APPENDIX E: STORMWATER TECHNICAL MEMORANDUM

TOLT AVE. STREETSCAPE
renewing downtown carnation

TECHNICAL MEMORANDUM

DATE: September 17, 2012

TO: Ken Carter
City of Carnation
City Manager

FROM: Nathan Polanski, PE

RE: **Stormwater Technical Memorandum**
Tolt Avenue/SR 203 Corridor Plan
SvR Project No. 11033

The Tolt Avenue/SR 203 Corridor Plan project will set a comprehensive 2030 vision for the corridor and provide an action plan for implementation and funding. An important element of this plan will address stormwater management and how stormwater infrastructure can support the project's guiding principles. Stormwater infrastructure can support the following principles:

- Safe: Providing all users with safe, comfortable access to the City's many destinations
- Authentic: Building on Carnation's assets by embracing a small town feel, agriculture and honoring the River
- Cohesive: Creating a unified, connected experience along the Tolt Avenue corridor
- Maintainable: Providing a maintainable streetscape that serves the City, business owners, and residents over the long-term.

This memorandum provides information regarding the existing storm drain system within the Tolt Avenue/SR 203 Right-of-Way (between Tolt Hill Road and NE 60th Street) and recommendations to improve the system to meet the goals and principles of the Tolt Avenue corridor study. A summary of the existing storm drainage system includes a description of the infrastructure currently in place and a summary of existing hydrologic information relative to the corridor. Alternatives for integrating storm drainage infrastructure into the Tolt Avenue concept design, developed as a part of the corridor study and final action plan, are also presented.

Overview of Existing Conditions

Project Corridor

The Tolt Avenue project corridor begins at Tolt Hill Road, the southern limits of the City of Carnation, and extends north approximately 1.5 miles, to NE 60th Street. The Tolt River passes under Tolt Avenue just north of Tolt Hill Road. The Snoqualmie River is approximately one-half mile west of Tolt Avenue and runs along a similar north/south alignment.

The project corridor consists of approximately 13 acres of City owned Right-of-Way, roughly half of which are impervious surfaces (asphalt pavement and concrete sidewalks). Along the north and south entries into downtown Carnation the right-of-way is vegetated beyond the roadway prism, however, between E Blanche Street and Morrison Street almost the entire right-of-way is pavement. Existing grades within the project limits are relatively flat along the length of the site.

Tolt Avenue Watershed and Adjacent Natural and Sensitive Areas

The project corridor is located in the Snoqualmie River drainage basin, with the exception of approximately 200 linear feet of roadway adjacent to the Tolt River, which is part of the Lower Tolt River drainage basin. According to King County records the southern 0.4 miles of the project corridor, extending from Tolt Hill Road north to the west entrance of Valley Memorial Park, is located in the Tolt River 100-year floodplain (the river's floodway extends approximately 750 north of the river). During large storm events Tolt Avenue can be closed due to flooding; in January 2009, the Tolt River overtopped Tolt Avenue at NE 40th Street.

King County maps identify two streams that cross the project corridor; both are located in the Tolt River's 100-year flood plain and drain to the Snoqualmie River. One stream is approximately 600 feet north of the Tolt River bridge and connects a small pond on the east side of Tolt Avenue with a series of ponds on the west side of Tolt Avenue. The other stream is located on the east side of Tolt Avenue between the Fire Station and Tolt Middle School and drains to the west through Tolt-McDonald Park.

Storm Drain Collection and Conveyance System

The City does not have a complete stormwater system. Stormwater runoff from the public Right-of-Ways and private land is generally managed using on-site infiltration facilities to avoid flooding from localized storms. GIS files and record drawings from recent public works projects were obtained from Roth Hill, LLC, the City's acting engineer, to understand the extents of the existing storm drainage infrastructure. Due to the project corridor's flat topography Carnation's existing storm drainage system consists of several small independent pipe networks.

Stormwater runoff from the project corridor drains to several localized low points where it is collected and conveyed to small infiltration facilities or conveyed off-site to the west. The City has no direct outfalls to the Snoqualmie River. The conveyance systems are a combination of open and closed conveyance systems. Along a majority of the north and south entries into town Tolt Avenue has a soft roadway edge (i.e. gravel shoulder). Along these unimproved road edges stormwater runoff sheet flows onto adjacent properties or into drainage ditches. Where the existing roadway is improved with a curb or curb and gutter runoff is collected at catch basins and infiltrated.

The City's 2003 Stormwater Comprehensive Plan recognizes the needs for a more comprehensive stormwater system and recommended constructing a regional facility to centralize the collection and infiltration of stormwater runoff.

Inadequacies of the Existing System
In addition to the limited nature of the existing storm drainage systems the surface grading also causes ponding of water along potions of Tolt Avenue. There are no water quality treatment facilities for stormwater runoff or pretreatment systems for runoff entering infiltration facilities.

Alternatives for Managing Stormwater Runoff

The following two options outline approaches for managing stormwater runoff along Tolt Avenue. Both alternatives can be designed to meet local stormwater requirements.

General Requirements
The City of Carnation has adopted the Department of Ecology Stormwater Management Manual for Western Washington, 2005 Edition (the "Manual"), for storm drainage requirements. The Manual covers site planning, hydrologic analysis, as well as best management practices for flow control and the water quality treatment for stormwater runoff. Redesign of the existing storm drain system should be in accordance with these requirements. The minimum requirements, not all of which apply, include:

1. Preparation of Stormwater Plans
2. Construction Stormwater Pollution Prevention
3. Source Control of Pollution
4. Preservation of Natural Drainage Systems and Outfalls
5. On-site Stormwater Management
6. Runoff Treatment
7. Flow Control
8. Wetlands Protection
9. Basin/Watershed Planning
10. Operation and Maintenance

Option 1 – Combined green infrastructure and conventional storm drain system
Public Rights-of-Way are increasingly recognized as valuable community resources that provide for diverse mobility needs, integrate environmental services and allow community expression. LID, or green infrastructure, systems have the capacity to provide multiple benefits and support these needs when appropriately designed.

A combined storm drain system will use green infrastructure to collect, filter, and retain stormwater runoff conveyed by a combination of low-impact development (LID) and conventional storm drain systems. LID systems emphasize reducing impervious surfaces that generate stormwater runoff and using multiple techniques and practices to:

- reduce the volume and rate of stormwater runoff;

- remove pollutants through filtration and biological uptake; and
- facilitate the infiltration and evapotranspiration of precipitation.

This approach is well-suited for the project corridor's flat topography, creating a decentralized system that can build upon the City's existing storm drainage infrastructure. A phased reconstruction of Tolt Avenue can readily be supported with a combined green and conventional storm drain system.

The following is a list of techniques recommended along a reconstructed Tolt Avenue:

- **Bioretention** uses vegetation and soil to provide water quality by filtering stormwater runoff through engineered soil media. Water quality is supplied by biological and chemical reactions in the soil media, root zone, and infiltration into the underlying subsoil. Bioretention facilities contain plants, mulch, amended soils, and are designed with a ponding depth to meet flow control and water quality requirements. Bioretention areas are typically planted with drought tolerant and/or native plants. These facilities can be designed to infiltrate stormwater or with an overflow designed to manage higher flows and convey runoff to downstream facilities.

  Bioretention facilities are recommended within traffic calming curb bulbouts, in roadside bioswales, and in place of standard landscape planting areas on streets, in parking areas and around buildings. Street edge treatments allow opportunities to integrate bioretention facilities systems into the Right-of-Way through breaks in curbs, eliminating curbs or using other soft road edges. Design considerations for the use of Bioretention along Tolt Avenue include the size of the facility's catchment area, infiltration capacity, site context, plant selection, soil selection, and irrigation.

- **Trees** are a great contributor to a healthy and livable urban landscape and provide many stormwater benefits. Mechanisms for stormwater benefits include interception, transpiration, and increased infiltration. Additional benefits provided by trees include enhancing the visual and spatial character of a place; improving air quality; reducing noise and light pollution; and reducing the heat island effect.

  Trees are recommended in all landscape areas as allowed by local regulations. Design considerations include providing tree protection zones for existing trees. For new trees considerations include: species selection, size, location, irrigation, underplanting, and maintenance. Proprietary products such as Deep Root's Silva Cell provide solutions to increase soil volume for trees within pavement areas without compromising the structural integrity of the subgrade.

- **Permeable Pavements** reduce impervious surfaces without limiting use. Permeable pavements can be constructed with porous asphalt, pervious concrete, or permeable paver blocks over a gravel subbase. Permeable pavements also facilitate the infiltration of stormwater runoff into existing soils.

  Permeable pavements are recommended on pedestrian walkways and on low-traffic streets and parking areas adjacent to Tolt Avenue. Design considerations for the use of permeable pavements along Tolt Avenue include: land-use, infiltration, site content, installation, and maintenance.

- **Biofiltration Swales** are planted swales that provide conveyance and water quality by removing pollutants through sedimentation, filtration, soil absorption, and/or plant uptake. Amended soils can be designed to target specific pollutants. Swales are typically planted with drought tolerant and/or native. Weirs or check dams can be designed to help attenuate runoff during larger storm events and facilitate treatment.

  Biofiltration swales are recommended along Tolt Avenue in the north and south entries into downtown Carnation where land-use is less dense and there is no on-street parking. Swales at these locations also provide a buffer between vehicular and pedestrian areas. Street edge treatments allow opportunities to integrate swale systems into the Right-of-Way through breaks in curbs, eliminating curbs or using other soft road edges.

- **Rainwater Harvesting or Cisterns** collect rainwater for later use and is most commonly associated with captured roof runoff. Stormwater runoff can be collected in rain barrels or cisterns and used during dry periods for irrigation.

  Rainwater harvesting or cisterns should be considered for collecting runoff from zero lot-line buildings.

Depending on the LID techniques implemented, construction may require contractors with experience in the construction of designed facilities. Proper installation is imperative to the functionality of LID facilities. Oversight and assistance during construction from designers and permitting agencies will also assist in ensuring facilities are properly constructed.

Maintenance of LID facilities differs from conventional systems. LID facilities require periodic replacement of amended soils, removal of leaves and debris buildup, and removal of litter. Conventional systems typically are able to visibly hide debris and garbage buildup in sumps and below ground structures, whereas LID facilities are more visible. Proper care for planted and vegetated areas will be important to maintain a visually aesthetic street.

<u>Option 2 –Conventional storm drain system</u>

This option would use conventional storm drainage facilities designed to collect, convey, filter, and detain stormwater using curbs and gutters, concrete catch basins, pipes, wet vaults, in-ground filter systems and oil-water separators. This system could drain to one large regional facility as recommended in the City's 2003 Stormwater Comprehensive Plan or several small facilities strategically located based on site topography to reduce the size and cost of proposed facilities. A conventional storm drain system would be similar to the existing storm drainage infrastructure on-site. Water quality treatment can be provided using Stormfilters, Filterra tree box units, or other precast, manufactured water quality facilities designed to meet water quality requirements.

Since contractors have experience and an understanding of conventional storm drain systems, construction of conventional storm drain systems are often more straightforward than LID facilities. Maintenance of precast, or other manufactured water quality systems typically come with maintenance procedures and typically require annual maintenance.

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