Puget Sound Gateway Project

SR 509, I-5 and SR 167 Funding and Phasing Study: Strategic Corridor Design Review

Appendix F: Stormwater Summary

Washington State Department of Transportation

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1. EXECUTIVE SUMMARY

The purpose of the SR 509/ I-5/ SR 167 Strategic Corridor Design Review is to review the highway corridor from SeaTac to Tacoma as a whole, including the SR 509 Corridor Completion, the I-5 Express Toll Lanes (ETLs) Tacoma to Seattle segment, and the SR 167 Completion projects. This review will consider the new and existing corridors as a whole, developing compatible alternatives that consider the design work performed to date, but also bring in new project phasing, practical design concept refinements, and uniform consideration of the related stormwater costs elements and risks.

The effort has included a review of the stormwater design with respect to the consideration of forward compatibility assumptions, permitting, and design guideline changes, particularly in the Highway Runoff Manual (HRM). The effort also included consideration of the changes due to roadway design refinements.

1.1 Scope of Stormwater Considerations

The efforts included review of the current stormwater management design concepts (location, limits, type, details, calculations, and quantities) within the project limits. Particular attention was given to the basis of drainage cost estimates including:

- runoff treatment
- flow control
- conveyance
- property acquisition
- temporary erosion control

The effort included review of the drainage cost elements for update per current unit pricing; review for potential missing items such as the WSDOT Subprogram I-4, Stormwater Retrofit Account (Retrofit Account) cost considerations (HRM Section 3-4.1); and review risk assessments to ensure that the base costs are current, consistent for the Project, and segmented appropriately to coincide with construction staging scenarios. In addition, the effort included review of the stormwater concepts for potential cost saving measures including use of the new Best Manage Practices (BMPs) that were not available for runoff treatment during previous design efforts.

The effort also supported design alternatives developed to refine or reduce construction costs associated with the refined Project Definition. This work element involved revisiting the five bulleted items above to adjust the drainage cost estimate to match the roadway improvements.

This document discusses final estimate and summary to document key changes in the proposed stormwater management concepts that are represented in the Project Definition.

1.2 Initial Scope Assumptions:

- The cost estimate updates will be prepared at the same level of detail relative to the current estimates.

- Exploring SR 509 and I-5 concept changes using new BMPs will be limited to converting stormwater treatment wetland ponds to compost-amended biofiltration swales (CABS).
- Exploring SR 167 concept changes using new BMPs will be limited to reviewing the environmental commitments and evaluating CABS and infiltration trench systems as a smaller footprint replacement for proposed compost-amended vegetated filter strips (CAVFS) facilities.

1.3 Findings

No change for SR 167 and SR 509 baseline estimates. Temporary erosion and sedimentation control (TESC) costs generally stayed the same. We also understand that major portions of the right of way are already acquired, so there are limited opportunities to reduce those costs.

I-5 ETL baseline project costs were estimated low. The more detailed review during this study nearly doubled the cost estimate for stormwater management and conveyance elements.

2. DESIGN REVIEW AND REFINEMENT

2.1 SR 167 Completion

The SR 167 Completion project is situated within the broad, flat valley of the Puyallup River from the existing freeway terminus of SR 167 at SR 161 near Puyallup to SR 509 in the Port of Tacoma in Pierce County. The proposed project runs through portions of the cities of Fife, Puyallup, Milton and Tacoma, and Pierce County. The SR 167 improvements would be new construction through primarily agricultural land. New interchanges will be constructed at 54th Avenue E, I-5, Valley Avenue E, and N Meridian Avenue (SR 161) with the roadway terminating as ramp junctions into SR 509.

2.1.1 Environmental Commitments

The proposal relies in part on the SR 167 Completion Project Riparian Restoration Proposal (RRP) that was defined by the Tier II FEIS. Also referenced as the Hylebos and Wapato RRPs, the stream restoration considered regional hydrology and hydraulics including habitat, wetland and floodplain elements that will address flow control requirements within the Hylebos and Wapato Creek basins. With those in place, the highway improvements will not require separate flow control facilities.

The Endangered Species Act (ESA) consultation includes extensive detail about water quality treatment goals and level of runoff loss through infiltration. The project will need to comply with the Highway Runoff Manual (HRM) and meet Biological Opinion (BO) project- and basin-specific requirements for pollutant loading, dilution and infiltration.

The USFWS, in its May 2007 BO, includes the following condition:

> *Restore infiltration capacity in the Puyallup River sub basin to the maximum extent possible. Utilize the sites identified as potential wetland mitigation sites with the objective of maximizing potential to create, restore and enhance infiltration through the use of native woody vegetation. Runoff/interflow is estimated at 250.74 acre-ft and*

infiltration is 120.1 acre-ft yearly under existing conditions for the 170.8 acre analysis area in the sub basin. An analysis demonstrating how planned restoration activities at the site will minimize the change to runoff/interflow and infiltration volumes listed above shall be provided to the FWS for review prior to finalization of the plan.

In negotiations with USFWS during development of the BO, it was demonstrated that the compost-amended vegetative filter strip (CAVFS) BMP would achieve a considerable portion of the target infiltration volume (based on modeling and minimal available performance data from early CAVFS installations). There was uncertainty over the specific volumes that could be expected from CAVFS.

2.1.2 Runoff Treatment and Flow Control

The proposal includes three runoff treatment BMPs: media filter drains, compost-amended vegetated filter strips, and constructed stormwater treatment wetlands.

Flow control is limited to the northern/eastern end where flows discharge to tributaries of the Puyallup River.

2.1.3 Best Management Practices

The baseline design includes combined constructed stormwater treatment wetlands/detention ponds. The design approach for these BMPs has been modified in the most recent 2011 HRM update. The change originated from plant establishment issues with this type of pond where the prior design criteria allowed as much as three feet of live storage over the wetland plants. This added depth was a factor in plant survival. Based on our experience, these BMPs may be modified to meet the current criteria within the footprint established following the prior design approach. The SR 167 corridor has some areas where available head may be limited. This may impact the feasibility for following the new design approach for these BMPs.

Reviewing the conceptual baseline design, the truck weigh station areas between SR 161 and the Valley Avenue E interchanges may be areas where low head issues drive the BMP choice. In these areas, the final design is expected to shift to weigh-in-motion, eliminating the weigh stations, which would allow a shift to other runoff treatment options. One possible solution would be to change the design approach to media filter drain BMPs along SR 167 with flow control downstream in detention pond BMPs. Our assessment is that this approach would have a similar footprint. The lower construction cost (no excavation for the constructed stormwater treatment wetland and wetpool) at the pond would be offset by construction cost for the media filter drain BMPs. Cost savings would not be substantial enough to warrant adjusting the costs as part of this effort.

Looking at new BMPs versus those proposed in the prior design, we identified the CAVFS BMP as one potential area to refine the design. Right of way requirements for this BMP are higher than for other enhanced treatment BMPs. Other options include the media filter drain BMP and the new compost-amended biofiltration swale (CABS). Unfortunately, the BO is based on pre- versus post-project pollutant loading and concentration calculations that assumed 92 percent infiltration loss in the CAVFS BMP. This unique quality of the CAVFS would trump all other

options. We also considered those other BMP options along with infiltration trenches, but the high groundwater and soil conditions would prevent that as an option based on the prevalence of standing water observed during our site inspection, March 2013.

2.1.4 Summary

The baseline estimate stands unchanged: unit prices were already adjusted, and no runoff treatment or flow control design refinements were identified for the baseline. The work to establish roadway/interchange design refinements and the exclusion of the truck weigh stations would not substantially reduce stormwater management costs.

2.1.5 Cost Estimate

No change from the original baseline estimate.

2.1.5.1 Sources and Assumptions

We reviewed the baseline cost estimate. There were no cost details backing up the generalized costs and no design calculations. The design summary document stated that the design was done at a conceptual level and then scaled according the pavement area to be treated. We found no reasons to change the design approach or prior assumptions that went into the design. Therefore, there has been no need to change the baseline estimate.

Based on the current understanding of WSDOT policy, this project would be exempt from the relatively new 20 percent added cost for stormwater retrofit. Most of the project will be constructed on a new alignment and all pavement runoff will be treated. There is no pavement to be retrofitted within the new SR 167 mainline and ramp areas. The conceptual design included retrofit of the I-5 corridor within the new SR 167 interchange area. Since this was carried through the environmental documentation, the retrofit has become an environmental commitment. Therefore, we understand that there is no opportunity to limit the retrofit to 20 percent added cost or defer cost to the Retrofit Account.

2.1.5.2 Risk Items

The preliminary design is incomplete because it did not determine whether the pollutant loading and dilution targets would meet the May 2007 BO conditions for infiltration within the Puyallup River basin. There is a risk that additional infiltrative measures will be needed for new infiltration BMPs and/or greater right of way acquisition for an “infiltration reserve” concept that was considered in 2008.

It’s possible that there are fish passage blockages within the scope of this segment that are also identified for the I-5 ETL. See fish passage discussion in the I-5 ETL, Risk Items.

Since the project relies on the Hylebos and Wapato Riparian Restoration Programs (RRPs), the timing for roadway improvements must follow the final design and implementation of these. The roadway staging scenarios for the area between SR 509 and Freeman Road should include the RRPs in the first stage of work. There is a risk that funding levels will limit the RRP work and therefore trigger additional flow control facilities to avoid downstream impacts.

2.1.5.3 Summary

The prior design work was sufficient to support this cost estimating/validation effort. The level of detail in the work and prior consideration of risks support confidence that the baseline estimate is correct.

2.2 I-5 Express Toll Lanes

The I-5 Express Toll Lanes have been a primary focus for the design review effort because the prior cost estimating effort was very preliminary with no detail beyond a set amount of mainline widening between set mileposts.

2.2.1 Environmental Commitments

The environmental process has not begun for the I-5 ETL project.

2.2.2 Runoff Treatment and Flow Control

The assumption is that runoff treatment and flow control would mitigate the new impervious area according to the current 2011HRM requirements and methods.

The new impervious area for cabinet pads and other tolling equipment is expected to be below thresholds, so I-5 ETL Phase 1 is assumed to have no runoff treatment or flow control. TESC measures would be required, but nothing else.

The full Gateway Vision widening to add a second ETL in each direction would add less than 50 percent of new impervious area, so the project would not trigger treatment for replaced pavement. Only new impervious area is considered.

Unlike the full retrofit commitments in the SR 167 and SR 509 projects, retrofit for the I-5 ETL project is assumed to follow the HRM guideline: 20 percent added above the cost to address the proposed roadway widening.

2.2.3 Best Management Practices

There is no detailed design information available. The basis of the cost estimate is still very general based on average costs for runoff treatment and flow control based on historical data from similar projects.

2.2.4 Summary

The cost estimating effort identified a substantial increase in the estimated stormwater costs associated with the ETL improvements along I-5.

2.2.5 Cost Estimate

The baseline cost estimate was revisited because the prior stormwater facility cost estimates were based on a percentage of the roadway and structure cost. HNTB has participated in preparing I-405 Corridor Program master planning level cost estimates since 2003 and has developed a more accurate approach to estimate stormwater facility cost as a function of new roadway impervious area requiring mitigation.

This approach was initially developed in 2003 using the SR 509 Corridor Completion Project and other WSDOT Cost Estimate Validation Process (CEVP®) estimates. In 2007, the I-405 Corridor Program had sufficient new estimates to replace the input based on more current I-405 Master Plan and Implementation level cost estimates. Those included 15 basins that were comparable to typical 6-foot deep detention ponds that we expect along I-5. The estimate also has sufficient detail to estimate runoff treatment using media filter drain BMPs that we expect to be implemented along I-5.

When no detailed design is available, we have found that this method provides a more accurate way to estimate stormwater costs relative to a percentage-based estimate. Our finding was that this method identified significantly higher costs than the percentage-based estimate; the cost estimate was updated based on the alternative method described below.

2.2.5.1 Sources and Assumptions

The estimating approach was developed to support estimates as a function of impervious pavement area and linear feet of roadway improvements. The stormwater costs were split into five components:

- Stormwater conveyance construction costs
- Stormwater management facility construction cost
- Temporary erosion and sediment control costs
- Retrofit Account add-on
- Stormwater management facility area

Stormwater conveyance construction costs calculate the pipe and structure cost necessary to collect stormwater runoff from the new roadway and convey it to the proposed stormwater treatment site.

Based on current bid tab information, the estimate uses $800,000 per mile per conveyance system. Factors that impact the number of systems estimated include, if the median shoulders reduce to 4 feet wide or less, additional inlets will be required so that would count as a new system. If the outside widening results in retaining walls or other feature(s) that trigger a storm drainage system, this would also count as a system. Since no mapping was available for the I-5 Corridor, the estimate includes two systems to address the widening, one in each direction for the full length of the project. The estimate is also based on:

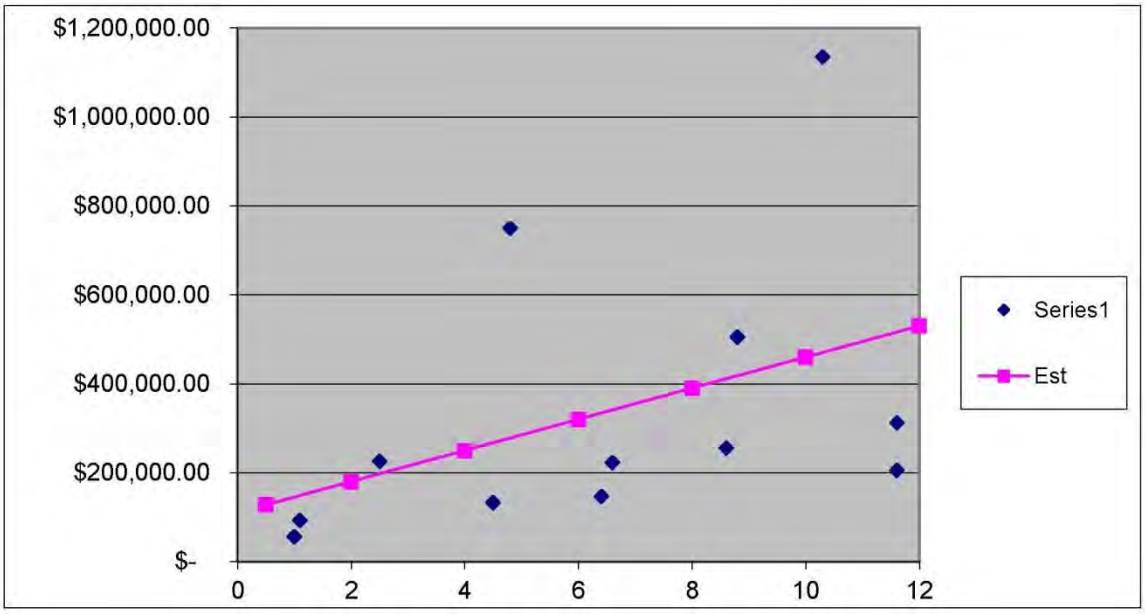
- The cost per mile per for ditch sections is covered by other items.
- No cross culverts or fish passage improvements were included in the estimate.

Stormwater management facility (SMF), open pond construction cost includes clearing and grubbing, pond excavation, fill and compaction of berms, plantings, riprap and control structures. The estimate uses the following equation:

SMF Cost = $130,000 + 40,000 x [the proposed new impervious area in acres]

Actual costs will vary according to the site grading needed to fit the pond into the local terrain. Figure F-1 illustrates how this straight line approximation fits costs from the sample projects.

Figure F-1 Cost estimate comparison the sample project data



(Source: WSDOT I-405 Corridor Program)

This approach assumes that the area of pavement widening adds less than 50 percent more area to the existing pavement in the basin, so only the new pavement area is considered. Based on available information, I-5 widening is minor, so this 50 percent threshold is not met and therefore the reconstructed pavement areas can be ignored.

Temporary erosion and sediment control calculated costs do not include mobilization, contingencies, or tax. It is further assumed that the TESC facilities will not require additional project site area and therefore will not require additional right of way. The TESC cost does not include progressive or experimental BMP such as chemical treatment of construction stormwater.

The Retrofit Account add-on adds 20 percent to the cost to address storm drainage system and stormwater mitigation costs as required by the HRM Section 3-4.1.

The stormwater management facility area was calculated based on what the I-405 corridor found for the sample basins that served as the basis for cost estimates. This is typically used for comparison to available right of way, thus allowing an estimator to review of lands acquisition needs. In the case of I-5, it was assumed that no land would be required.

2.2.5.2 Risk Items

Siting of Detention Ponds

The cost estimate assumes that flow control can be accomplished within existing right of way. A detailed review of the TDAs and available space was not completed, so there is a risk that the detention storage will need to be constructed as more expensive detention tanks or built on new right of way.

Fish Passage

A recent court settlement mandates that current fish barriers be removed by the year 2020. There are I-5 culverts on that list (as of June 2012).

Table F-1 Fish Passage Barrier Culverts (July 2012)

Site ID	Road	MP	Stream Name	Dia.	Length
995295	I-5: NB ROW	141.2	EF Hylebos Cr. Trib	0.61 m	16.5 m
995292	I-5	141.5	EF Hylebos Cr. Trib	1.22 m	81.1 m
995297	I-5; SB Exit 142	142	EF Hylebos Cr. Trib	0.76 m	145.6 m
995293	I-5; SB Exit 142	142.2	Hylebos Cr. Trib	0.76 m	78.1 m
995299	I-5; NB Exit 143	143	Hylebos Cr. Trib	0.76 m	20.5 m
995300	I-5; NB Exit 143	143	Hylebos Cr. Trib	0.76 m	65.7 m
992364	I-5	143.6	EF Hylebos Cr. Trib	0.91 m	745 m

Source: WSDOT Fish Passage Barrier Inventory, July 2012. Appendix I

Three of these fish passage barriers cross under the I-5 mainline that will be widened as part of the proposed improvements.

Though the ramps would not be widening there is a risk that all of those locations will be addressed as part of the Gateway Project.

Changing Design Criteria

Ecology recently issued changed runoff treatment and flow control standard which are referred to as the "LID Standard." This could have implications on the size of detention ponds, but the current WSDOT expectation is that the current BMPs already incorporate infiltration. For example, media filter drain BMPs, which are anticipated as runoff treatment, are known to infiltrate runoff. The earthen ponds that are assumed for flow control also infiltrate runoff. The current design approach ignores this, so the new Ecology standards may mostly influence engineering design assumptions and methods.

Environmental Commitments

Having no environmental documents in place, this section has risk in facing unknown permitting challenges. Fast delivery pressures can often result in going beyond the required WSDOT standards to speed up the permitting process.

2.2.5.3 Summary

The cost estimate was developed based on the latest understanding of the roadway widening proposed by WSDOT. Those new values were added to the revised baseline estimate.

2.3 SR 509 Corridor Completion

The SR 509 corridor improvements would connect the existing south terminus of SR 509 at Des Moines Memorial Way to Interstate 5 (I-5) in the vicinity of S 216th Street. Phase 1 of SR 509 will also provide a new interchange at 28th/24th Avenue S. The project also proposes additional

lanes along I-5 from the S 200th Street interchange to the S 272nd Street interchange. Within the I-5 corridor, the improvements would also modify the SR 516 interchange as well as local street improvements between that interchange and SR 509.

This project was advanced to 30 percent level design including an approved Hydraulic Report that covers flow control and runoff treatment facility designs to match the full build condition (2003 Tier II FEIS and ROD) for this project.

2.3.1 Environmental Commitments

Enhanced runoff treatment was provided for all new roadways along the SR 509 corridor. Along the I-5 corridor, the runoff treatment followed interim WSDOT guidance requiring enhanced runoff treatment for 140 percent of the new impervious area proposed along I-5.

Project impacts are below 0.5 acres, so the project fits under a NPDES general permit.

WSDOT's investment in the Des Moines Creek Watershed Plan allows the flow control to follow a basin-specific flow control standard that resulted from the regional detention pond and high-flow bypass. This sets the pre-development condition to the pre-project land cover condition rather than the forested land cover condition that would normally be required per the HRM.

ESA consultation pre-dated the more stringent pre- versus post-project pollutant load and concentration analysis approach that was used to assess the SR 167 corridor.

2.3.2 Runoff Treatment and Flow Control

Similar to the SR 167 discussion, no design changes were identified to reduce baseline costs within the SR 509 project limits.

The key in this segment was the extensive reliance on flow control provided by the Des Moines Creek Watershed Plan. WSDOT has invested in the regional flow control in lieu of forested flow control along the SR 509 corridor. No opportunities exist for further cost savings.

2.3.3 Best Management Practices

Similar to the SR 167 discussion, no changes were identified. The close proximity to the airport limits BMP choices along SR 509 because of prohibitions on locating bird-attracting stormwater facilities in runway approach zones..

2.3.4 Summary

The baseline estimate stands unchanged: unit prices were already adjusted, and no design refinements were identified for the baseline.

Project definition changes were insignificant.

2.3.5 Cost Estimate

No change from the original baseline estimate.

2.3.5.1 Sources and Assumptions

This project had detailed stormwater design and cost backup to support the cost estimate. The design has been advanced to 30 percent level design for the full build-out. We found no reasons to change the design approach or prior assumptions that went into the design. Therefore, there has been no need to change the estimate.

This project is assumed to be exempt from the relatively new 20 percent added cost for stormwater retrofit. Most of the project is constructed on a new alignment, so all pavement is being treated. There is no retrofit within the new SR 509 mainline and ramp areas. The conceptual design included retrofit of the I-5 corridor within the new SR 509 interchange. This goes beyond the current requirements for retrofit, but it was carried through the environmental documentation. Being an environmental commitment, we understand that there is no opportunity to limit the retrofit to 20 percent added cost or defer cost to the Retrofit Account.

2.3.5.2 Risk Items

See the discussion for SR 167.

2.3.5.3 Summary

The baseline estimate stands unchanged: unit prices were already adjusted, and no design refinements were identified for the baseline. The prior design work was sufficient to support this cost estimating/validation effort. The level of detail in the work and prior consideration of risks support confidence that the baseline estimate is correct.

Project definition changes were insignificant.