

King County
Initial Infiltration and Inflow Reduction Project Alternatives Analysis Report

**APPENDIX E.
RISK ASSESSMENT RESULTS**

April 2009

TABLE 4.2								
Risk Identification		Risk Qualification			Risk Quantification			Risk Mitigation / Response
Risk #	Description of Risk Event	Probability	Impact	Rating	Probability	Impact (dollars)	Risk Cost	Description
1.0	Right of Way, Easement and Property Acquisition							
1.1	Sufficient right-of-entries for low and medium properties are not attained requiring higher difficulty properties to be rehabbed at a higher cost.	M	H	MH	40%	\$ 457,600	\$ 183,040	Key to addressing this risk is to strive to attain more ROE's than needed to reach I/I removal targets.
1.2	Sufficient right-of-entries are not attained for the planned amount of private property rehabilitation. Project cannot proceed to implementation (Skyway)	H	H	HH	50%	\$ 500,000	\$ 250,000	* Explain the financial benefits of participation through communications materials. Key to addressing this risk is to strive to attain more ROE's than needed to reach I/I removal targets.
1.3	King County is understaffed to collect and/or record right-of-entries in a timely fashion	L	H	LH			\$ -	Find right person/ consultant to do the collection work and a good collection system is set up Accurately identify number of ROE's required to ensure proper staffing is available to secure.
1.4	There are errors in right-of-entry records	L	M	LM			\$ -	Find right person/ consultant to do the collection work and a good collection system is set up Establish accurate database for tracking of ROE's.
1.5	Work is done on wrong property, special conditions are not met during field work	L	M	LM			\$ -	Field staff confirm work locations visually on map as well as by address. * See mitigation steps in 8.3 and 8.6 about project team and contractor briefings.
1.6	High property acquisition cost leading to increase in project cost higher than expected.	L	L	LL			\$ -	ID all properties in question before doing work; do not work on properties that require acquisitions
2.0	Permit Acquisition (List all Permits)							
2.1	Permit mitigation requirements (for items such as pavement overlays; drainage improvements; etc.) increase project costs higher than expected.	L	L	LL			\$ -	Negotiate on mitigation costs before proceeding with design Establish mitigation requirements for all required permits and reflect in contract bid documents.
2.2	Discharge permits needed for construction dewatering may delay construction, limit amount of allowable discharge, and may require water treatment prior to disposal	L	L	LL			\$ -	Investigate discharge permits needed Acquire Dewatering permits prior to start of construction.
2.3	Potential for delays or rejection of anticipated County procured permits: local Critical Areas Ordinance permits (Bellevue, Issaquah, Renton, and King County), SEPA (King County), Shoreline Exemption (King County)	L	M	LM			\$ -	Avoid properties/ areas that trigger permits Investigate all permits needed Begin permit acquisition process early in formal design.
2.4	Other unanticipated permits are required and delay project, such as Nationwide Permit (U.S. Corps of Engineers), 401 Water Quality Certification (Ecology), and/or Hydraulic Project Approval (WDFW)	L	H	LH			\$ -	Avoid properties/ areas that trigger permits Investigate all permits needed Avoid work in areas which trigger Federal and State permits.

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3.0	Environmental / Public Impact							
3.1	Unexpected hazardous materials encountered during excavation and/or dewatering activities results in project delays and unanticipated disposal costs	L	L	LL			\$ -	Do as thorough as job as possible gathering info regarding property profile Avoid work in areas which have greater potential for hazardous materials
3.2	Potential spills, emissions, or violations occur during construction	L	L	LL			\$ -	Hire contractors who place safety as a priority Include explicit requirements in specifications for control of spills and emissions during construction.
3.3	Changes to environmental regulations after NTP	L	L	LL			\$ -	This is highly unlikely if NTP is within the time frame of a valid permit
3.4	Identification of potential Environmental issue that were not identified during the design phase.	L	L	LL			\$ -	Do as thorough as job as possible gathering info regarding environmental characteristics of property Avoid work in areas where the likelihood of these types of discoveries is high.
4.0	Engineering / Design							
4.1	I/I is not uniformly distributed across basins as assumed; and reduction targets are not achieved in the basin (Bellevue & Issaquah)	M	H	MH	30%	\$ 1,571,250	\$ 471,375	Add additional meters in the basin in smaller areas and monitor the flows. Mitigation - work in additional basins to get a greater I/I reduction. Determine during design if this would be cost effective approach. Contingency - arrange I/I contract to do unit price work to increase the amount of work if needed.
	Skyway	M	H	MH	30%	\$ 1,367,500	\$ 410,250	Planning - continue to monitor and model flows during design phase to gain more comfort with flows. Planning - continue to compare I/I project to capital project during design to check for cost effectiveness. Planning - assume multiple phases, over several years, for construction so that flows can be checked as the work proceeds. Does this work with KC budget? Obtain sufficient ROE's to allow for addition of properties to reach reduction targets.
	I/I removal targets in basins are achieved; however, a lesser reduction rate at the location of the downstream CSI project is realized because additional flows enter the system from other tributary areas (Bellevue & Issaquah).	M	H	MH	30%	\$ 1,571,250	\$ 471,375	Perform more metering throughout the basin and refine the model. Mitigation - work in additional basins to get a greater I/I reduction. Determine during design if this would be cost effective approach. Contingency - arrange I/I contract to do unit price work to increase the amount of work if needed.

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4.2	Skyway	H	H	HH	50%	\$ 1,641,000	\$ 820,500	<p>Planning - continue to monitor and model flows during design phase to gain more comfort with flows.</p> <p>Planning - continue to compare I/I project to capital project during design to check for cost effectiveness.</p> <p>Planning - assume multiple phases, over several years, for construction so that flows can be checked as the work proceeds. Does this work with KC budget?</p> <p>Obtain sufficient ROE's to allow for addition of properties to reach reduction targets. Skyway could have lower level of service.</p>
4.3	Peak I/I rates have been over-estimated in a basin selected for implementation. Following rehabilitation, target reductions are not achieved (Bellevue & Issaquah)	M	M	MM	30%	\$ 1,257,000	\$ 377,100	<p>Perform more metering throughout the basin and refine the model.</p> <p>Mitigation - work in additional basins to get a greater I/I reduction. Determine during design if this would be cost effective approach.</p> <p>Contingency - arrange I/I contract to do unit price work to increase the amount of work if needed.</p>
	Skyway	L	M	LM			\$ -	<p>Planning - continue to monitor and model flows during design phase to gain more comfort with flows.</p> <p>Planning - continue to compare I/I project to capital project during design to check for cost effectiveness.</p> <p>Planning - assume multiple phases, over several years, for construction so that flows can be checked as the work proceeds. Does this work with KC budget?</p> <p>Ensure modeling results have been verified with real world rainfall and flow measurement data.</p>

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4.4	Rise in groundwater levels as a result of a reduction in I/I may require resizing of existing surface drainage systems (ditches, inlets, etc.) due to increase in seepage/spring volumes.	M	L	ML			\$ -	<p>Build some storm work into project cost up to 10 properties.</p> <p>Planning - document drainage complaints before I/I construction and monitor after construction, for at least the warranty period, especially in Skyway.</p> <p>Planning - look at the existing drainage systems during design to see how the systems are configured and what connections or changes could be made if a groundwater problem did arise due to I/I rehab work. Also look for houses with basements or steep slopes where increases in groundwater levels increase risks.</p> <p>Transfer - let storm drainage agency know about I/I project and tell them to expect complaints and that they may need to deal with the drainage issues.</p> <p>Contingency - set aside money to make improvements to a storm drainage system on private property to fix the problem after it occurs. (Could involve french drains, piping, and creation of easements across a neighbors property.)</p> <p>Avoid work in areas of surface drainage elements which convey seeps/springs.</p>
5.0	Construction / General and Subsurface Site Conditions							
5.1	Rehabilitation product or implementation issues arise during construction; requiring a large change order to change product requirements or means and methods of project implementation.	L	M	LM			\$ -	Utilize well established construction products and methods for proposed project.
5.2	Drainage issues arise on multiple private properties resulting from I/I removal that require resolution as part of the project; increasing project costs.	M	L	ML				Update project construction cost estimates at regular intervals during design to reflect market conditions.
5.3	Slope stability issues arise on multiple private properties resulting from I/I removal that require resolution as part of the project; increasing project costs.	L	M	LM			\$ -	Identify properties with increased risk of surface drainage impacts and account for potential mitigation in construction cost estimates.
5.4	Soil erosion issues arise on multiple private properties resulting from I/I removal that require resolution as part of the project; increasing project costs.	L	M	LM			\$ -	Avoid work in areas that have a high probability of slope instability. Put II in storm sewer.

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5.5	Inability to control groundwater causes pipe installation to stop.	L	M	LM			\$ -	Avoid work in areas where the likelihood of these types of discoveries is high.
5.6	Construction dewatering during excavation activities may result in localized ground settlement, which could damage existing structures or facilities.	L	M	LM			\$ -	This is trenchless construction - groundwater is probably not much of an issue in the pits. (It was not a problem in the Skyway pilot basin.) Avoid work in areas where the likelihood of these types of discoveries is high.
5.7	Soil and groundwater conditions different than anticipated may reduce effectiveness of constructed dewatering system resulting in delays and additional costs.	L	M	LM			\$ -	Should be almost no dewatering because of minimal amount of excavation, mainly doing pipe bursting. Define project to avoid sensitive area. Avoid work in areas where the likelihood of these types of discoveries is high. Mitigation - can avoid work in areas with fish windows or can easily schedule around the windows. Construction scheduling has a lot of flexibility, including KC budget timing.
5.8	Construction is delayed or is limited to certain months due to fish and wildlife windows.	L	M	LM			\$ -	Should be almost no dewatering because of minimal amount of excavation, mainly doing pipe bursting. Avoid work in areas where the likelihood of these types of discoveries is high. Need Exploration to understand conditions
5.9	Improper construction leading to more drainage complaints after the completion of the project.	L	M	LM			\$ -	Avoid work in areas where the likelihood of these types of discoveries is high. I/I rehab work is unlikely to cause problems, mainly because pipe bursting requires so little excavation. Ensure specifications provide for adequate testing and verification to avoid poor construction.
5.10	Construction drawings don't accurately show sewers or side sewers and construction problems occur.	L	M	LM			\$ -	Mitigation - plan on these issues occurring and make contractor responsible for CCTV of all pipes before construction. Add bid item for extra pipe location work. Planning - work with homeowners during design to see if they can help locate sewers - they often know where the pipes are on their property.
5.11	Problems with utility conflicts	L	L	LL			\$ -	There is some potential for other utilities to be in the way of excavation for pipe bursting pits.
5.12	Claims from property owners	M	L	ML			\$ -	Likely and difficult to argue against. Easiest claims to deal with are obvious, such as the the damaged tree or blocked sewer.

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5.13	Bypass pumping problems	L	H	LH				Bypass pumping can be problematic for contractors depending on the amount of flow in the pipe. Mainly sewer main issue. Somewhat less of a problem for side sewers. Planning - make the bypass specifications clear on requirements and make clear how important bypassing operations are to the work.
5.14	I/I rehab construction finds many inflow sources that are problematic to fix	L	L	LL				
5.15	Coordination issues between cities/districts and King County.	L	M	LM				Develop relationship with city/district staff during design and get inspectors involved during design. Example is keeping in touch with Skyway's inspector during the pilot project.
5.16	Inspectors are unfamiliar with pipe bursting or other rehab methods	L	M	LM				Think about how to find or train inspectors in construction methods before construction starts.
6.0	Contracting Issues / Materials, Equipment and Labor							
6.1	High Bids	M	M	MM	15%	\$ 1,400,000	\$ 210,000	- Pick Bid Timing - Bid marketing/ advance notice to contractors - Prequalify Structure bid packages to allow for release of smaller packages to more contractors if necessary
7.0	Public Relations/Community Action							
7.1	Community rallies against perceived surface water risks.	L	L	LL			\$	- Keep on radar 1. Work closely with local jurisdiction regarding surface water issues during design phase. 2. Look at E&P discussions on this topic for issues to be considered. 3. Identify any known problem areas. 4. Avoid areas with known surface water problems. 5. Develop supplemental stormwater/drainage information materials.
7.2	Property owners don't understand the project or the relationship of the Local Agency and WTD.	H	L	HL			\$	- * Produce clear and comprehensive public information materials and provide to communities by mail, at open houses and via the project website. * Ensure local agencies reviews these materials. * Ensure County and local elected are briefed on project and receive materials in advance, in case they are the ones contacted by property owners. * Hold informal open houses with Q&A sessions co-sponsored by County and local agency (or at least with local agency representation) where community members can become informed and ask questions.

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7.3	Members of project team communicate incorrect or incomplete information to the public.	L	M	LM			\$ -	<ul style="list-style-type: none"> * Prepare all members of project team who will be interacting with public to provide accurate verbal and written information, at team meetings. Review communication protocols at regular intervals during team mtgs.. * Hold a briefing for contractors before they go into the field and at regular intervals throughout construction to review the communications protocol and highlight information they need to be looking at in the database and maps, including right of entry issues. Familiarize contractors with public information materials; provide copies for them to hand out to public.
7.4	Community members perceive that side sewer work is not equitably distributed.	H	L	HL			\$ -	<ul style="list-style-type: none"> * Project team is clear in materials, at information sessions and other communications that King County can legally only work on side sewers expected to be cost-effective at reducing downstream flow.
7.5	Mailings are sent to the wrong addresses, leading people to become unnecessarily distressed about potential work on their property or disappointed when they learn they are not candidates for side sewer rehabilitation.	M	L	ML			\$ -	<ul style="list-style-type: none"> - Visual confirmation of map of mailing addresses versus project area map. Confirm that GIS staff can generate maps from address lists. QC protocol for mailing lists established. 1.Ensure adequate staff resources are available for ROW acquisition and roles and responsibilities are clearly defined. 2. ROW and CR team members work together to create QA/QC protocol for mailings lists 3. Work with GIS to create map of mailing addresses prior to each mailing.
7.6	Project team member communicates with community member without regard to previously communicated special needs (e.g. language needs) or concerns. Community member does not build trust with project team/King County.	M	L	ML			\$ -	<ul style="list-style-type: none"> 1. Develop and beta test communications database to ensure it provides the tool we need. 2. Develop clear project communication protocols and review at regular intervals with project team and contractors. 3. Follow mitigation measures in 8.3 4. Identify person(s) responsible for entering and tracking public comments.
7.7	Community perceives that their concerns were not addressed during design/construction.	M	L	ML			\$ -	<ul style="list-style-type: none"> * Track comments properly, as described in 8.6. * Ensure project team takes public input into account in project design and execution. * In all informational materials, open houses, other communications with public, ensure County's decision making process is explicitly described. * Once decisions are made regarding what properties to work on, create public information pieces that describe these decisions and how public input was taken into account.
7.8	After warranty period for construction ends residents contact KC community relations and report surface water problems.	M	L	ML			\$ -	

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7.9	Property owners expect more mitigation/restoration than the County is willing to or legally able to provide.	H	L	HL			\$ -	* Document preexisting conditions clearly, including developing guidelines for preconstruction digital photos. Include these guidelines in contractor scopes of work. * Be clear in all communications what the County can and cannot do in the way of mitigation and restoration.
8.0	Safety and Security							
8.1	Damage to public or private property due to improper construction techniques and practices.	L	M	LM			\$ -	1. Contingency - should set aside some money to deal with major backups. Minor backups should be the responsibility of the contractor. 2. Ensure specifications provide for adequate testing and verification to avoid poor construction, and provide adequate inspection as work progresses to eliminate the establishment of practices leading to damage.
9.0	Policy Related External Risks							
9.1	Schedule is delayed for political or budgetary reasons.	M	M	MM			\$ -	
9.2	State auditor or AG rules against KC's use on available funds on private property.	M	H	MH			\$ -	
9.3	Local jurisdiction political leaders or management removes support for project.	L	H	LH			\$ -	
TOTAL RISK COSTS:							\$ 3,193,640	