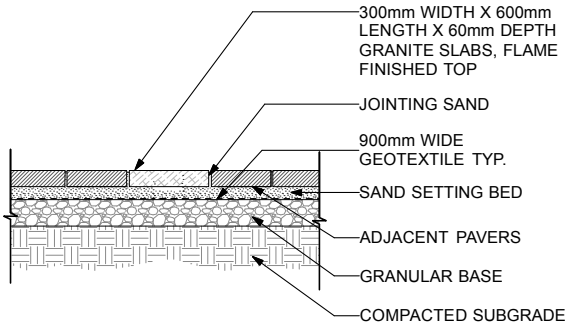
SEFC LANEWAY MID BLOCK TREATMENT WITH SHORELINE MARKER



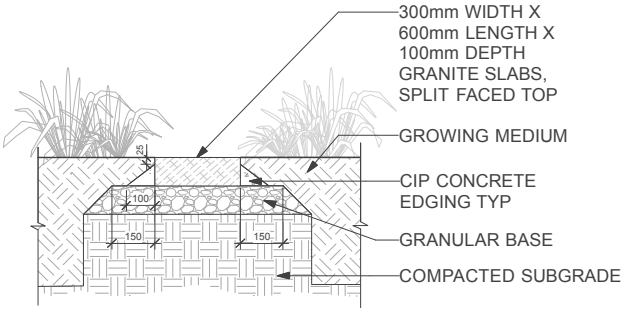
1: SEFC 1889 ORIGINAL SHORELINE TREATMENT - ASPHALT



2: SEFC 1889 ORIGINAL SHORELINE TREATMENT - CONCRETE



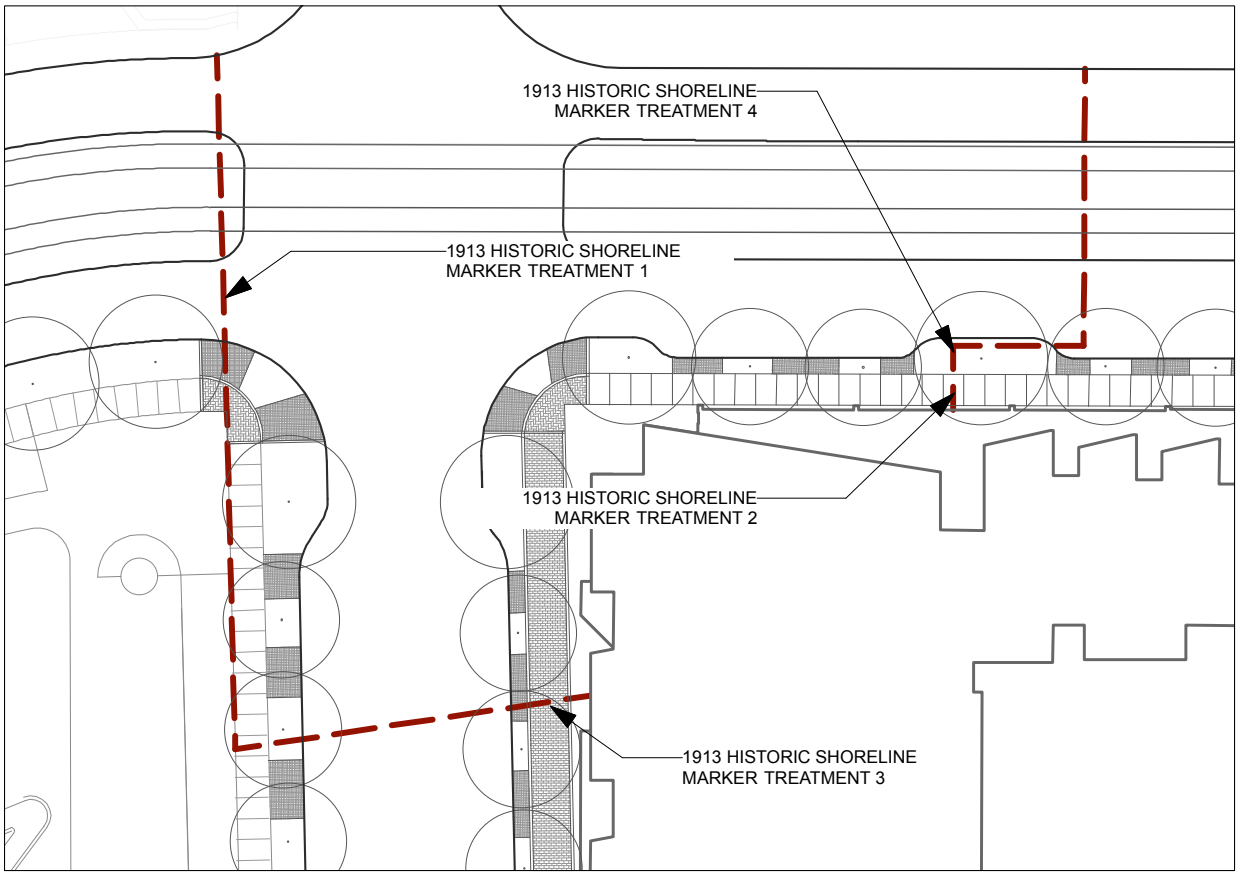
3: SEFC 1889 ORIGINAL SHORELINE TREATMENT - PAVERS



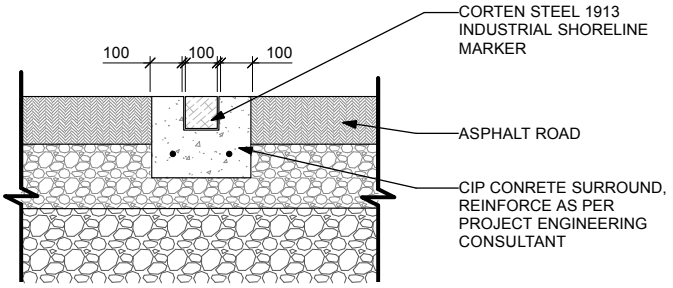
4: SEFC 1889 ORIGINAL SHORELINE TREATMENT - GROWING MEDIUM

5.6 INDUSTRIAL 1913 SHORELINE

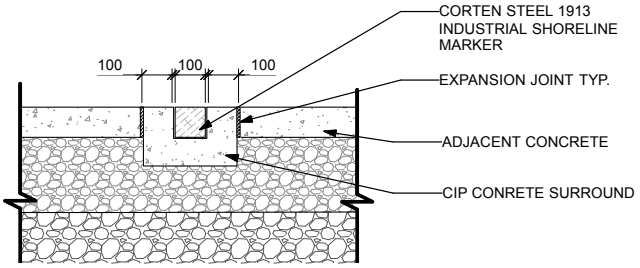
An additional feature of the ground level landscape development is the 1913 'shoreline' represented with a corten steel band that occurs across the site. Text marking the historic 1913 shoreline will be included in the bands. The 1913 shoreline was composed of piers and dredged shipways, and represents the first major change to the Southeast False Creek shoreline. Consult project engineer regarding concrete reinforcement requirements.



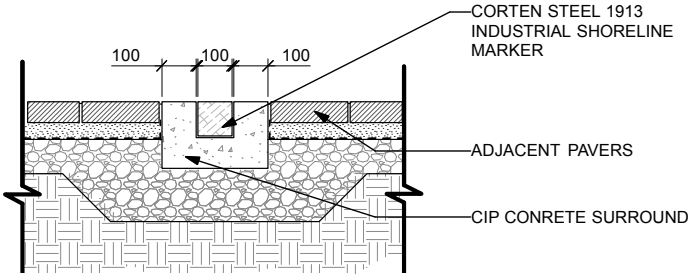
SEFC 1913 INDUSTRIAL SHORELINE TREATMENT PLAN



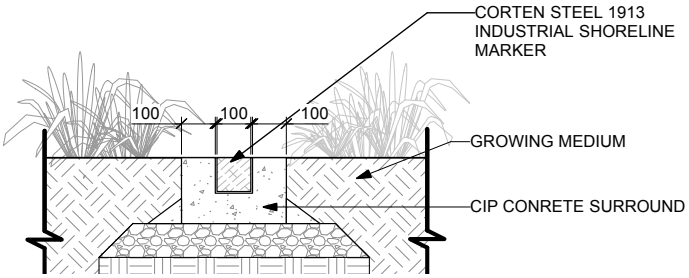
1: SEFC 1913 INDUSTRIAL SHORELINE TREATMENT - ASPHALT



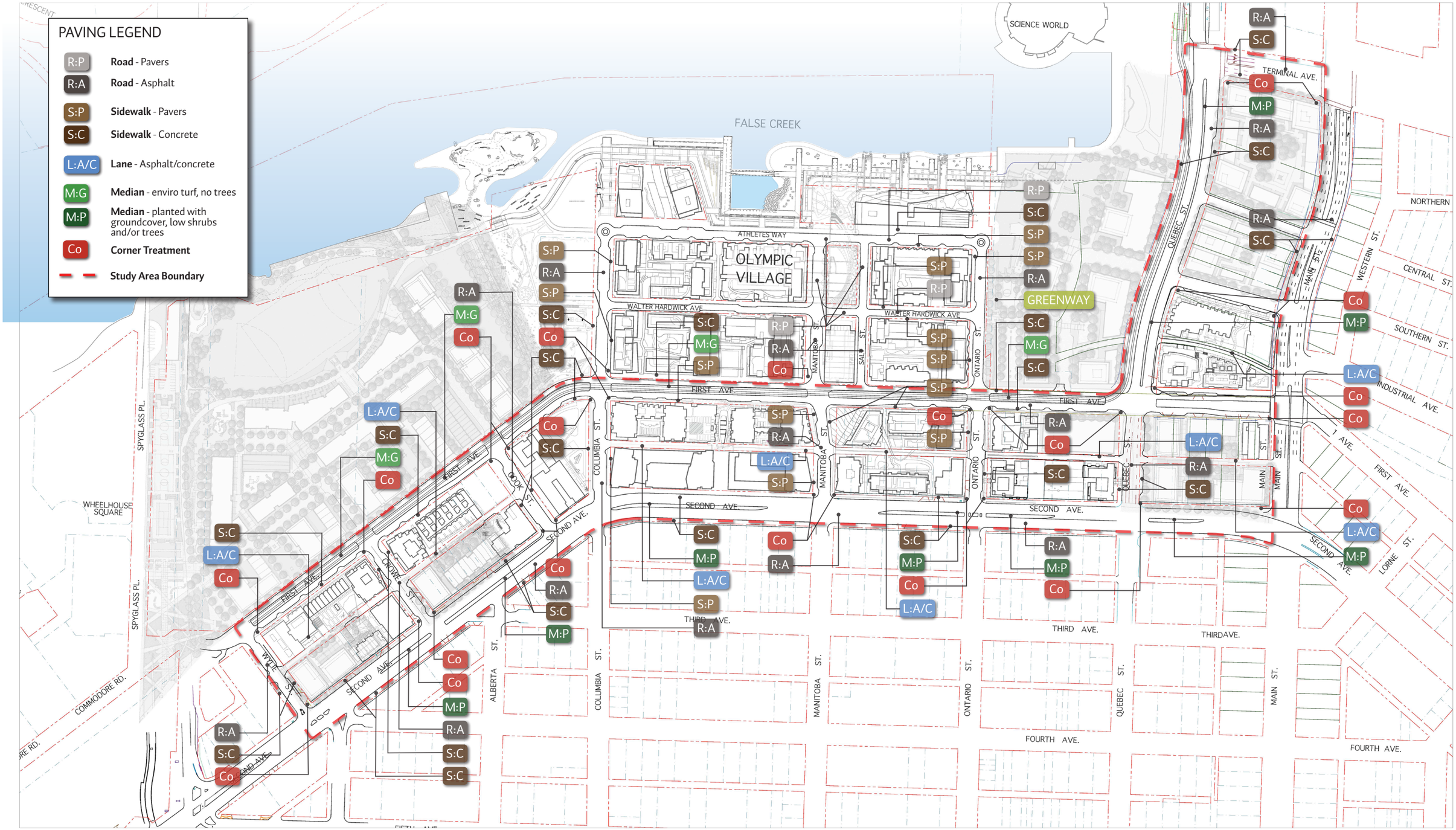
2: SEFC 1913 INDUSTRIAL SHORELINE TREATMENT - CONCRETE



3: SEFC 1913 INDUSTRIAL SHORELINE TREATMENT - PAVERS



4: SEFC 1913 INDUSTRIAL SHORELINE TREATMENT - GROWING MEDIUM



PWL partnership

Southeast False Creek Private Lands

LANDSCAPE PAVING KEY PLAN

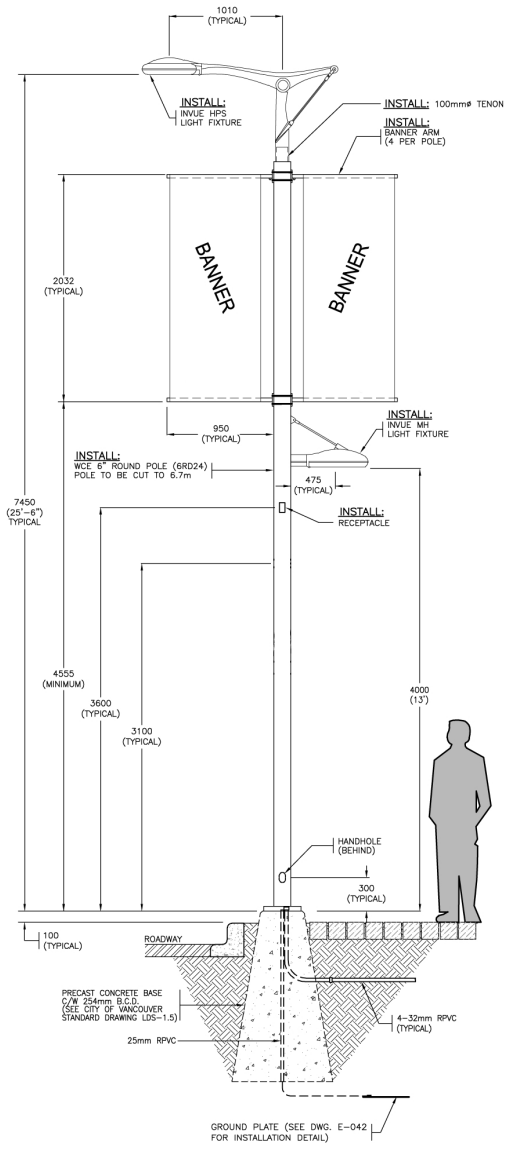
FINAL AUGUST 2009

5.7

6.0 LIGHTING

Distinctive lighting precincts have been established for Southeast False Creek. Both Metal Halide and High Pressure Sodium fixtures have been utilized to create different ambient light qualities.

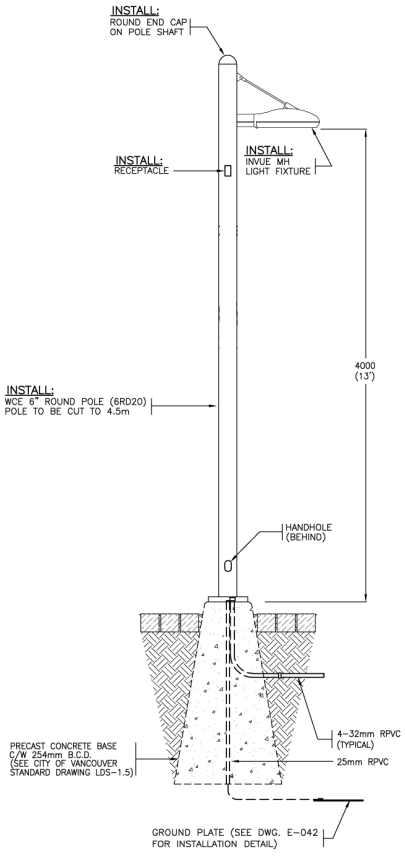
MH = WHITE LIGHT (COOL QUALITY)
HPS = AMBER LIGHT (WARM QUALITY)



STREET LIGHTING/PEDESTRIAN POLE

POLE TYPE (A)

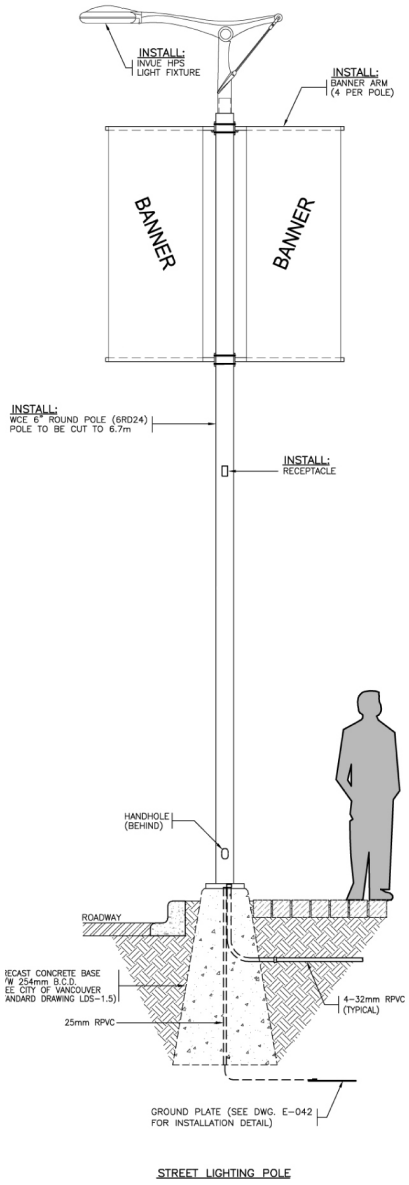
INVUE HPS (STREET) MH (PEDESTRIAN)



PEDESTRIAN POLE

POLE TYPE (B)

INVUE MH (PEDESTRIAN)



'INVUE' SLIDE STREET LIGHT TYPE C

INVUE HPS (STREET)

LIGHTING LEGEND

- High Pressure Sodium (Amber Light Quality)
- Metal Halide (White Light Quality)
- Both High Pressure Sodium road lighting and Metal Halide pedestrian lighting in combination
- Study Area Boundary

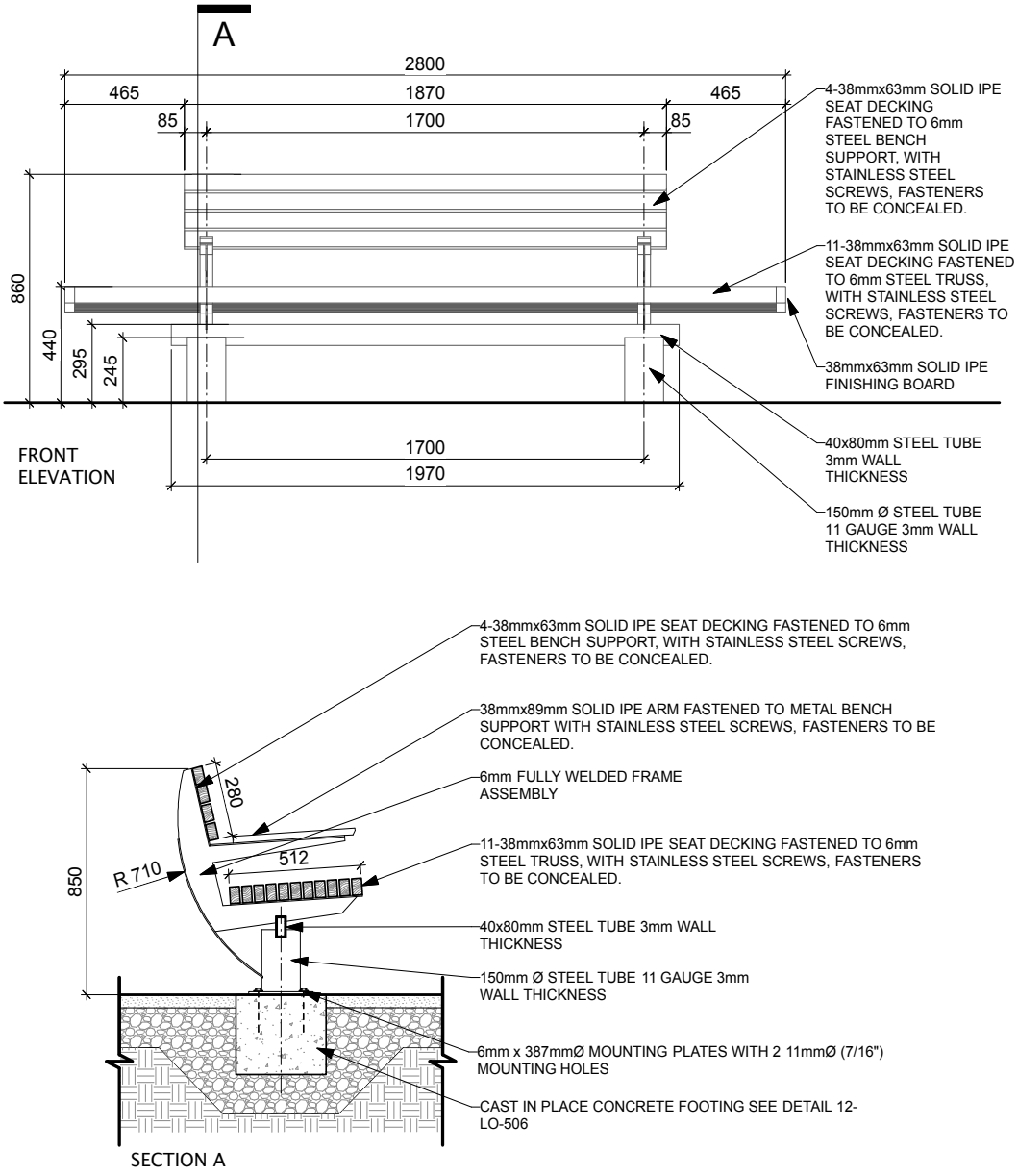
7.0 SITE FURNISHING

7.1 BENCHES

The benches proposed for the SEFC Neighbourhood are custom benches that originated from elements featured in the SEFC waterfront design. These benches have an industrial look and can be modified and further customized for particular site conditions at each of the required proposed locations and additional locations identified and desired on the semi private areas of the development parcels.

The developer is encouraged to utilize the SEFC benches and or modified benches on the private parcel areas and zones that are in close proximity to the public realm. Areas where these benches or modified benches are suggested include street or entry plazas off sidewalks, lane plazas, and corner plazas.

SEFC WATERFRONT BENCHES. SEE LANDSCAPE FURNISHING KEY PLAN FOR PROPOSED LOCATIONS OF BENCHES



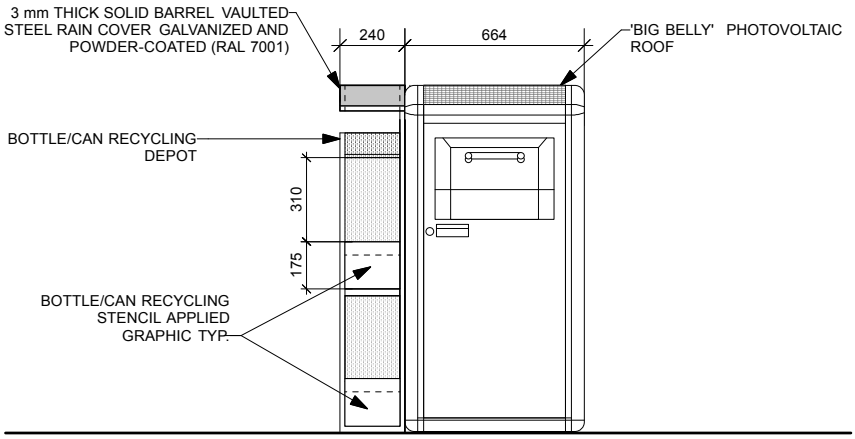
SEFC WATERFRONT BENCHES DETAIL. SEE SITE FURNISHING PLANS FOR SUGGESTED LOCATIONS OF BENCHES

7.2 TRASH RECEPTACLES & RECYCLING UNITS

7.2.1 TRASH RECEPTACLES

The selected trash receptacle for the Southeast False Creek neighbourhood is the Big Belly Solar Trash Compactor. These trash receptacles have been selected to dramatically reduce the collection frequency for trash, thus reducing the truck traffic. Concrete foundations are required for all Trash and Recycling Units. All trash receptacles will have companion recycling unit(s) associated with it. (See Section 7.2.2 Recycling Units for more information)

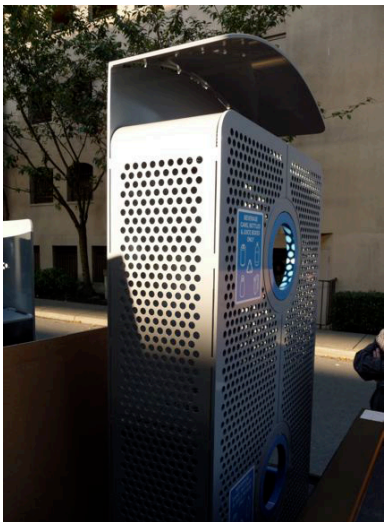
SEFC WATERFRONT 'BIG BELLY' TRASH RECEPTACLE. SEE LANDSCAPE FURNISHING KEY PLAN FOR PROPOSED LOCATIONS OF RECEPTACLE.



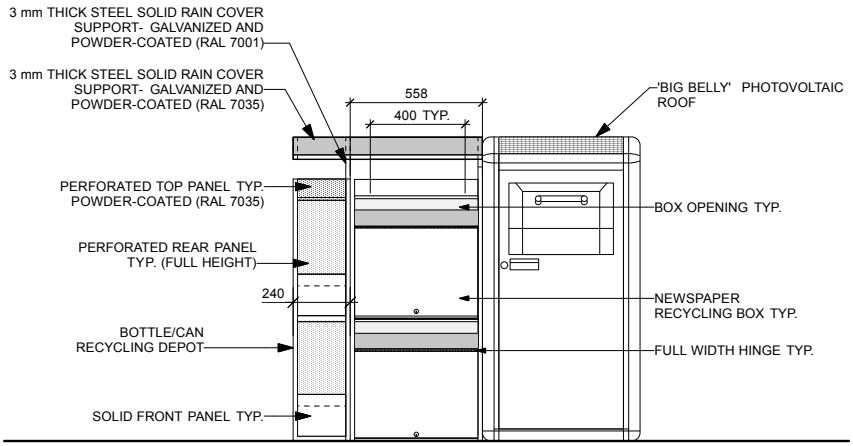
FRONT ELEVATION:
BOTTLE/CAN RECYLING WITH TRASH COMPACTOR ONLY

7.2.2 RECYCLING UNITS

Associated with each of the Big Belly Trash receptacles are recycling units distributed locally by Danica Agencies, or City of Vancouver approved equal, that have been custom designed for all of the trash receptacles. There are two (2) recycling units; one of the recycling units is for bottles and cans while the other is for newspaper. There are two conditions that these occur in the landscape. First, the two recycling units can be utilized together with the trash receptacle or second, the bottles and cans recycling unit can occur individually along with the trash receptacle.



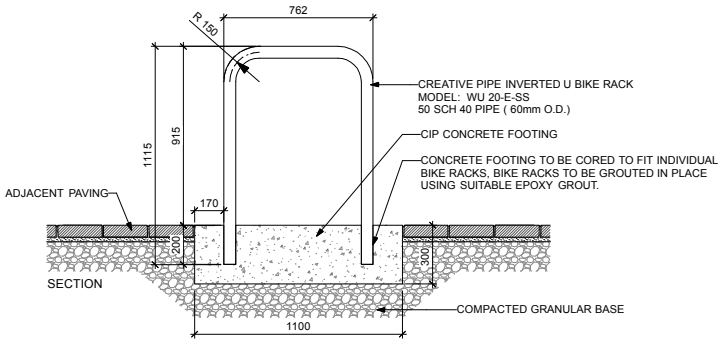
SEFC WATERFRONT RECYCLING UNIT. SEE LANDSCAPE FURNISHING KEY PLAN FOR PROPOSED LOCATIONS OF RECYCLING UNITS



FRONT ELEVATION:
BOTTLE/CAN & NEWSPAPER RECYLING
WITH TRASH COMPACTOR

7.3 BIKE RACKS

Being a sustainable neighbourhod, cycling is planned for in all areas of the public and private realm. Bike racks should be prevalent and installed on both the public realm lands, where appropriate and space allows, as well as on private lands. The foundations for all bike racks are to be buried below the finished paving material and not visible.



SEFC PUBLIC REALM 'CREATIVE PIPE - INVERTED U RACKS' INSTALLED ACCORDING TO MANUFACTURERS RECOMMENDATIONS AND SPECIFICATIONS. SEE LANDSCAPE FURNISHINGS KEY PLAN FOR PROPOSED LOCATIONS.

7.4 DRINKING FOUNTAINS

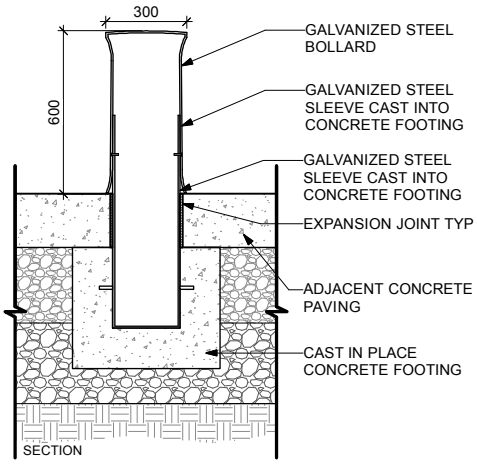
Drinking fountains are proposed around Southeast False Creek to provide drinking water to the residents and visitors to the area. These fountains are desired to assist in discouraging the use of bottled water. Some of the drinking fountains are proposed with dog fountains at the base to serve the numerous dogs that are anticipated to reside in the community. All drinking fountains should be installed on a concrete foundation and attached with galvanized tamper proof acorn nuts.

SEFC WATERFRONT 'HAWS' PEDESTAL DRINKING FOUNTAIN. SEE LANDSCAPE FURNISHINGS KEY PLAN FOR DRINKING FOUNTAIN LOCATIONS.

7.5 BOLLARDS

Custom Metal Bollards are utilized in the public realm to separate pedestrians from vehicles in roads, lanes and at crossings, provide protection where required for trees, and identify traffic patterns. These bollards have been originally used in the Olympic Village Public Realm and are reflective of bollards that may have originally been on the site and / or manufactured on the site in the past.

The custom design established and can be utilized in a variety of areas, with particular focus in the lane environment.



SEFC WATERFRONT BOLLARD. METAL CUSTOM GALVANIZED BOLLARD DETAIL AND INSTALLATION PICTURE.

7.6 GRANITE BLOCKS

Within the public realm and located in the rain gardens and / or planting bulges and boulevards are granite blocks of varying sizes. These blocks provide texture, character, seating or perching opportunities.

The blocks could vary in texture and finish from split face to smooth face depending on the design and character of the adjacent property and the character the developer prefers. Sizes can vary from 300mm to 600mm in width and length while varying from 500mm to 600mm in height from above the finished grade. All blocks must be offset by a minimum of 300mm from any walkway/bikeway.

As a sustainable project it is preferable that the granite within the public realm is from local BC quarries. See section 9 of this document: Manufacture/Supplier/Distributor Contacts for information.

SEFC GRANITE BLOCKS. SEE SECTION 5.3 STREET CORNERS FOR PLACEMENT DIAGRAM

FURNISHINGS LEGEND

- Bn — Bench
- Br — Bike Racks
- Df — Drinking Fountain
- Tr1 — Trash Receptical with Bottles/Cans Recycling Unit
- Tr2 — Trash Receptical with Bottles/Cans/Newspaper Recycling Unit
- Bol — Bollards
- Study Area Boundary

Typical Bollard Grouping
Location, see section 7.5

8.0 ARTISTIC ELEMENTS

8.1 VISION

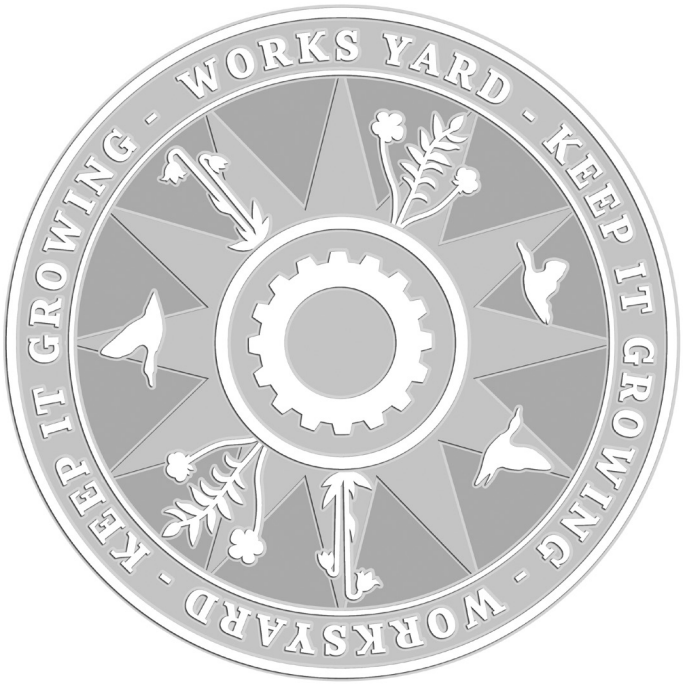
The artistic elements promote the sustainability promise of the place, poetically revealing innovations and engaging visitors and residents in participation, understanding and caring. Artists' ideas and works are a true catalyst of positive change and on-going stewardship of the Southeast False Creek neighborhood, and our earth (SEFC Art Master Plan).
References: http://vancouver.ca/commsvcs/southeast/documents/index.htm#artmasterplan

8.2 SIDEWALK MEDALLIONS (3 UNIQUE DESIGNS)

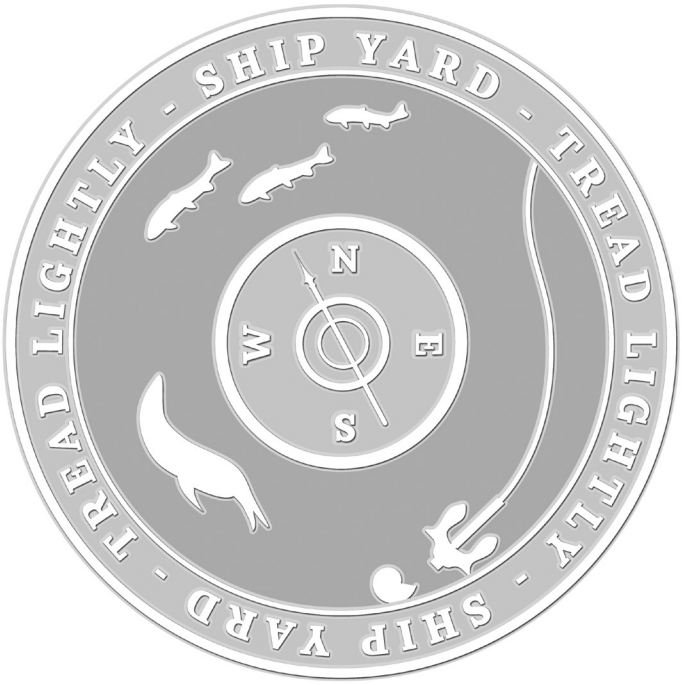
The proposed sidewalk medallions explore and envision the relationship between the ecological heritage (prolific estuary, hunting and trade route for Coast Salish People) and the industrial heritage of SEFC, and the reintegration of the indigenous flora and fauna back into the landscape. A visual synthesis of ideas, the medallions offer a semi-literal, iconic chronology of the past uses of the SEFC site.

Matching neighbourhood character with appropriate ecological taxonomies, an abstracted industrial icon occupies the centre core, ecological imagery surrounds the core and the outer rim employs text to locate pedestrians to the specific neighbourhood (Works Yard, Ship Yard, Rail Yard), alternating between name and a friendly sustainability axiom: tread lightly, look up, keep it growing. See Section 8.7 of this document: Artistic Elements Plan for suggested locations.

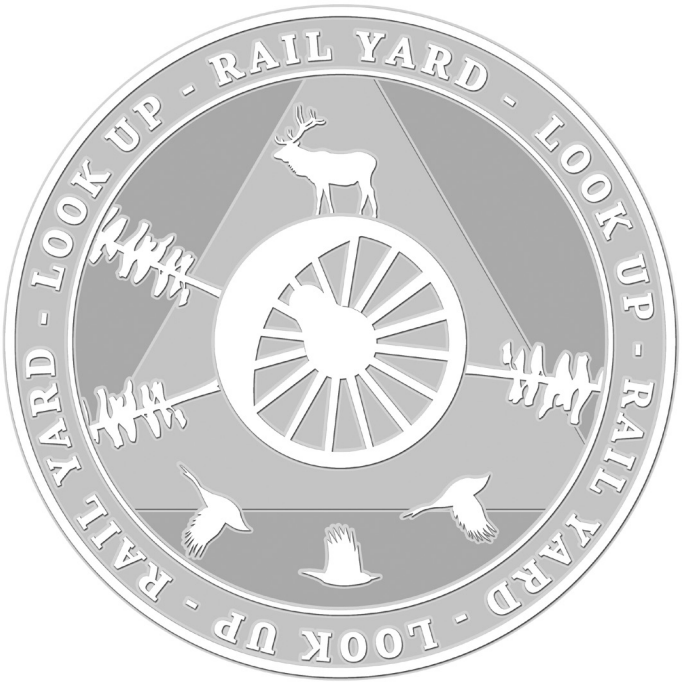
1. WORKS YARD MEDALLION DESIGN



2. SHIP YARD MEDALLION DESIGN



3. RAIL YARD MEDALLION DESIGN

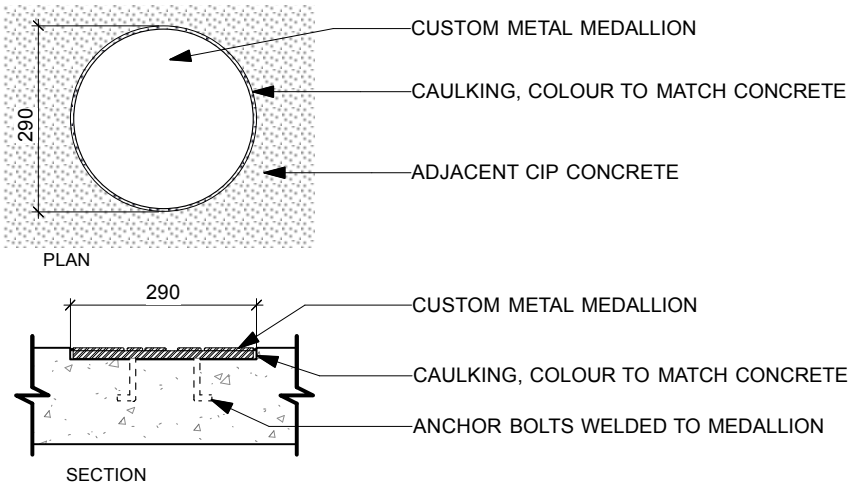


MEDALLIONS FABRICATION:

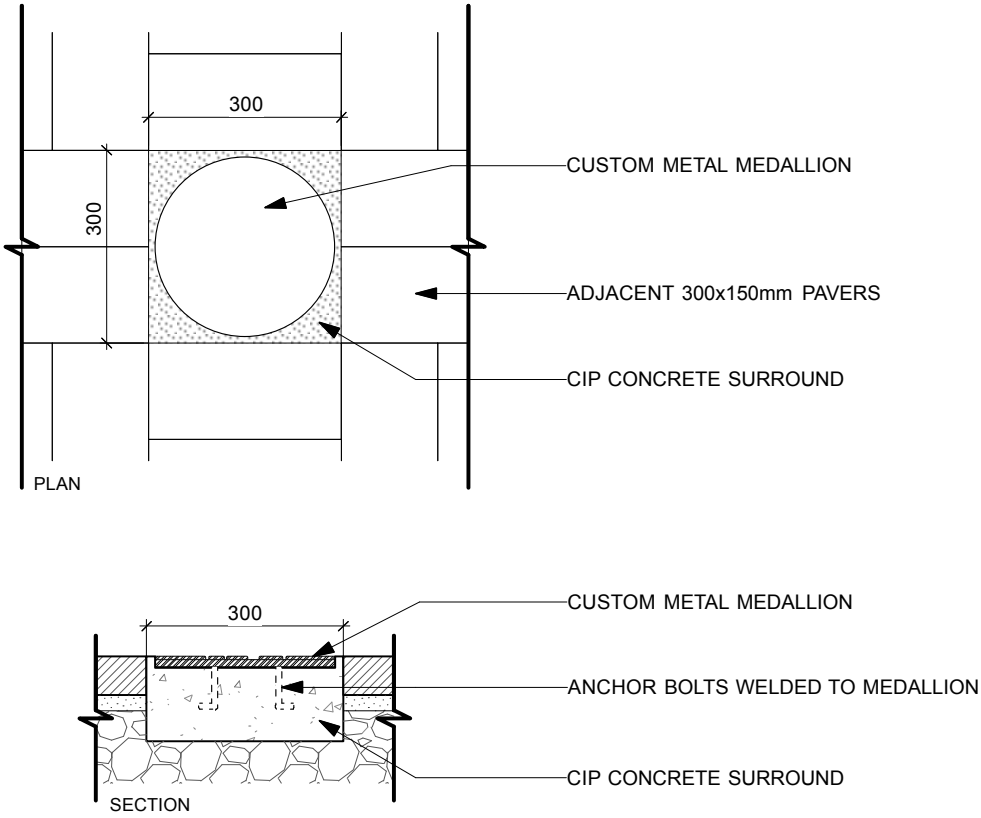
Number	34 (12 in the OV)
Size	11 inches in diameter
Material	Iron
Method	· Green Sand Cast · Inset 11" diameter medallions into concrete tile 12" square · Rooted into the sidewalk (See detail) · 0.6 coefficient of friction · Relief no greater that 1/4" difference
Location/ Orientation	In the utility strip (Engineering's preference), identified in PREG, SHIP YARD medallion should be placed according to cardinal direction with North aligning with true North.
Recommended Manufacturer	Century Pacific Foundry in Surrey BC (TBD) Established relationship, initial costing options, and overall concept feasibility with Eric Hasselmann, Vice President of Sales. http://www.century-pacific.com/
Notes	Explore placing them in OV

MEDALLIONS IMPLEMENTATION PLAN:

As the sites are developed, the medallions will be installed at the same time as the sidewalks are laid.



PLAN & SECTION DIAGRAMS OF MEDALLION CAST IN CONCRETE BANDING



PLAN & SECTION DIAGRAMS OF MEDALLION CAST IN CONCRETE BLOCK AND SET INTO SIDEWALK REPLACING TWO PAVERS

8.3 BC HYDRO VISTA LIDS – EXPLORING THE SPATIAL HISTORY OF SEFC

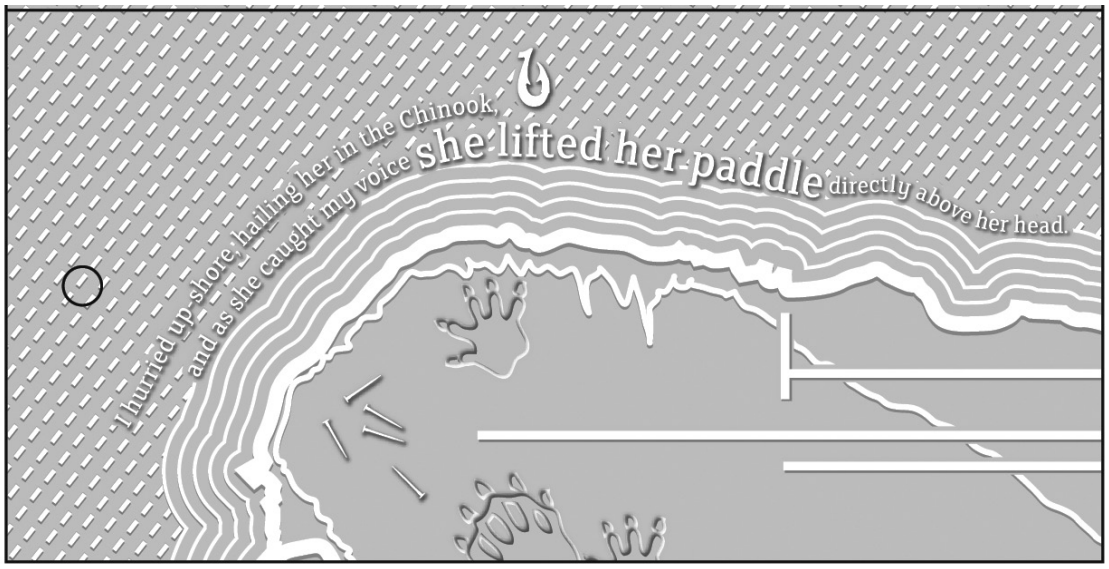
These large 'canvases' on the ground will portray a continual narrative across the public realm of the SEFC private lands that pulls pedestrians through the site, opening their eyes to the very rich and complex histories (spatial, cultural, ecological, etc.) of the area.

THEMES

Each lid has a general theme that can be tied to aspects of sustainability, and connects three voices from different eras, specific to SEFC, Mount Pleasant and early Vancouver. Each lid contains four content layers: 1. base map, 2. text, 3. objects and 4. animal tracks.

MAPS

Each lid begins with a textured base map that includes SEFC at a unique scale. The maps ought to be oriented to correspond with true compass directions on each Lid. This further anchors the vista lid within the ground of its geographic context.

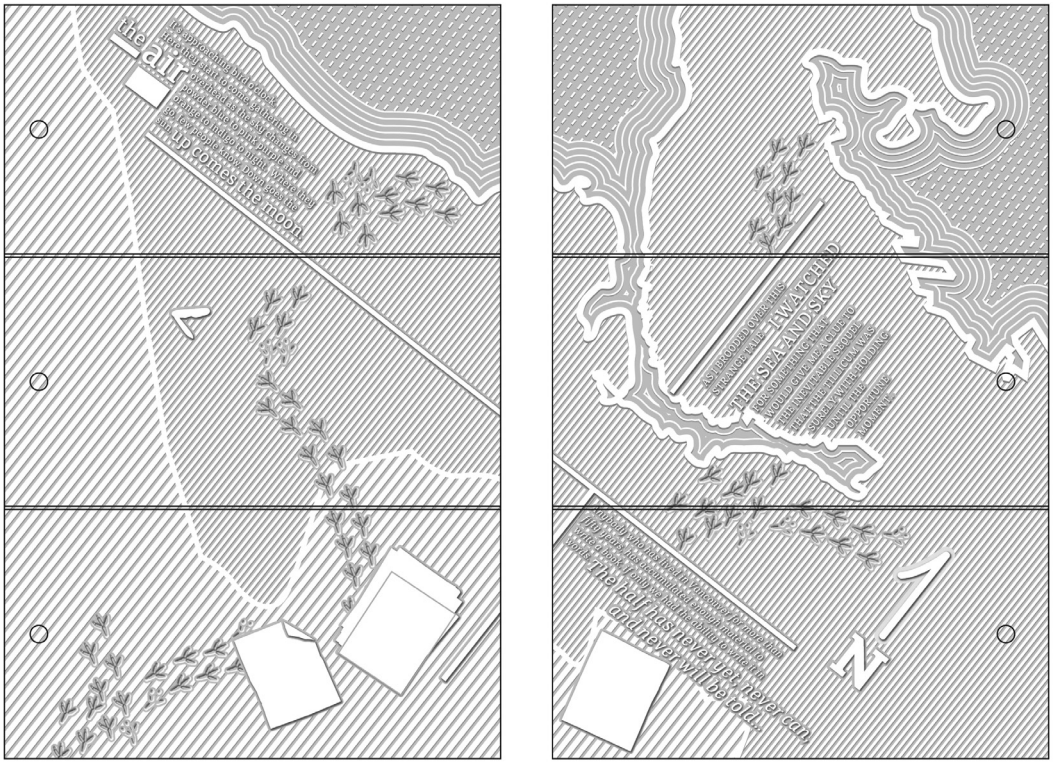


DETAIL OF BAS RELIEF (FORGED NAILS AND FISHING HOOK) AND SUNKEN RELIEF (BEAVER TRACKS)

TEXT

The text used in each lid contains three distinct but personal voices from three distinct eras. The first is designer-Sarah Hay a currently practicing designer and artist, taken from spontaneous journal entries, specific to the False Creek developments and personal experiences. The second voice is of Reuben Hamilton, an early pioneer to Mount Pleasant and an obsessive historian who frequently wrote letters to Major JS Matthews – Vancouver's first archivist – recounting his memories of trout streams, working conditions and the impossibilities of documenting Vancouver's developments. The book from which the text is sourced was published by Vancouver Archives and is called: Mount Pleasant Early Days: Memories of Reuben Hamilton Pioneer 1890 (1957). The third voice is that of Pauline Johnson-Tekahionwake, daughter of Mohawk Chief, George Johnson. Pauline Johnson was notable for her poems and performances that celebrated her aboriginal heritage of the late 19th Century. The excerpts taken from her book Legends of Vancouver (1911) recount stories of Chief Joe Capilano of the Skwxwú7mesh (Squamish).

VISTA LID 1 – WORKS YARD » FURTHEST WEST



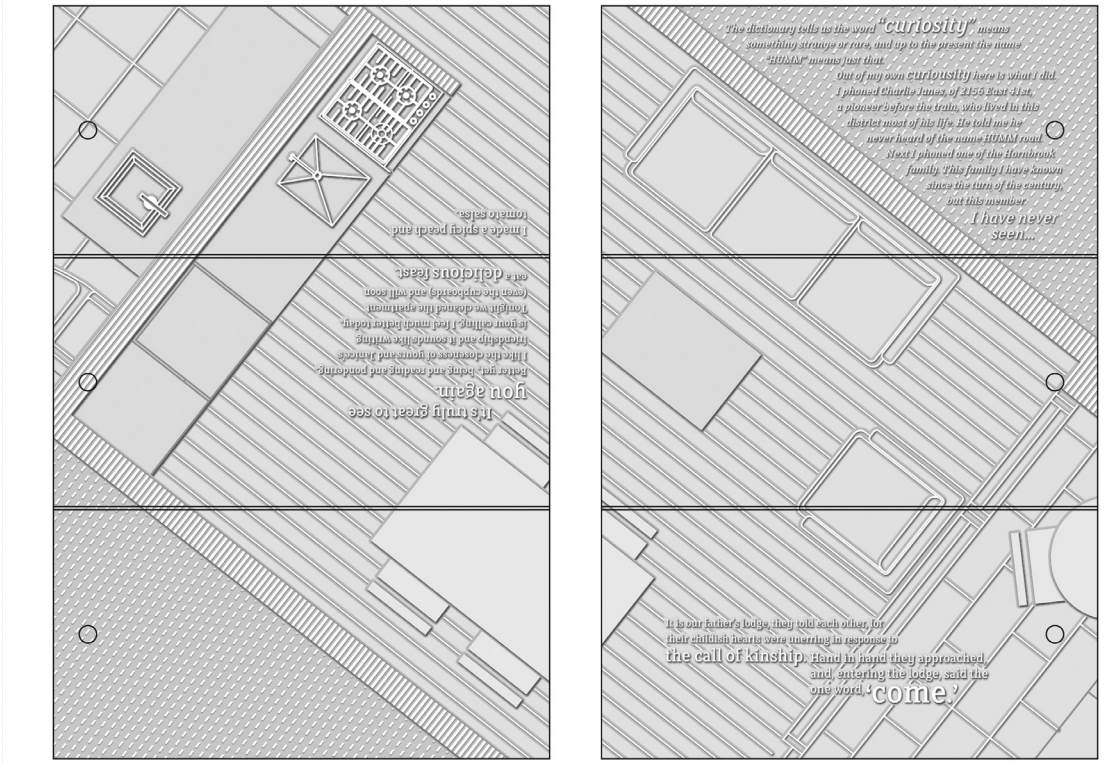
CONTENT:

SH It's approaching bird o'clock. Here, they start to come, gathering in the air over head as the sky changes from powder blue to pink purple and orange to indigo to night. Where they go, few people know. Down goes the sun, up comes the moon. (Hay, 2008)

RH Anybody who has lived in Vancouver for more than fifty years has accumulated enough material to write a book, if only we had the ability to write it in words. The half has never yet, never can, and never will be told... (Hamilton, 1951, page 11)

PJT As I brooded over this strange tale I watched the sea and sky for something that would give me a clue to the inevitable sequel that the tillicum was surely with-holding until the opportune moment. (Johnson, 1911, page 1)

VISTA LID 2 – WORKS YARD » EAST



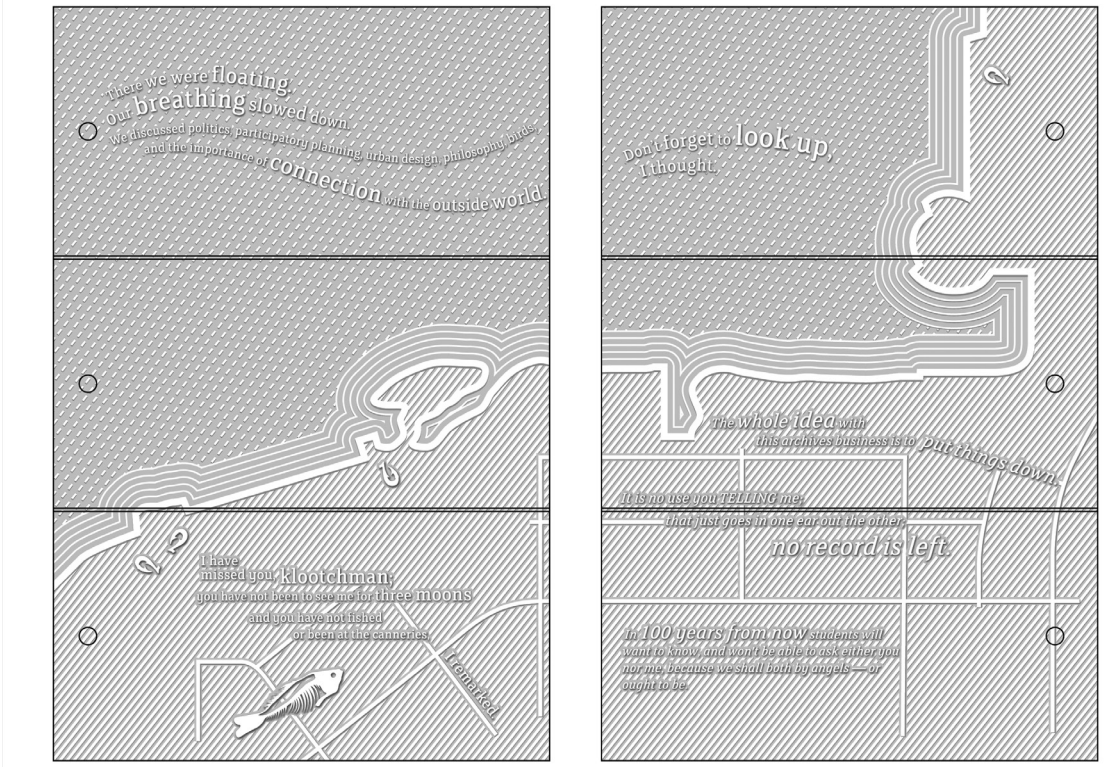
CONTENT:

SH It's truly great to see you again. Better yet, being and reading and pondering. I like the closeness of yours and Janice's friendship and it sounds like writing is your calling. I feel much better today. Tonight we cleaned the apartment (even the cupboards) and will soon eat a delicious feast. I made a spicy peach and tomato salsa. (Hay, 2008)

RH The dictionary tells us the word "curiosity" means something strange or rare, and up to the present the name "HUMM" means just that. Out of my own curiosity here is what I did. I phoned Charlie Janes, of 2156 East 41st, a pioneer before the train, who lived in this district most of his life. He told me he never heard of the name HUMM road. Next I phoned one of the Hornbrook family. This family I have known since the turn of the century, but this member I have never seen.... (Hamilton, 1957, page 51)

PJT It is our father's lodge, they told each other, for their childish hearts were unerring in response to the call of kinship. Hand in hand they approached, and, entering the lodge, said the one word, 'Come.' (Johnson, 1911, page 33)

VISTA LID 3 – SHIPYARD » WEST



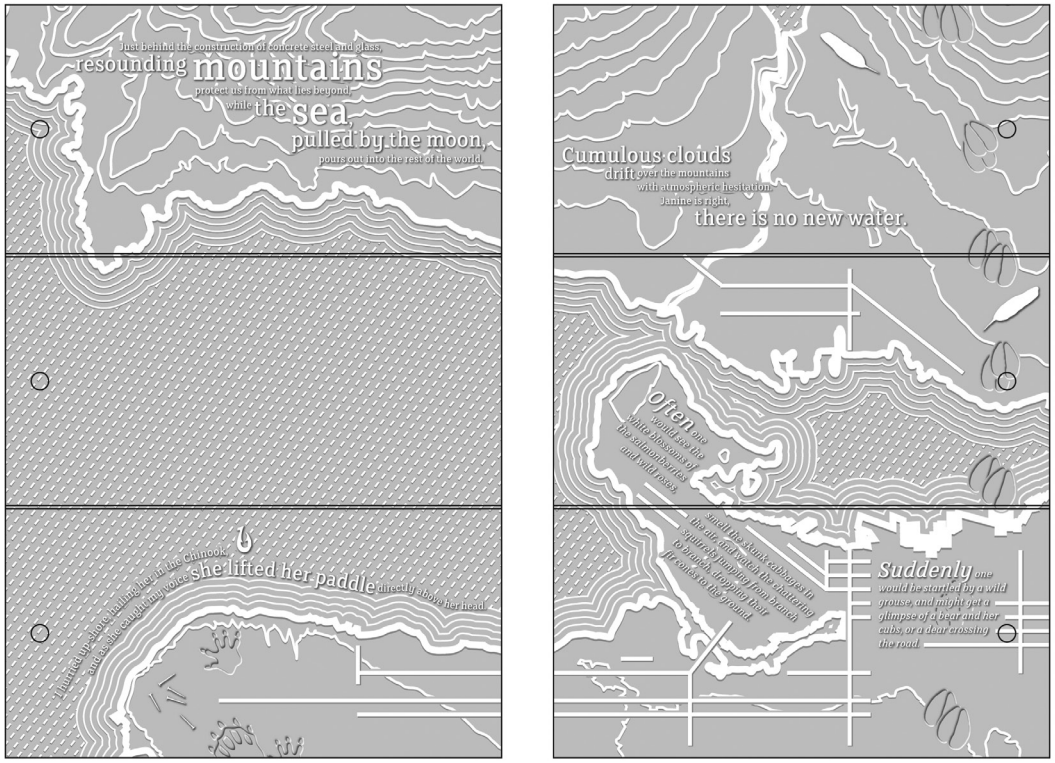
CONTENT:

SH There we were floating. Our breathing slowed down. We discussed politics, participatory planning, urban design, philosophy, birds, and the importance of connection with the outside world. Don't forget to look up, I thought. (Hay, 2008)

RH Some credit should be given those of our old city jail who with chains on their legs, and in their blue overalls dug out by hand many stumps, and sawed up the windfalls on a many of our streets in full view of the public, while policemen with loaded rifles stood on guard... (Hamilton, 1957, page 11)

PJT Build fires at sunset on all the coast headlands – fires of welcome. Man your canoes and face the north, greet the enemy, and them that I, the Tyee of the Capilanos, ask – no, command – that they join me for a great feast in honour of my two daughters. (Johnson, 1911, page 8)

VISTA LID 4 – SHIPYARD » EAST



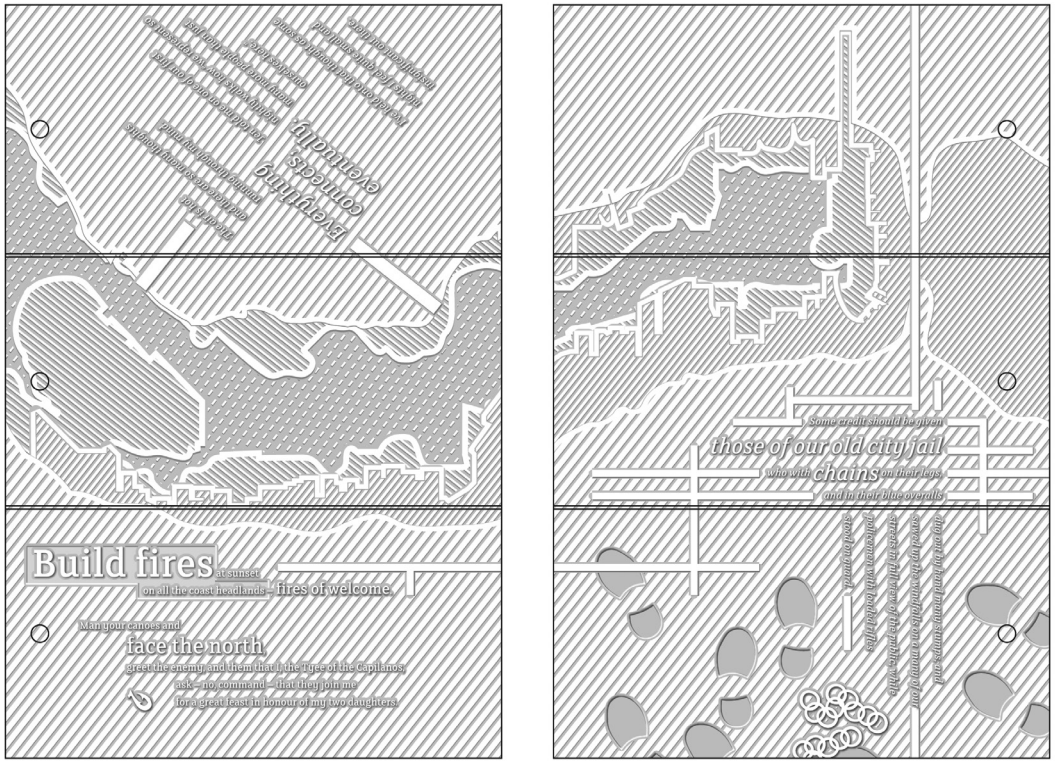
CONTENT:

SH Just behind the construction of concrete steel and glass, resounding mountains protect us from what lies beyond, while the sea, pulled by the moon, pours out into the rest of the world. Cumulous clouds drift over the mountains with atmospheric hesitation. Janine is right, there is no new water. (Hay, 2008)

RH Often one would see the white blossoms of the salmonberries and wild roses, smell the skunk cabbages in the air, and watch the chattering squirrels jumping from branch to branch, dropping their fir cones to the ground. Suddenly one would be startled by a wild grouse, and might get a glimpse of a bear and her cubs, or a dear crossing the road. (Hamilton, 1954, pg 42)

PJT I hurried up-shore, hailing her in the Chinook, and as she caught my voice she lifted herpaddle directly above her head. (Johnson, 1911, page 36)

VISTA LID 5 – RAILYARD » WEST



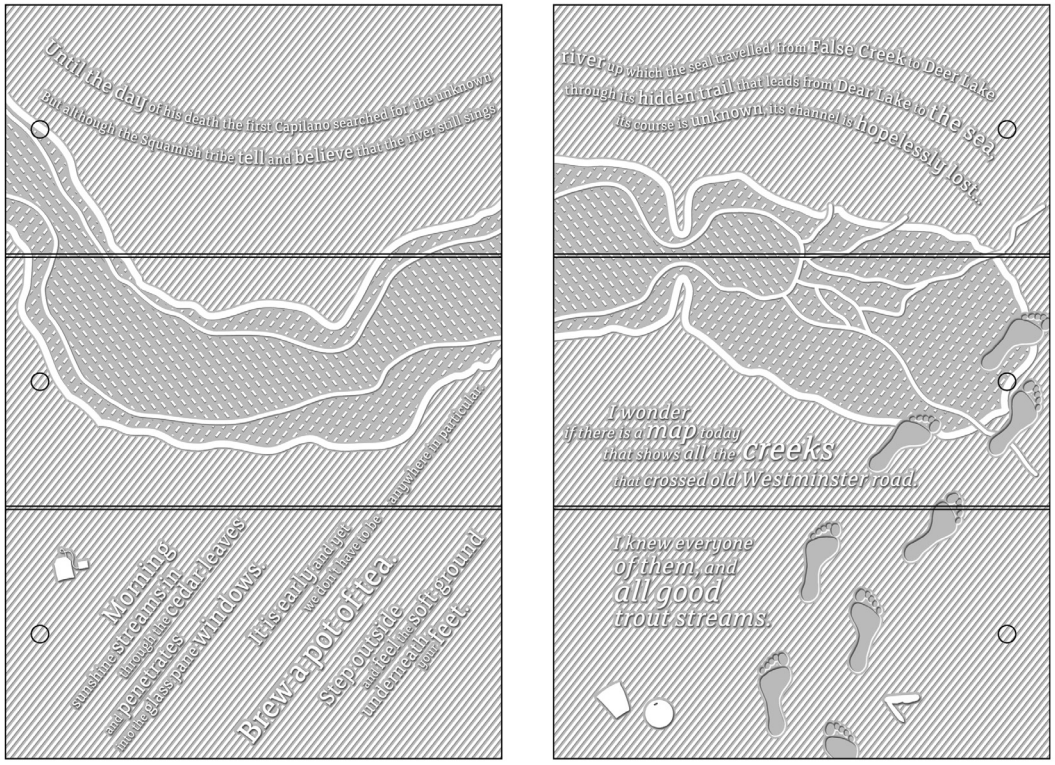
CONTENT:

SH The air is hot and there are so many thoughts running through my mind. Everything connects, eventually. Jen told me on one of our first nightly walks how "we represent so many more people than just ourselves here." I've held onto that thought as some nights I feel quite small and insignificant out there.

RH The whole idea with this archives business is to put things down. It is no use you TELLING me; that just goes in one hear out the other; no record is left. In 100 years from now students will want to know, and won't be able to ask either you nor me, because we shall both be angels — or ought to be. (JS Matthews, 1953, page 33)

PJT I have missed you, klootchman; you have not been to see me for three moons, and you have not fished or been at the canneries, I remarked. (Johnson, page 27)

VISTA LID 6 – RAILYARD » EAST



CONTENT:

SH Morning sunshine streams in through the coniferous cedar leaves and penetrates into the glass pane windows. It is early and yet we don't have to be anywhere in particular. Brew a pot of tea. Step outside and feel the soft ground underneath your feet. (Hay, 2008)

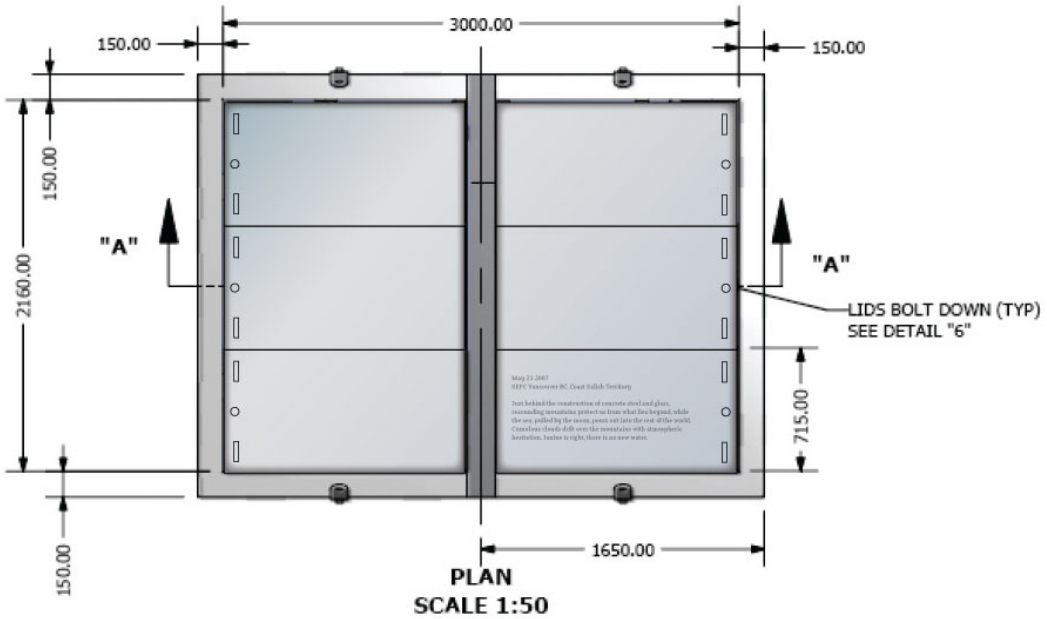
RH I wonder if there is a map today that shows all the creeks that crossed the old Westminster road. I think this is historic and important, as there are none today. I knew everyone of them, and all good trout streams (Hamilton, 1953, page 26).

PJT Until the day of his death the first Capilano searched for the unknown river up which the seal travelled from False Creek to Deer Lake. But although the Squamish tribe tell and believe that the river still sings through its hidden trail that leads from Dear Lake to the sea, its course is unknown, its channel is hopelessly lost... (Johnson, page 154).

VISTA LID FABRICATION

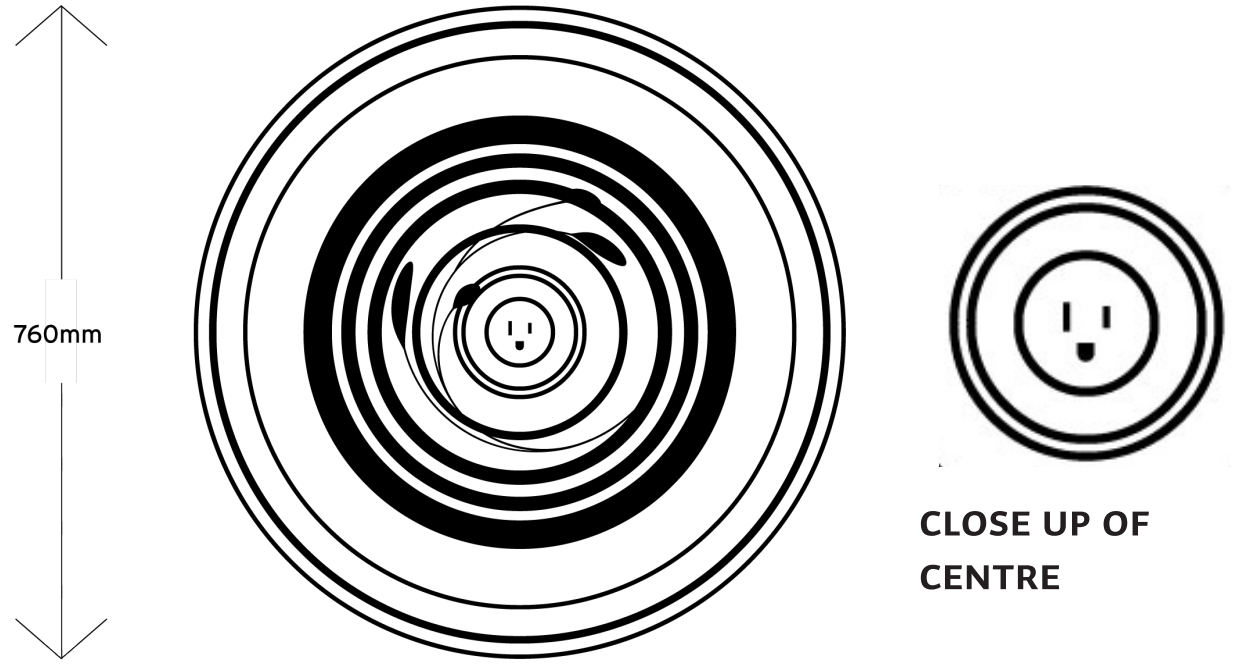
Type	5-way (Design TBD, currently in the process of being approved by CoV's Utilities Group)
Number	Breakdown between 4 way and 5 way TBD (depends on the size of development), total of 6 (2 in each neighbourhood)
Size	About 1425mm x 715mm (6 panels per VL)
Material	Aluminum
Method	CNC machine-Aluminium sheets are etched or CNC'd individually
Location/ Orientation	In the private land off lane (Engineering's preference), identified in PREG, SHIP YARD medallion should be placed according to true compass directions.
Manufacturer	AE Concrete
Notes	Confirm that lids in the OV are the old designs, if not, possible replacement?

VISTA LID GENERAL DIMENSIONS BELOW:



8.4 BC HYDRO UTILITY HOLE COVER

There will be three BC Hydro manhole covers through out the Private Lands of the same design. The approach here is a playful self-referential one, with a simple tweak of the electrical outlet common to every household. By flipping the third prong 180 degrees, a happy face is revealed signaling that a reduction in energy use is good for all. Concentric circles around the outside connect with the mandala / medallions theme.



CLOSE UP OF CENTRE

BC HYDRO UTILITY HOLE COVERS IMPLEMENTATION PLAN:

Type	Caste Iron Boulevard Duty (cover stock #400-0412, frame stock #400-0403)
Number	3 (1 worksyard, 2 shipyard)
Size	760mm in diameter
Material	Iron
Method	Cast • Forged at local foundry • 0.6 coefficient of friction • Relief no greater that 1/4" difference
Location/ Orientation	In the road or sidewalk, identified on BCH map, orientation does not matter.

8.5 BC HYDRO PMT (JUNCTION) BOXES

CONCEPTS:

1. HISTORIC SHORELINES OF SEFC:

The electrical boxes become communication tools to illustrate the geographic transformation and evolution of SEFC through its historic shorelines.

HISTORIC SHORELINES OF SEFC: LEGEND WITH QUESTIONABLE INVISIBLE LINE FOR A SHORELINE OF THE FUTURE...

2. LIFE SIZE ANIMALS AND PLANTS:

Imagery taken from forms represented on Medallions and Vista Lids

MEDICINAL PLANTS WITH RAVEN / CROW FLYING TOWARDS THE SUN.

LIFE SIZE ELK WALKING ALONG THE ALLEY WAY.

PMT BOX IMPLEMENTATION PLAN:

Type	500 kVA and smaller
Number	6 (4 worksyard, 1 shipyard, 1 railyard)
Size	1480mm x 1370mm x 1500mm (W x L x H)
Material	Steel with Paint Specs 221-4016
Method	Constructed and painted by manufacturer
Location/ Orientation	Adjacent to the property line, long side parallel to the property line, letters are upright when looking from the road, identified on BCH map

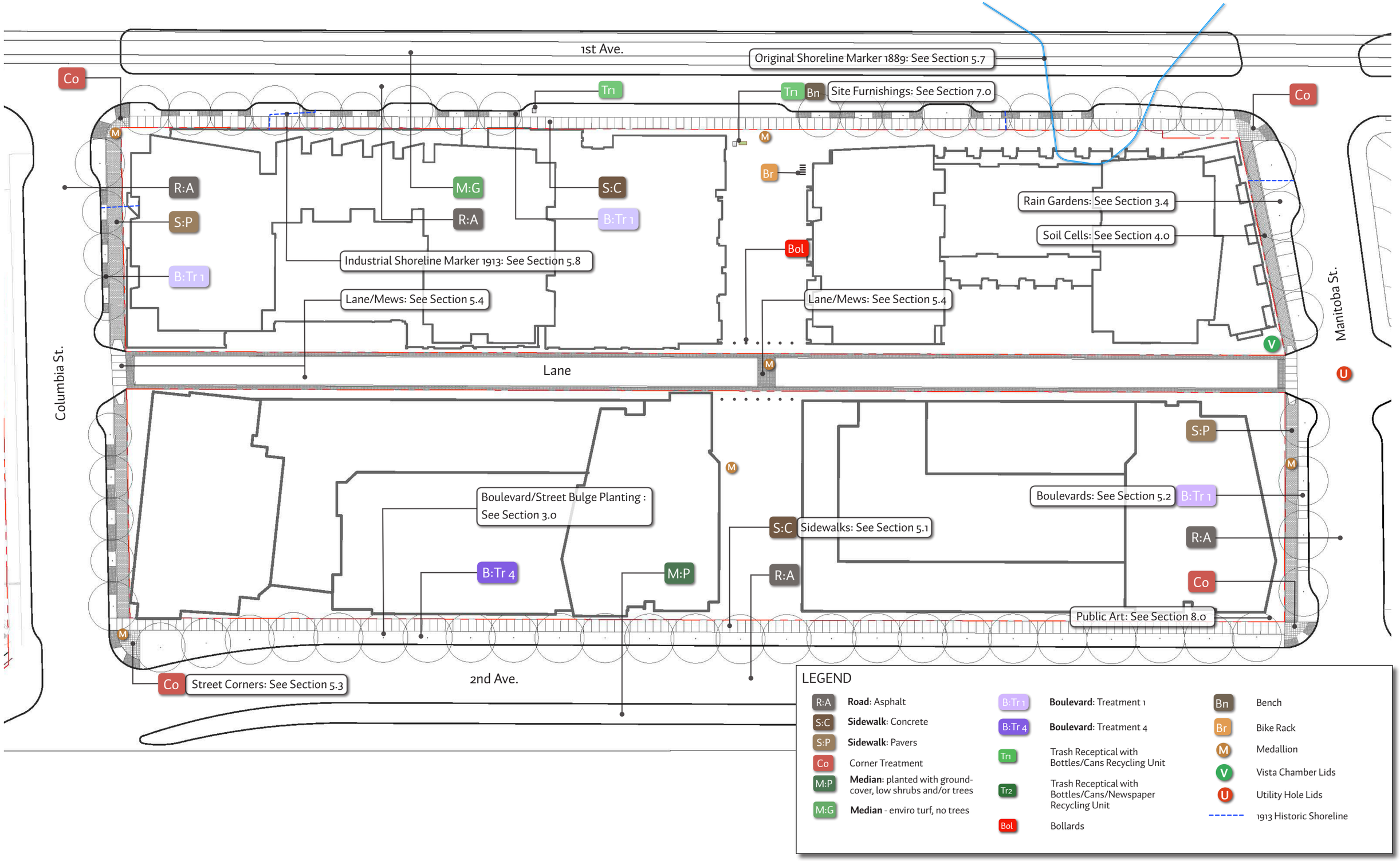
ARTISTIC ELEMENTS LEGEND

- M — Medallions
- U — Utility Hole Lids
- V — Vista Chamber Lids
- P — PMT Boxes
- 1913 Historic Shoreline
- 1889 Historic Shoreline
- Study Area Boundary

FALSE CREEK
SCIENCE WORLD
TERMINAL AVE.
NORTHERN
OLYMPIC VILLAGE
ATHLETES WAY
WALTER HARDWICK AVE
QUEBEC ST.
MAIN ST.
WESTERN ST.
CENTRAL ST.
SOUTHERN ST.
INDUSTRIAL AVE.
1 AVE.
FIRST AVE.
SECOND AVE.
THIRD AVE.
FOURTH AVE.
LORNE ST.
MANITOBA ST.
SALT ST.
ONTARIO ST.
COLUMBIA ST.
COOK ST.
CRETE ST.
WYATT ST.
ALBERTA ST.
SPYGLASS PL.
WHEELHOUSE SQUARE
COMMODORE RD.
FIFTH AVE.

9.0 EXAMPLE BLOCK PLAN

The following plan is an example of how the Public Realm Enrichment Guidelines would apply to one (1) block within the study area.



LEGEND

R:A	**Road**: Asphalt	B:Tr 1	**Boulevard**: Treatment 1	Bn	Bench
S:C	**Sidewalk**: Concrete	B:Tr 4	**Boulevard**: Treatment 4	Br	Bike Rack
S:P	**Sidewalk**: Pavers	Tr1	Trash Receptical with Bottles/Cans Recycling Unit	M	Medallion
Co	Corner Treatment	Tr2	Trash Receptical with Bottles/Cans/Newspaper Recycling Unit	V	Vista Chamber Lids
M:P	**Median**: planted with ground-cover, low shrubs and/or trees	Bol	Bollards	U	Utility Hole Lids
M:G	**Median** - enviro turf, no trees			------	1913 Historic Shoreline

10.0 MANUFACTURE / SUPPLIER / DISTRIBUTOR CONTACTS

Distributor / Supplier and Manufacture of:

CUSTOM BENCHES AND CUSTOM RECYCLING UNITS

Local Distributor: Danica Agencies
attn: Martin Peterson
(604) 987-7461 - office
(604) 803-2781 - mobile
martinp@landscapeforms.com
Manufacture: Landscapeforms
www.landscapeforms.com

BIG BELLY TRASH COMPACTOR

Supplier: Big Belly Solar
Attn: Earnest
1(888) 820-0300
www.bigbellysolar.com

BIKE RACKS

Supplier: Creative Pipe
1(800) 644 8467
sales@creativepipe.com
www.creativepipe.com
Model Reference Number: 474-023
Finish: Stainless Steel

Future locally manufactured bike rack option:
Supplier: Advantage Bikeracks
Model Reference: stainless steel class B bikeracks
Contact: Zephyr
PO Box 103-3456 Dunbar Street
Vancouver, BC
604 734-2527

CUSTOM BOLLARDS

Fabricator/Manufacturer: To Be Determined

DRINKING FOUNTAINS

Local Supplier: Axford Agencies Inc.
(604) 526-6361
Model: Haws 3380 GFR
Finish: Galvanized

CONCRETE UNIT PAVER SUPPLY

Recommended Source:
Abbotsford Concrete
1(800) 663-4091

GRANITE SUPPLY

Acceptable and or recommended sources include:
Hardy Island Granite: Bedrock Granite Sales
(604)941-7783
Chilliwack Granite:
Whistler Granite:

SOIL CELLS

Local Supplier: Deep Root Canada Corp.
Unit 740 - 1190 Melville Street
Vancouver, BC V6E 3W1
Contact: Mike James
mjames@deeproot.com
Tel: 604 687 0899
Fax: 604 684 6744
Toll Free: 800 561 3883 (Canada Only)

11.0 APPENDIX

The Appendix include the following three specifications:

02214 - Structural Growing Medium Spec
02216 - Structural Cells Spec
02920.30 - Structural Cell Growing Medium Spec

These specifications are not for construction purposes, are subject to change and should be used as a guideline.

1.00 GENERAL

1.01 GENERAL REQUIREMENTS

.1 Refer to Division 1, General Requirements

.2 All contract documents form an integral part of this section.

.3 Structural Growing Medium only to be used in areas where required for tree root growth and where structural cells do not fit. Landscape drawings and details will note these areas.

1.02 RELATED WORK

.1	Sub-Grading/Landscape Areas	Section 02211
.2	Excavation, Backfill and Grading	Section 02230
.3	Subsurface Drainage	Section 02712
.4	Planting of Trees, Shrubs and Ground Covers	Section 02950
.5	Structural Cells	Section 02216

1.03 TESTING

.1 Submit to the Engineer a copy of a structural growing medium analysis and an analysis of its components from a laboratory approved by the Engineer. The analysis shall be of tests done on the proposed structural growing medium from samples taken at the supply source within two weeks immediately prior to structural growing medium placement. Cost of initial analysis and subsequent tests to ensure compliance with specification shall be borne by the contractor. **Results of these tests shall be presented to the Engineer for review BEFORE any structural growing medium delivery to site.** Structural growing medium placed prior to the review of test results by the Engineer will result in rejection of structural growing medium and subsequent removal of material by the contractor at no cost to the owner.

.2 Components:

- .1 Growing Medium: The analysis of the growing medium shall include break down of the following components: particle size class and properties, total nitrogen by weight, available levels of phosphorus, potassium, calcium, magnesium, soluble salt content, organic matter by weight, and pH value.
- .2 Rock: Provide the manufacturers analysis of loose & rodded unit weight, bulk specific Gravity and absorbency, stone dimension. Provide a percent pore space analysis defined as follows: (1- rodded unit weight / bulk specific gravity) X 100

.3 The analysis shall outline the testing laboratory's recommendations for amendments, fertilizer and other required modifications to make the proposed structural growing medium meet the requirements of this specification.

.4 At the discretion of the Engineer submit up to two additional samples (cost to be borne by the contractor) at intervals outlined by Engineer of structural growing medium taken from material delivered to site. Samples shall be taken from a minimum of three random locations and mixed to create a single uniform sample for testing. Results of these tests shall be presented to the Engineer for review.

1.04 SAMPLES

.1 Submit to the Engineer samples of the following materials:

.1	Crushed Stone:	.5 kg (1 lb)
.2	Growing Medium:	.5 kg (1 lb)

.2 Structural Growing Medium Sample: One (1) composite sample. Sample shall be a composite of at least three (3) samplings from the proposed source or, and shall be at least one (1) litre (one (1) quart) in volume.

1.05 QUALITY CONTROL

.1 Carry out structural growing medium preparation and placement such that the final product is within 2% of the standard established which has incorporated the recommendations for amendment by the testing laboratory.

1.06 PRODUCT HANDLING, DELIVERY AND STORAGE

.1 Do not move, work or deliver structural growing medium or additives when they are excessively wet, extremely dry, frozen or in any manner which will adversely affect growing medium structure. Structural growing medium whose structure has been destroyed by handling under these conditions will be rejected and shall be replaced by the contractor at no cost to the owner.

.2 Protect structural growing medium and additives against contamination by weeds and insects, and construction debris.

.3 Structural growing medium shall be delivered at or near optimum compaction moisture content.

.4 Protect structural growing medium from absorbing excess water from and exposure to rainfall.

.5 All structural growing medium will be delivered to site **premixed** from a recognized growing medium source or at the discretion of the Engineer mixed on site or at a predetermined location, ensuring consistency throughout the mix.

6 Deliver fertilizer and other chemicals in manufacturer's original containers. Protect against damage and moisture until incorporated into the work.

2.00 PRODUCTS

2.01 MATERIALS

.1 **Imported Structural Growing Medium**: Growing medium shall be imported and stockpiled on site in an approved location. Stockpiling work shall be such that the soil is not damaged or contaminated.

.2 Structural Growing medium shall be free of subsoil, pests, roots, wood, construction debris, undesirable grasses including crabgrass or couch grass, noxious or weeds and weed seeds or parts thereof foreign objects and toxic materials.

.3 Fertilizer:

.1 Complete commercial synthetic slow release fertilizer meeting the requirements of the Canada Fertilizer Act, packed in water proof containers, clearly marked with the name of the manufacture, weight and analysis.

.2 Fertilizer Formulation Ratio: as per soil test recommendations.

.3 Lime:

.1 Coarse (unless noted otherwise), ground dolomite limestone containing minimum 85% of total carbonates.

.4 Organic Material: submit sample prior to shipping to site:

.1 Organic Material shall be Soil Amender, black/brown in colour, manufactured by Fraser Richmond Bio-Cycle, Richmond, B.C., or pre-approved equal.

.5 Wood Residuals: Content of wood residuals such as Fir or Hemlock sawdust present in the growing medium shall not cause the total Carbon to total Nitrogen ratio to exceed 33: 1. Cedar or redwood sawdust shall not be present in growing medium.

.6 Soil Binder – Stabilizer; manufactured by Stabilizer Solutions Inc., Phoenix Arizona. Distributed by Sport Turf Inc., Abbotsford, BC. (ph. 604.850.7857). **Or**,
Hydrogel; potassium propenamide copolymer Hydrogel as manufactured by Gelscape, Amereq Corp., (ph. 1.800.832.8788).

.7 Sand: hard, sharp, granular, river pump sand, well washed and free of contaminants, chemical and organic matter. Particle sizes by weight:

SIEVE SIZE	CLASSIFICATION	% RETAINED
No. 4 (4.76mm)	Gravel	0%
No. 10 (2.0 mm)	Fine gravel	0-5%
No.18 (1.0 mm)	Very coarse sand	5-10%
No.35 (0.50 mm)	Coarse sand	15-20%

No.60 (0.25 mm)	Medium sand	50-75%
No.140 (0.105 mm)	Fine sand	5-15%
No. 270	Very fine sand	0-2%
Passing No. 270	Silt, clay	0%

.8 Crushed Structural Stone: 70 mm (3"), highly angular crushed stone free of large flat surfaces. contaminants, chemical and organic matter, As supplied by LeFarge Aggregates, Ward Road Quarry, Abbotsford, B.C.; Product Code: 3680, or pre-approved equal.

.1 Particle shape ratio: 2: 1: 1

.2 Particle size by weight:

SIEVE SIZE	PERCENT PASSING
70mm(3")	100
60mm(2 1/2")	5-10
50mm (2")	0

.9 Structural Growing Medium: uniform mixture of crushed stone, growing medium and soil binder combined to the following proportions:

MATERIAL	% UNIT OF WEIGHT
Crushed Stone	75% dry weight
Growing Medium	22-25% dry weight
Soil Binder **Or**	0.05% (1.5 kg / m^3 finished material)
(Hydrogel)	0.03% (0.9 kg / m^3 finished material)
Total Moisture	10% (includes water in other ingredients)

.10 Filter Medium: Needled, non-woven polypropylene mat. Nilex 4545 by Nilex Geotechnical Projects, Burnaby, B.C., or other approved equal.

2.02 STANDARD FOR GROWING MEDIUM COMPONENT OF STRUCTURAL GROWING MEDIUM

		(%Dry Weight)
.1	Particle Size Class and Properties Structural Soil	
	Sand (Larger than 0.05mm and smaller than 2 mm)	65 - 70%
	Silt (Larger than 0.002 mm and smaller than 0.05mm)	5-15%
	Clay (Smaller than 0.002mm)	5-10%
	(Maximum Clay and Silt Combined)	**20%**
	Organic Material Content	10 - 15%
	(Particle size in Percent (%) of Dry Weight)	
.2	Acidity (pH): 5.5 - 6.5	
.3	Salinity: Maximum saturation extract conductivity: 3.0 millihos/cm at 25 degrees C.	
.4	Cation exchange:	30 - 50 meq.
.5	Carbon to nitrogen ratio:	maximum 33:1
.6	Hydraulic Conductivity: Minimum saturated hydraulic conductivity 5.0 - 7.0 cm/hour in place.	
.7	Fertility:	
	Total nitrogen:	. 4 - .8% by weight.

Available phosphorus	70 - 80 ppm
Available potassium	150 - 250 ppm

3.00 EXECUTION

3.01 MIXING STRUCTURAL GROWING MEDIUM

.1 Structural growing medium is to be prepared using appropriate measuring, mixing and shredding equipment of sufficient capacity and capability to assure consistent mixing ratios.

.2 Maintain adequate moisture content during the mixing process. The contractor shall periodically monitor the amount of moisture present in the growing medium at the mixing site.

.3 Mixing Procedure with Front End Loader:

- .1 Spread 200mm (8") to 300 mm (12") of crushed stone on a flat asphalt or concrete paved surface.
- .2 Spread a consistent amount of soil binder over the crushed stone.
- .3 Spread a specified amount of growing medium over the soil binder/crushed stone.
- .4 Blend the entire amount by turning using a front-end loader or other suitable equipment until a consistent blend is achieved.
- .5 Addition of water during the blending and turning process shall be carefully monitored to ensure required moisture content is not exceeded. Delay application of water for ten (10) minutes prior to successive applications.
- .6 Mixing should produce a material within 1% if the optimum moisture level for compaction.
- .7 Structural growing medium amendments as per the growing medium analysis shall be added and thoroughly mixed with the growing medium prior to start of batching operations.

4. If the mixture dries out and separates at any time during the mixing, storing, transport or placement process, the structural growing medium should be wetted and re-mixed.

3.02 PLANTING TRENCH PREPARATION

.1 Scarify and or break up and loosen existing sub grade and compacted gravel areas to a minimum depth of 200 mm (8") to allow for proper drainage in all planting areas and tree pits.

.2 Place perforated PVC subsurface drain line to grades noted on plans as per Section 02712. Ensure sub grade is sloped to allow positive flow of subsurface water to subsurface drain.

3.03 PLACEMENT OF STRUCTURAL GROWING MEDIUM

.1 Engineer to review sub grade prior to the placement of structural growing medium.

.2 Ensure that irrigation lines to be installed have been reviewed by the Engineer prior to the placement of growing medium.

.3 Place prepared structural growing medium in 150 mm (6") lifts compacted to a minimum of 95% MPD in tree pits and planting trenches indicated on drawings. Do not over compact structural growing medium. Operate compaction equipment over structural growing medium the minimum number of passes required to achieve specified compaction. Delay compaction for a minimum of 24 hours if moisture content in structural growing medium exceeds maximum allowable. Protect structural growing medium during delays with plywood or plastic.

.4 Place structural growing medium ensuring adequate moisture, in uniform layers, **during dry weather,** over approved, dry, unfrozen sub grade where planting is indicated to the following minimum depths:

Trees pits and trenches: 760 mm (2'-6") or as otherwise indicated.

.5 Structural growing medium to be placed such that the finished grade elevation allows for the required build up for pavement base material and pavement thickness to finished grade.

.6 Protect structural growing medium from all contamination that will alter the particle distribution or make up of the mix with plastic or plywood cover.

3.04 PLACEMENT OF FILTER MEDIUM

.1 Place filter medium over entire Structural Growing Medium layer ensuring joint overlap of a minimum of 150 mm (6").

3.05 WEED CONTROL

.1 Eliminate all weeds and weed roots from growing medium prior to start of mixing operations.

.2 Have method for elimination of weeds reviewed by Engineer prior to any action by the contractor.

3.06 FINISH GRADING

.1 Fine grade (manually) growing medium areas to contours and elevations shown on drawings or as directed by Engineer. Provide smooth transition between slopes of different gradients. Eliminate rough spots and low areas to ensure positive drainage.

.2 Structural growing medium to be placed such that the finished grade elevation allows for the required build up for pavement base material and pavement thickness to finished grade.

.3 Leave surface smooth, uniform, with a maximum of 50 mm (2") in 3.0M (10'-0") deviation in gradient plane.

3.07 PROTECTION OF MATERIAL

.1 **DO NOT WASH ADJACENT PAVING AREAS, HARD SURFACES OR LANDSCAPE AREAS UNTIL FINISH PAVING HAS BEEN INSTALLED OVER STRUCTURAL GROWING MEDIUM.**

3.08 SURPLUS MATERIAL

.1 Dispose of surplus growing medium not required for fine grading and landscaping off site.

END OF SECTION 02214

1.00 GENERAL

1.01 GENERAL REQUIREMENTS

.1 Refer to Division 1, General Requirements

.2 All contract documents form an integral part of this section.

1.02 RELATED WORK

.1	Excavation and Placement of Granular Materials	Section 02223
.2	Structural Cell Growing Medium Preparation and Placement	Section 02920.30
.3	Planting of Trees, Shrubs and Ground Covers	Section 02950

1.03 DESCRIPTION

.1 Furnish all labour, materials, equipment, and services necessary for supply and installation of structural deep growing medium cells:
- .1 Excavation and base preparation to provide adequate support for project designs loads and safety from excavation sidewall collapse.
- .2 Supply and install structural deep growing medium cell frames and decks, drainage layers, filter cloth, and geogrids.
- .3 Supply and installation of growing medium into structural deep growing medium cells.

1.04 DEFINITIONS

.1 Aggregate Sub Base (below Cell frame): Aggregate material between the bottom of the Structural Cell frame and the compacted subgrade below, designed to distribute loads from the frame to the subgrade.

.2 Aggregate Base Course (above Cell deck): Aggregate material between the paving and the top of the Structural Cell deck below designed to distribute loads across the top of the deck.

.3 Aggregate Setting Bed – For Pavers (above Cell deck): Aggregate material between the aggregate base course and unit surface pavers, designed to act as a setting bed for the pavers.

.4 Backfill: The earth used to replace or the act of replacing earth in an excavation beside the Structural Cell frames to the excavation extents.

.5 Finish Grade: Elevation of finished surface of Growing Medium or paving.

.6 Geogrid: Net-shaped synthetic polymer-coated fibers that provide a stabilizing force within soil structure as the fill interlocks with the grid.

.7 Geotextile: A geosynthetic fabric, applied to either the soil surface or between materials, providing filtration, separation, or stabilization properties.

.8 Growing Medium: As defined in Division 2, Section 02920.30, - Structural Cell Growing Medium – Preparation and Placement intended to fill the frames and other planting spaces.

.9 Root Barrier: Plastic root diversion device.

.10 Structural Cells: Plastic structural cellular system with posts, beams and decks designed to be filled with Growing Medium for tree rooting and support of vehicle loaded pavements. The soil within the cells may also be used as part of rainwater filtering, retention and detention systems.

.11 Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill.

.12 Strongback: Modified Structural Cell frame designed to be attached to top of Structural Cells for stability while installing Growing Medium and backfill.

.13 Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.05 SAMPLES/ SUBMITTALS

.1 Upon forty-five (45) days prior to start of installation of items in this section, the Contractor shall provide submittals required in this section to the Consultant for review and approval.

.2 Submit three (3) copies of written manufacturer's product data and installation instructions. Product Data: For each type of product, submit manufacturer's product literature with technical data sufficient to demonstrate that the product meets these specifications.

.3 Submit the following products;
- .1 One (1) 120cmx40cmx60 cm (48”x16”x24”) sample of the Structural Cell frame.
- .2 One (1) 120 cmx5.15cmx60cm (48”x2”x24”) Structural Cell deck.
- .3 Submit material certificates for filter cloth, geogrid, base course and backfill materials.

.4 Compaction testing results: Submit results of all compaction testing required by the specifications including the bulk density test of the mock up and installed soil, and the compaction testing log of penetrometer and moisture meter readings to the landscape architect for approval.

.5 Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

- .1 Manufacturer's certified analysis for standard products.
- .2 Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- .3 Structural Cell manufacturer's letter of review and approval of the project, plans, details and specifications for compliance with product installation requirements.

1.06 MOCK UP

.1 Prior to the installation of Structural Cells, construct a mock up of the complete installation at the site. The Consultant to review mock up prior to the start of the work in this section.

.2 The mock up shall be a minimum of 5 Metres square in area and include the complete Structural Cell system installation with granular sub base compaction, drainage installation, crushed

granular base and filter cloth as required, geogrids, backfill, growing medium, decks, drainage layer, and top geotextile.

.3 The mock up area may remain as part of the installed work at the end of the project provided that it remains in good condition and meets all the conditions of the specifications.

1.07 QUALITY CONTROL

.1 Installer Qualifications

.1 Installer Qualifications: Structural Cells and related products shall be installed by a qualified installer whose work has resulted in successful installation of Growing Mediums and planter drainage systems, underground piping, chambers and vault structures.

.2 Submit list of at least five (5) completed projects of similar scope and scale to the as part of the Tender documentation, demonstrating capabilities and experience.

.3 The installer and the field supervisor shall have a minimum of five years successful experience with construction of similar scope in dense urban areas.

.4 Installer's Field Supervision: Installer is required to maintain an experienced full-time supervisor on Project site when work is in progress. This person shall be identified during the Pre-installation Conference, with appropriate contact information provided, as necessary. The same supervisor shall be utilized throughout the Project, unless a substitution is submitted to and approved in writing by the Engineer.

.5 The installer shall be required to notify the manufacture's representative and ensure that manufacture's representative is on site during the critical milestones of installation.

.2 Layout and Elevation Control

.1 Provide layout and elevation control during installation of Structural Cells. Utilize grade stakes, surveying equipments and other means and methods to assure that layout and elevations conform to the layout and elevations indicated on the plans

.2 Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, Provincial and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

1.08 PRODUCT HANDLING

.1 Do not move or work growing medium or additives when they are excessively wet, extremely dry, frozen or in any manner which will adversely affect growing medium structure. Growing medium whose structure has been destroyed by handling under these conditions will be rejected and shall be replaced by the contractor at no cost to the owner.

.2 Protect growing medium and additives against extreme wetting by rain or other agents, and against contamination by weeds and insects.

.3 All growing medium will be delivered to site **premixed** from a recognized growing medium source ensuring consistency throughout the mix.

.4 Deliver organic fertilizer and other chemicals in manufacturer's original containers. Protect against damage and moisture until incorporated into the work.

.5 Protect Structural Cells from damage during delivery and store under tarp to protect from sunlight when time from delivery to installation exceeds one week. Storage should occur on smooth surfaces, free from dirt, mud and debris.

.6 Handling is to be performed with equipment appropriate to the size (height) of cells and site conditions, and may include, hand, handcart, forklifts, extension lifts, small cranes, etc., with care given to minimize damage to spacer bars and surrounding structural deep growing medium cells.

.7 Do not dump or store bulk materials near structures, utilities, sidewalks, pavements, and other facilities, or on existing trees, turf areas or plants.

.8 Provide protection including tarps, plastic and or matting between all bulk materials and any finished surfaces sufficient to protect the finish material.

.9 Provide erosion-control measures to prevent erosion or displacement of bulk materials and discharge of soil-bearing water runoff or airborne dust to adjacent properties, water conveyance systems, and walkways. Provide additional sediment control to retain excavated material, backfill, soil amendments and planting mix within the project limits as needed.

.10 Structural Cells: Protect Structural Cells from damage during delivery, storage and handling.
- .1 Store under tarp to protect from sunlight when time from delivery to installation exceeds one week. Storage should occur on smooth surfaces, free from dirt, mud and debris.
- .2 Handling is to be performed with equipment appropriate to the size (height) of Cells and site conditions, and may include, hand, handcart, forklifts, extension lifts, small cranes, etc., with care given to minimize damage to Structural Cell frames, decks and adjacent Structural Cells. Backhoes, front-end loaders and skid steers are considered inappropriate for Structural Cell transport and placement.

1.09 PROJECT CONDITIONS

.1 Review installation procedures and coordinate Structural Cell work with other work affected, such as grading, excavation, utilities, construction access, erosion control to prevent all non-installation related construction traffic over the completed structural deep growing medium cell installation, especially with loads greater than design loads.

.2 Cold weather:
- .1 Do not use frozen materials or materials mixed or coated with ice or frost.
- .2 Do not build on frozen work or wet, saturated or muddy subgrade.

.3 Protect adjacent work from damage during Structural Cell installation.

.4 Provide erosion-control measures to prevent erosion or displacement of bulk materials and discharge of soil-bearing water runoff or airborne dust to adjacent properties, water conveyance systems, and walkways. Provide additional sediment control to retain excavated material, backfill, soil amendments and planting mix within the project limits as needed.

.5 Protect partially completed Structural Cell installation against damage from other construction traffic when work is in progress, and following completion with highly visible construction tape, fencing, or other means until construction is complete. Prevent all non-installation related construction traffic over the completed structural deep growing medium cell, especially with loads greater than design loads.

.6 Protect open excavations and partially completed Structural Cell installation from access and damage when work is in progress, and following completion with highly visible construction tape, fencing, or other means until all construction is complete.

1.09 EXISTING CONDITIONS

.1 Verification of Existing Conditions and Protection of New or Existing Improvements: Prior to proceeding with work in this section, the Contractor shall carefully check and verify all dimensions, quantities, and grade elevations, and inform the Engineer immediately of any discrepancies.

.2 Carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.

.3 Verify the location of all aboveground and underground utility lines, infrastructure, other improvements, and existing plants to remain including their root system, and take proper precautions as necessary to avoid damage to such improvements and plants.

.4 In the event of conflict between existing and new improvements notify the Engineer in writing and obtain written confirmation of revisions to the work prior to proceeding.

.5 When new or previously existing utility lines are encountered during the course of excavation, notify the Engineer in writing and make recommendations as to remedial action. Proceed with work in that area only upon approval of appropriate remedial action. Coordinate all work with the appropriate utility contractors, utility company or responsible public works agency.

.6 Weather Limitations: Do not proceed with work when subgrades, sub soils and growing medium are in a wet, muddy or in a frozen condition.

1.10 PRE CONSTRUCTION MEETING

.1 Prior to the start of the installation of structural deep growing medium cell, meet at the site with the Engineer, General Contractor and the structural deep growing medium cell installer to review installation layout, procedures, means and methods.

2.00 PRODUCTS

2.01 MATERIALS

.1 Structural Cells shall consist of injection molded polypropylene and fiberglass compound frame with injection molded polypropylene and fiberglass with galvanized steel tubular reinforced perforated deck.

.1 Load capacity of AASHTO-H20.

.2 Contain 0.3 cu Metres of growing medium per cell.

.3 92% void space

.4 Dimensions

	Length	Height	Width
Deck	120cm (48”)	5.0cm (2”)	60cm (24”)
Frame (including manufactured installed galvanized steel tubes)	120cm (48”)	40cm (16”)	60cm (24”)

.5 Acceptable suppliers and / or manufactures include, DeepRoot Partners, L.P. (Deep Root) 530 Washington Street, San Francisco, Ca 94111, 415.781.9700, 800.458.7668, www.deeproot.com. or approved equal.

.2 Filter Medium: Needled, non-woven polypropylene mat. Nilex 4545 by Nilex Geotechnical Projects, Burnaby, B.C., or other approved equal.

.4 Structural Cells Marker: Metallic tape suitable for exterior subsurface applications.

.5 Structural Cell Deck Screws: Manufacturer's supplied stainless steel screws to attach decks to frames.

.6 Structural Cell Strongback: 400mm x 600mm x 150mm (24 inches x 48 inches x 6 inches) modified Structural Cell Frame units designed to stiffen and align the frames as planting soil and backfill material is placed. Strongbacks are to be removed prior to placing decks. They are to be reused as the work progresses.

.7 Anchoring Spikes : 10" (250mm) long X 19/64" (8mm) diameter, spiral, galvanized timber spikes. Utilize 4 nails in each frame on the first layer of Structural Cells to anchor the frames to the aggregate subbase

.8 Solid and Perforated Drain Lines:

.1 PVC double wall perforated pipe. Pipe, manufactured from virgin, low filler cell class PVC resin (12454 per ASTM D1784). Pipe shall be Contech A-2000 as manufactured by Contech construction Products, Inc, Chicago IL Phone 630 573 1110, www.contech-cpi.com.

.2 Perforated pipe shall have slots on the bottom quadrant of the pipe of 1-1/16” long by .031” wide at .413 on center.

.3 All fittings, "T", "Y", end caps, and splices shall be compatible fittings by the same manufacturer. Size - 4” diameter.

.4 Pipe and fitting joints shall be glued using glue and techniques recommended by the pipe manufacturer.

.9 Inspection Riser and Cap:

.1 Inspection riser shall consist of a rigid, schedule 40 non-perforated PVC pipe, 4 inches in diameter. Cut slots in the bottom to allow water access for inspection risers that extend to the sub base aggregate.

.2 Cap shall be PVC solid threaded cleanout or removable inlet grate designed to fit standard PVC schedule 40 pipe-fittings.

.10 Geogrid:

.1 Miragrid 2XT as manufactured by Ten Cate Nicolon, Norcross, GA, or approved equal, www.tcmirafi.com

.11 Geotextile: Shall be one of the following geofabrics:

.1 When warranties are required, verify with Owner's counsel that special warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

Non woven polypropylene fabric with the following properties:

Grab tensile strength	370 lb.
Grab tensile elongation	50%
Mullen burst strength	380 psi
Puncture strength	130 lb.
Apparent opening size	US sieve 80 (0.180 mm)
Water flow rate	95 gpm/SF

.2 Geotextile shall be delivered in 12 feet (3600mm) wide rolls min.

.3 Geotextile shall be non woven polypropylene geotextile, Mirafi 180 N as manufactured by Ten Cate Nicolon, Norcross, GA, or approved equal, www.tcmirafi.com

.12 Aggregate sub base (below cell frame):

.1 Aggregate meeting the requirements of ASTM D1241-07, Type 1, Gradation B, Standard Specification for Materials for Soil-Aggregate Sub base, Base, and Surface Courses.

.13 Aggregate base course (above cell deck):

.1 Aggregate meeting the requirements of ASTM D448-07, No. 8 Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

.14 Aggregate base course and setting bed for unit pavers (above cell deck)

.1 Aggregate Base Course. Aggregate meeting the requirements of ASTM D 448, No. 57, Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

.2 Aggregate Setting Bed. Aggregate meeting the requirements of ASTM D 448, No. 8, Standard Classification of Sizes of Aggregate for Road and Bridge Construction.

.3 Backfill Material (adjacent to Structural cells): Clean, compactable, coarse grained fill soil meeting the requirements of the Unified Soil Classification system for soil type GW, GP, GC with less than 30% fines, SW, and SC with less than 30% fines. Backfill material shall be free of organic material, trash and other debris, and shall be free of toxic material injurious to plant growth.

.15 Growing Medium- (See Specification Division 2 Section 02920.30 - Structural Cell Growing Medium – Preparation and Placement.

.16 Mulch: Soil Amender Mulch, available from Fraser Soil and Fibre Ltd, Richmond, BC. Submit sample for review prior to shipment to site. Contractor to submit a one (1) litre sample to the Consultant for review prior to shipping to the site.

.17 Root Barrier:

.1 Root Barrier shall be DeepRoot; Tree Root Barriers; UB 18-2, manufactured by DeepRoot Partners, L.P. (Deep Root); 530 Washington Street, San Francisco, CA 94111; 415.781.9700; 800.458.7668; fax 415.781.0191; www.deeproot.com.

.2 Material: 0.080" wall thickness, nominal, injection molded 50% post-consumer recycled polypropylene panels with UV inhibitors.

.1 Integral molded 0.080" thickness by 2" deep vertical root directing ribs spaced at 6" O.C.

.2 7/16" wide integral molded 0.080" thickness double top edge with stiffening ribs; bottom edge attached to vertical root deflecting ribs.

.3 Integral molded 0.080" thickness by 2" long by 3/8" wide horizontal anti-lift ground lock tabs; minimum nine per panel.

.4 Integrated zipper joining system for panel connection to adjacent panel.

.5 Size (each panel): 24" wide by 18" deep.

.6 Color: Black.

3.00 EXECUTION

3.01 INSPECTION

.1 Examine prepared excavation and conditions for smoothness, compaction and level.

.2 Do not begin installation of Structural Cells until unsatisfactory conditions are corrected.

.3 High water table must be kept at levels below the bottom of the Structural Cell at all times.

.4 Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found unsatisfactory, contact Engineer for resolution.

3.02 LAYOUT APPROVAL

.1 Prior to the start of work, layout and stake the limits of excavation and horizontal and vertical control points sufficient to install the Structural Cells and required drainage features in the correct locations.

3.03 EXCAVATION

.1 Prior to excavation mark on site location and limits of Structural Cell installation including location of tree pits.

.2 Ensure excavation to required sub grade depths is level and free of lumps, debris, and miscellaneous non load bearing organic materials.

.3 Do not over excavate existing soil. If soil is over excavated, reinstall in lifts not more than 200mm (8 inches) deep and compact to the required density.

.4 Where aggregate sub base material is not required, grade surface of the bottom of the excavation a plane parallel to the grades of the paving above.

.5 Existing or reinstalled subgrade to be compacted to a minimum of 95% MPD.

.6 Confirm that the depth of the excavation is accurate to accommodate the depths and thickness of materials required throughout the extent of the excavation.

.7 Confirm that the width and length of the excavation is a minimum of 6 inches (150mm), in all directions, beyond the edges of the Structural Cells.

3.04 SUB GRADE COMPACTION

.1 Check compaction of the subgrade below the Structural Cells and confirm that the subgrade soil is compacted to a minimum of 95% of maximum dry density at optimum moisture content in accordance with ASTM D 698 Standard Proctor Method.

.2 Proof compact the subgrade with a minimum of three passes of a suitable vibrating compacting machine or apply other compaction forces as needed to achieve the required subgrade compaction rate.

.3 Apply additional compaction forces at optimum water levels.

3.05 INSTALLATION OF GEOTEXTILE OVER SUBGRADE

.1 Where indicated on the drawings, install geotextile over the compacted subgrade material.

.2 Install the geotextile with a minimum joint overlap of 18 inches (450mm) between sections of material.

3.06 INSTALLATION OF SOLID AND PERFORATED DRAIN LINES

.1 Layout the location of all drains lines. Adjust the alignments to conform to the final locations of sleeves and risers. Do not locate drain lines within 6 inches (150mm) of the edge of any Structural Cell post.

.2 Provide horizontal field engineering at all times when drain lines are being installed to assure that the slope on all drain lines is positive toward its intended outfall and also remains at the correct depth as shown on the drawings.

.3 Excavate a trench a minimum of 12 inches (300mm) wide to a depth required to provide positive drainage from the high points of the system to the outfall or connection point to storm sewer. Eliminate dips or rises that will trap water. Minimum slope shall be 1%.

.4 Install the perforated drain lines as indicated on the drawing. All connections and splices shall use the manufacturer's standard splice and fitting connections. Joints shall be secure. Place perforated pipe with drain slots on the bottom side of the pipe.

3.07 INSTALLATION OF INSPECTION RISERS

.1 Install 4" solid P.V.C. inspection risers to grade.
  .1 Install manufacturer's PVC solid "T's," elbows, and reducers. Use the proper sized "T's" and reducers.
  .2 Extend risers into sub base aggregate and or make connections to drain lines where indicated on the drawings.

.3 Where inspection risers are indicated to be placed on top of the Structural Cell Deck, assemble riser and fittings to dimensions requires such that the rim of the riser is flush with the paving. Set the rim top with a slope consistent with the slope of the pavement.

.4 Adjust the location of the riser such that the center of the riser falls along the centerline of one of the ribbed sots in the deck. Cut the deck geotextile with an X cut and insert the riser through the geotextile.

.5 Make a geotextile collar secured to the riser with zip ties that over lap the surrounding geotextile a minimum of 12-inches. Secure in place with tape.

.6 Brace all risers while backfill and paving is being installed to secure its location and elevation.

.2 Install cleanout caps on top of each riser flush to grade.

3.08 INSTALLATION OF AGGREGATE SUB BASE BELOW STRUCTURAL CELL FRAME

.1 Install aggregate sub base to the depths indicated on the drawings, under the first layer of Structural Cell frames.

.2 Compact aggregate sub base layer to a minimum of 95% of maximum dry density at optimum moisture content in accordance with ASTM D 698 Standard Proctor Method.

.1 Compact the subgrade with a minimum of three passes of a suitable vibrating compacting machine or apply other compaction forces as needed to achieve the required subgrade compaction rate.

.3 Grade surface in a plane parallel to the grades of the paving above.

.1 The tolerance for dips and bumps in the aggregate under Structural Cells shall be a 3/8-inch (9mm) deviation from the plane in 10 feet (3m) and 1/8-inch (3mm) in 4 feet (1200mm).

.2 The grade and elevations of the base under the Structural Cells shall be approved by the landscape architect prior to proceeding with the installation of the Structural Cells.

.4 Place filter medium over entire aggregate sub base area ensuring joints overlap of a minimum of 150 mm (6”).

3.09 INSTALLATION OF STRUCTURAL CELLS, PLANTING SOIL, GEOGRID, BACKFILL AND MULCH

.1 Identify the outline layout of the structure and the edges of paving around tree planting areas on the floor of the excavation, using spray paint or chalk line. The layout shall be calculated to include shift in layout locations due to depth and the slope of the Cells.

.2 Lay out the first layer of Structural Cell frames on the sub base. Verify that the layout is consistent with the required locations and dimensions of paving edges to be constructed over the Structural Cells.

.1 Check each Structural Cell frame unit for damage prior to placing in the excavation. Any cracked or chipped unit shall be rejected.

.3 Place frames no less than 1 inch (25mm) and no more than 3 inches (75mm) apart.

.4 Assure that each frame sits solidly on the surface of the sub base. Frames shall not rock or bend over any stone or other obstruction protruding above the surface of the sub base material. Frames shall not bend into dips in the sub base material. The maximum tolerance for deviations in the plane of the sub base material under the bottom of the horizontal beams of each Structural

Cell frame shall be 1/4 inch (6mm) in 4 feet (1200mm). Adjust sub base material including larger pieces of aggregate under each frame to provide a solid base of support.

.5 Anchor each Structural Cell into sub base with four-10 inch (250mm) spikes, driven through the molded holes in the Cell frame base. The purpose of the anchoring system is to maintain cell spacing and layout during the installation of planting soil and backfill.

.1 For applications where cells are installed over waterproofed structures, develop a spacing system consistent with requirements of the waterproofing system. Do not use anchoring nails that will come within 6" or less of any waterproofing material. Submit spacing system procedure for approval by the waterproofing provider.

.6 Install the second layer of Structural Cell frames on top of the first layer. Comply with manufacturer's requirements to correctly register and connect the Cell frames together.

.1 Register each frame on top of the lower frame post. Rotate each frame registration arrow in the opposite direction from the frame below to assure that connector tabs firmly connect. Each frame shall be solidly seated on the one below.

.2 Build layers as stacks of frames set one directly over the other. Do not set any frame half on one Cell frame below and half on an adjacent frame.

.7 Install Strongbacks on top of the Structural Cell frames prior to installing planting soil and backfill.

.1 Strongbacks are required only during the installation and compaction of the planting soil and backfill.

.2 Strongbacks should be moved as the work progresses across the installation.

.3 Strongbacks shall be removed prior to the installation of Structural Cell decks.

.8 Install planting soil, geogrid curtain and backfill as indicated on the drawings. The process of installation requires that these three materials be installed and compacted together in several alternating operations to achieve correct compaction relationships within the system.

.9 Where required, place the geogrid curtain along the outside of the limit of the Structural Cell frames.

.1 Geogrid curtains are required between the edge of the Structural Cells and any soils to be compacted to support paving beyond the area of Structural Cells. Do not place geogrid curtains between the edge of the Cells and any planting area adjacent to the Cells.

.2 Pre-cut the geogrid to allow for 6 inches (150mm) minimum under lapping below backfill, and 12 inches (300mm) minimum overlapping top of Structural Cell stack.

.3 Where cell layout causes a change direction in the plane of the geogrid, slice the top and bottom flaps of the material so that it lies flat on the top of the cell deck and aggregate base course along both planes.

.4 Provide a minimum of 300mm (12 inch) overlaps between different sheets of geogrid.

.5 Place the geogrid in the space between the Structural Cell frames and the sides of the excavation. Attach the geogrid to the Structural Cell frames using 3/16 inch x 12-inch (5x300mm) zip ties. Attach with zip ties at every cell and at Cell Deck.

.10 Install no more than two layers of Structural Cell frames before beginning to install planting soil and backfill. Compact the planting soil within the Structural Cell frames and the backfill material outside the frames in alternating lifts until the desired elevations and density is achieved in both soils.

.11 Install and compact backfill material in the space between the Structural Cells and the sides of the excavation in lifts that do not exceed 8 inches (200mm).

.1 Compact backfill to 95% of maximum dry density using a powered mechanical compactor. Use a pneumatic compacting tool or narrow foot jumping jack compactor for spaces less than 12 inches (300mm) wide and a 12-inch wide jumping jack compactor or larger equipment in wider spaces.
.2 Maintain the geogrid curtain between the Structural Cells frames and the backfill material.
.3 Install backfill in alternating lifts with the planting soil inside the Structural Cells.

.12 Fill the first layer or layers of frames with Growing Medium, specified in Division 2, Section 02920.30 - Structural Cell Growing Medium Preparation and Placement. Install in lifts that do not exceed 8 inches (200mm). Lightly compact the soil inside the frames at each lift to remove air pockets and settle the soil within the frames.
.1 Do not compact greater than 85% of maximum dry density. Check the Growing Medium compaction with a penetrometer or densitometer to achieve similar compaction levels provided in the mock up.
.2 If the Growing Medium becomes overly compacted, remove the Growing Medium and reinstall. Use hand tools or other equipment that does not damage the Structural Cell frames.
.3 Do not walk directly on horizontal beams of the frames.
.4 Work Growing Medium under the horizontal frame beams of the second level of Cell frames and between columns eliminating air pockets and voids. Fill each frame such that there is a minimum of 10 inches (250mm) of Growing Medium over the top of horizontal frame beams before beginning compaction.
.5 The top 1-2 inches (25-50mm) of each frame post should remain exposed above the Growing Medium to allow the placement of the next frame or deck.

.13 After the first two layers of Structural Cell frames have been installed, filled with Growing Medium and backfilled, proceed to install the third layer, if required, of Structural Cells frames. Comply with manufacturer's requirements to correctly register and connect the Cell frames together.
.1 Remove the strongbacks. Sweep any Growing Medium from tops before adding the next layer of frames.
.2 Register each frame on top of the lower frame post. Rotate each frame registration arrow in the opposite direction from the frame below to assure that connector tabs firmly connect. Each frame shall be solidly seated on the one below.
.3 Build layers as stacks of frames set one directly over the other. Do not set any frame half on one Cell frame below and half on an adjacent frame.

.14 Install Strongbacks on top of third layer of Structural Cells.

.15 Continue to install and compact the Growing Medium within the Structural Cell frames and the backfill material outside the frames in alternating lifts until the desired elevations and density is achieved in the Growing Medium and the backfill material.
.1 When using mulch, add a final layer of Growing Medium as required to bring the Growing Medium level to not more than 3 inches (75mm) below the bottom of the Structural Cell Deck when installed. When using air space rather than mulch, the Growing Medium shall be brought to level not more than 1 inch (25mm) below the bottom of the Structural Cell Deck when installed.
.2 Obtain final approval by the landscape architect of soil installation prior to installation of the Structural Cell deck.

.16 Remove Strongbacks after Growing Medium and backfill has been compacted to the top of the entire set of Structural Cells.

.17 Install 3 inches (75mm) of mulch, or leave 1-inch (25mm) air space, below Structural Cell Deck as indicated on the drawings.

3.10 STRUCTURAL CELL DECK INSTALLATION

.1 Install the Structural Cell Decks over the top of each frame stack. Clean dirt from the tops of the Structural Cell frame columns. Register the deck and make connections as recommended by the manufacturer to secure the deck to the top of the Structural Cell Frame. Secure each deck at the four corners with screw fasteners as recommended by the manufacturer. Assure that each deck is seated firmly on the frame top with all connectors attached.

.2 Install and compact remaining backfill material such that the backfill material outside the limits of the Structural Cells is flush with the top of the installed deck.

3.11 INSTALLATION OF GEOTEXTILE, GEOGRID, INSPECTION RISER AND AGGREGATE OVER THE DECK

.1 Overlap geogrid over the top of the Structural Cell Decks, with minimum of 12 inches (300mm) overlap.

.2 Place geotextile over the top of the deck and where indicated on the drawings, extending beyond the outside edge of the excavation by at least 18 inches (450mm). Any joints must be overlapped by a minimum of 18 inches (450mm).

.3 Cut geotextile a minimum of 20 percent larger than the size of the deck area to be covered to accommodate for required conforming of the geotextile and stone to the deck contours.

.4 Install 4-inch (100mm) diameter inspection risers above geotextile.

.5 Install the aggregate base course (including aggregate setting bed if installing unit pavers) over the geotextile immediately after completing the installation of the fabrics and inspection risers. Work the aggregate from one side of the deck to the other to assure that the fabric and aggregate conforms to the cell deck contours. Do not apply aggregate in several positions at the same time.

.1 Load the aggregate from equipment that is outside the limits of the excavated area. Use small, low impact material mover such as a concrete buggy or Georgia Buggy to move aggregate over the cells. Work over material already in place. Never allow any motorized equipment of any size to operate directly on the Structural Cell Deck.

.2 For large or confined areas, where aggregate cannot easily be placed from the edges of the excavated area, obtain approval for the installation procedure and types of equipment to be used in the installation from the Structural Cell manufacturer.

.3 Compact aggregate base course(s) in lifts not to exceed 6" in depth, to 95% of maximum dry density. Utilize a roller or plate compactor with a maximum weight of 1000 pounds. Make sufficient passes with the compacting equipment to attain the required compaction.

3.12 INSTALLATION OF PAVING ABOVE THE STRUCTURAL CELL SYSTEM

.1 Place paving material over Structural Cell system as specified.

.2 Take care when placing paving or other backfill on top of Structural Cell system not to damage the system components.

3.13 INSTALLATION OF ROOT BARRIERS

.1 Install root barrier in accord with manufacturer's reviewed installation instructions.

.2 Install with vertical root directing ribs facing inwards towards trees or plants.

.3 Connect panels together as required with manufacturer's standard joining system.

3.14 INSTALLATION OF GROWING MEDIUM AND MULCH WITHIN THE TREE PLANTING AREA

.1 Prior to planting trees, install additional Growing Medium, to the depths indicated, within the tree opening adjacent to paving supported by Structural Cells.

.2 Remove all rubble, derbies, dust and silt from the top of the Growing that may have accumulated after the initial installation of the planting soil within the Structural Cells.

.3 Assure that the Growing medium under the tree root ball is compacted to approximately 85-90% to prevent settlement of the root ball.

.4 The Growing Medium within the tree opening shall be the same Growing Medium as in the adjacent Structural Cells.

.5 Cover the Growing Medium finished grade with 2 inches (50mm) of mulch.

3.15 REPAIR OF CUT GEOTEXTILE

.1 In the event that any geotextile over subgrades or the Structural Cell decks must be cut during or after installation, repair the seam with a second piece of geotextile that overlaps the edges of the cut by a minimum of 12-inches in all directions prior to adding aggregate material.

3.16 PROTECTION

.1 Ensure that all construction traffic is kept away from the limits of the Structural Cells until the final surface materials are in place. No vehicles shall drive directly on the Structural Cell deck or aggregate base course.

.2 Provide fencing and other barriers to keep vehicles from entering into the area with Structural Cell supported pavement.

.3 Maintain a minimum of 4 inches (100mm) of aggregate base course over the geotextile material during construction.

.4 When vehicle must cross Structural Cells that does not have final paving surfaces installed, use construction mats designed to distribute vehicle loads to levels that would be expected at the deck surface once final paving has been installed. Use only low impact track vehicles with a maximum surface pressure under the vehicle of 4 pounds per square inch, on top of the mats over Structural Cells prior to the installation of final paving.

3.09 CLEAN UP

1. Perform cleaning during the installation of work and upon completion of the work.

.2 Remove from site all excess materials, debris, and equipment. Repair any damage to adjacent

materials and surfaces resulting from installation of this work.

END OF SECTION 02216

1.00 GENERAL

1.01 GENERAL REQUIREMENTS

.1 Refer to Division 1, General Requirements

.2 All contract documents form an integral part of this section.

1.02 RELATED WORK

.1	Structural Cells	Section 02216
.2	Excavation and Placement of Granular Materials	Section 02223
.3	Planting of Trees, Shrubs and Ground Covers	Section 02950

1.03 TESTING

.1 Submit Mixed sample of Structural Cell Growing Medium and a sample of the three (3) components (Organic Compost, Base Soil and Course Sand) to a testing laboratory approved by the Consultant. Sample of the Organic Compost, Base Soil and Course Sand shall be submitted with analysis testing reports and be approved by the Engineer prior to preparing the Structural Cell Growing Medium for testing. Samples of the Base Soil, Structural Cell Growing Medium shall not be screened and shall have soil peds similar in size and proportion to that found in the source stockpile for each material included within the samples.

.2 Submit to the Engineer a copy of analysis of the Structural Cell Growing Medium, Organic Compost, and Base Soil from a laboratory approved by the Engineer. The analysis shall be tests described in the following paragraphs of the proposed materials from samples taken at the supply source within three weeks immediately prior to the removal of the samples. Cost of initial analysis and subsequent tests to ensure compliance with specification shall be borne by the contractor. Results of these tests shall be presented to the Engineer for review and be approved BEFORE any Structural Cell Growing Medium delivery to site.

.3 The analysis of the Base Soil and the Structural Cell Growing Medium shall include measurement of:

Physical properties: (percent: Stone > 50mm; gravel >2mm; course sand 0.5mm to 2.0mm; medium sand 0.25mm to 0.5mm; fine sand 0.05mm to 0.25mm; fines (combined silt and clay) <0.05mm) and percent organic matter by dry weight.

Chemical properties: (pH, salinity - conductivity (E.C.) mmhos/cm or dS/m, carbon to nitrogen ratio, total nitrogen % and available levels of phosphorus, potassium, calcium and magnesium in ppm.

The analysis shall outline the testing laboratory's recommendations for amendments to the Structural Cell Growing Medium including: lime required to achieve pH 5.5 to 7.0, fertilizer and

any other required modifications required to make the proposed Structural Cell Growing Medium meet the requirements of this specification.

.4 The analysis of the Organic Compost shall include: Carbon to nitrogen ratio, ph, conductivity (E.C.) mmhos/cm or dS/m, and particle size distribution percent passing a 50mm (2 inch) and a 9mm (3/8 inch) screen

.5 Provide infiltration test data of the final Structural Cell Growing Medium as determined from a 780mm (30 inch) deep mock up of the Structural Cell Growing Medium, compacted to the required density levels using equipment and methods similar to those proposed for the final installation. Infiltration test shall be conducted using equipment and methods for field testing outlined in "Methods of Soil Analysis - Part 1" as published by the Soil Scientist Society of America, most current edition. The infiltration mockup shall be performed at the mixing site and results submitted to the Engineer for review and approval prior to delivery of the material.

.6 At the discretion of the Engineer, submit up to two additional samples for testing at intervals outlined by Engineer of Structural Cell Growing Medium taken from material delivered to site. Samples shall be taken from a minimum of three random locations and mixed to create a single uniform sample for testing. Results of these tests shall be presented to the Engineer for review.

.7 Failure to satisfy these contractual requirements could result in the contractor being required to remove unacceptable Structural Cell Growing Medium at their expense.

1.04 SAMPLES

The Structural Cell Growing Medium is made up of a number of products. Samples and other material are required to be submitted to the Engineer for review and approval as follows:

.1 Organic Compost: Submit 2-liter sample and manufacturer's literature and material certification that the product meets the requirements.

.2 Coarse Sand: Submit 2 liter sample and manufacturer's literature and material certification that the product meets the requirements.

.3 Base Soil: Submit 2 liter sample and testing data from the approved testing agency as outlined above. The sample shall be a mixture of three random samples taken around the source stockpile or field.

.4 Structural Cell Growing Medium: Submit 2 liter sample and testing data from the approved testing agency as outlined above. The sample shall be a mixture of three random samples taken around the source stockpile or field.

1.05 QUALITY CONTROL

.1 Carry out Structural Cell Growing Medium preparation and placement such that the final product matches the standard established and which has incorporated the recommendations for amendment by the testing laboratory.

1.06 PRODUCT HANDLING

.1 Do not move or work Structural Cell Growing Medium or additives when they are excessively wet, extremely dry, frozen or in any manner which will adversely affect Structural Cell Growing Medium peds.

.2 Protect Structural Cell Growing Medium and additives against extreme wetting by rain or other agents, and against contamination by weeds and insects.

.3 The Base Soil and the Structural Cell Growing Medium shall be handled using equipment and methods that preserves the soils natural peds. Retain 50 mm (2") to 75 mm (3") soil peds in Structural Cell Growing Medium. Structural Cell Growing Medium whose ped structure has been destroyed by handling under these conditions will be rejected and shall be replaced by the contractor at no cost to the owner. The Engineer shall determine when the Structural Cell Growing Medium has lost sufficient peds to warrant rejection.

.4 Structural Cell Growing Medium shall be imported and stockpiled at the site in an approved location. Stockpiling work shall be such that the soil is not damaged or contaminated.

.5 Deliver fertilizer and other chemicals in manufacturer's original containers. Protect against damage and moisture until incorporated into the work.

.6 All Structural Cell Growing Medium will be delivered to site premixed from a recognized growing medium source.

1.07 QUALITY ASSURANCE

.1 Structural Cell Growing Medium supplier must have experience mixing growing medium and be approved by Deeproot Canada Corp., (604)687-0899

2.00 PRODUCTS

2.01 BASE SOIL (for use as a base in Structural Cell Growing Medium, Base Soil shall have the following properties):

.1 Shall be a naturally produced soil harvested from the O or A horizon of the soil profile. Base Soil shall retain a significant portion of the soils ped structure.

.2 Shall have an organic matter content of no less than 3%, a combined silt/clay content of no more than 25% and a combined gravel and stone content of no more than 8%

.3 Shall have a maximum salinity of saturation extract conductivity: 3.0 mmhos/cm or dS/m at 25 degrees C.

.4 May be purchased from a source of collected topsoil from development sites provided the sources of the soil stock pile is of similar textures and meets the requirements of this specification.

.5 Shall not be a soil mix with sand, fertilizer, or organic matter or compost added to soil in order to meet the texture, chemical or organic requirements for Base Soil. The organic matter content of the soil shall be residue of long term, natural soil building processes and not from added organic matter.

.6 Shall not be screened through sieves or screens smaller than 1" to avoid eliminating the required soil ped sizes.

.7 Shall not contain materials and contaminants at levels that would be harmful to plant growth; or impair drainage, installation or maintenance of the resulting soil mix; or adversely impact its intended use including the following: refuse; roots; heavy or stiff lumps of clay; stones larger than 75 mm (3"); roots, wood or sticks larger than 25mm (1 inch) in diameter; construction debris; brush; litter; large clumps of root mats of plants; deleterious substances; subsoil; plant or soil pests; undesirable grasses including crabgrass or couch grass, noxious or weeds and weed seeds; foreign objects; and/or toxic materials. The Engineer shall determine if the quantities of any of these materials is sufficient to cause rejection of the Base Soil

.8 Approved suppliers of Base Soil Component are as follows;

EcoSoils
PO Box 61632 Brookswood, RPO, Langley, BC V3A 8C8
(604)541-7645

Yardwords Supply Ltd.
1900 Savage Road, Richmond B.C., Canada
(604)304-0932

2.02 ORGANIC COMPOST (for use as Organic Compost Component in Structural Cell Growing Medium, Organic Compost shall have the following properties):

.1 Shall be Soil Amender, the colour of a 70% Dark Chocolate Bar

.2 Shall be mature, stable, weed free, and produced by aerobic decomposition of organic matter. Organic compost feedstock shall be yard waste trimmings and/or source-separated municipal solid waste to produce a fugally dominated organic material.

.3 The product must not contain any visible refuse or other physical contaminants, substances toxic to plants. No more than 60% of the total dry weight of the Organic compost shall be a combination of sand, silt, clay and /or rock material.

.4 The product shall possess no objectionable odors as determined by the Engineer.

.5 Shall have a strong aerobic (sweet) odor. Organic material lacking a strong aerobic odor or which has an anaerobic (sour) odor shall be rejected.

.6 Shall meet the following parameters:

Parameter	Range
pH	5.5-7.5
Soluble Salt Concentration	Maximum saturation extract conductivity <4mmhos/cm or dS/m at 25 degrees C
Moisture	35-55% wet weight basis
Carbon to nitrogen ratio	15:1 - 40:1
Particle Size	99% pass through 25mm (1 inch) screen or smaller; 25% pass through 3/8 inch screen or smaller

.7 Approved suppliers of Organic Compost Component are as follows;

EcoSoils
PO Box 61632 Brookswood, RPO, Langley, BC V3A 8C8
(604)541-7645

Yardwords Supply Ltd.
1900 Savage Road, Richmond B.C., Canada
(604)304-0932

2.03 COARSE SAND:

.1 Sand will be river pump sand or pit run sand well washed of contaminants, chemical and organic matter satisfying the following gradation, (dry weight basis):

SIEVE SIZE	CLASSIFICATION	% RETAINED
No. 4 (4.76mm)	Gravel	0%
No. 10 (2.0 mm)	Fine gravel	0-5%
No.18 (1.0 mm)	Very coarse sand	5-10%
No.35 (0.50 mm)	Coarse sand	15-20%
No.60 (0.25 mm)	Medium sand	50-75%
No.140 (0.105 mm)	Fine sand	5-15%
No. 270	Very fine sand	0-2%
Passing No. 270	Silt, clay	0%

.2 Sand PH shall be lower than 7.0

2.04 FERTILIZER:

.1 Complete commercial synthetic slow release fertilizer meeting the requirements of the Canada Fertilizer Act, packed in water proof containers, clearly marked with the name of the manufacture, weight and analysis.

.2 Fertilizer Formulation Ratio: as per soil test recommendations.

2.05 STRUCTURAL CELL GROWING MEDIUM

.1 Structural Cell Growing Medium shall be a mixture of Base Soil, Coarse Sand and Organic Compost. Each mix component shall be submitted and approved prior to developing mix ratios and submitting Structural Cell Growing Medium samples and testing for approval.

.2 Structural Cell Growing Medium mix ratio of the three components shall be within the following range. Due to the variation in the natural properties of these products these mix recommendations may be adjusted to allow the mix to meet the other criteria a stated below.

Mix Component	% by volume
Base Soil	40-45%
Course Sand	45-50%
Organic Compost	8-10%

.3 Adjust the ratio of the components to achieve water infiltration between 20mm (0.75 inch) and 50mm (2.0 inches) per hour. Infiltration testing shall be performed on the soil at the required compaction rate in the Structural Cell Growing Mix mock up described above.

.4 Prepare multiple mix ratios for permeability and physical properties testing to establish the correct mix ratio. The Engineer shall be present at the infiltration mockup testing.

3.00 EXECUTION

3.01 MIXING PREPARED STRUCTURAL CELL GROWING MEDIUM

.1 Mix the Coarse Sand and Organic Compost together separate from the soil. Spread the Base Soil in a layer approximately 300mm (12 inches) thick. Spread the Coarse Sand/Organic Compost mixture over the Base Soil layer at the approved proportions.

.2 Mix Structural Cell Growing Medium products with a front end loader, or similar equipment. Mix as little as possible to lightly blend the different components together. 50-75mm sized peds shall be evident in the final Structural Cell Growing Medium. Structural Cell Growing Medium shall not be mixed in a blending machine or screened in such a manner that soil peds are crushed or removed.

.3 Stockpile the final mix and protect from rain with tarps after mixing.

3.02 STRUCTURAL CELL GROWING MEDIUM AMENDMENTS

.1 Apply Structural Cell Growing Medium amendments including fertilizer and lime at rates determined by testing laboratory's recommendations to the soil at the time of mixing. Spread the amendments over the Base Soil and Coarse Sand pile at the beginning of the mixing process.

.2 Applied lime (if required) must not come in direct contact with the nitrogen - phosphate - potash fertilizers. Apply the lime over the Base Soil mix first, then the Coarse Sand/Organic Compost mixture, and finally the fertilizer before the mixing begins.

3.03 SITE PREPARATION

.1 Ensure proper drainage in all tree pit and Structural Cell areas.

3.04 PLACEMENT OF STRUCTURAL CELL GROWING MEDIUM

.1 Refer to Structural Cells Specification Section - 02216.

3.05 WEED CONTROL

.1 Eliminate all weeds and weed roots from Structural Cell Growing Medium that germinate within the stockpile or which are growing in the installed

.2 Have method for elimination of weeds reviewed by Engineer prior to any action by the contractor.

3.06 SURPLUS MATERIAL

.1 Dispose of surplus Structural Cell Growing Medium off site.

END OF SECTION 02920.30