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**E00119E08**

Bellevue Influent Trunk  
Sewer Improvements

***FINAL***  
**Pre-Design Report**

*Prepared for*  
**King County Wastewater Treatment Division**

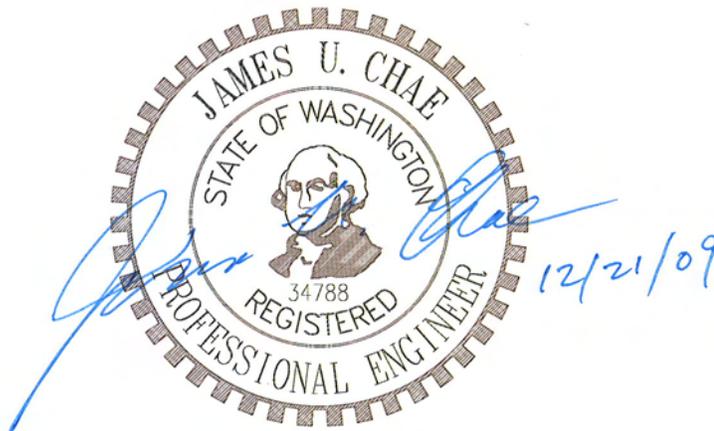
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December 21, 2009

## CERTIFICATION

The technical material and data as noted below and contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.



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## 1.0 INTRODUCTION

### 1.1 Facility Description and Project Background

The Bellevue Inflow Trunk (BIT) is a King County trunk sewer located in west Bellevue, and was originally constructed in 1966. The existing inflow trunk line is approximately 1,600 feet of 12 to 24-inch reinforced concrete pipe running east along SE 3rd Street between 101<sup>st</sup> Avenue SE and 102<sup>nd</sup> Avenue SE, and south along 102<sup>nd</sup> Avenue SE to the intersection with SE 6<sup>th</sup> Street where it enters the Bellevue Pump Station (see Figure 1). The existing BIT sewer line has been estimated to currently have a 2 to 5-year peak flow level of service. This level is below the standard 20-year peak flow level of service defined in the Regional Wastewater Service Plan (RWSP) Conveyance Policies.

The Bellevue Inflow Trunk also collects flows from local sewer lines owned by the City of Bellevue, including the West CBD trunkline sewer (see Figure 1). The City's trunkline currently runs west from Bellevue Way down SE 3<sup>rd</sup> Street to approximately mid block where it turns south and runs parallel to Meydenbauer Creek through existing easements on private property before it enters 102<sup>nd</sup> Avenue right-of-way approximately 500 feet north of Bellevue Pump Station. From this point the West CBD parallels the BIT until it connects to the BIT just upstream of the pump station.

In December 2007, King County completed a report titled "*Hydraulic Analysis of Bellevue Inflow Trunk*" that detailed the results of a hydraulic modeling analysis performed by the County using MOUSE software on the existing Bellevue Inflow Trunk. This report calculated flow projections out to the population saturation year of 2050 and revealed that the existing trunk, prior to surcharging at the pump station, has a capacity of 8.75 MGD (although some surcharging does occur upstream of the Pump Station at this flow rate).

### 1.2 Predesign and Project Overview

The Alternatives Analysis and Predesign Phase of the Bellevue Inflow Trunk Improvements Project began in February of 2009, and investigated rehabilitation of the existing BIT trunk with installation of a parallel inflow line or replacement of the existing trunk in order to provide the required 20-year level of service. In addition, the City of Bellevue Utilities Department also notified the County of their desire to construct an extension of their existing West CBD sewer trunk line westerly down SE 3<sup>rd</sup> Street to the intersection with 102<sup>nd</sup> Avenue where it would connect to the new County inflow trunk. The County and City are currently negotiating an interagency agreement that would incorporate the City's West CBD extension into the County's BIT improvements project.

The results of the predesign phase evaluation and recommendations for final design and construction are summarized in this Predesign Report. The appendices to this Report also contain numerous technical memorandums and documents that were written in support of the predesign evaluation and selection process for final design.

Based on the recommendations made during the predesign phase, the Bellevue Inflow Trunk Improvements Project will include the following elements for final design:

- Abandonment of the existing BIT sewer and construction of 1600 lineal feet of a new replacement BIT trunk sewer, ranging in diameter from 18 to 42 inches.

- Construction of 460 lineal feet of a new 24-inch West CBD trunkline sewer extension along SE 3<sup>rd</sup> ST and connection to the new BIT sewer at the intersection of SE 3<sup>rd</sup> ST and 102<sup>nd</sup> Ave SE.
- The existing West CBD trunkline, downstream of the new extension, will be capped and only carry local side sewers through the existing trunkline and connect to the new BIT on 102<sup>nd</sup> Ave SE approximately 800 south of SE 3<sup>rd</sup> ST.
- Re-connection of all existing lateral sewers to the new BIT sewer and new West CBD trunk sewer extension.

Revisions: After completion of the 30% drawings on October 21, 2009, two major changes to the design were made as follows:

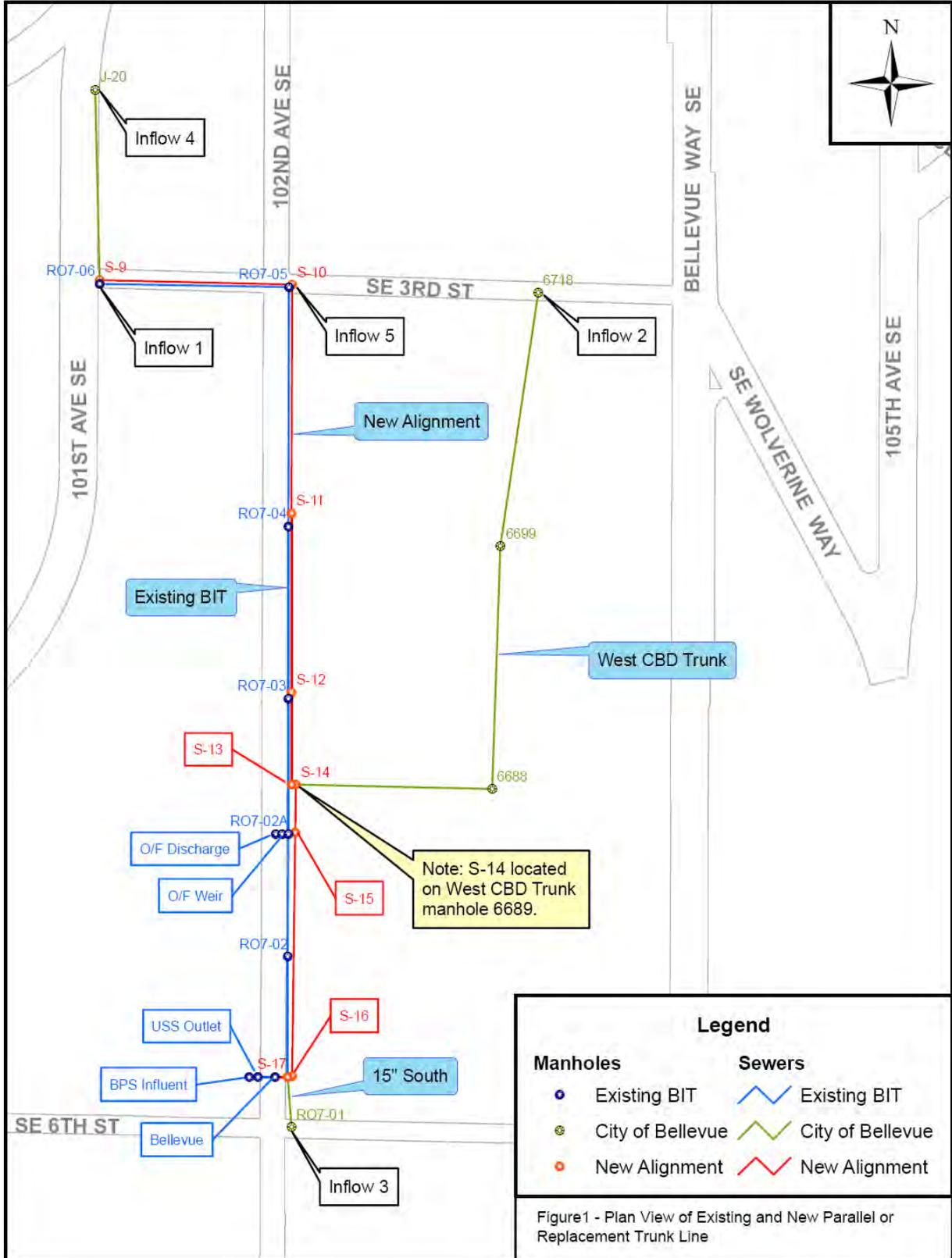
- The Meydenbauer Creek culvert crossing near Station 6+00 on 102<sup>nd</sup> Ave SE was changed from a 36" diameter, "excavate under and support culvert" crossing to a trenchless, auger-bored crossing. It should be noted that the 30% drawings were not revised to reflect this new auger-bored crossing, but the baseline cost estimate and schedule provided in Appendix O and P were revised to include the auger-boring. In addition, a technical memorandum summarizing the evaluation of the culvert crossing is included in Appendix Q.
- As part of the 30% design review comments, the City of Bellevue requested that the West CBD trunkline sewer be upsized by one pipe diameter (for additional margin of safety) and be extended approximately 178 feet from Station 24+59 to 26+37. These changes to the West CBD trunkline sewer were reflected in the revised drawing C205 and new drawing C206 (added to Appendix E), and updated in the baseline cost estimate and schedule (Appendix O and P).

## **2.0 PREDESIGN ANALYSES**

### **2.1 Design Flow: 17.71 mgd**

King County's Regional Wastewater Services Plan (RWSP) established the 20-year peak flow as the standard to be used for both sizing and timing of facility improvements. For conveyance system improvements, it is projected that the King County wastewater service area will reach saturation (maximum population density) conditions by the year 2050. Therefore, it is the County's policy to design conveyance system improvements to carry the 20-year peak flow event projected to occur in 2050. This peak flow takes into consideration not only base and peak wastewater flows, but also accounts for groundwater infiltration and stormwater inflow into the County's system. Infiltration and inflow quantities are calculated based on monitoring data the County gathered between 2000 and 2002. Complete details on the King County method for calculation of design flows are included in the County's *June 2007 Conveyance System Improvement Program Update*.

At the outset of the Predesign Phase, a design flow analysis was performed by Jacobs in order to determine and coordinate future flow projections between King County and the City of Bellevue. After a review of both the King County and City of Bellevue population projections, average flow estimates, and peak I/I estimates, the results and recommendations were summarized in the *Design Flow Analysis Technical Memorandum* included as an appendix to the *Flow and Surge Analysis Technical Memorandum* (Appendix A). This analysis resulted in an increase to the 2050 design



**Figure 1 – Plan View of Existing and New Parallel or Replacement Trunk Line**

flow the County calculated in their 2007 hydraulic analysis. This flow projection increase was largely due to the rapid growth experienced in Bellevue's Central Business District over the last seven years. The 2007 hydraulic analysis performed by the County calculated a 2050 20-year peak flow of 15.69 MGD while the most current flow projection agreed upon by both the City of Bellevue and King County is 17.71 MGD.

## **2.2 Alternatives Development**

Early in predesign, several conceptual alignment alternatives were considered that involved routing the replacement or parallel sewer through easements on private property. These alternatives were dropped from further consideration due to higher permitting, construction cost, easement, and property restoration requirements. For these reasons, the four initial design alternatives that were considered were all located within existing right-of-way along SE 3<sup>rd</sup> Street and 102<sup>nd</sup> Avenue. These four alternatives are summarized as follows:

- Alternative A – Rehabilitation of the existing BIT trunk sewer and construction of a parallel trunk sewer. No change to existing City of Bellevue West CBD sewer.
- Alternative B – Rehabilitation of the existing BIT trunk sewer and construction of a parallel trunk sewer. New West CBD sewer extension and connection at SE 3<sup>rd</sup> ST.
- Alternative C – Abandonment of the existing BIT trunk sewer and construction of a new replacement trunk sewer. No change to existing City of Bellevue West CBD sewer.
- Alternative D – Abandonment of the existing BIT trunk sewer and construction of a new replacement trunk sewer. New West CBD sewer extension and connection at SE 3<sup>rd</sup> ST.

After an initial evaluation of the four conceptual design alternatives, Alternative C was dropped from further evaluation since it did not include the West CBD extension and did not involve a more complex parallel sewer system to be modeled. The *Alternatives Analysis Technical Memorandum, dated October 23, 2009* (Appendix B), includes detailed descriptions and drawings of the four conceptual design alternatives.

## **2.3 Hydraulic Analysis**

A hydraulic analysis of the three best apparent alternatives (A, B, and D) was completed in June 2009 to ensure that the calculated design flow of 17.71 mgd could be provided. A flow and surcharge analysis was performed for the three best apparent alternatives using MOUSE hydraulic modeling software to evaluate pipe sizes, inverts, and hydraulic gradelines. All three alternatives were modeled using various combinations of pipe sizes, and hydraulic gradeline elevations were compared at the overflow weir, West CBD Connection, and other locations within the sewer system.

Several modeling criteria were set during the hydraulic analysis including:

- Downstream boundary condition of the influent trunk at an elevation of 17.1. This elevation matches the pump station start standby pump elevation (in standby level control mode).
- Hydraulic grade line of the influent trunk would be allowed to reach within half a foot of the overflow weir elevation in manhole R7-02A.

- To prevent surcharging of the City's West CBD trunk line, the hydraulic gradeline at the West CBD connection to the new BIT (manhole S-14) was kept below the West CBD pipe crown elevation of 19'.
- A Manning's roughness coefficient of 0.013 was also assumed for the new influent line to account for grit and slime buildup over time.

All of the three alternatives modeled resulted in pipe sizes ranging from 15" to 36" in diameter to meet the design flow and modeling criteria. After a formal alternatives analysis (see Section 2.7), Alternative D was ultimately selected to proceed to 30% design. Subsequently in September 2009, two additional options (D-3 and D-4) were modeled for Alternative D to reduce surcharging of the BIT in the downstream portion of the system, and to also provide additional freeboard at the overflow weir. Due to the limited slope available between the Meydenbauer Creek culvert and pump station, the hydraulic model determined that a 42" pipe would be required to reduce surcharging of this portion of the system, which resulted in a hydraulic gradeline that is 1.3' lower than the weir crest elevation at the overflow structure for Alternative D. Appendix A provides a full summary of the hydraulic modeling task as well as all modeling assumptions.

## **2.4 Condition Assessment**

King County performed CCTV inspections of the existing BIT in 1998 and 2008 as part of its routine maintenance program. Jacobs staff reviewed these CCTV videos as part of the condition assessment task (see *Condition Assessment Memo, dated June 10, 2009*, in Appendix C). Overall, this condition assessment revealed that the upstream portions of the influent trunk pipe showed severe corrosion damage while remaining downstream pipe portions showed a moderate degree of corrosion due to hydrogen sulfide attack. In general, manholes showed only minor to moderate damage. This condition assessment also found several active and plugged services leaking groundwater into the existing influent trunk.

An evaluation of potential rehabilitation options was also included in the *Condition Assessment* memo that reviewed methods for pipeline, lateral, and manhole rehabilitation for the existing trunk sewer system. The various rehabilitation methods were compared based on constructability, durability and cost. The evaluation concluded that if rehabilitation would be required, Cured-in-place pipe (CIPP), Top Hat, and cementitious lining with epoxy coating were recommended for the pipeline, lateral, and manhole rehabilitation, respectively. The total rehabilitation cost estimated for the three recommended rehab methods was approximately \$500,000 for the full length of the Bellevue Influent Trunk.

## **2.5 Fate of Existing Trunk**

The *Existing Bellevue Influent Trunk Alternatives Technical Memorandum, dated June 18, 2009* (Appendix C), evaluated options associated with either abandoning the existing trunk sewer or rehabilitation of the existing trunk sewer and the installation of a parallel trunk sewer. The advantages and disadvantages of both options are listed in Table 1 below, and were utilized in selecting a recommended alternative.

**Table 1 – Fate of Existing Trunk Summary**

	<b>Advantages</b>	<b>Disadvantages</b>
<b>Abandonment of Existing Trunk and Installation of Replacement Trunk Sewer</b>	<ul style="list-style-type: none"> <li>• Reduced maintenance associated with a single pipe</li> <li>• Reduced odor concerns with no diversion structures</li> <li>• Potential lower construction cost</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of redundancy / Fewer maintenance options</li> <li>• Higher construction costs associated with larger diameter of replacement sewer</li> <li>• Higher costs associated with relocation of existing service laterals</li> <li>• Cost of abandonment of the existing pipeline</li> </ul>
<b>Rehabilitation of Existing Trunk and Installation of Parallel Trunk Sewer</b>	<ul style="list-style-type: none"> <li>• Redundancy provided by two pipes</li> <li>• Simpler maintenance activities that normally require a bypass</li> <li>• Service lateral connections do not require relocation</li> <li>• Flow capacity of rehabilitated pipe reduces the pipe sizes required for a parallel pipe</li> </ul>	<ul style="list-style-type: none"> <li>• Increased cost to rehabilitate the existing trunk line</li> <li>• Maintenance costs associated with maintaining two pipelines rather than one</li> <li>• Odor and corrosion risks will be slightly higher for the parallel option due to the need for diversion structures, although these risks can be mitigated during the final design process.</li> </ul>

## **2.6 Odor and Corrosion Control**

An odor and corrosion control evaluation was completed for the proposed design alternatives, and the conclusions were documented in the *Odor and Corrosion Control Technical Memorandum, dated June 12, 2009* (Appendix D).

The evaluation confirmed that the ventilation system to be installed during the current Bellevue pump station upgrade project will exceed the King County design standard (40 to 100 feet per minute) and will provide the required venting velocity for the influent sewer for all design alternatives. This technical memorandum also recommended design measures (e.g., ventilating head space in pipe, avoiding flow splitting, and avoiding/minimizing elevation drops at junctions) to prevent the release of odors and reduce the generation of hydrogen sulfide in the BIT options. Corrosion-resistant pipe materials and/or liners were also recommended for the new or existing sewer pipes and appurtenances due to the known corrosion issues.

## **2.7 Alternatives Evaluation**

Once the design flow had been determined and the hydraulic modeling was complete, the three best alternatives (A, B and D) were narrowed down to just one recommended alternative as described in the *Alternatives Analysis Technical Memorandum* (Appendix B). This memorandum detailed the three alternatives that were considered, and described the criteria that were used to evaluate each alternative. These criteria included environmental/permitting issues, easement acquisitions, community relations, geotechnical conditions, risk assessment, design and construction schedule, constructability, and project costs. The criteria were then weighted in level of importance, and the alternatives were rated and assigned a final weighted score for each criteria category.

Overall, the alternatives analysis indicated that Alternatives A and B that involved rehabilitating the existing influent trunk and installing a parallel trunk line had a longer construction schedule, and had higher design, construction, and life cycle costs (and hence lower scores) as compared with Alternative D. In general, the three alternatives ranked equally for the other evaluation criteria (design schedule, risks, permitting, geotech cost, and survey cost), although Alternative D had slightly lower scores for easement/right-of-way and community relations costs due to the costs associated with the lateral re-connections. After all the alternatives were scored for each criteria, Alternative A totaled a final score of 5.50, Alternative B totaled 4.83, and Alternative D totaled 6.22. Therefore, the replacement alternative (Alternative D) was recommended and carried forward to the 30% design stage.

## **2.8 30% Design**

The recommended Alternative D was formally approved at the King County Gate 2 meeting on September 14, 2009, and Alternative D was then carried forward to the 30% design level. This effort built upon the conceptual level design of Alternative D by refining the horizontal and vertical alignment of the new BIT sewer and West CBD trunk sewer extension, determining existing utility conflicts and relocations, and identifying construction staging area and traffic control requirements. A potential construction work sequence was also completed that evaluated an efficient order in constructing the new sewer, re-connecting existing lateral sewers, and maintaining active flows through the use of temporary gravity and pumped sewer bypassing. The 30% drawings, a draft table of contents for project specifications, and two draft specifications (Work Sequence and PVC Pipe) are included in Appendix E.

A *Basis of Design (BOD) Technical Memorandum* (Appendix F) was also completed for the 30% design submittal, and described the various technical and design standards used in the 30% design. Where applicable, King County Wastewater Treatment Division standards were used for the 30% design. In the absence of a County standard, requirements from either the Washington State Department of Ecology Criteria for Sewage Works Design or City of Bellevue 2009 Sewer Standards were used. For items related to storm drainage and roadway restoration, City of Bellevue 2003 Surface Water Engineering Standards and 2009 Transportation Design Manual were utilized.

The BOD memo also included discussions and recommendations on pipe materials, manhole lining, alignment criteria and permitting requirements (see section 3.0), and can

be summarized as follows:

- Solid wall PVC pipe was recommended for the pipe material after researching various pipe materials such as reinforced concrete, corrugated PVC, ductile iron and HOBAS pipe. Based on cost, corrosion resistance and product history, PVC pipe was determined to be the most feasible pipe material option.
- Due to existing corrosive conditions in the influent sewer, it was recommended that all drop manhole structures be lined to prevent concrete corrosion. Structural polymer lining (Linabond) is the current specified lining, but fully adhered PVC sheet lining (T-Lock) and cementitious lining with epoxy coating also appear to be feasible and will require further evaluation.
- A minimum clearance of 5.5 feet from the centerline of the sewer alignment to existing utilities will be required to provide enough width for the sewer installation and trench support system.

## **2.9 Green Building and Sustainable Development**

A *Green Process Sustainability Scorecard Evaluation* (Appendix G) was completed during the predesign phase and evaluated potential sustainable design and construction approaches that may be incorporated into the project. This evaluation utilized a combination of a Building Score as determined by the LEED rating system and a Process Score as determined by the Wastewater Treatment Division Scorecard. Potential green / sustainable elements that could be incorporated into the design included the following:

- Demolition Waste Management (diverting asphalt removed from project to recycling facility)
- Construction Waste Management (diverting construction waste materials to recycling facility)
- Resource Reuse (re-use removed asphalt by grinding and using as backfill material)
- Recycled Product Content (specify recycled materials in asphalt overlays and pavement)
- Local/Regional Materials (specify use of local manufacturers within a 500 mile radius)
- Rapidly Renewable Materials (specify use of straw bales for erosion control)
- Low-Emitting Materials (specify use of low-emitting asphalt seal coatings)
- Good Neighbor Targets (specify use of low-emitting asphalt seal coatings).

Overall this evaluation determined that there were 29 possible building points and 33 possible process points that could be obtained for the BIT project. Application and implementation of the identified building and process credits will be discussed with the County during final design.

Table 2 below summarizes the estimated costs associated with implementation of green / sustainable elements listed above. It should be noted that all costs listed below are associated with construction only, and that there were no additional costs associated with operation and maintenance for incorporation of the green / sustainable elements.

**Table 2 – Green / Sustainable Cost Summary**

	102nd Ave 1286 57.75%	SE 3rd (West) 306 13.74%	West CBD 635 28.51%	Total 2227 100%
<b>Demolition Waste Management:</b>	\$3,811.23	\$906.87	\$1,881.90	\$6,600
<b>Construction Waste Management:</b>	\$866.19	\$206.11	\$427.71	\$1,500
<b>Resource Reuse:</b>	(\$2,397.61)	(\$570.50)	(\$1,183.89)	(\$4,152)
<b>Recycled Project Content:</b>	\$5,081.63	\$1,209.16	\$2,509.21	\$8,800
<b>Low Emitting Materials/Minimizing Fugitive Odor:</b>	\$12,320.65	\$2,931.66	\$6,083.68	\$21,336
<b>Green / Sustainable Elements</b>				
<b>Total:</b>	\$19,682.09	\$4,683.30	\$9,718.61	\$34,084
<b>Total Construction Cost:</b>	\$2,269,135	\$313,243	\$907,673	\$3,490,051
<b>Percentage of Total Construction:</b>	0.87%	1.50%	1.07%	0.98%

### **3.0 ENVIRONMENTAL AND PERMITTING REQUIREMENTS**

An *Environmental Conditions Memorandum*, dated June 2009 (Appendix H), was completed during predesign that discussed the existing environmental features along the project corridor and documented existing Aquatic resources, wetlands, wildlife habitats and other environmental factors. In summary, the critical areas in the vicinity of the project include Meydenbauer Creek, wetlands associated with the Meydenbauer Creek watershed, a portion of the 100 yr floodplain along 102nd Ave. SE, and habitat associated with species of local importance.

A *Cultural Resources Preliminary Investigation*, dated May 21, 2009 (Appendix I), was also completed during predesign, and determined that the project area was considered highly sensitive for archaeological resources due to its proximity to Meydenbauer Bay and Mercer Slough. As a result of these findings, it was recommended that the soil borings be carefully reviewed for evidence of disturbance, and that appropriate parties be consulted as the design process progresses.

During predesign, it was determined that sewer construction would require several permits from King County and the City of Bellevue. It should be noted that no in-water work was assumed for the crossing of the Meydenbauer Creek culvert during predesign. If in-water work is confirmed to be required after additional evaluation of the Meydenbauer creek culvert crossing along 102<sup>nd</sup> Ave SE, additional environmental permits (e.g., Army Corps Section 404 and Critical Areas) and conditions will be required. The permit matrix in Appendix J contains a listing of all potential permits required for construction of the new trunk line and its appurtenances along with descriptions of the triggers, requirements, and timelines for each permit. Table 3 below provides a quick summary of the permits discussed in the permit matrix.

**Table 3 – Permit Summary Table**

Regulatory Agency		Permit
Federal	US Army Corps of Engineers	Clean Water Act Section 404*
	NOAA Fisheries	Section 7 review for 404 permit*
	U.S. Fish & Wildlife Agency	Section 7 review for 404 permit*
Washington State	WA Dept of Fish & Wildlife	Hydraulic Projects Approval*
	WA Dept of Ecology	NPDES Permit
	WA Dept of Archaeology & Historic Preservation	Section 106 review for 404 permit*
Tribes	Muckleshoot, Tulalip, Suquamish, Snoqualmie	Section 7 review for 404 permit*
		Consultation on SEPA
		Consultation on HPA
County	King County	SEPA
		Industrial Waste Discharge
City	City of Bellevue	Critical Areas*
		Street Use
		Noise variance
		FEMA CLOMR*

\*Required if construction requires in-water work in Meydenbauer Creek.

## **4.0 EASEMENTS AND RIGHTS OF ENTRY ACQUISITION**

### **4.1 Rights of Entry**

Construction of the new replacement trunk sewer will require re-connecting all of the existing 17 lateral sewers from the existing BIT sewer to the new replacement sewer. These reconnections of the existing lateral sewers will most likely take place within the right-of-way; however, it is anticipated that some reconnections will occur on private properties and not within the right-of-way. Due to the limited accuracy of the existing lateral locations (identified by side sewer cards, CCTV video, and as-built records) and potential conflicts with existing utilities during construction, it is unknown which specific lateral sewers will require access onto private property. Therefore, it is recommended that rights-of-entry be obtained for all of the 16 private properties (see Rights-of-Entry Matrix in Appendix J) whose lateral sewers will be reconnected to the new BIT sewer (note that one property has two lateral sewer connections). The right-of-entry process is scheduled to begin by May 2010 and be completed by July 2010. It is anticipated that these rights of entry will not require any compensation to the property owners.

### **4.2 Easements**

Since the new sewer alignment is within the right-of-way, permanent easements will not be required for any portion of the replacement trunk line. During predesign it was

determined that a temporary construction easement may be required for the Village Garden Apartments adjacent to the pump station resulting from impacts to resident parking stalls. The potential compensation for this easement or a provision for alternative parking locations for Village Garden residents will be determined by King County staff during final design.

### **4.3 Staging Areas**

Three potential staging areas were evaluated during the alternatives analysis phase – one on private property and two within the right-of-way. One of the staging areas is located along SE 6<sup>th</sup> Street, adjacent to and south of the pump station. This area is currently being utilized as a staging area for the Bellevue Pump Station Upgrade project, and has closed SE 6<sup>th</sup> ST in this area since the summer of 2007. Using this area for construction staging on the Bellevue Influent Trunk project would require a right of way / street use permit from the City of Bellevue, and continued community relations efforts with the adjacent residents. Another potential staging area that was evaluated is SE 3<sup>rd</sup> ST, located between 101<sup>st</sup> Ave SE and 102<sup>nd</sup> Ave SE. However, based on initial discussions with the City of Bellevue transportation department, this area was not as favorable as the SE 6<sup>th</sup> ST staging area due to the higher density of residents along SE 3<sup>rd</sup> ST.

A third potential staging area that was evaluated is a gravel parking lot located along 102<sup>nd</sup> Ave SE, just south of Main Street. During the alternatives analysis, the property owner was contacted regarding the use of his parking lot as a temporary staging area, but the site is currently leased out with a waiting list and he subsequently denied the request for a future staging area. Use of this parking lot would require a temporary construction easement and negotiations with the property owner.

In summary, the use of SE 6<sup>th</sup> ST is currently the recommended construction staging area based on discussions with the City of Bellevue and the parking lot owner. This staging area is shown on Drawing C101 in Appendix E.

## **5.0 UTILITY CONFLICTS**

### **5.1 Existing Utilities**

There are numerous existing utilities located within the 40 foot wide right-of-way where the new sewer will be constructed. These utilities include the existing County BIT sewer, City of Bellevue storm drains and water lines, PSE gas and power conduits, Qwest telephone, and Comcast cable lines. To minimize impacts to the larger existing utilities, the new BIT sewer was routed to the east of the existing BIT sewer down 102<sup>nd</sup> Avenue and along the south half of SE 3<sup>rd</sup> ST. This new alignment prevents impacts to the existing BIT, water main, gas line and abandoned AC water main along 102<sup>nd</sup> Ave SE, and prevents impacts to the water main along SE 3<sup>rd</sup> ST. However, the new alignment will impact telecommunications, power, and television cable conduits along the east side of 102<sup>nd</sup> Ave SE, and telecommunications and power conduits on the south side of SE 3<sup>rd</sup> ST near the Meydenbauer Creek culvert.

Several existing utilities were potholed during Predesign to determine their exact location, depth and geotechnical conditions. These potholes are summarized as follows:

- Numerous potholes were performed at the Meydenbauer Creek culvert crossing under 102<sup>nd</sup> Avenue to determine the culvert alignment and depth. The depth to the bottom of the culvert (at the location of the new sewer) was found to be at the same elevation as the top of the new 36" PVC pipe. Therefore, alternate design options and construction methods are currently being evaluated to convey the design flows while providing enough clearance under the existing culvert bottom.
- During construction of the upstream storage structure (USS) for the Bellevue pump station upgrade project, it was discovered that the existing BIT had been encased in a 6' by 3' block of concrete as it entered the pump station wet well. Therefore, a pothole was completed for the existing BIT in the paved portion of 102<sup>nd</sup> Avenue just before the influent trunk enters the USS. The pothole information stated that the sewer was encased in concrete and that it was "located by feel only due to excessive ground water". Discussions with the pump station contractor also indicated that the concrete encasement around the existing BIT was reducing in size as excavation proceeded upstream of the BIT sewer towards the 102<sup>nd</sup> Ave SE right-of-way.
- A 3' X 1.5' slot cut of the existing telephone and power conduits was also performed near the culvert crossing along 102<sup>nd</sup> Ave SE to determine the number of conduits and whether they were encased in a concrete ductbank. The slotcut revealed no concrete encasement and a total of seven conduits or wires in this duct bank ranging from 4" power conduits to 1" communication cables.
- The West CBD trunk sewer extension along SE 3<sup>rd</sup> ST will be constructed over the existing Meydenbauer Creek culvert (on SE 3<sup>rd</sup> ST), and will connect to the existing West CBD sewer approximately 90 feet east of the culvert. Potholes along SE 3<sup>rd</sup> ST indicated that the culvert is approximately 9 inches lower (at the new sewer location) than the current basemap, and that there is a 4" PVC telecommunications conduit and 2" and 4" PVC power conduits near the eastern end of the new sewer alignment.

## **5.2 Utility Relocation**

The new trunk sewer alignment will require relocation of existing PSE power, Qwest telecommunications, and Comcast cable lines. Through preliminary discussions with all three utilities during predesign, it was determined that the most feasible method of utility relocation would place all three utilities in a joint trench. This joint trench would most likely run north along 102<sup>nd</sup> Avenue under the western sidewalk from the intersection with SE 6th Street and would cross over to the eastern sidewalk just before the Meydenbauer Creek Culvert outlet. Relocation of these utilities would continue along the east side of 102<sup>nd</sup> Ave SE up to the intersection with SE 3<sup>rd</sup> ST. Minor power and telecommunications relocations would also be required on SE 3rd Street near the proposed connection to the existing West CBD.

## **5.3 Utility Agreements**

Discussions with private utilities during the predesign phase focused only on the technical requirements related to the utility relocations, and did not focus on utility agreements or franchise requirements. Utility agreements between King County, City of Bellevue and private utilities will be discussed during the final design phase, as the technical utility relocation requirements are also finalized.

## **6.0 GEOTECHNICAL**

The predesign scope for Geotechnical services included drilling and sampling three borings, preparing field logs of the explorations, geotechnical tests on samples obtained during the borings, performing hydrogeologic tests, and preparing a Draft Geotechnical Design Memorandum, Draft Geotechnical Data Report, and a Limited Phase I Environmental Site Assessment. The three borings performed during predesign were evenly spaced along 102<sup>nd</sup> Avenue SE with one near the Bellevue Pump Station at station 3+50, one near the Meydenbauer Creek Culvert crossing near station 6+50, and one near SE 3<sup>rd</sup> Street at approximately station 11+25. All three borings were advanced to a depth of approximately 25' with the maximum depth of the replacement BIT expected to be approximately 20 feet. Groundwater monitoring wells were also installed at each boring location, and groundwater elevations will continue to be taken during the course of final design.

The *Draft Geotechnical Data Report, dated June 10, 2009* (Appendix K), contains all of the data that was collected from the geotechnical explorations and testing during predesign. Appendix L contains the *Draft Geotechnical Design Memorandum, dated June 19, 2009*, which contains design recommendations based on the subsurface conditions encountered during geotechnical explorations.

### **6.1 Subsurface Soil Conditions**

The new sewer along 102nd Avenue SE will be underlain by approximately 4 to 10 feet of loose to dense fill soils. At the south end of 102<sup>nd</sup> Avenue SE, between the pump station and the western extension of Meydenbauer Creek, the fill soils are underlain by 6 to 13 feet of recent alluvial deposits consisting of very soft peat and loose to medium dense sands and silts with wood and organics. To the north of Meydenbauer Creek, the alluvial deposits become thin and the fill is underlain by dense to very dense, weathered till and till soils. Along SE 3rd Street, the new trunk alignment is underlain by shallow fill and very dense glacial till soils.

The fill, alluvial deposits, and glacial till soils will likely be excavated using conventional excavating equipment such as a rubber-tire backhoes or tracked hydraulic excavators. Trench excavation in the fill and alluvial soils should not require any unusual equipment or procedures. However, the glacial till soils are very dense and may require the use of ripper teeth or a hoe ram on the excavation equipment.

Due to the proximity of utilities, streets, sidewalks, and other facilities, temporary shoring will be required to retain the sides of the trench excavations. For temporary shored excavations, construction practice in the Puget Sound area generally includes the use of trench boxes for excavations of 15 feet or less and cantilevered or braced shoring consisting of interlocking steel sheet piles or soldier piles and lagging for excavations greater than 15 feet.

The glacial till soils north of Meydenbauer Creek and along SE 3rd Street are considered to be very good foundation soils, and settlement due to placement of the pipeline, manholes, and backfill is anticipated to be minimal. South of Meydenbauer Creek, the foundation soils consist of loose to medium dense alluvium and soft peat and organic soils. The loose to medium dense alluvium are considered to be suitable foundation soils for pipelines and manholes, but the soft peat and organic soils are considered to be

unsuitable and will require overexcavation and replacement with a geosynthetic-wrapped backfill and/or quarry spall stabilization.

## **6.2 Ground Water Conditions**

In general, there are two groundwater levels - the first is an unconfined groundwater level within the recent fill and alluvial deposits, and the second is a confined groundwater level in relatively clean sand layers within and below the glacial till deposits. The unconfined groundwater level in the fill and alluvial deposits appears to be perched on the underlying glacial till deposits at depths of 3 to 10 feet below the existing ground surface. The confined groundwater level in the clean sand layers within and below the glacial till deposits is artesian, with water levels at or above the existing ground surface.

The new sewer will be constructed beneath the groundwater table, and some form of groundwater control will be necessary to complete the work. Based on the depth of groundwater, it is anticipated that a combination of sumps and pumps and closely to moderately spaced well points will be required to lower the confined and unconfined groundwater levels.

## **6.3 Contaminated Soils**

Hydrocarbon contamination was encountered in one boring located just north of the Meydenbauer Creek crossing on 102nd Avenue SE. The contamination was detected in two samples in fill soils between the depths of approximately 5 and 10 feet. Environmental testing results indicated that both diesel range organics and lube oil were present in one sample at concentrations below the Model Toxics Control Act Method Cleanup criteria of 2,000 milligrams/kilograms. It is anticipated that these contaminated soils will be encountered along the new sewer alignment, particularly near the creek crossings, and will require special handling and disposal.

## **6.4 Environmental Site Assessment**

*A Limited Phase I Environmental Site Assessment, dated June 11, 2009 (Appendix M), was completed during predesign to determine the likelihood for the presence of recognized environmental conditions (RECs), or regulated hazardous or dangerous wastes and/or substances, along the new sewer alignment corridor. The site screening resulted in the identification of 55 RECs that appear to pose some risk to the project. Since RECs were identified adjacent to and/or near the corridor, potential soil and/or groundwater contamination may be encountered during sewer excavation activities. Therefore, due to identification of RECs along the project corridor and the presence of contamination found in the soil boring near the Meydenbauer Creek Culvert crossing (described in Section 6.3), a Limited Phase II Environmental Site Assessment is recommended for completion in final design in the vicinity of the SE 3<sup>rd</sup> ST Meydenbauer Creek crossing and at regular intervals along 102<sup>nd</sup> Ave SE to investigate for potential contamination and define the lateral and horizontal extents of observed contamination.*

## **7.0 SURVEYING**

Base mapping was performed in the Metro Datum using the vertical National Geodetic Vertical Datum of 1929 with the 1947 adjustment [NGVD 29(47)], and the horizontal North American Datum of 1983 using the Washington State Reference Network [NAD 83(WSRN)].

Early in the predesign phase an aerial basemap was created to assist in the alternatives analysis. Once it had been determined that construction of the new trunk line would take place completely within the right-of-way, a ground survey was performed for the entire project corridor within the public right-of-way along 102<sup>nd</sup> Ave SE and SE 3<sup>rd</sup> ST. As-built utility records were compared against field locates of existing utilities to determine accuracy of utility locations, and several potholes were performed to determine the exact orientation and location of several critical utilities. Sewer CCTV records from both the City of Bellevue and King County and City side sewer cards were also used to verify side sewer locations.

## **8.0 COMMUNITY RELATIONS**

Community relations activities during predesign involved creating a community relations plan, assembling a database of contacts for the project area, and providing information to the local community regarding geotechnical investigations, potholing activities, and survey work.

After the predesign phase, community relations will be centered on communicating with residents, property owners and managers throughout the final design and construction phases. Construction is anticipated to have significant impacts on the neighborhood including construction noise, driveway access impediments, road restrictions, and the potential for utility interruptions. Continued road closures, dense multi-family housing, narrow right-of-way, and a potentially complex culvert crossing all contribute to the increased impacts on local residences who have already experienced three continuous years of construction in the neighborhood associated with the Bellevue Force Main and Pump Station Upgrade projects.

Appendix N includes the Community Relations Plan created during the predesign phase which details the community relations approach and lists the project stakeholders.

## **9.0 BASELINE COST ESTIMATES**

### **9.1 Final Design Cost**

The final design phase scope of work and budget is currently being negotiated by King County and Jacobs, and will be finalized by January of 2010. After this process is complete, the final baseline design cost will be finalized. King County and the City of Bellevue are also finalizing the interagency agreement that will determine the allocation of design costs between the various segments of the project. If design costs are allocated by lineal footage of each design segment, 102<sup>nd</sup> Ave SE accounts for 57.75%, SE 3<sup>rd</sup> ST (west of 102<sup>nd</sup>) 13.74%, and the West CBD segment (between 102<sup>nd</sup> and Bellevue Way) 28.51%.

It should be noted that consultant costs for final design and construction phase services were estimated for the *Alternatives Analysis Technical Memorandum, dated October 23, 2009* (Appendix B). Although a scope of work had not been determined at the time of memorandum completion for these phases, a similar level of effort was assumed based on the effort required for this project's predesign phase scope of work and past experience on King County projects for final design and construction phase services. Final design phase services estimated included project management, design drawings and specifications, cost estimating and scheduling, permitting support, right-of-way support, geotechnical soil borings and reports, survey support, and community relations. Construction phase services included engineering services (submittal, RFI reviews,

design clarifications, etc.), site observations, and community relations. Unanticipated supplemental services were not included in the estimates.

In the *Alternatives Analysis Technical Memo*, the selected Alternative D was estimated to be \$630,000 for final design and construction phase consultant services.

## **9.2 Construction Cost**

After the completion of the 30% design documents, initial baseline construction cost estimates were prepared for the new BIT sewer and the new West CBD sewer extension. These costs were based on the 30% drawings and specifications table of contents, and also followed the King County WTD cost estimating guidelines. After County and City review of the 30% design submittal, the baseline cost estimate was revised to include the auger-bored culvert crossing, the West CBD trunkline extension to Bellevue Way, and new pipe and manhole sizes per the 30% review comments. A basis of estimate memorandum was also completed that summarized the major assumptions used for the cost estimates. The cost estimates and memo are included in Appendix O, and are summarized in Table 4 below:

**Table 4 – Construction Cost Breakdown**

	<b>30% Baseline Estimate</b>	<b>King County WTD</b>	<b>City of Bellevue</b>
<b>102<sup>nd</sup> Ave SE</b>	\$2,269,135	\$1,134,568	\$1,134,568
<b>SE 3<sup>rd</sup> St (West)</b>	\$313,243	\$313,243	\$0
<b>West CBD</b>	\$907,673	\$0	\$907,673
<b>TOTAL</b>	<b>\$3,490,051</b>	<b>\$1,447,811</b>	<b>\$2,042,241</b>
<b>RANGE</b>	<b>Low (-30%)</b>	\$1,013,467	\$1,429,568
	<b>High (+50%)</b>	\$2,171,716	\$3,063,361

## **9.3 Life Cycle Cost**

Using the 30% construction cost estimate, a life cycle cost for the new BIT sewer was calculated using the County's guidelines for estimating life cycle costs and the templates provided by King County. The life cycle cost estimate assumes construction will start in 2011, and the new BIT sewer will be online by 2012. Appendix O includes the detailed life cycle cost analysis, which is summarized below:

- Net Project Life Cost - \$2,582,376
- Average Project Annual Cost - \$83,945

It should be noted that the capital outlays used to calculate this life cycle cost only includes the total estimated construction cost for the 102<sup>nd</sup> Ave SE and SE 3<sup>rd</sup> St (west of 102<sup>nd</sup> Ave) portions of the replacement trunk, and does not include costs associated with engineering, permitting, construction management, inspection, or project and construction contingencies.

In addition, the life cycle cost assumed installation of an inert pipe material (PVC). Although an inert pipe material has higher capital costs than the more commonly used reinforced concrete pipe, these higher costs were mitigated since PVC pipe did not require any pipe rehabilitation costs to be considered over the 50-year life cycle.

## **10.0 BASELINE SCHEDULE ESTIMATES**

### **10.1 Final Design Schedule**

The final design phase scope of work and budget is currently being negotiated by King County and Jacobs, and will be finalized by January of 2010. After this process is complete, a detailed final design schedule will be completed at the start of the final design phase.

For the Final Predesign Report, a final design schedule (based on PERT expected value) was estimated based on major tasks to be performed in the final design phase, and is included as part of the project schedule included in Appendix P. Although a scope of work for final design had not been finalized, a similar schedule effort was assumed based on the effort required for this project's predesign phase scope of work and past experience on King County projects for final design phase services. Final design phase services estimated included major design deliverables at 60%, 90%, and 100%. Tasks assumed to be included were project management, design drawings and specifications, cost estimating and scheduling, permitting support, right-of-way support, geotechnical soil borings and reports, survey support, and community relations.

Overall, the final design phase is estimated to begin on January 18, 2010 and to complete on October 15, 2010, for a total duration of approximately 9 months. This duration is dependent on obtaining all permits prior to completion of the 100% design submittal. After design completion, the bidding period is anticipated to last approximately 4 months, beginning on October 18, 2010 and ending on February 17, 2011.

### **10.2 Construction Schedule**

At the end of the Predesign phase, a baseline construction schedule (Appendix P) was prepared based on the 30% drawings and specifications table of contents, and updated in December 2009 based on comments and discussions with King County and City of Bellevue. The durations in the schedule were prepared using PERT based estimates, and assumptions for these estimates are also documented in Appendix P.

Construction of the replacement BIT is currently scheduled to start on February 24, 2011. It is anticipated that all private utility relocations required for the construction of the new influent trunk will be completed prior to the BIT contractor mobilizing on site. Total construction time is expected to last approximately 217 working days, with substantial completion by October 11, 2011 and final restoration and demobilization by December 26, 2011.

## **11.0 APPENDICES**

**APPENDIX A:** *Flow and Surge Analysis Technical Memorandum*

**APPENDIX B:** *Alternatives Analysis Technical Memorandum*

**APPENDIX C:** *Existing Bellevue Influent Trunk Alternatives Technical Memorandum*

**APPENDIX D:** *Odor and Corrosion Control Technical Memorandum*

**APPENDIX E:** *30% Design Submittal / Revised West CBD Drawings*

**APPENDIX F:** *Draft Basis of Design Technical Memorandum*

**APPENDIX G:** *Draft Green Process Sustainability Scorecard Evaluation*

**APPENDIX H:** *Environmental Conditions Memorandum*

**APPENDIX I:** *Cultural Resources Memorandum*

**APPENDIX J:** *Permit and Rights-of-Entry Matrix*

**APPENDIX K:** *Draft Geotechnical Data Report*

**APPENDIX L:** *Draft Geotechnical Design Memorandum*

**APPENDIX M:** *Limited Phase 1 Environmental Site Assessment*

**APPENDIX N:** *Community Relations Plan*

**APPENDIX O:** *Basis of Estimate, Baseline Cost Estimates, Life Cycle Cost*

**APPENDIX P:** *Baseline Schedule Estimates*

**APPENDIX Q:** *Culvert Crossing Options Technical Memorandum*