SMWSA
SOUTH METRO WATER SUPPLY AUTHORITY

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September 11, 2014

State of Colorado
Derek R. Johnson
1580 Logan Street, Suite 600
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PROGRESS REPORT: Contract number C150535
WSRA Grant – Water Infrastructure Supply Efficiency – WISE Partnership

Dear Mr. Johnson,

The Connections and Turnout Preliminary Design portion for the overall WISE project commenced with our Notice to Proceed on October 23, 2013. To date, the following progress has been made on Tasks 1 and 2 per Exhibit A of the Grant Agreement:

Task 1 – This task identifies and assesses 3 location options for the turnout building or valve vault for each of the required facilities. The deliverables include a Technical Memorandum analyzing the 3 site options and gives a recommendation for the site location for each of the turnouts. Task I has been completed and the Technical Memorandum containing both analysis and recommendation is attached to this progress report.

Task 2 – Task 2 covers the analysis and production of plans, documents, and drawings necessary for 30% of the preliminary design of the turnouts. This work performed, as detailed in monthly progress reports from the consultant, includes but is not limited to the following: developing aerial mapping for all potential pipeline routes, developing flow control process diagrams to facilitate equipment layout and selection, performing hydraulic modeling and analysis, doing preliminary sizing of flow control valves, conducting survey work through Farnsworth, conducting supervisory control and data acquisition (SCADA) meetings, completing a desktop radio path study, control architecture drawings, and process and instrumentation drawings (P&IDs), conducting various meetings with participants and sub-consultants, discovering participant preferences, and submitting draft basis of design and construction memorandums to the WISE Authority. Task 2 is still in progress and Technical Memorandums containing the 30% design are anticipated in approximately one month.

Please contact me with any questions at 303-409-7747.

Sincerely,

Eric B. Hecox

Eric Hecox, Executive Director

Enclosures (1)

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MEMORANDUM - DRAFT

South Metro WISE Authority
SMW Connections Phase 1
Identify, Evaluate and Select Alternatives

B&V PN 182463
B&V File 50.0114
March 13, 2014

To: Eric Hecox, South Metro Water Supply Authority
Rick Marsicek, South Metro Water Supply Authority
South Metro WISE Participants

From: Klint Reedy, Dan Kugler, Bill Stoner and Chris Tadanier; Black & Veatch

Subject: SMW Connections Alternatives Evaluation

The purpose of this memorandum is to document the evaluation that was completed regarding the Western Pipeline connection location alternatives for the South Metro WISE participants. The following tasks were completed in the evaluation:

- Identify the location of existing tees on the Western Pipeline.
- Identify and evaluate options for Western Pipeline connection locations for each proposed connection.
- Identify and evaluate options for pipeline alignments between the Western Pipeline and the participants' point of connection (POC).
- Select preferred connection locations and pipeline alignments.

Background

The Water Infrastructure and Supply Efficiency (WISE) Partnership is a regional water supply project between Aurora Water, Denver Water and the South Metro WISE Authority (SMW). East Cherry Creek Valley Water District (ECCV) is selling certain pipelines (the Western Pipeline and portions of the State Land Board Line) to Denver Water and SMW. ECCV will retain a right to limited capacity in these pipelines.

To distribute WISE water to its participants, SMW will require several turnout facilities along the Western Pipeline (aka ECCV Pipeline). The design of these turnouts must consider the planned modifications to the Western Pipeline system and a wide range of expected operating conditions of the WISE system and the individual SMW participants. Each SMW participant will be responsible for accepting WISE water at its designated turnout and conveying the water to their distribution system. The WISE water will have a combined-chlorine disinfectant residual. Those participants using free-chlorine for disinfection will need to address the issue of disinfectant compatibility. This issue is further discussed in the breakpoint chlorination section for each participant.

The following connections are required to deliver WISE water to the individual SMW participants:

- Connection 1: Rangeview Metropolitan District Short-Term Connection to the State Land Board Line

  The Rangeview Metropolitan District Long-Term WISE Connection will be designed in the future as part of the Binney Pumping Station and pipeline package.

- Connection 2: Cottonwood Water and Sanitation District Connection to the Western Pipeline

- Connection 3: Southern Participants Connection to the Western Pipeline

  This connection is for all participants south of Rueter-Hess Reservoir (RHR), or those who may utilize storage in RHR, or those who may share in a joint breakpoint chlorination facility at the RHR Water Treatment Plant (WTP). The participants in this connection are: Parker, Stonegate, Cottonwood, Inverness, Pinery, Castle Rock, Dominion, and Douglas County.

- Connection 4: Meridian Metropolitan District Connection to the Western Pipeline

- Connection 5: Inverness Water and Sanitation District Connection to the Western Pipeline

- Connection 6: Centennial Water and Sanitation District Connection to the Western Pipeline

- Connection 7: Stonegate Village Metropolitan District Connection to the Western Pipeline

Several participants will require connections with Parker Water and Sanitation District (PWSD). These connections will require similar or identical layouts and controls. The following connections are not included in this evaluation, but will be evaluated by the applicable individual participants.

- PWSD Connection to Cottonwood

- PWSD Connection to Pinery

- PWSD Connection to Stonegate

- PWSD Connection to Castle Rock

- Castle Rock Connection to Dominion

Each connection will include, at a minimum, the following components. These components are shown in a connection process flow diagram (PFD) as included in Appendix A. Some connections will require additional infrastructure that is discussed later in this memorandum.

- Connection to existing SMW Pipeline (either the Western Pipeline or the State Land Board Line). The connection will include a tap/tee, isolation valve (buried, manual butterfly valve), and blind flange. These components are considered "Core" components. Core components will be designed, constructed, operated, and maintained by SMW.

- Flow control/meter structure. This structure will be a buried concrete vault (with the possible exception of Centennial) housing a flow control valve, flow meter, instrumentation and control equipment, and communication equipment. These components are considered "Local" components. Local components will be designed, constructed, and maintained by the applicable participants in each connection. SMW will operate the flow control/meter structure.

- Pipeline from the flow control/meter structure to the participants' POC. This pipeline is also included in the Local components. The participants will operate this pipeline.

The demarcation point between Core and Local components is not discussed any further in this memorandum. Although it is the participants' responsibility to design and construct their Local components, the participants have the opportunity to pass this responsibility to SMW. SMW intends to issue a single design/build package for the following components:

- Temporary Connection to Aurora Water's System

- SMW Connections to the Western Pipeline

- Smoky Hill Storage Tank

- Chloramine Disinfection and Iron and Manganese Removal Systems for Willows Wells

- Quebec Pump Station Bypass

- ECCV Well PA-3 Modifications

- Controls/SCADA system

Each participant will need to determine if they want their Local components included in the SMW design/build package. If included, SMW will be responsible for design and construction of the local components. The overarching purpose of this memorandum is to assist the participants with selecting their preferred configuration of Local components to allow them to determine if they or SMW will design and construct their Local components.

Each alternative locates participant flow control/meter structures as close as practicable to the Western Pipeline.

Breakpoint Chlorination

As previously discussed, the WISE water will have a combined-chlorine disinfectant residual (chloraminated water). The following participants use free-chlorine for disinfection and are considering continued use of free-chlorine after WISE deliveries begin.

- Rangeview (only from future Binney Pumping Station connection)
- Cottonwood
- Meridian
- Southern Participants (breakpoint chlorination designed by others)

Chloraminated drinking water contains residual chlorine predominantly in the form of monochloramine (NH_2Cl), typically with a trace amount of unreacted free ammonia (~0.1 mg/L NH_3 as N). In situations where chloraminated drinking water is blended with drinking water containing free residual chlorine, either directly in distribution system piping or in a storage reservoir, any residual free ammonia from the chloraminated supply rapidly reacts with free-chlorine forming additional monochloramine. Monochloramine then reacts with remaining free-chlorine through a complex set of simultaneous chemical reactions that form dichloramine ($NHCl_2$), trichloramine (NCl_3), and several other oxidized nitrogen-containing products including molecular nitrogen (N_2), nitrate (NO_3^-), nitrous oxide (N_2O), and nitric oxide (NO). Collectively, these reactions are known as the breakpoint chlorination process.

The products formed by breakpoint chlorination of chloraminated drinking water depend in a complicated way on a variety of water quality and treatment related conditions including source water, pH, temperature, initial chlorine and ammonia concentrations, chlorine to ammonia ratio (mg Cl_2/mg NH_3-N), and reaction time. If these factors are carefully controlled during breakpoint chlorination N_2 is the principle product, which is unreactive with free-chlorine residual and does not pose a public health hazard or have undesirable aesthetic properties in drinking water. However, if breakpoint chlorination is allowed to occur in an uncontrolled manner, significant amounts of NCl_3 may be formed, which imparts an objectionable chlorinous taste and odor to drinking water. Because NCl_3 is highly volatile it also produces irritation to the eyes and mucous membranes of the respiratory system, particularly in settings where large volumes of water are exposed to the atmosphere such as indoor swimming pools or during showering.

Stringent process monitoring and control are required to maintain appropriate reaction conditions during breakpoint chlorination. Thorough mixing of free-chlorine with the chloraminated process stream is also required to prevent localized high Cl_2:NH_3-N conditions from occurring, which would lead to NCl_3 formation. Blending unchlorinated groundwater with chloraminated drinking water prior to breakpoint chlorination further complicates process control due to the unsatisfied chlorine demand of the groundwater. For the purposes of the evaluations described here, it is assumed that chloraminated drinking water would be chemically dechlorinated to release ammonia bound in

monochloramine (using sodium bisulfite with approximately 2 minutes of contact time), then sodium hypochlorite would be added to remove free-ammonia by breakpoint chlorination (requiring approximately 30 minutes of contact time). Sodium hypochlorite would then be added to provide a free-chlorine residual.

Due to the difficulties of breakpoint chlorination and its associated cost, it is recommended that those participants that plan to continue to use free-chlorine consider converting their systems to a combined-chlorine residual. Some participants have a single chlorine injection point for disinfection. It is a fairly simple, straightforward process and a relatively small cost to add ammonia after chlorine contact time has been provided. Once ammonia is added, the conversion process from free-chlorine to combined-chlorine is relatively rapid (1 minute is conservative).

Existing Tee's on the Western Pipeline

There are several existing tees on the Western Pipeline at locations that could potentially be used for the purposes of this project. The Western Pipeline drawings were reviewed and the locations of the existing tees were identified. The location of these tees is shown on Figure 1. The tee diameter and station (using Western Pipeline stationing) is also identified on Figure 1.

Each outlet includes an isolation valve (buried, manual butterfly valve) and a blind flange. The drawings do not indicate on which side of the Western Pipeline the outlet is located. No additional details of the existing outlets were found in the drawings.

If an existing tee is planned to be used, its location should be field verified as the actual location may vary from the location shown on the drawings.

High Level Hydraulics

Water delivery to each participant is based on their pro-rata share of the water available from Aurora Water. The hydraulic evaluations in this memorandum are based solely on each participant taking their pro-rata share. There will be some scenarios where additional water is available (from other participants not taking their pro-rata share or from Douglas County's share), but this has not been accounted for in this hydraulic analysis.

Prior to the next step in design, each participant should review their pro-rata share and associated connection/pipe sizes and determine what, if any, additional future pipe capacity over their pro-rata share is desired. The hydraulics and pipe sizing (and costs) will need to be updated for those participants that desire additional capacity. If any participant chooses to increase its pro-rata share, then hydraulics would need to be re-evaluated at the higher total flow rate and all pro-rata shares and costs would need to be updated.

The pro-rata share and peak flows for the participants' in each connection are shown in Table 1. The peak flows are based on a peaking factor of 3.36. Connection 3 totals are calculated with and without Cottonwood and Inverness. The remainder of the discussion on hydraulics in this memorandum for Connection 3 includes Cottonwood and Inverness.

Stonegate is included only in Connection 3 in Table 1. Stonegate is considering a second connection that would be directly from the Western Pipeline (Connection No. 7). Stonegate is also considering increasing its annual demand from 500 AF to 1,000 AF.

Table 1. Pro-Rata Share and Peak Flows

PARTICIPANT	ANNUAL DEMAND, AF	PEAK FLOW, MGD	CURRENT PRO-RATA SHARE	FUTURE PRO-RATA SHARE *
Connection 1 – Rangeview	500	1.50	6.9%	5.0%
Connection 2 – Cottonwood	400	1.20	5.5%	4.0%
Connection 3 - Current	5,425 (with Cottonwood and Inverness) 4,525 (without Cottonwood and Inverness)	16.27 (with Cottonwood and Inverness) 13.57 (without Cottonwood and Inverness)	75.1% (with Cottonwood and Inverness) 62.6% (without Cottonwood and Inverness)	NA
Parker	1,200	3.60	16.6%	12.0%
Stonegate	500	1.50	6.9%	5.0%
Cottonwood	400	1.20	5.5%	4.0%
Inverness	500	1.50	6.9%	5.0%
Pinery	500	1.50	6.9%	5.0%
Castle Rock	1,000	3.00	13.8%	10.0%
Dominion	1,325	3.97	18.3%	13.3%
Connection 3 - Future	8,200 (with Cottonwood and Inverness) 7,300 (without Cottonwood and Inverness)	24.60 (with Cottonwood and Inverness) 21.90 (without Cottonwood and Inverness)	NA	82.0% (with Cottonwood and Inverness) 73.0% (without Cottonwood and Inverness)
Douglas County	2,775	8.32	0.0%	27.8%
Connection 4 – Meridian	300	0.90	4.2%	3.0%

PARTICIPANT	ANNUAL DEMAND, AF	PEAK FLOW, MGD	CURRENT PRO-RATA SHARE	FUTURE PRO-RATA SHARE *
Connection 5 – Inverness	500	1.50	6.9%	5.0%
Connection 6 – Centennial	1,000	3.00	13.8%	10.0%

* Future Pro-Rata Share includes the Douglas County allocation.

The minimum, average, and maximum flows and selected pipe sizes for each connection are listed in Table 2. Diameters for both the pipeline and flowmeter are listed. The pipe was sized to limit the maximum velocity to 5 ft/sec. The flowmeter was sized to keep the velocity between 1 ft/sec and 18 ft/sec.

Table 2. Flow Rates and Selected Pipe Sizes

CONNECTION	FLOW CONDITION	FLOW RATE, MGD *	DIAMETER, INCHES	VELOCITY, FT/S
Connection 1 – Rangeview (or Stonegate Connection at 500 AF)	Min (Pipe)	0.14	10	0.39
	Min (Flowmeter)	0.14	6	1.09
	Avg (Pipe)	1.04	10	2.94
	Avg (Flowmeter)	1.04	6	8.18
	Peak (Pipe)	1.50	10	4.25
	Peak (Flowmeter)	1.50	6	11.82
Connection 2 – Cottonwood	Min (Pipe)	0.11	10	0.31
	Min (Flowmeter)	0.11	6	0.87
	Avg (Pipe)	0.83	10	2.36
	Avg (Flowmeter)	0.83	6	6.54
	Peak (Pipe)	1.20	10	3.40
	Peak (Flowmeter)	1.20	6	9.45
Connection 3 - Future	Min (Pipe)	1.64	42	0.26

CONNECTION	FLOW CONDITION	FLOW RATE, MGD *	DIAMETER, INCHES	VELOCITY, FT/S
	Min (Flowmeter)	1.64	TBD By Others	TBD By Others
	Avg (Pipe)	12.30	42	1.98
	Avg (Flowmeter)	12.30	TBD By Others	TBD By Others
	Peak (Pipe)	24.60	42	3.96
	Peak (Flowmeter)	24.60	TBD By Others	TBD By Others
Connection 4 – Meridian	Min (Pipe)	0.08	10	0.24
	Min (Flowmeter)	0.08	6	0.65
	Avg (Pipe)	0.62	10	1.77
	Avg (Flowmeter)	0.62	6	4.91
	Peak (Pipe)	0.90	10	2.55
	Peak (Flowmeter)	0.90	6	7.09
Connection 5 – Inverness	Min (Pipe)	0.14	10	0.39
	Min (Flowmeter)	0.14	6	1.09
	Avg (Pipe)	1.04	10	2.94
	Avg (Flowmeter)	1.04	6	8.18
	Peak (Pipe)	1.50	10	4.25
	Peak (Flowmeter)	1.50	6	11.82
Connection 6 – Centennial (or Stonegate Connection at 1000 AF)	Min (Pipe)	0.28	16	0.31
	Min (Flowmeter)	0.28	12	0.55
	Avg (Pipe)	2.08	16	2.30
	Avg (Flowmeter)	2.08	12	4.09

CONNECTION	FLOW CONDITION	FLOW RATE, MGD *	DIAMETER, INCHES	VELOCITY, FT/S
	Peak (Pipe)	3.00	16	3.32
	Peak (Flowmeter)	3.00	12	5.91

* Minimum flow rate based on 2 mgd from Aurora Water. Average flow rate based on 15 mgd from Aurora Water. Maximum flow rate based on 21.67 mgd from Aurora Water, except for Connection 3, which is based on 30 mgd flow rate from Aurora Water.

Centennial's and Meridian's pipe and flowmeter sizes were increased to the next size for hydraulic purposes to minimize headloss through their connection.

A ground profile of each alternative pipeline was created using Google Earth and is included in Appendix B. There were no locations where the ground profile was higher than the hydraulic gradient, thus no tunneling of high points due to hydraulics is required.

Alternatives Evaluation – Rangeview

B&V discussed Rangeview's short-term connection to the State Land Board Line via email with Scott Lehman of Pure Cycle Corp. Their long-term WISE connection will be designed in the future as part of the Binney Pumping Station and pipeline package.

Rangeview requested that its connection be from the State Land Board Pipeline near the intersection of Smoky Hill Parkway and Powhaton Road. Rangeview's turnout would be located immediately downstream of Aurora Water's connection to the State Land Board Pipeline. Rangeview's water would be delivered east in the State Land Board Pipeline, while all other participants would take their water west through the State Land Board Pipeline. To allow Rangeview to use the State Land Board Pipeline, a line valve on the State Land Board Pipeline must be closed and Rangeview's flow control/meter vault would bypass around this normally closed line valve. A line valve on the State Land Board Pipeline exists approximately 250 feet east of the intersection of Smoky Hill Parkway and Powhaton Road. Figure 2 and Figure 3 illustrate the alternatives for Rangeview's connection at this line valve. The only difference between the alternatives is whether the connection is located on the north or south side of the State Land Board Pipeline.

The area on the south side of the State Land Board Pipeline has a detention pond, sidewalk, and trees. The area on the north side is not developed. It is recommended that the connection be located on the north side where the property is not yet developed. The flow control/meter vault should be located north of the future travel lane for Smoky Hill Parkway. Locating the Rangeview connection vault on the north side may also have advantages for SCADA/control in combination with Aurora Water's vault.

Rangeview plans to use the WISE water from the short-term connection for non-potable industrial/commercial and irrigation customers so they will not need to address the combined-chlorine (versus) free-chlorine residual issue. For future deliveries from the Binney Pumping Station, Rangeview plans to use a tank for breakpoint chlorination for only the WISE water that is subsequently delivered to their potable domestic water system.

The hydraulic grade line (HGL) in the State Land Board Pipeline east of the intersection of Smoky Hill Parkway and Powhaton Road as it operates today is between approximately 6,050 ft (commercial/industrial customers) and approximately 6,140 ft (Blackstone CC). Rangeview requested a minimum WISE delivery HGL of 6,140 ft in the State Land Board Pipeline. Initial evaluations indicate this delivery HGL can be met, even with a minimum water level in Aurora Water's Blackstone Tank (Zone 7).

The configuration/pipe sizing of the flow control/meter vault from Aurora Water to the State Land Board Pipeline will need to consider maintaining a minimum HGL of 6,140 ft downstream of the Rangeview connection.

Alternatives Evaluation – Cottonwood

B&V attended a meeting with Pat Mulhern of Mulhern MRE, Inc. to discuss Cottonwood's connection.

Cottonwood currently uses free-chlorine for a disinfectant residual. Cottonwood has five groundwater wells and shares capacity with another utility in a water treatment plant (WTP). Free-chlorine is added at each well and at the WTP. At this point, it is Cottonwood stated it would continue using free-chlorine. Six alternatives for delivery of WISE water to Cottonwood that consider breakpoint chlorination have been developed. These alternatives are illustrated in Figures 4 through 9.

Cottonwood requested that its WISE water be delivered near the Stone Canyon Apartment complex near Cottonwood Drive and Highway E-470. Cottonwood has an existing well and storage tank on the east/southeast side of the apartment complex. A 30-inch diameter pipeline conveys water from Cottonwood's tank through the apartment complex, crosses the Western Pipeline near an existing tee, and crosses Highway E-470 on the way to a pump station on the west side of Highway E-470.

All six alternatives would use breakpoint chlorination to deliver WISE water with a free-chlorine residual to either the 30-inch pipeline or the tank southeast of the apartment complex. Breakpoint chlorination contact time would be achieved in the alternatives using either a pipe or a tank. Based on discussions with Mulhern MRE, a new building would be needed to house the breakpoint chlorination chemicals and equipment (including chemical metering pumps and monitoring equipment) as the existing building next to the well does not have any excess storage available. This new building is referred to as the breakpoint chlorination building.

The overflow elevation of the tank southeast of the apartment complex is approximately 5,923 ft. Initial evaluations indicate this delivery HGL can be met. If breakpoint chlorination is used, the breakpoint chlorination tank would be located at grade above the Cottonwood tank. This would allow water to flow from the breakpoint chlorination tank to the Cottonwood tank without pumping.

If Cottonwood were to convert its system to a combined-chlorine disinfectant residual, only the flow control/meter vault in Alternative 6 would be required.

Cottonwood Alternative 1 – Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at Western Pipeline Connection

Cottonwood Alternative 1 is illustrated in Figure 4. The flow control/meter vault would be located at the connection to the Western Pipeline. The breakpoint chlorination building would be located adjacent to the flow control/meter vault. The pipeline diameter from the breakpoint chlorination building to near the existing well would be upsized to 16-inches to allow at least 30 minutes of contact time. Additional hypochlorite to obtain the free-chlorine residual would be added near the well (using existing hypochlorite building and equipment at the well). Analyzers and static mixers would be located at each chemical injection point. An analyzer may also be required at the discharge to the existing tank.

Photo 1. Alignment Behind Apartment Complex

Cottonwood Alternative 2 – Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at Existing Well

Cottonwood Alternative 2 is illustrated in Figure 5. Alternative 2 is similar to Alternative 1, except the breakpoint chlorination building would be located next to the existing well. Breakpoint chlorination contact time would be achieved through a 500 foot "pipe loop" of 36-inch diameter pipe. Additionally, the pipe diameter from the Western Pipeline to the breakpoint chlorination building would be 10 inches.

Photo 2. Existing Hypochlorite Storage Building

Cottonwood Alternative 3 – Alignment South of Apartments / Breakpoint Chlorination (In Pipe) at Existing Well

Cottonwood Alternative 3 is illustrated in Figure 6. Alternative 3 is similar to Alternative 2, except the Western Pipeline tee and flow control/meter vault would be located on the south side of the apartment complex.

Photo 3. Alignment South of Apartment Complex

Cottonwood Alternative 4 – Alignment South of Apartments / Breakpoint Chlorination (In Tank) at Existing Tank

Cottonwood Alternative 4 is illustrated in Figure 7. Alternative 4 is similar to Alternative 3, except that breakpoint chlorination contact time would be achieved in a tank rather than in a pipe. The breakpoint chlorination tank and building would be located adjacent to Cottonwood's existing storage tank southeast of the apartment complex. Potential freezing issues in the tank would need to be addressed during periods with zero flow.

Cottonwood Alternative 5 – Alignment Through Apartments / Breakpoint Chlorination (In Tank) at Existing Tank

Cottonwood Alternative 5 is illustrated in Figure 8. Alternative 5 is similar to Alternative 4, except the existing Western Pipeline tee would be used. The flow control/meter vault would be located at the existing Western Pipeline tee. The pipeline from the flow control/meter vault to the breakpoint chlorination tank and building would parallel and be located in the same easement as the existing 30-inch diameter pipeline through the apartment complex.

Photo 4. Cottonwood Tank at Top of Hill

Cottonwood Alternative 6 – Breakpoint Chlorination (In Pipe) at Existing Western Pipeline Tee

Cottonwood Alternative 6 is illustrated in Figure 9. Under Alternative 6, the existing Western Pipeline tee would be used. Breakpoint chlorination would be achieved through a 500 foot "pipe loop" of 36-inch diameter pipe located parallel to the existing 30-inch pipeline. The breakpoint chlorination building would be located between the 30-inch pipeline and the adjacent parking lot. The flow control/meter vault would be located at the existing Western Pipeline tee.

Cottonwood Alternative 7 – Existing Western Pipeline Tee to Potable Water Distribution System (Existing System Converted to Chloramines)

The basis for Alternative 7 is Cottonwood converting its system to a combined-chlorine disinfectant residual. Therefore, only the flow control/meter vault would be required. The flow control/meter vault would be located in the same location as Alternative 6.

Photo 5. Existing Western Pipeline Tee

Alternatives Evaluation – Southern Participants

B&V attended a meeting with the Southern Participants to discuss their connection. The pipeline for the Southern Participants will extend from the Western Pipeline to the Rueter-Hess Reservoir WTP. From there, WISE water will either be delivered to Rueter-Hess Reservoir or to Parker's distribution system for conveyance to each participant. WISE water will undergo breakpoint chlorination before entering Parker's distribution system.

The pipeline from the Western Pipeline to the Rueter-Hess Reservoir WTP is being designed and constructed by others. It will not be included in the SMW design/build package. The only component of the Southern Participants' Pipeline that will be included in the SMW design/build package is the Western Pipeline tee (54-inch x 42-inch), isolation valve (42-inch), and blind flange.

Two alignments are being considered for the Southern Participants' Pipeline: 1) the Chambers Road alignment, and the 2) Grandview Estates alignment. The Southern Participants have selected the Grandview Estates alignment. Therefore, the Western Pipeline tee for the Grandview Estates alignment will be located approximately 2,750 feet east of Peoria Street on the north side of Highway E-470. The Southern Participants connection is illustrated in Figure 10.

Alternatives Evaluation – Meridian

B&V attended a meeting with Randy Gabriel of Shea Properties to discuss Meridian's connection. Meridian's water system includes the following:

- Twelve groundwater wells that discharge to either a 3 MG storage tank or a surface irrigation reservoir. The groundwater in the well pipelines is not disinfected.
- A 3 MG water storage tank where free-chlorine is added prior to the tank for disinfection.
- All water from the 3 MG storage tank is pumped at a booster pump station into the potable water distribution system. The pump station discharge is the single point of entry into the water distribution system.

- The wastewater treatment plant pumps all its effluent to the surface irrigation reservoir (same reservoir that the wells can discharge to).
- A separate non-potable irrigation distribution system uses the surface irrigation reservoir as its source of supply.

Meridian has several options for using its WISE water. The options evaluated herein are:

- Deliver WISE water to the groundwater well collection pipelines. Because the groundwater is not disinfected, either an air gap or a reduced pressure zone (RPZ) assembly will be required between WISE water and the groundwater supply. Once the WISE water is in the groundwater collection pipelines, it can be delivered to either the 3 MG storage tank or the surface irrigation reservoir. Meridian prefers the WISE water be delivered to the 3 MG tank so its beneficial use can be maximized.
    - However, prior to delivering the combined WISE water and un-disinfected groundwater to the 3 MG tank (and prior to Meridian's free-chlorine injection point), the ammonia must be removed through the breakpoint chlorination process. If the ammonia is not removed prior to Meridian's free-chlorine injection point, some ammonia may remain and cause taste and odor issues.
- Deliver WISE water in a new pipeline directly to the 3 MG storage tank. Breakpoint chlorination is required to remove the ammonia prior to Meridian's free-chlorine injection point at the 3 MG tank.
- Breakpoint chlorinate WISE water and deliver it directly to the potable water system.
- If Meridian converts to chloramines, deliver WISE water directly to the potable water system. WISE water could also be delivered to the groundwater well collection pipelines without breakpoint chlorination (only if Meridian converts to chloramines).

Each of these options could be considered at two sites: 1) I-25 Site (southeast corner of the intersection of Interstate I-25 and Highway E-470), and 2) Liberty Blvd Site (where Liberty Blvd is closest to Highway E-470 on the southeast side of the Centennial Airport runway).

The Liberty Blvd Site is located close to the Centennial Airport. Meridian indicated that any height limitations for construction equipment can most likely be coordinated with the airport manager.

Meridian Alternative 1 – RPZ/Flow Control Vault to Well Supply Pipeline

Meridian Alternative 1 is illustrated in Figure 11. Under Alternative 1, WISE water would be delivered directly to the groundwater well pipelines. Because the groundwater is not disinfected, cross-connection protection is required. If approved by the Colorado Department of Health and Environment (CDPHE), an RPZ would be used for cross-connection protection. CDPHE has initially indicated the RPZ would be acceptable to use under the following conditions: 1) RPZ must be installed above grade, 2) RPZ must be NSF 61 compliant, and 3) RPZ must be testable. One primary disadvantage of an RPZ is the high headloss through the assembly (approximately 13 psi or 30 feet). Depending on the diameter of the existing well collection pipeline and the groundwater flow rate in the well collection pipeline, there may be too much headloss to meet the 3 MG tank maximum HGL of 6,000 ft. If the headloss is too high, a booster pump could be added to the flow control/meter vault (adding approximately 7 feet of length to the vault). Adding the booster pump is Alternative 1A. A booster pump may also be needed if the pressure in the groundwater collection pipeline is higher than the pressure after the RPZ.

Photo 6. Looking North Across E-470 at Liberty Blvd Connection Site

Breakpoint chlorination to remove ammonia could occur downstream of the RPZ or near the 3 MG tank. For the purposes of this memorandum, breakpoint chlorination is assumed to occur downstream of the RPZ prior to mixing with the well water. Similar to some of Cottonwood's alternatives, breakpoint chlorination would occur in a short "pipe loop" of larger diameter pipe.

Alternatives 1 and 1A could be located at either the I-25 Site or Liberty Blvd Site. Approximately 300 feet of additional pipe is required at the I-25 Site. Electrical power appears to be available at both sites (based on review of Meridian's electrical system distribution map).

Meridian Alternative 2 – Flow Control Vault to Tank and Pump to Well Supply Pipeline

Meridian Alternative 2 is illustrated in Figure 12. Alternative 2 is the same as Alternative 1, except the RPZ is replaced with a tank. The tank would be used for both breakpoint chlorination and to provide a cross-connection air gap between the WISE water and groundwater. A booster pump would be required to pump the water from the tank into the groundwater collection pipeline.

Similar to Alternative 1, Alternative 2 could be located at either the I-25 Site or Liberty Blvd Site.

Meridian Alternative 3 – Flow Control Vault to New Pipeline to 3 MG Tank

Meridian Alternative 3 is illustrated in Figure 13. Alternative 3 would use a new, dedicated pipeline to deliver WISE water directly to the 3 MG storage tank. This alternative was considered only at the Liberty Blvd Site as this site requires the shortest pipe length. Similar to Alternative 1, a "pipe loop" for breakpoint chlorination would be required prior to Meridian's free-chlorine injection point at the 3 MG tank.

Photo 7. Looking North at Alternative 3 Alignment on East Side of Golf Course

Meridian Alternative 4 – Breakpoint Chlorinate and Pump to Potable Water Distribution System

Meridian Alternative 4 is illustrated in Figure 14. Under this alternative, breakpoint chlorination would be used to deliver WISE water directly to the potable water system with a free-chlorine residual disinfectant. Breakpoint chlorination contact time would be achieved in a tank. A new breakpoint chlorination building would be required.

Photo 8. Looking East from I-25 Connection Site

The normal system gradient created by the Meridian Booster Pump Station is approximately 6,139 ft. This gradient is higher than the gradient in the Western Pipeline and the breakpoint chlorination tank. Therefore, a pump would be required to deliver the WISE water to the potable water main.

Meridian Alternative 5 – Pump to Potable Water Distribution System (Existing System Converted to Chloramines)

Meridian Alternative 5 is similar to Alternative 4, except that no breakpoint chlorination is required. The basis for Alternative 5 is Meridian converting its system to a combined-chlorine disinfectant residual. Therefore, only the flow control/meter vault, booster pump, and pipeline to the potable water system would be required.

WISE water could also be delivered to the groundwater well collection pipelines without breakpoint chlorination (only if Meridian converts to chloramines). This would require adding a RPZ to Alternative 5. The cost would be similar to Alternative 5.

Alternatives Evaluation – Inverness

B&V attended a meeting with Pat Mulhern of Mulhern MRE, Inc. to discuss Inverness's connection.

Inverness currently uses free-chlorine for a disinfectant residual. However, Inverness plans to convert its system to a combined-chlorine disinfectant residual. Therefore, direct delivery of WISE water to its distribution system is the basis for the alternatives evaluated herein.

Inverness requested that its WISE water be delivered to their existing 12-inch diameter water line located in Inverness Drive South. The connection to the Western Pipeline will be near the intersection of Highway E-470 and South Jamaica Street. Three alternatives have been identified to deliver WISE water from the Western Pipeline to Inverness's system.

The Inverness system has a single pressure zone with an HGL of approximately 5,972 ft. Initial evaluations indicate this delivery HGL can be met.

Inverness Alternative 1 – East Alignment

Inverness Alternative 1 is illustrated in Figure 15. The Western Pipeline connection and flow control/meter vault would be located on the east side of Cottonwood Creek. The pipeline would then go north along the east side of Cottonwood Creek, east on Liberty Blvd, and north on Inverness Lane South.

The pipeline would parallel Meridian's existing sanitary sewer on the east side of Cottonwood Creek. It is assumed Inverness's pipeline could be located in the same easement as Meridian's sanitary sewer. Inverness's pipeline would also be located in Meridian's easement on the south side of Liberty Blvd.

It is assumed the pipeline would be located within Inverness Lane South.

Photo 9. East Alignment on Left Side of Creek and Central Alignment on Top of Slope

Photo 10. Looking South at Central Alignment From Inverness Drive South

Inverness Alternative 2 – Central Alignment

Inverness Alternative 2 is illustrated in Figure 16. The Western Pipeline connection and flow control/meter vault would be located on the west side of Cottonwood Creek. The pipeline would then go north along the west side of Cottonwood

Creek to Inverness Drive South.

The Western Pipeline connection and flow control/meter vault may need to be located in South Jamaica Steet due to potential utility conflicts and limited space available between the street and the creek. Once the pipeline is north of Liberty Blvd, it would be located under the existing sidewalk that parallels the creek.

Photo 12. Looking North at Central Alignment from Liberty Blvd

Photo 11. Looking North at Central Alignment from Western Pipeline

Inverness Alternative 3 – West Alignment

Inverness Alternative 3 is illustrated in Figure 17. Alternative 3 is similar to Alternative 2, except that the pipeline would continue along South Jamaica Street and then north along Inverness Parkway to Inverness Drive South.

Photo 13. Looking South at West Alignment from Inverness Drive South

Photo 14. Looking East at West Alignment from Intersection of Inverness Parkway and South Jamaica Street

Alternatives Evaluation – Centennial

B&V attended a meeting with staff from Centennial to discuss their connection. Centennial currently uses a combined-chlorine disinfectant residual so they can take direct delivery of WISE water to its distribution system.

Centennial requested that its WISE water be delivered to its existing 16-inch diameter pipeline located on the west side of the Quebec Pumping Station (between the creek and Wal-Mart). Centennial's connection to the Western Pipeline must be downstream of the Quebec Pumping Station (and the associated Quebec Pumping Station master flow meter located downstream of the pumping station).

Figure 18 illustrates one potential configuration for Centennial's connection and pipeline. This configuration would need to be coordinated with ECCV (as the pumping station and property owner), the Denver Water pumping station bypass, and the configuration of the Chloramine Disinfection and Iron and Manganese Removal System at either the pumping station or the parcel to the north.

Centennial requested an HGL of approximately 6,055 ft. Initial evaluations indicate this delivery HGL can be met under most conditions. However, at peak flow with ECCV doing ASR, the desired delivery gradient will likely not be met. Therefore, the flow control/meter structure should include provisions to add a booster pump. Centennial may desire for all the components of the flow control/meter structure and booster pump be located in an above ground structure. This would need to be further coordinated with ECCV.

Alternatives Evaluation – Stonegate

B&V attended a meeting with staff from Stonegate to discuss their connection. Stonegate currently uses free-chlorine for a disinfectant residual. However, Stonegate plans to convert its system to a combined-chlorine disinfectant residual. Therefore, direct delivery of WISE water to its distribution system is the basis for the alternatives evaluated herein.

Stonegate's water system includes the following:

- Groundwater wells with flow conveyed to a single location where all the water passes through pressurized greensand filters. Each well pump provides enough head to push the water through the pressurized filters and to a 2.5 MG storage tank.
- Free-chlorine is added prior to the 2.5 MG storage tank and would also need to be added prior to the pressure filters. To convert to a combined-chlorine residual, ammonia would need to be added in the pipe directly downstream of the 2.5 MG tank. One to two minutes of contact time after the ammonia addition is required before the WISE water is added to this pipe.

- All water from the 2.5 MG storage tank flows by gravity to a booster pump station and then enters the potable water distribution system.
- The 2.5 MG tank and booster pump station are located near the intersection of Jordan Road and Lincoln Avenue.
- A 3.6 MG storage tank located near the intersection of Chambers Road and Newlin Gulch Blvd. This is the tank where Stonegate would receive delivery of its WISE water through the Parker distribution system. Ammonia would also need to be added at this location to convert the water from Parker to a combined-chlorine residual.

Stonegate requested that its WISE water be delivered upstream of its existing booster pump station. This delivery location will require further analysis considering the location for chloramination (ammonia injection).

Four alternatives for delivery of WISE water to Stonegate have been developed. These alternatives are illustrated in Figures 19 through 22. Alternatives 1 through 3 would use an existing tee on the Western Pipeline, but all would require a trenchless crossing of Highway E-470. Alternative 4 does not use an existing tee, but would not cross Highway E-470. Under all alternatives the flow control/meter vault would be located near the connection to the Western Pipeline.

Advantages / Disadvantages

Table 3 lists the advantages and disadvantages of each alternative for the various participants.

Table 3. Comparison of Alternatives / Advantages and Disadvantages

ALTERNATIVE	ADVANTAGES	DISADVANTAGES
Rangeview Alternative 1 – South Side of State Land Board Line	• Shorter pipe length	• Conflicts with detention pond, sidewalk, and trees
Rangeview Alternative 2 – North Side of State Land Board Line	• Site is not currently developed • Potential SCADA synergy with Aurora Water connection vault	• Additional pipe length needed to locate vault north of the future travel lane for Smoky Hill Parkway

ALTERNATIVE	ADVANTAGES	DISADVANTAGES
Cottonwood Alternative 1 – Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at Western Pipeline Connection	• Pipeline alignment is undeveloped	• Breakpoint chlorination building located at a new site potentially resulting in permitting challenges • Delivery access to breakpoint chlorination building is difficult; a long access road may be required (cost is not included for access road) • Unknown source of electrical power to connection vault and breakpoint chlorination building
Cottonwood Alternative 2 – Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at Existing Well	• Pipeline alignment is undeveloped • Breakpoint chlorination building located adjacent to existing hypochlorite building should minimize permitting challenges • Established delivery access to breakpoint chlorination building • Potential to use same electrical power source as for existing well and hypochlorite building • Flow control vault could be located near the well and breakpoint chlorination building	• Unknown source of electrical power to connection vault if vault is located next to Western Pipeline

ALTERNATIVE	ADVANTAGES	DISADVANTAGES
Cottonwood Alternative 3 – Alignment South of Apartments / Breakpoint Chlorination (In Pipe) at Existing Well	• Shorter pipe alignment • Breakpoint chlorination building located adjacent to existing hypochlorite building should minimize permitting challenges • Established delivery access to breakpoint chlorination building • Potential to use same electrical power source as for existing well and hypochlorite building • Flow control vault could be located near the well and breakpoint chlorination building	• Pipe alignment is through heavily treed landscape area next to apartment complex
Cottonwood Alternative 4 – Alignment South of Apartments / Breakpoint Chlorination (In Tank) at Existing Tank	• Shorter pipe alignment • Breakpoint chlorination building located within 600 feet of existing hypochlorite building should minimize permitting challenges • Established delivery access to existing hypochlorite building • Potential to use same electrical power source as for existing well and hypochlorite building • Flow control vault could be located near the breakpoint chlorination tank	• Pipe alignment is through heavily treed landscape area next to apartment complex • Need to extend hypochlorite delivery access approximately 600 feet to new building • Breakpoint chlorination tank is above grade at the top of the hill – visual impact may need to be mitigated • Potential freezing issues with breakpoint chlorination tank

ALTERNATIVE	ADVANTAGES	DISADVANTAGES
Cottonwood Alternative 5 – Alignment Through Apartments / Breakpoint Chlorination (In Tank) at Existing Tank	• Existing Western Pipeline Tee is used • Shorter pipe alignment • Breakpoint chlorination building located within 600 feet of existing hypochlorite building should minimize permitting challenges • Established delivery access to existing hypochlorite building • Potential to use same electrical power source as for existing well and hypochlorite building • Flow control vault could be located near the breakpoint chlorination tank	• Difficult/space constrained construction through apartment complex • Need to extend hypochlorite delivery access approximately 600 feet to new building • Breakpoint chlorination tank is above grade at the top of the hill – visual impact may need to be mitigated • Potential freezing issues with breakpoint chlorination tank
Cottonwood Alternative 6 – Breakpoint Chlorination (In Pipe) at Existing Western Pipeline Tee	• Existing Western Pipeline Tee is used • Shortest pipe alignment • Facilities located in undeveloped area • Breakpoint chlorination building located adjacent to a parking lot resulting in good access • All components located in close proximity to each other	• Breakpoint chlorination building located at a new site potentially resulting in permitting challenges • Breakpoint chlorination building located adjacent to existing hotel
Cottonwood Alternative 7 – Existing Western Pipeline Tee to Potable Water Distribution System (Existing System Converted to Chloramines)	• Breakpoint chlorination is not required • Minimizes pipeline length • Existing Western Pipeline tee can be used	• Cottonwood must convert entire system to a combined-chlorine disinfectant residual (requires ammonia addition at each well and at WTP) • A new source of supply is added to distribution system
Southern Participants	• NA	• NA

ALTERNATIVE	ADVANTAGES	DISADVANTAGES
Meridian Alternative 1 – RPZ/Flow Control Vault to Well Supply Pipeline	• Meridian maximizes use of WISE water by delivering to the potable water side • WISE water can also be diverted to the surface irrigation reservoir	• Cross-connection protection is required • RPZ has significant headloss and may require booster pumping • Breakpoint chlorination is required •
Meridian Alternative 2 – Flow Control Vault to Tank and Pump to Well Supply Pipeline	• Meridian maximizes use of WISE water by delivering to the potable water side • WISE water can also be diverted to the surface irrigation reservoir • Tank can also be used for breakpoint chlorination	• Cross-connection protection is required • Vault length is longer to accommodate booster pump • Tank requires booster pumping • Breakpoint chlorination is required •
Meridian Alternative 3 – Flow Control Vault to New Pipeline to 3 MG Tank	• No cross-connection protection is required • Meridian maximizes use of WISE water by delivering to the potable water side • No booster pumping is required	• WISE water cannot be diverted directly to the surface irrigation reservoir (unless additional pipeline is constructed or an RPZ is added) • Alternative requires the longest length of new pipeline • Tunnel under Highway E-470 is required from the Liberty Blvd Site • Breakpoint chlorination is required

ALTERNATIVE	ADVANTAGES	DISADVANTAGES
Meridian Alternative 4 – Breakpoint Chlorinate and Pump to Potable Water Distribution System	• No cross-connection protection is required • Meridian maximizes use of WISE water by delivering to the potable water side •	• WISE water cannot be diverted directly to the surface irrigation reservoir • Booster pumping is required • A second point of entry for a new source of supply is added to distribution system • Breakpoint chlorination is required
Meridian Alternative 5 – Pump to Potable Water Distribution System (Existing System Converted to Chloramines)	• No cross-connection protection is required • Meridian maximizes use of WISE water by delivering to the potable water side • Breakpoint chlorination is not required	• WISE water cannot be diverted directly to the surface irrigation reservoir • Booster pumping is required • Meridian must convert entire system to a combined-chlorine disinfectant residual (although this is straightforward as ammonia needs to be added to the pipe between the 3 MG tank and booster PS) • A second point of entry for a new source of supply is added to distribution system
Inverness Alternative 1 – East Alignment	• Potential to be located in Meridian's existing sanitary sewer easement on east side of Cottonwood Creek • Potential to be located in Meridian's existing utility easement on the south side of Liberty Blvd	• Potential utility conflicts at Liberty Blvd crossing and POC • East side of Cottonwood Creek is lower in elevation than the west side resulting in potential for groundwater impacts to construction and maintenance

ALTERNATIVE	ADVANTAGES	DISADVANTAGES
Inverness Alternative 2 – Central Alignment	• Potential groundwater issues are minimized • Shortest pipeline length	• Potential utility conflicts at Western Pipeline connection, along South Jamaica Street, Liberty Blvd crossing, and POC • Unknown development plans for parcel between Liberty Blvd and Cottonwood Creek could impact pipeline in the future • New easement may be required across parcel between Liberty Blvd and Cottonwood Creek
Inverness Alternative 3 – West Alignment	• Potential groundwater issues are minimized • Potential to locate pipe within existing easements	• Potential utility conflicts at Western Pipeline connection, along South Jamaica Street, along Inverness Parkway, and POC • Unknown development plans for parcel between Liberty Blvd and Inverness Parkway could impact pipeline in the future • Longest pipeline length
Centennial Connection	• No new easements required • Storm drainage conflicts with proposed Goodwill are avoided • Avoids utility conflicts and large diameter storm pipe in Business Center Drive	• Obtain approval from ECCV to place pipeline and structure on their property • Requires crossing of drainage/creek • Must coordinate with Denver Water pumping station bypass and the configuration of the Chloramine Disinfection and Iron and Manganese Removal System at either the pumping station or the parcel to the north
Stonegate Alternative 1 - West 470 Bore, Along Jordan	• None noted	• Requires a trenchless crossing of Highway E-470

ALTERNATIVE	ADVANTAGES	DISADVANTAGES
Stonegate Alternative 2 - West 470 Bore, Along Keystone Blvd	• Jordan Road is avoided minimizing traffic/public impacts	• Requires a trenchless crossing of Highway E-470
Stonegate Alternative 3 - East 470 Bore, Along Jordan	• None noted	• Requires a trenchless crossing of Highway E-470
Stonegate Alternative 4 - No Bore, Along Jordan	• No crossing of Highway E-470	• None noted

Costs

Preliminary costs for the alternatives for each of the participants are presented in Table 4. The total project cost includes the capital cost, engineering design and construction costs, and land/easement costs. Detailed opinions of probable cost are included in Appendix C. The costs include the following allowances: general requirements (10%), construction contingency (30%), and design and construction phase services (19%).

Table 4. Preliminary Cost Opinions for the Alternatives

ALTERNATIVE	CONNECTION	PIPELINE	TOTAL PROJECT COST
Rangeview Alternative 1 – South Side of State Land Board Line	Similar to Alternative 2	Similar to Alternative 2	Similar to Alternative 2
Rangeview Alternative 2 – North Side of State Land Board Line	$310,000	Included in Connection	$310,000
Cottonwood Alternative 1 – Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at Western Pipeline Connection	$277,000	$1,592,000	$1,869,000
Cottonwood Alternative 2 – Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at Existing Well	$277,000	$1,609,000	$1,886,000
Cottonwood Alternative 3 – Alignment South of Apartments / Breakpoint Chlorination (In Pipe) at Existing Well	$277,000	$1,498,000	$1,775,000

ALTERNATIVE	CONNECTION	PIPELINE	TOTAL PROJECT COST
Cottonwood Alternative 4 – Alignment South of Apartments / Breakpoint Chlorination (In Tank) at Existing Tank	$277,000	$1,240,000	$1,517,000
Cottonwood Alternative 5 – Alignment Through Apartments / Breakpoint Chlorination (In Tank) at Existing Tank	$277,000	$1,310,000	$1,587,000
Cottonwood Alternative 6 – Breakpoint Chlorination (In Pipe) at Existing Western Pipeline Tee	$277,000	$1,053,000	$1,330,000
Cottonwood Alternative 7 – Existing Western Pipeline Tee to Potable Water Distribution System (Existing System Converted to Chloramines)	$277,000	Included in Connection	$277,000
Southern Participants	$68,000	$0	$68,000
Meridian Alternative 1 – RPZ/Flow Control Vault to Well Supply Pipeline	$1,389,000	Included in Connection	$1,389,000
Meridian Alternative 1A – Alternative 1 Plus Booster Pump	$1,546,000	Included in Connection	$1,546,000
Meridian Alternative 2 – Flow Control Vault to Tank and Pump to Well Supply Pipeline	$1,478,000	Included in Connection	$1,478,000
Meridian Alternative 3 – Flow Control Vault to New Pipeline to 3 MG Tank	$2,079,000	Included in Connection	$2,079,000
Meridian Alternative 4 – Breakpoint Chlorinate and Pump to Potable Water Distribution System	$1,542,000	Included in Connection	$1,542,000
Meridian Alternative 5 – Pump to Potable Water Distribution System (Existing System Converted to Chloramines)	$565,000	Included in Connection	$565,000
Inverness Alternative 1 – East Alignment	$268,000	$351,000	$619,000
Inverness Alternative 2 – Central Alignment	$268,000	$316,000	$584,000

ALTERNATIVE	CONNECTION	PIPELINE	TOTAL PROJECT COST
Inverness Alternative 3 – West Alignment	$268,000	$400,000	$668,000
Centennial Connection	$618,000	Included in Connection	$618,000
* Stonegate Alternative 1 - West 470 Bore, Along Jordan	$293,000	$1,911,000	$2,204,000
* Stonegate Alternative 2 - West 470 Bore, Along Keystone Blvd	$293,000	$1,839,000	$2,132,000
* Stonegate Alternative 3 - East 470 Bore, Along Jordan	$293,000	$1,740,000	$2,033,000
* Stonegate Alternative 4 - No Bore, Along Jordan	$293,000	$1,648,000	$1,941,000

* Stonegate's costs are based on 1,000 AF subscription rate and use a 16-inch diameter pipe. A 500 AF subscription rate would use a 10-inch diameter pipe and total cost for Alternative 4 would be $1,323,000.

Selected Alternatives

The selected alternatives that will be carried forward are provided in Table 5. Primary reasons for selecting these alternatives are as follows:

Rangeview Alternative 2 – North Side of State Land Board Line

Alternative 2 was selected because: 1) No development has occurred at this site, 2) Vault can be located north of the future lane for Smoky Hill Road, and 3) Cost for additional pipe length is approximately equal to the landscaping restoration cost for Alternative 1.

Cottonwood Alternative 6 – Breakpoint Chlorination (In Pipe) at Existing Western Pipeline Tee

Alternative 6 was selected because: 1) It is assumed that Cottonwood will continue to use free-chlorine in the near-term, 2) The existing Western Pipeline tee can be used, 3) Impacts to the apartment complex and the open space around the apartment complex are eliminated, 4) All components are located in close proximity to each other reducing the construction impact, 5) It was the lowest cost option, and 6) Access for delivery of hypochlorite is available via the adjacent parking lot; however, separate access from Cottonwood Drive may be required.

If Cottonwood converts to chloramines, the cost of Alternative 6 could be reduced by $1,053,000.

Southern Participants

This location was selected by the southern participants. No additional evaluation was completed.

Meridian Alternative 2 – Flow Control Vault to Tank and Pump to Well Supply Pipeline

Alternative 2 was selected because: 1) It maximizes use of WISE water by delivering it to the potable water side, 2) Allows WISE water to be diverted to the surface irrigation reservoir, 3) Uses the tank for both an air gap and for breakpoint chlorination, 4) It does not add a new point of entry to Meridian's potable water system, and 5) It maximizes existing infrastructure.

If Meridian converts to chloramines, the cost of Alternative 2 could be reduced by $913,000.

Inverness Alternative 2 – Central Alignment

Alternative 2 was selected primarily because it was the lowest cost. However, Alternative 1 (east alignment) has many advantages and could also be considered.

Centennial Connection

The configuration evaluated appears to be the most viable across the pumping station site, but will need to be confirmed and approved by ECCV.

Stonegate Alternative 4 - No Bore, Along Jordan Road

Alternative 4 was selected because it does not cross Highway E-470 and it is the lowest cost. Approximately 375 feet of pipeline length could be saved by following the alignment for Alternative 3 between the Western Pipeline connection and Aventerra Pkwy.

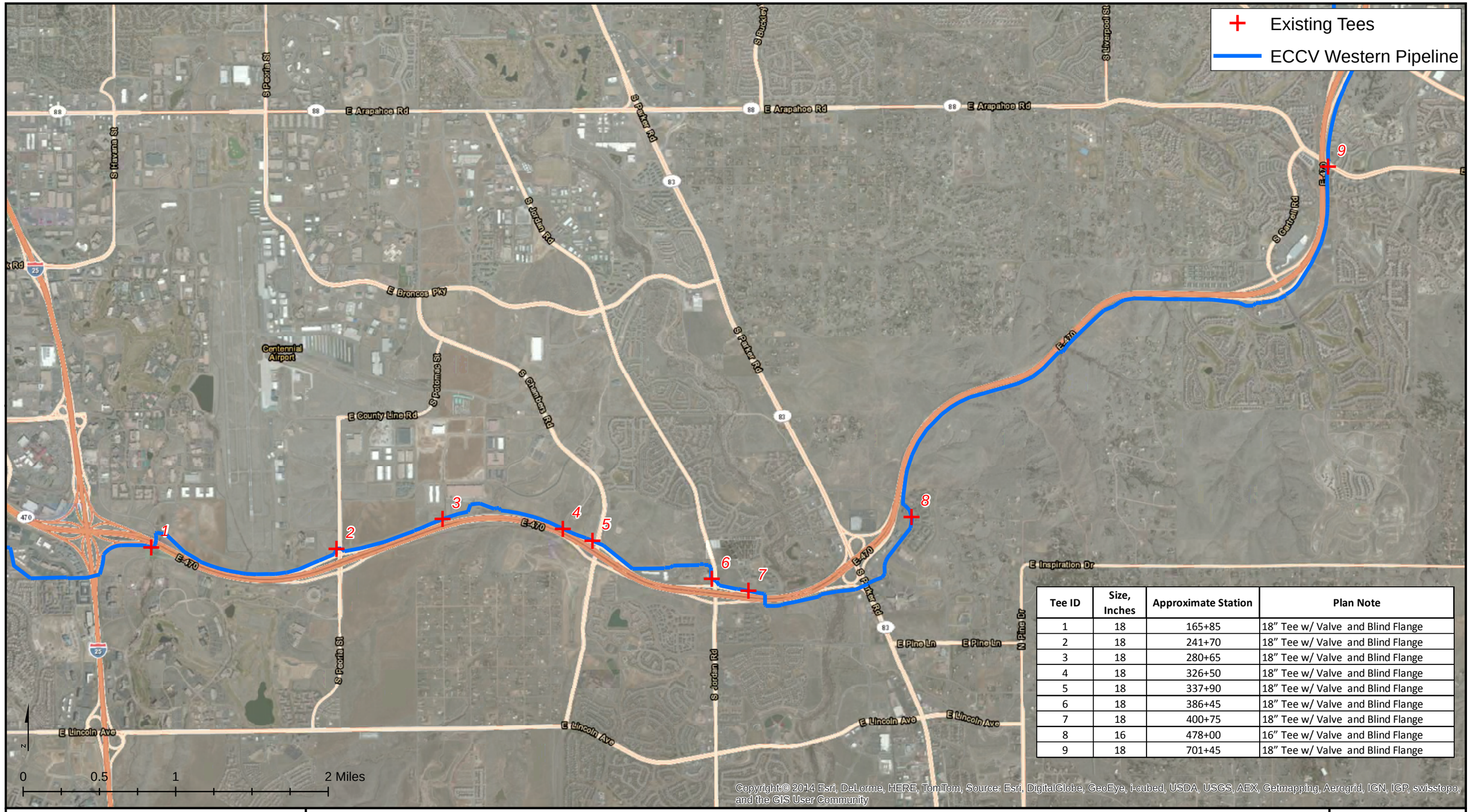
Table 5. Selected Alternatives (Cottonwood and Meridian Remain Free-Chlorine)

ALTERNATIVE	CONNECTION	PIPELINE	TOTAL PROJECT COST
Rangeview Alternative 2 – North Side of State Land Board Line	$310,000	Included in Connection	$310,000
Cottonwood Alternative 6 – Breakpoint Chlorination (In Pipe) at Existing Western Pipeline Tee	$277,000	$1,053,000	$1,330,000
Southern Participants	$68,000	$0	$68,000
Meridian Alternative 2 – Flow Control Vault to Tank and Pump to Well Supply Pipeline	$1,478,000	Included in Connection	$1,478,000

ALTERNATIVE	CONNECTION	PIPELINE	TOTAL PROJECT COST
Inverness Alternative 2 – Central Alignment	$268,000	$316,000	$584,000
Centennial Connection	$618,000	Included in Connection	$618,000
Stonegate Alternative 4 - No Bore, Along Jordan	$293,000	$1,648,000	$1,941,000
Totals	$3,312,000	$3,017,000	$6,329,000

Table 6. Selected Alternatives (Cottonwood and Meridian Convert to Chloramines)

ALTERNATIVE	CONNECTION	PIPELINE	TOTAL PROJECT COST
Rangeview Alternative 2 – North Side of State Land Board Line	$310,000	Included in Connection	$310,000
Cottonwood Alternative 6 – Breakpoint Chlorination (In Pipe) at Existing Western Pipeline Tee	$277,000	Included in Connection	$277,000
Southern Participants	$68,000	$0	$68,000
Meridian Alternative 2 – Flow Control Vault to Tank and Pump to Well Supply Pipeline	$565,000	Included in Connection	$565,000
Inverness Alternative 2 – Central Alignment	$268,000	$316,000	$584,000
Centennial Connection	$618,000	Included in Connection	$618,000
Stonegate Alternative 4 - No Bore, Along Jordan	$293,000	$1,648,000	$1,941,000
Totals	$2,399,000	$1,964,000	$4,363,000



Tee ID	Size, Inches	Approximate Station	Plan Note
1	18	165+85	18” Tee w/ Valve and Blind Flange
2	18	241+70	18” Tee w/ Valve and Blind Flange
3	18	280+65	18” Tee w/ Valve and Blind Flange
4	18	326+50	18” Tee w/ Valve and Blind Flange
5	18	337+90	18” Tee w/ Valve and Blind Flange
6	18	386+45	18” Tee w/ Valve and Blind Flange
7	18	400+75	18” Tee w/ Valve and Blind Flange
8	16	478+00	16” Tee w/ Valve and Blind Flange
9	18	701+45	18” Tee w/ Valve and Blind Flange

WISE Authority

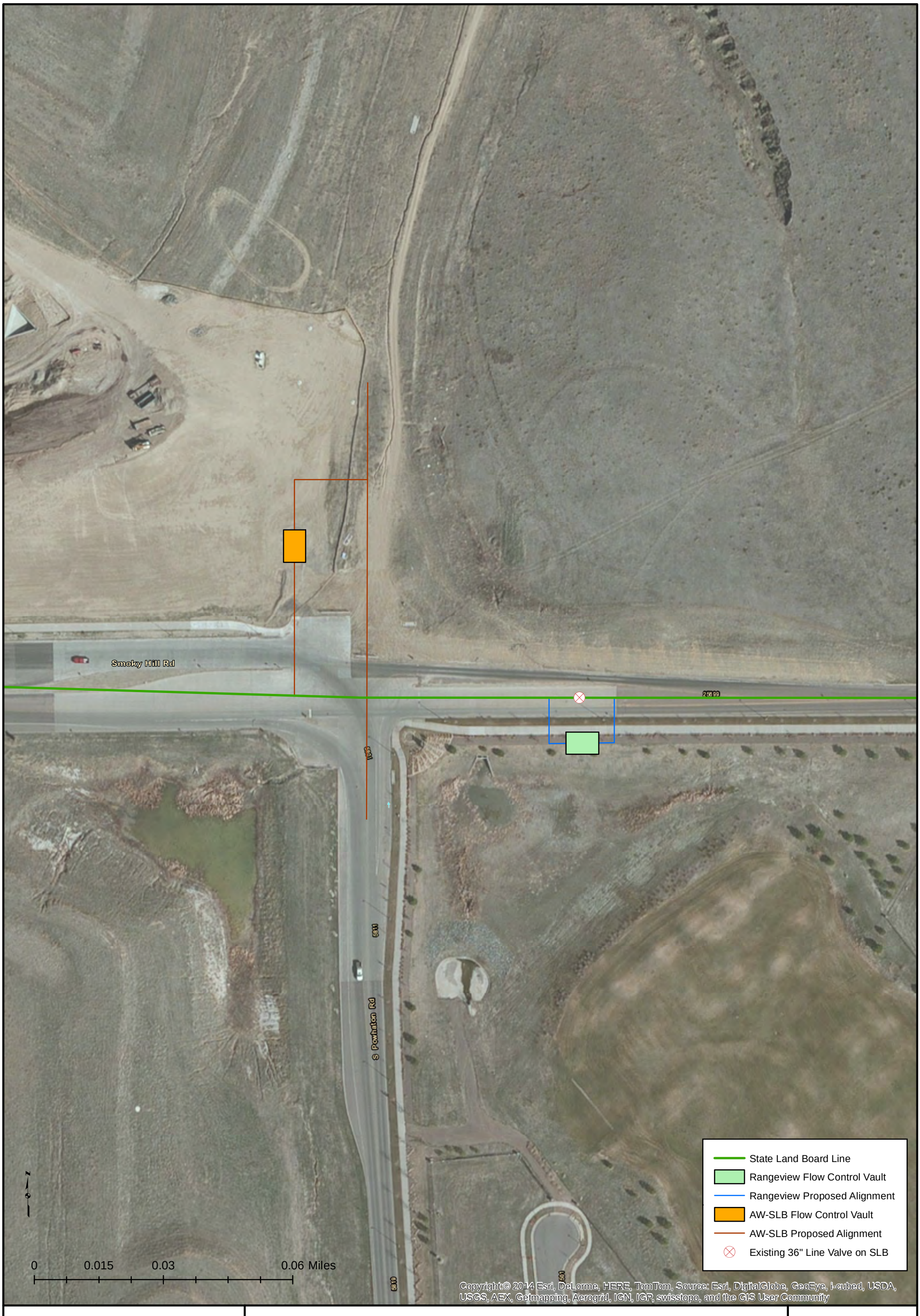
BLACK & VEATCH

SMW Connections to the Western Pipeline

Western Pipeline Existing Tees

Figure 1

v2.26.14



WISE Authority

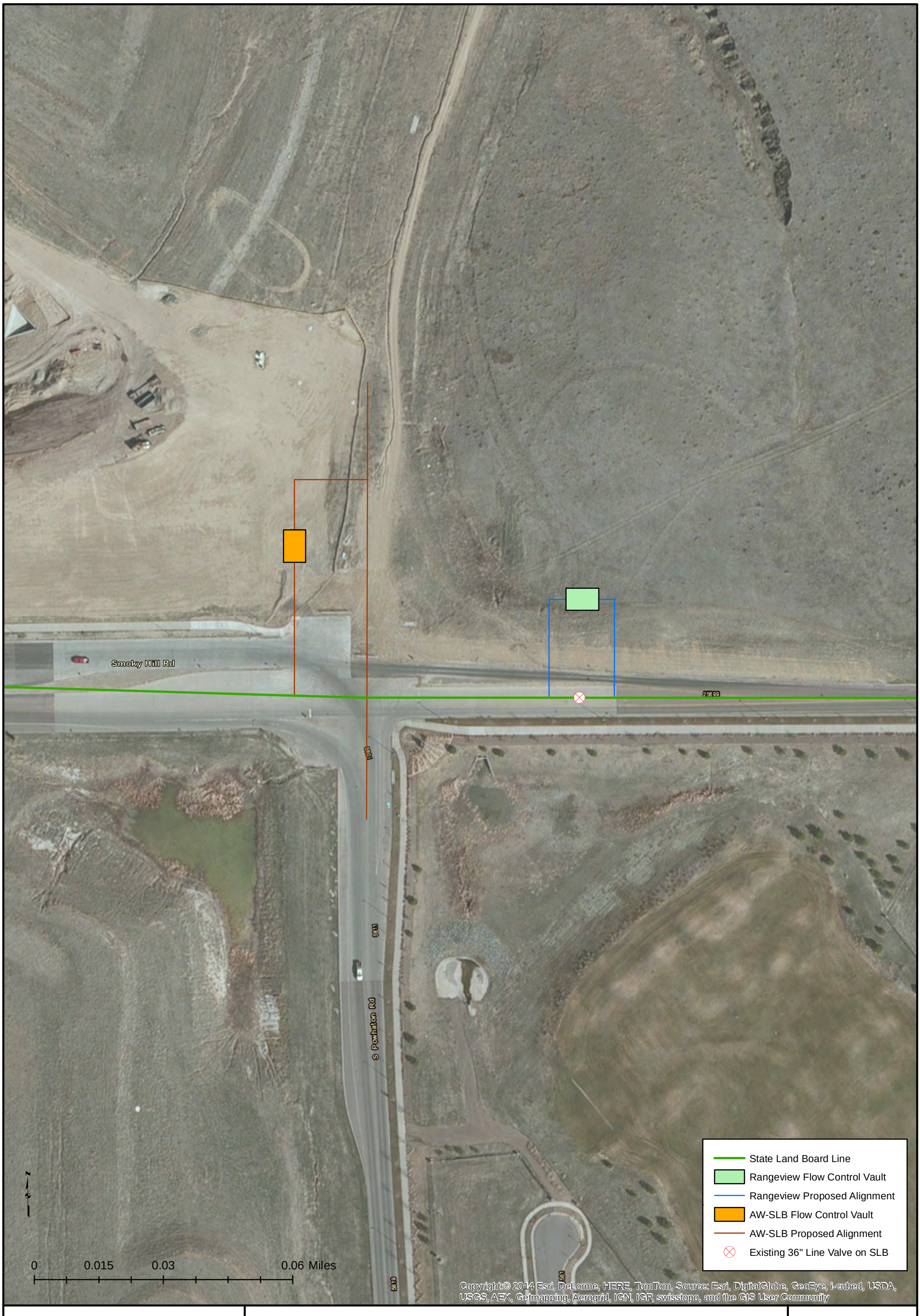
BLACK & VEATCH

SMW Connections to the Western Pipeline

Rangeview Connection Alternative #1

Figure 2

v2.26.14



WISE Authority

BLACK & VEATCH

SMW Connections to the Western Pipeline

Rangeview Connection Alternative #2

Figure 3

v2.26.14

CWSD Existing Pipes
CWSD Easements
ECCV Western Line
ECCV Existing Tees
Sodium Hypochlorite Storage
Flow Control Vault
A Chlorine Analyzer
M Static Mixer

Alternative 1 Alignment
Diameter (in.)
12
16
Undetermined

A
M

Breakpoint chlorination contact time achieved in 16" pipe

A
M
Chlorine Trim Injection Pipe

E-470
Cottonwood Dr
E Lookout Dr
N Dixon Dr
19000
19012
19131
19161
19180
19190
19220
19240
19100
19105
19083
19061
19029
19230
19200
19310
13139

0 0.03 0.06 0.12 Miles

WISE Authority BLACK & VEATCH	**SMW Connections to the Western Pipeline** **Cottonwood Connection Alternative #1**	**Figure 4**

v3.5.14

CWSD Existing Pipes
CWSD Easements
ECCV Western Line
ECCV Existing Tees
Sodium Hypochlorite Storage
Flow Control Vault
A Chlorine Analyzer
M Static Mixer

Alternative 2 Alignment
Diameter (in.)
10
12
36
Undetermined

Vault could alternately be located next to Sodium Hypochlorite Storage Building

Breakpoint chlorination contact time achieved in 36" pipe

0 0.03 0.06 0.12 Miles

WISE Authority BLACK & VEATCH	**SMW Connections to the Western Pipeline**	**Figure 5**
	Cottonwood Connection Alternative #2	

v2.21.14

CWSD Existing Pipes
CWSD Easements
ECCV Western Line
ECCV Existing Tees
Sodium Hypochlorite Storage
Flow Control Vault
A Chlorine Analyzer
M Static Mixer

Alternative 3 Alignment
Diameter (in.)
10
12
36
Undetermined

E-470
Cottonwood Dr
E Lookout Dr
N Dixon Dr
19000
19072
19083
19061
19105
19129
19131
19161
19180
19190
19220
19240
19200
19230
13199

A
M
A
M
36
12
10

Breakpoint chlorination contact time achieved in 36" pipe

0 0.03 0.06 0.12 Miles

WISE Authority

BLACK & VEATCH

SMW Connections to the Western Pipeline

Cottonwood Connection Alternative #3

Figure 6

v3.5.14

CWSD Existing Pipes
CWSD Easements
ECCV Western Line
ECCV Existing Tees
Sodium Hypochlorite Storage
Flow Control Vault
Breakpoint Chlorination Tank
A Chlorine Analyzer

Alternative 4 Alignment
Diameter (in.)
10
Undetermined

E-470
Cottonwood Dr
E Lookout Dr
N Dixon Dr
19000
19072
19131
19161
19180
19190
19200
19220
19230
19240
19061
19083
19105
19129
13199
A
A
10
N
0 0.03 0.06 0.12 Miles

WISE Authority

BLACK & VEATCH

SMW Connections to the Western Pipeline

Cottonwood Connection Alternative #4

Figure 7

v3.5.14

CWSD Existing Pipes
CWSD Easements
ECCV Western Line
ECCV Existing Tees
Sodium Hypochlorite Storage
Flow Control Vault
Breakpoint Chlorination Tank
A Chlorine Analyzer
Alternative 5 Alignment

E-470
Cottonwood Dr
E Lookout Dr
N Dixon Dr
19000
19061
19083
19105
19129
19131
19161
19072
19180
19190
19220
19240
19200
19230
13199
30
A
A
0 0.03 0.06 0.12 Miles

WISE Authority

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SMW Connections to the Western Pipeline

Cottonwood Connection Alternative #5

Figure 8

v3.5.14

WISE Authority	**SMW Connections to the Western Pipeline**	**Figure 9**
BLACK & VEATCH	**Cottonwood Connection Alternative #6**	

v3.5.14

WISE Authority

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SMW Connections to the Western Pipeline

Southern Participants Connection

Figure 10

v3.3.14

Flow Control Vault / RPZ Assembly
Existing Well Line
Alternative 1 Alignments
ECCV Existing Tees
ECCV Western Line

I-25 Connection Site

Liberty Blvd Connection Site

Exist 3 MG Tank

Rtd-County Line Stn And Park-N-Ride
Inverness Pky
S Valley Hwy Rd
Inverness Dr S
Inverness Ln S
Liberty Blvd
470
CO-470
E-470
25
195
1A
S Jamaica St
E-470
Liberty Blvd
E-470
2
E Lansing Cir
194
E Belford Ave
Rtd-Lincoln Stn And Park-N-Ride
S Meridian Blvd
Macon Ct
San Luis St
S Jamaica St
Station St
S Meridian Blvd
Mt Wilson
Bierstadt Way
S Kingston Ct
Maroon Cir
El Diente Ct
193
San Luis St
25
Mt Pyramid Ct
S Meridian Blvd
E Oswego St
E Oswego St
S Havana St
Jefferson Pky
E Lincoln Ave
E Lincoln Ave
Lioness Pl
Lioness Way

0 0.1 0.2 0.4 Miles

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SMW Connections to the Western Pipeline

Meridian Connection Alternative #1

Figure 11

v2.27.14

Flow Control Vault / Tank / Booster Pump
Existing Well Line
Alternative 2 Alignments
ECCV Existing Tees
ECCV Western Line

I-25 Connection Site

Liberty Blvd Connection Site

Exist 3 MG Tank

0 0.1 0.2 0.4 Miles

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SMW Connections to the Western Pipeline

Meridian Connection Alternative #2

Figure 12

v3.3.14

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SMW Connections to the Western Pipeline

Meridian Connection Alternative #3

Figure 13

v2.27.14

Exist Meridian Distribution Main
Sodium Hypochlorite Storage
Flow Control Vault
Breakpoint Chlorination Tank
Alternative 4 Alignments
ECCV Existing Tees
ECCV Western Line

I-25 Connection Site

Liberty Blvd Connection Site

Exist 3 MG Tank

0 0.1 0.2 0.4 Miles

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SMW Connections to the Western Pipeline

Meridian Connection Alternative #4

Figure 14

v3.3.14

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SMW Connections to the Western Pipeline

Inverness Connection Alternative #1

Figure 15

v3.3.14

WISE Authority

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SMW Connections to the Western Pipeline

Inverness Connection Alternative #2

Figure 16

v3.3.14

WISE Authority

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SMW Connections to the Western Pipeline

Inverness Connection Alternative #2

Figure 17

v3.3.14

WISE Authority

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SMW Connections to the Western Pipeline

Centennial Connection Alternative #1

Figure 18

v3.3.14

WISE Authority

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SMW Connections to the Western Pipeline

Stonegate Connection Alternative #1

Figure 19

WISE Authority

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SMW Connections to the Western Pipeline

Stonegate Connection Alternative #2

Figure 20

WISE Authority

BLACK & VEATCH

SMW Connections to the Western Pipeline

Stonegate Connection Alternative #3

Figure 21

WISE Authority

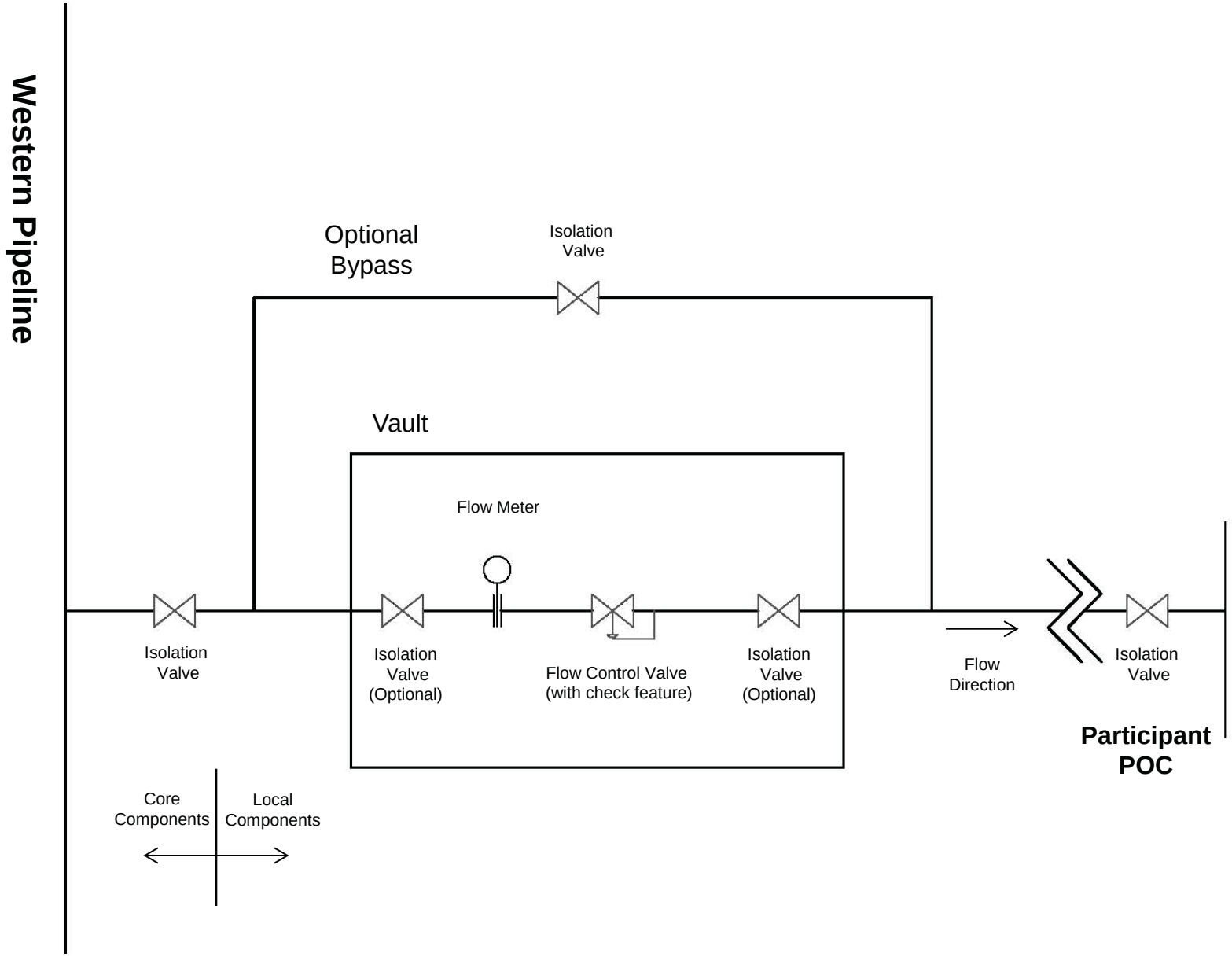
BLACK & VEATCH

SMW Connections to the Western Pipeline

Stonegate Connection Alternative #4

Figure 22

Appendix A
Process Flow Diagram



v2.26.14

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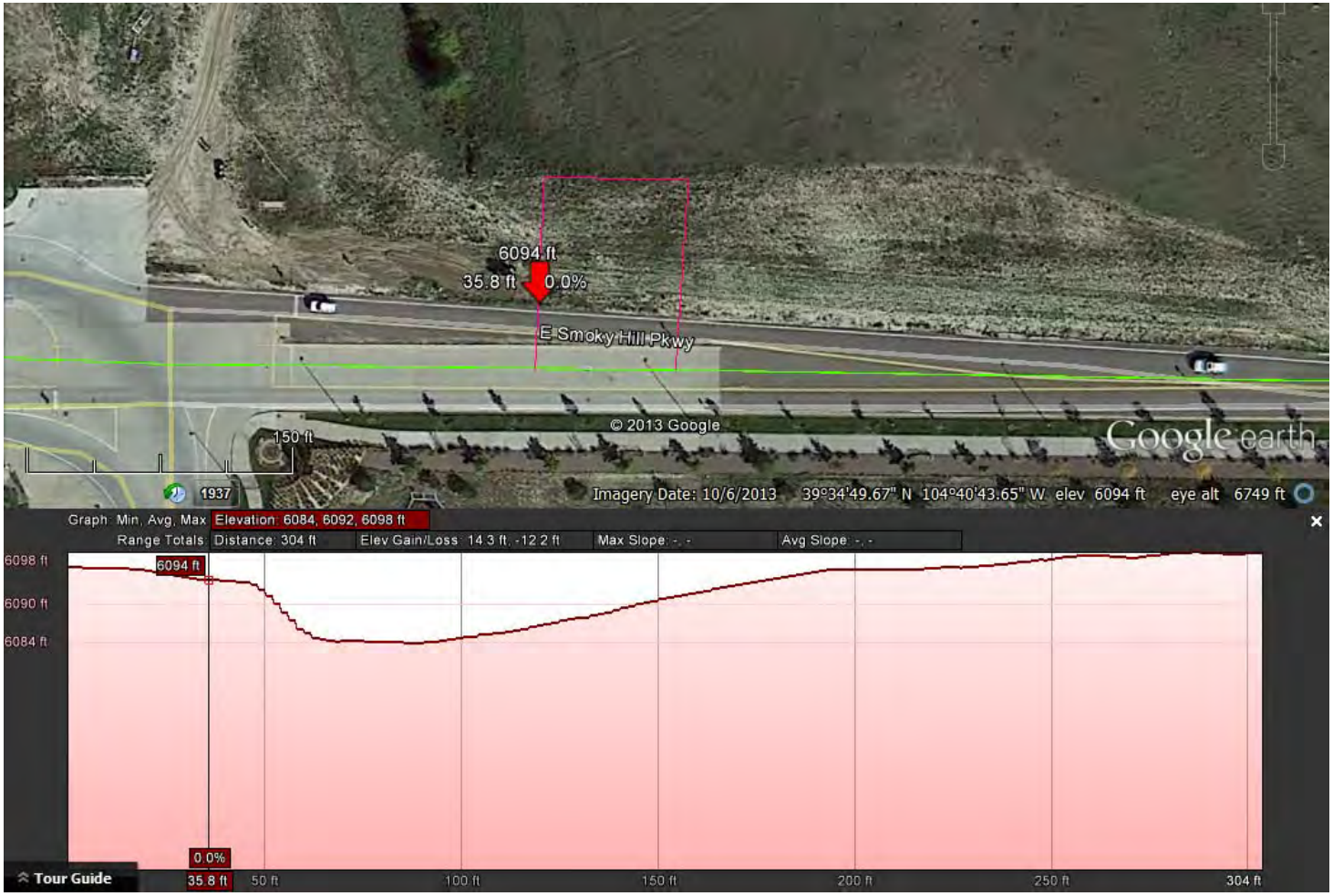
SMW Connections to the Western Pipeline

Participant Connection Process Flow Diagram

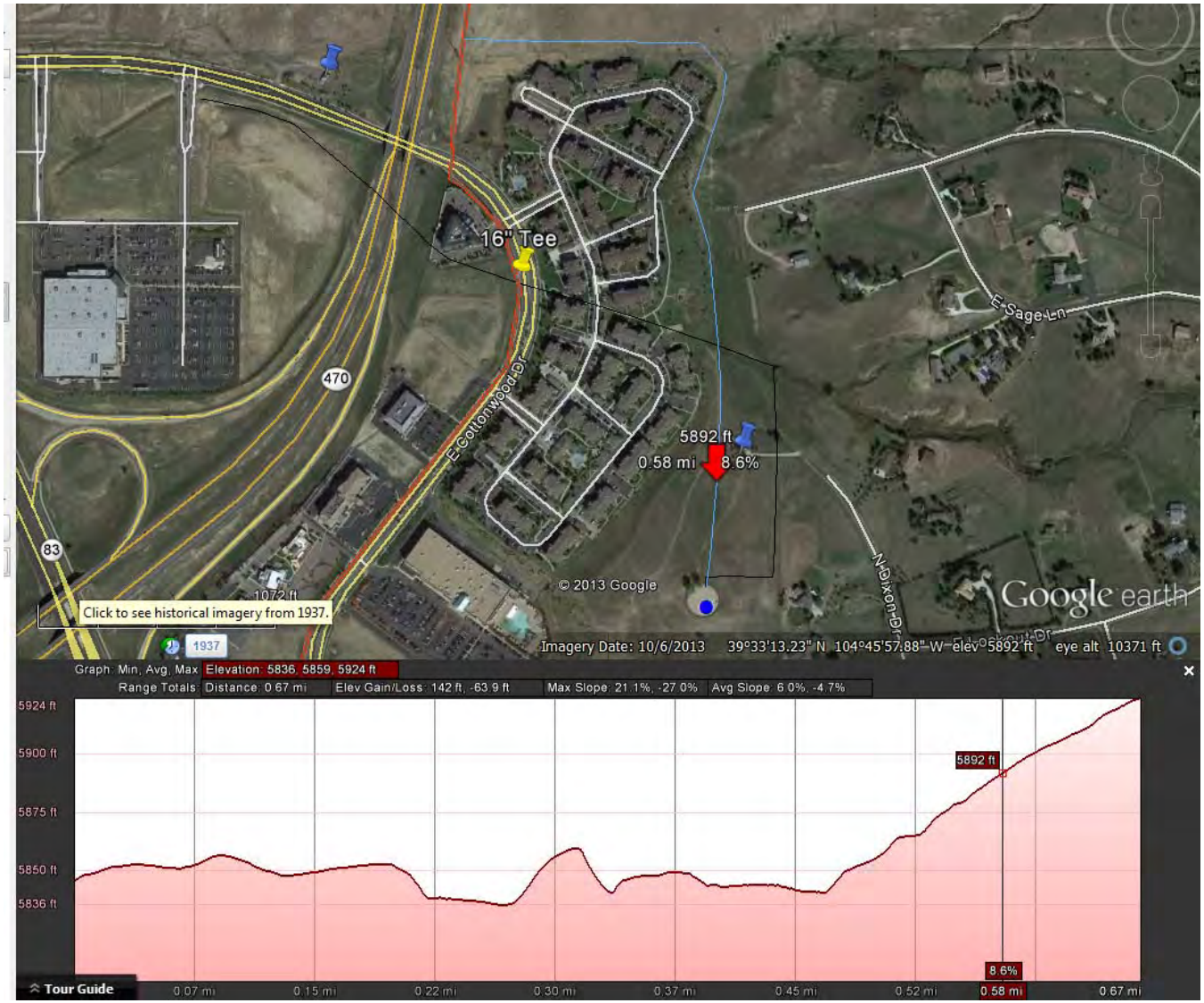
Appendix B
Pipeline Ground Profiles of Alternatives



Rangeview – Alternative 2 – North Side of State Land Board Line

v2.26.14

WISE Authority BLACK & VEATCH building a world of difference™	**SMW Connections to the Western Pipeline**	
	Pipeline Ground Profiles	



Cottonwood – Alternatives 1 and 2

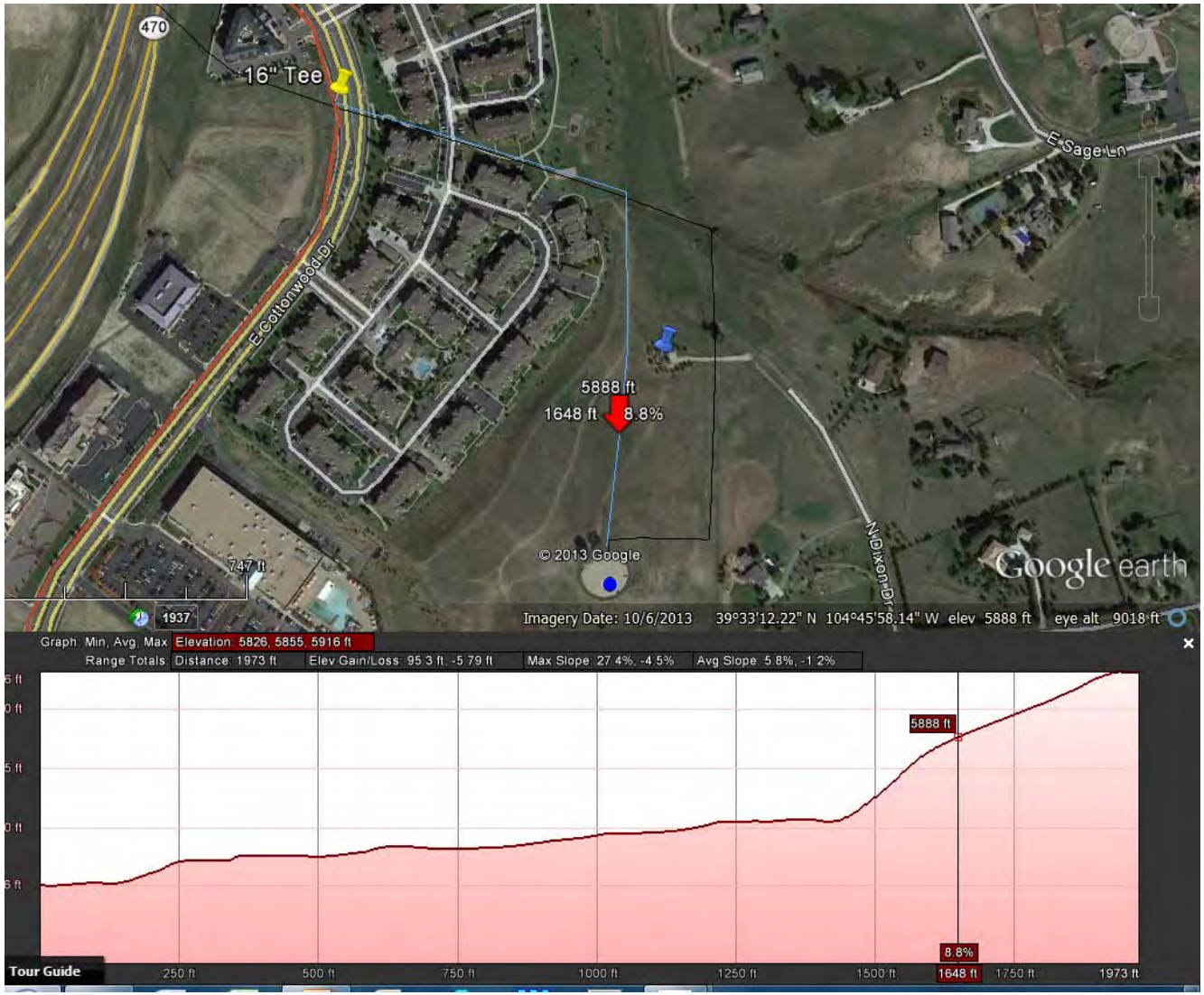
v2.26.14

WISE Authority BLACK & VEATCH building a world of difference™	**SMW Connections to the Western Pipeline**	
	Pipeline Ground Profiles	

Cottonwood – Alternatives 3 and 4

v2.26.14

WISE Authority BLACK & VEATCH building a world of difference™	**SMW Connections to the Western Pipeline**	
	Pipeline Ground Profiles	

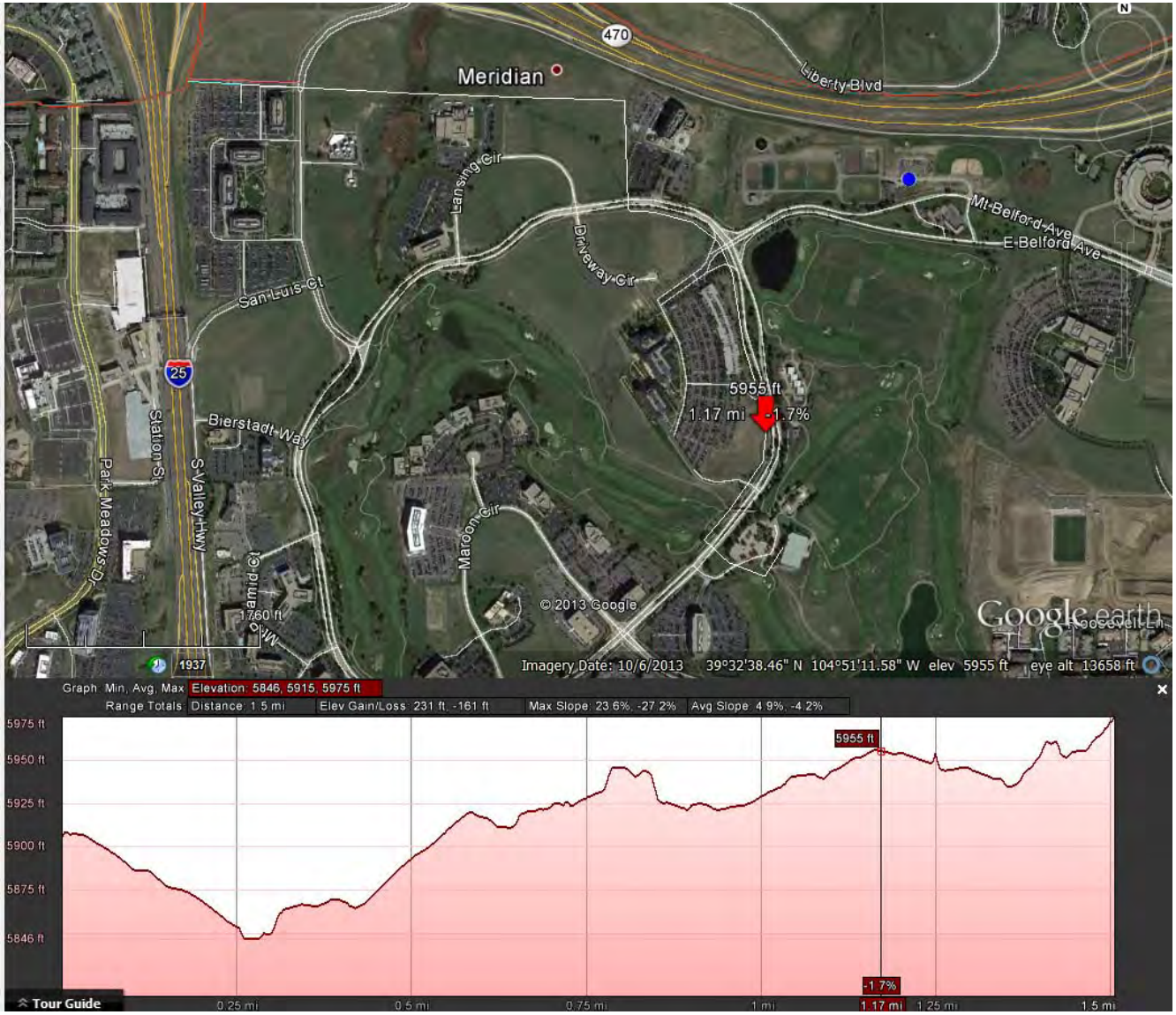


Cottonwood – Alternative 5

Cottonwood – Alternatives 6 and 7 are flat and are not shown.

v2.26.14

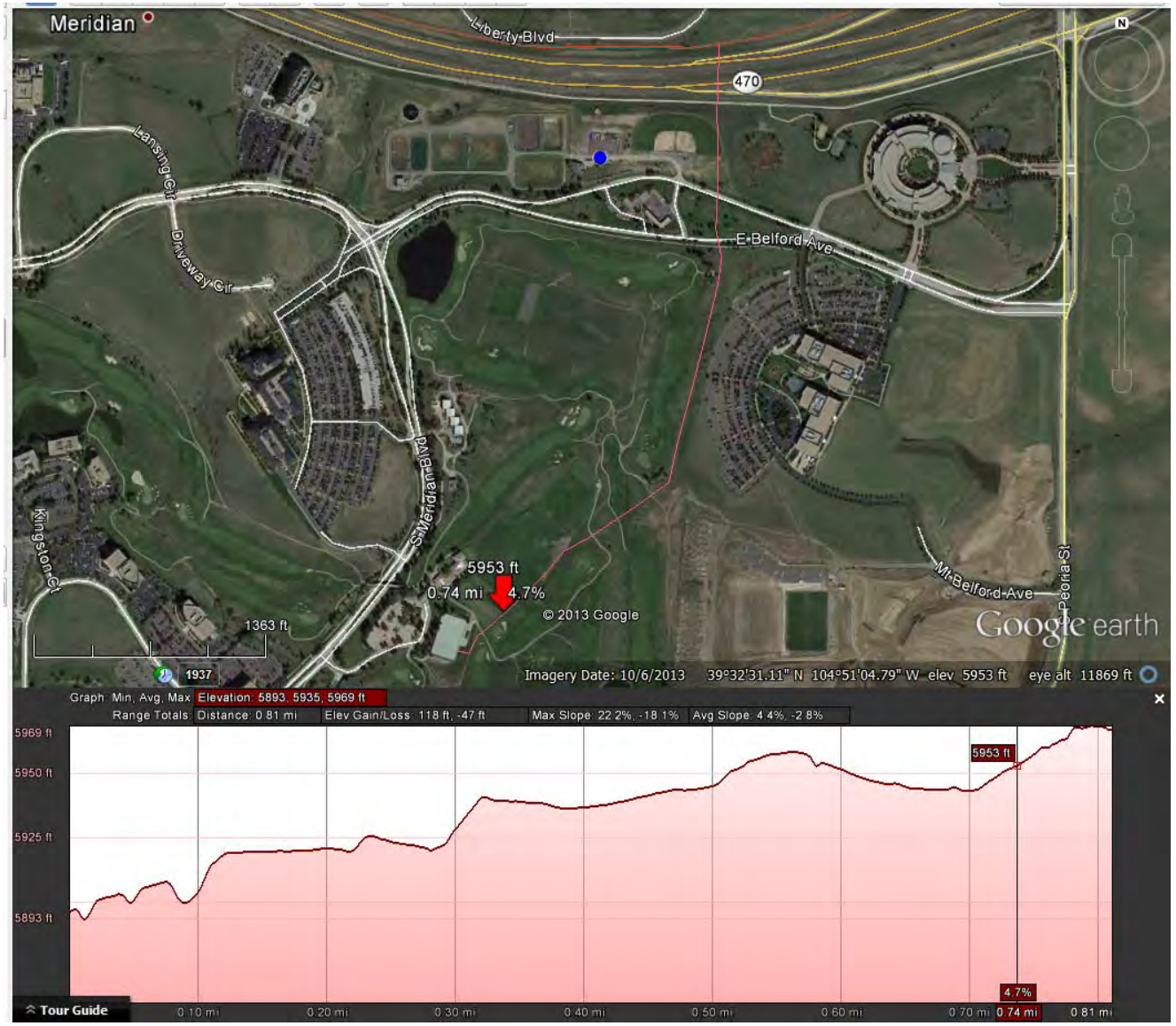
WISE Authority BLACK & VEATCH building a world of difference™	**SMW Connections to the Western Pipeline**	
	Pipeline Ground Profiles	



Meridian – Existing Well Supply Pipeline from I-25 Site to 3 MG Storage Tank

v2.26.14

WISE Authority BLACK & VEATCH building a world of difference™	**SMW Connections to the Western Pipeline**	
	Pipeline Ground Profiles	



Meridian – New Pipeline from Liberty Blvd Site to 3 MG Storage Tank

v2.26.14

WISE Authority BLACK & VEATCH building a world of difference™	**SMW Connections to the Western Pipeline**	
	Pipeline Ground Profiles	

Inverness – Alternative 1

v2.26.14

WISE Authority BLACK & VEATCH building a world of difference™	**SMW Connections to the Western Pipeline**	
	Pipeline Ground Profiles	

Inverness – Alternative 2

v2.26.14

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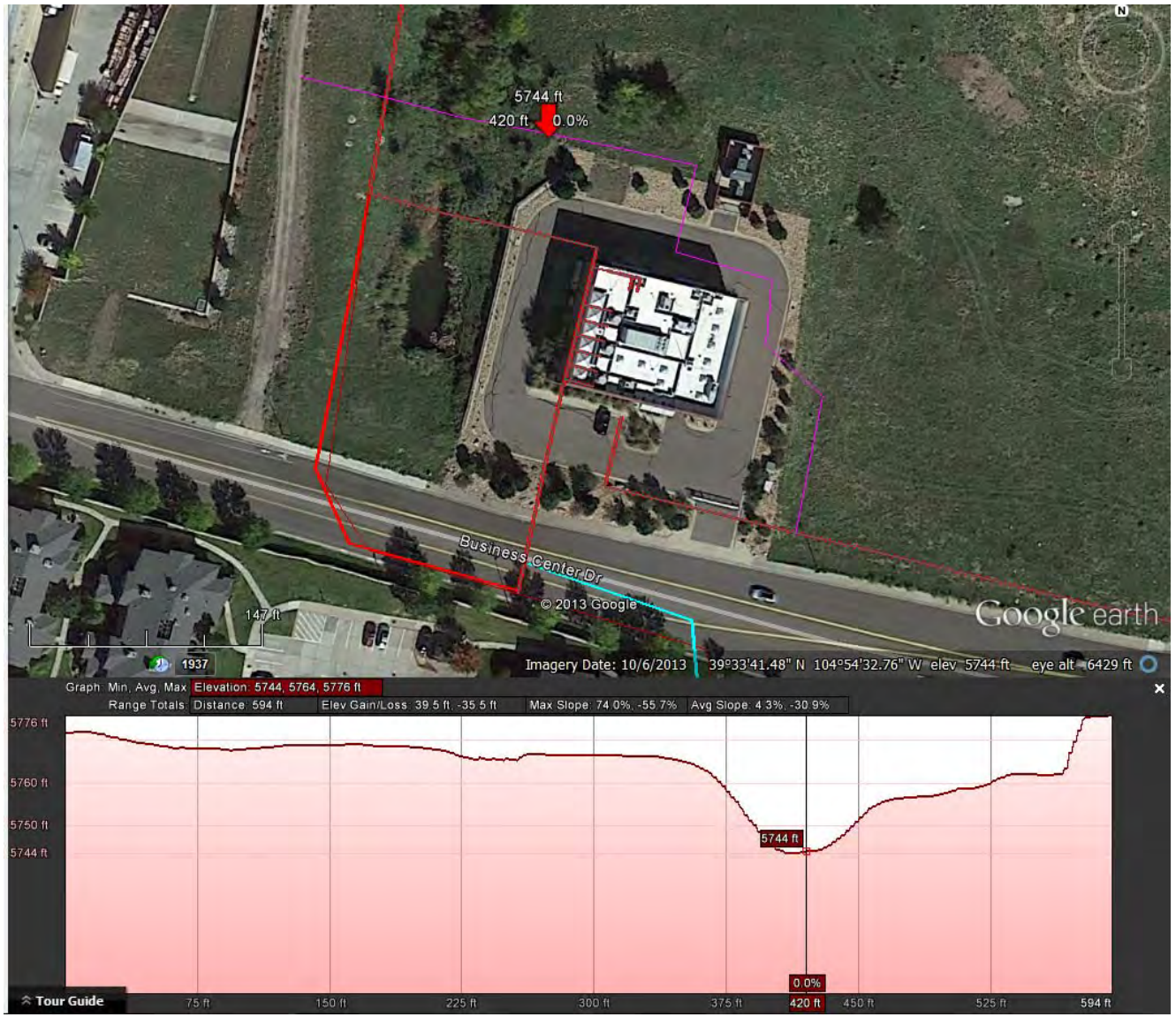
	Pipeline Ground Profiles	

Inverness – Alternative 3

v2.26.14

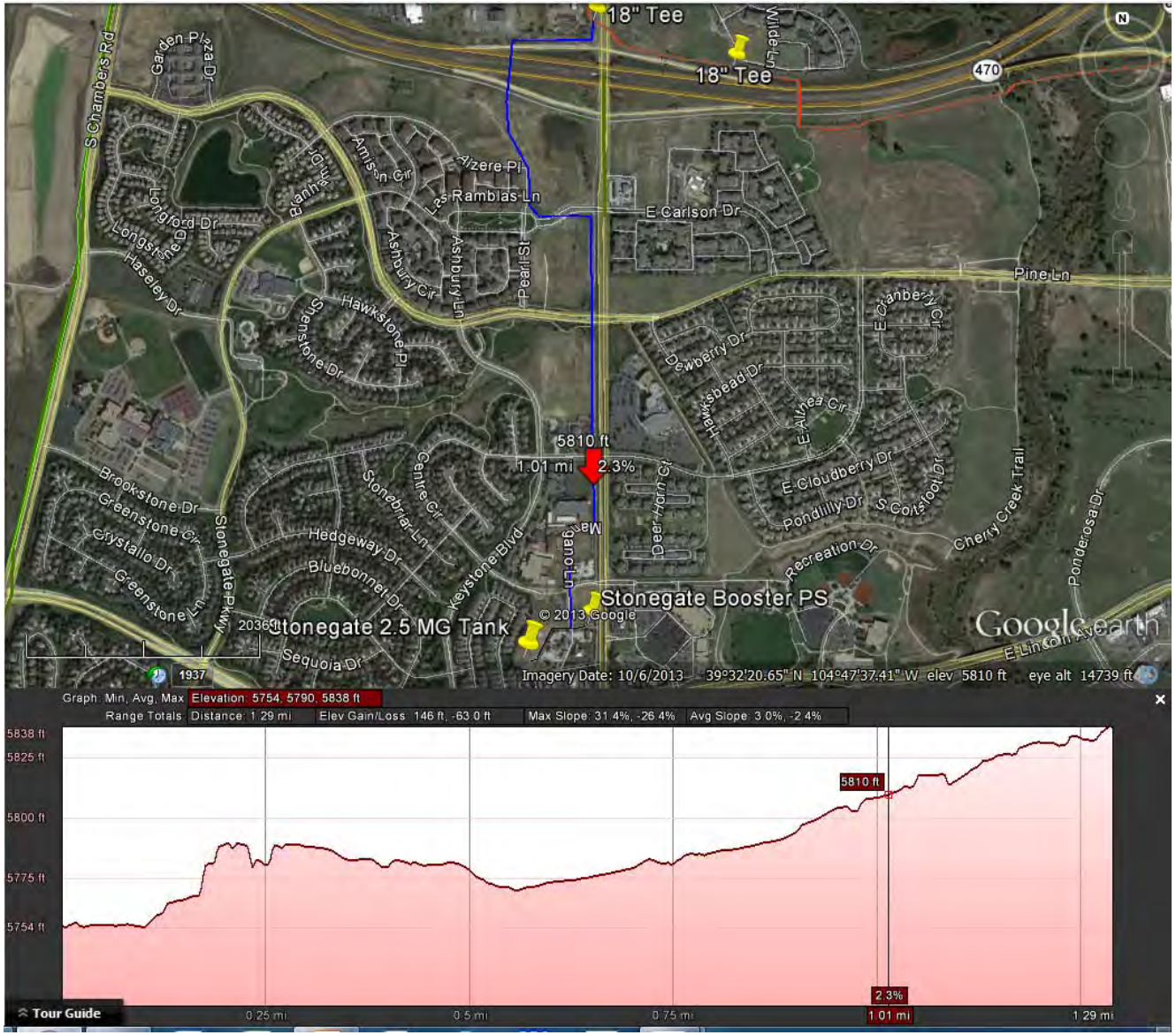
WISE Authority BLACK & VEATCH building a world of difference™	**SMW Connections to the Western Pipeline**	
	Pipeline Ground Profiles	



Centennial

v2.26.14

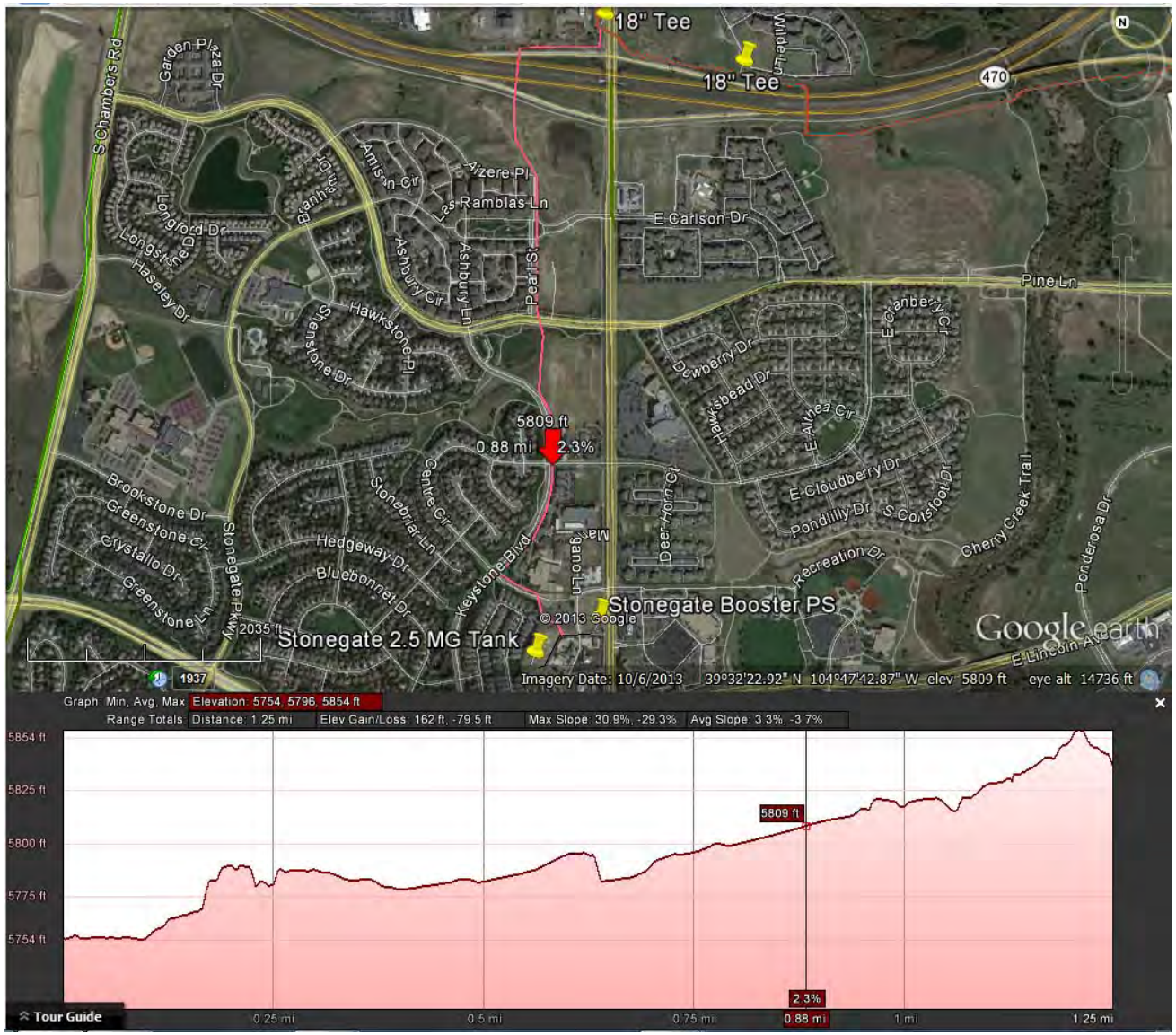
WISE Authority BLACK & VEATCH building a world of difference™	**SMW Connections to the Western Pipeline**	
	Pipeline Ground Profiles	



Stonegate – Alternative 1

v2.26.14

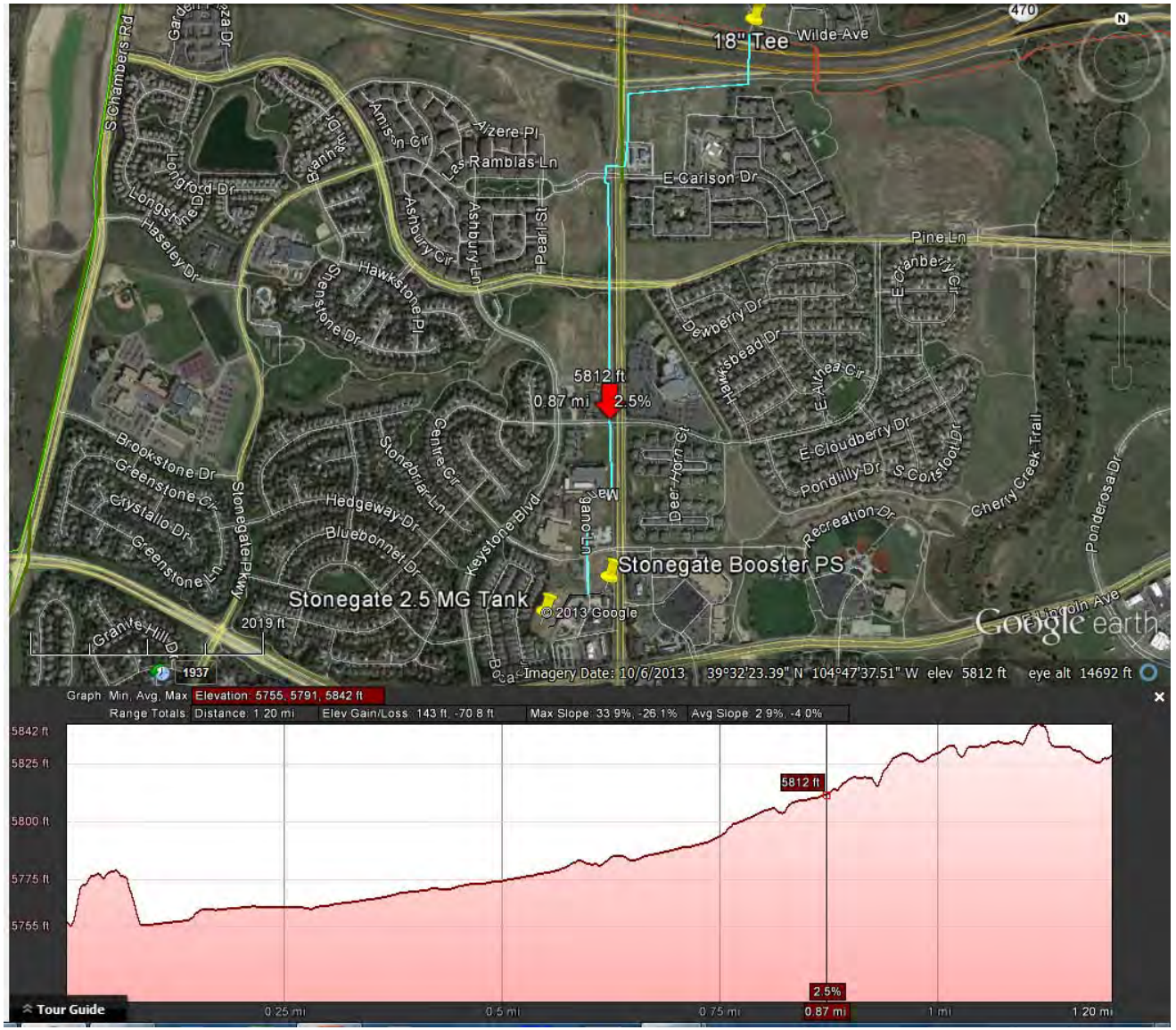
WISE Authority BLACK & VEATCH building a world of difference™	**SMW Connections to the Western Pipeline**	
	Pipeline Ground Profiles	



Stonegate – Alternative 2

v2.26.14

WISE Authority BLACK & VEATCH building a world of difference™	**SMW Connections to the Western Pipeline**	
	Pipeline Ground Profiles	



Stonegate – Alternative 3

v2.26.14

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	Pipeline Ground Profiles	

Stonegate – Alternative 4

v2.26.14

WISE Authority BLACK & VEATCH building a world of difference™	**SMW Connections to the Western Pipeline**	
	Pipeline Ground Profiles	

Appendix C
Preliminary Cost Estimates

These costs are consistent with a Class 5 cost estimate as defined by the Association for the Advancement of Cost Engineering (AACE).

SMW Authority

Project Cost Summary

SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives

Location: SMW Connections to Western Pipeline 3/13/2014
Process: **Phase 1 - Identify, Evaluate, and Select Connection Alternatives**

Project Cost Summary

Description	Connection	Pipeline	Total
All Alternatives			
Rangeview Alternative 2 – North Side of State Land Board Line	$310,044	$0	$310,044
Cottonwood Connection (Also Alt 7 - Connect to Existing Tee and System Convert	$276,864	$0	$276,864
Cottonwood Pipeline - Alt 1 - Long Alignment Around Apartments / Breakpoint Ch	$276,864	$1,592,430	$1,869,293
Cottonwood Pipeline - Alt 2 - Long Alignment Around Apartments / Breakpoint Ch	$276,864	$1,609,423	$1,886,286
Cottonwood Pipeline - Alt 3 - Alignment South of Apartments / Breakpoint Chlorir	$276,864	$1,497,792	$1,774,656
Cottonwood Pipeline - Alt 4 - Alignment South of Apartments / Breakpoint Chlorir	$276,864	$1,239,945	$1,516,809
Cottonwood Pipeline - Alt 5 - Alignment Through Apartments / Breakpoint Chlorir	$276,864	$1,309,954	$1,586,818
Cottonwood Pipeline - Alt 6 - Breakpoint Chlorination (In Pipe) at Existing Westerr	$276,864	$1,053,334	$1,330,197
Southern Participants Connection	$68,216	$0	$68,216
Meridian Alt 1 - RPZ/FM Structure to Well Supply Pln	$1,388,657	$0	$1,388,657
Meridian Alt 1A - Alt 1 Plus Booster Pump	$1,546,282	$0	$1,546,282
Meridian Alt 2 - FM Structure to Tank/Pump to Well Supply Pln	$1,478,412	$0	$1,478,412
Meridian Alt 3 - FM Structure and WISE Pln to 3 MG Tank	$2,079,083	$0	$2,079,083
Meridian Alt 4 - Breakpoint Chlorinate to Pump to Potable Water System	$1,541,724	$0	$1,541,724
Meridian Alt 5 - FM Structure to Potable Water System (Existing System Converte	$564,849	$0	$564,849
Inverness Connection	$267,607	$0	$267,607
Inverness Pipeline - Alt 1 (East Alignment)	$267,607	$351,414	$619,022
Inverness Pipeline - Alt 2 (Central Alignment)	$267,607	$315,758	$583,365
Inverness Pipeline - Alt 3 (West Alignment)	$267,607	$400,343	$667,950
Centennial Connection	$618,101	$0	$618,101
Stonegate Connection	$293,264	$0	$293,264
Stonegate Pipeline Alternative 1 - West 470 Bore, Along Jordan	$293,264	$1,910,964	$2,204,227
Stonegate Pipeline Alternative 2 - West 470 Bore, Along Keystone Blvd	$293,264	$1,838,696	$2,131,960
Stonegate Pipeline Alternative 3 - East 470 Bore, Along Jordan	$293,264	$1,739,842	$2,033,106
Stonegate Pipeline Alternative 4 - No Bore, Along Jordan	$293,264	$1,647,667	$1,940,931
Selected Alternatives (Cottonwood & Meridian Stay Free-Chlorine)			
Rangeview Alternative 2 – North Side of State Land Board Line	$310,044	$0	$310,044
Cottonwood Pipeline - Alt 6 - Breakpoint Chlorination (In Pipe) at Existing Westerr	$276,864	$1,053,334	$1,330,197
Southern Participants Connection	$68,216	$0	$68,216
Meridian Alt 2 - FM Structure to Tank/Pump to Well Supply Pln	$1,478,412	$0	$1,478,412
Inverness Connection and Inverness Pipeline - Alt 2 (Central Alignment)	$267,607	$315,758	$583,365
Centennial Connection	$618,101	$0	$618,101
Stonegate Pipeline Alternative 4 - No Bore, Along Jordan	$293,264	$1,647,667	$1,940,931
Totals	**$3,312,508**	**$3,016,758**	**$6,329,266**
Selected Alternatives (Cottonwood & Meridian Convert to Chloramines)			
Rangeview Alternative 2 – North Side of State Land Board Line	$310,044	$0	$310,044
Cottonwood Connection (Also Alt 7 - Connect to Existing Tee and System Convert	$276,864	$0	$276,864
Southern Participants Connection	$68,216	$0	$68,216
Meridian Alt 5 - FM Structure to Potable Water System (Existing System Converte	$564,849	$0	$564,849
Inverness Connection and Inverness Pipeline - Alt 2 (Central Alignment)	$267,607	$315,758	$583,365
Centennial Connection	$618,101	$0	$618,101
Stonegate Pipeline Alternative 4 - No Bore, Along Jordan	$293,264	$1,647,667	$1,940,931
Totals	**$2,398,944**	**$1,963,425**	**$4,362,369**

Black & Veatch Corp. March 13, 2014

SMW Authority
SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives
Conceptual Opinion of Construction Cost
Rangeview Connection

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Summary				
Rangeview Alternative 2 – North Side of State Land Board Line				310,044
Rangeview Pipeline				0
			Total	310,044
Rangeview Alternative 2 – North Side of State Land Board Line				
General Requirements				
Mobilization	2.0%	Lump Sum		3,542
Supervision	5.0%	Lump Sum		8,855
Temporary facilities	1.2%	Lump Sum		2,125
Temporary utilities	0.8%	Lump Sum		1,417
Equipment rental & misc.	1.0%	Lump Sum		1,771
Total - General Requirements				$17,710
Rangeview Alternative 2 – North Side of State Land Board Line				
Yard Work				
Yard Pipe / Mechanical				
10" Pipe	175	lin ft	150.00	26,250
6" Pipe	20	lin ft	90.00	1,800
36"x10" Tap	2	each	2,000.00	4,000
10"x6" Reducer	2	each	1,000.00	2,000
6" Dismantling Joint	1	each	1,500.00	1,500
6" Magmeter Flowmeter	1	each	2,500.00	2,500
6" Flow Control Valve	1	each	6,000.00	6,000
Air release valve	2	each	750.00	1,500
Smoky Hill Road, Asphalt, 40 feet x 10 ft	44	sq yd	50.00	2,222
Thrust blocks, concrete	4	cu yd	650.00	2,600
Yard Valves				
10"	2	each	1,500	3,000
Earthwork for Valve Vault				
Structural excavation	200	cu yd	25.00	5,000
Compacted fill	133	cu yd	12.00	1,600
Waste	67	cu yd	5.00	333
Landscape allowance		Lump Sum		7,500
Concrete, cast in place, for Valve Vault				
Slab on Grade	9	cu yd	650.00	5,778
Walls	33	cu yd	800.00	26,074
Suspended Slab	5	cu yd	1,050.00	5,600
Embedded accessories		Lump Sum		1,100
Metal				
Access Hatch, 4'x6'	1	each	7,500	7,500
Access Hatch, 2.5'x2.5' with ladder	1	each	5,000	5,000
Wall and Ceiling Insulation	296	sq ft	2.50	740
Finishes				
Painting				
Piping		Lump Sum		5,000
Heating and Ventilating				
Heat (Unit Heater) and ventilation (vent pipe fan)		Lump Sum		10,000
Electrical				
Lighting - Indoor fluorescent		Lump Sum		5,000
Misc. conduit, Wiring, Hardware & Labor		Lump Sum		10,000
I&C				
RTU		Lump Sum		10,000
PLC		Lump Sum		15,000
Pressure guages and transmitters		Lump Sum		2,500
Subtotal - Rangeview Alternative 2 – North Side of State Land Board Line				177,097

SMW Authority
SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives
Conceptual Opinion of Construction Cost
Rangeview Connection

30% Contingencies Class 5				53,129
19% Engineering and Construction Phase Services				47,108
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	7,500	sq ft	2.00	15,000
Total - Rangeview Alternative 2 – North Side of State Land Board Line				310,044

Rangeview Pipeline

General Requirements				
Mobilization	2.0%	Lump Sum		0
Supervision	5.0%	Lump Sum		0
Temporary facilities	1.2%	Lump Sum		0
Temporary utilities	0.8%	Lump Sum		0
Equipment rental & misc.	1.0%	Lump Sum		0
Total - General Requirements				$0
Rangeview Pipeline				
Pipeline				
Cost Included in Connection	0	lin ft	0.00	0
Subtotal - Rangeview Pipeline				0
30% Contingencies Class 5				0
19% Engineering and Construction Phase Services				0
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	0	sq ft	2.00	0
Total - Rangeview Pipeline				0

Black & Veatch Corp. March 13, 2014

SMW Authority
SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives
Conceptual Opinion of Construction Cost
Cottonwood Connection

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Summary				
Cottonwood Connection (Also Alt 7 - Connect to Existing Tee and System Converted to Chloramines)				276,864
Cottonwood Pipeline - Alt 1 - Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at Western Pipelir				1,592,430
Cottonwood Pipeline - Alt 2 - Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at Existing Well				1,609,423
Cottonwood Pipeline - Alt 3 - Alignment South of Apartments / Breakpoint Chlorination (In Pipe) at Existing Well				1,497,792
Cottonwood Pipeline - Alt 4 - Alignment South of Apartments / Breakpoint Chlorination (In Tank) at Existing Tank				1,239,945
Cottonwood Pipeline - Alt 5 - Alignment Through Apartments / Breakpoint Chlorination (In Tank) at Existing Tank				1,309,954
Cottonwood Pipeline - Alt 6 - Breakpoint Chlorination (In Pipe) at Existing Western Pipeline Tee				1,053,334
Cottonwood Connection (Also Alt 7 - Connect to Existing Tee and System Converted to Chloramines)				
General Requirements				
Mobilization	2.0%	Lump Sum		3,144
Supervision	5.0%	Lump Sum		7,859
Temporary facilities	1.2%	Lump Sum		1,886
Temporary utilities	0.8%	Lump Sum		1,257
Equipment rental & misc.	1.0%	Lump Sum		1,572
Total - General Requirements				$15,718
Cottonwood Connection (Also Alt 7 - Connect to Existing Tee and System Converted to Chloramines)				
Yard Work				
Yard Pipe / Mechanical				
10" Pipe	20	lin ft	150.00	3,000
6" Pipe	20	lin ft	90.00	1,800
48"x10" Tap	2	each	2,000.00	4,000
10"x6" Reducer	2	each	1,000.00	2,000
6" Dismantling Joint	1	each	1,500.00	1,500
6" Magmeter Flowmeter	1	each	2,500.00	2,500
6" Flow Control Valve	1	each	6,000.00	6,000
Air release valve	2	each	750.00	1,500
Cottonwood Drive, Asphalt, 100 feet x 10 ft	111	sq yd	50.00	5,556
Thrust blocks, concrete	4	cu yd	650.00	2,600
Yard Valves				
10"	2	each	1,500	3,000
Earthwork for Valve Vault				
Structural excavation	200	cu yd	25.00	5,000
Compacted fill	133	cu yd	12.00	1,600
Waste	67	cu yd	5.00	333
Landscape allowance		Lump Sum		7,500
Concrete, cast in place, for Valve Vault				
Slab on Grade	9	cu yd	650.00	5,778
Walls	33	cu yd	800.00	26,074
Suspended Slab	5	cu yd	1,050.00	5,600
Embedded accessories		Lump Sum		1,100
Metal				
Access Hatch, 4'x6'	1	each	7,500	7,500
Access Hatch, 2.5'x2.5' with ladder	1	each	5,000	5,000
Wall and Ceiling Insulation	296	sq ft	2.50	740
Finishes				
Painting				
Piping		Lump Sum		5,000
Heating and Ventilating				
Heat (Unit Heater) and ventilation (vent pipe fan)		Lump Sum		10,000
Electrical				
Lighting - Indoor fluorescent		Lump Sum		5,000
Misc. conduit, Wiring, Hardware & Labor		Lump Sum		10,000
I&C				
RTU		Lump Sum		10,000
PLC		Lump Sum		15,000
Pressure guages and transmitters		Lump Sum		2,500

SMW Authority
SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives
Conceptual Opinion of Construction Cost
Cottonwood Connection

Subtotal - Cottonwood Connection (Also Alt 7 - Connect to Existing Tee and System Converted to Chloramines)				157,181
30% Contingencies Class 5				47,154
19% Engineering and Construction Phase Services				41,810
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	7,500	sq ft	2.00	15,000
Total - Cottonwood Connection (Also Alt 7 - Connect to Existing Tee and System Converted to Chloramines)				276,864

Cottonwood Pipeline - Alt 1 - Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at Western Pipeline Connection

General Requirements				
Mobilization	2.0%	Lump Sum		18,108
Supervision	5.0%	Lump Sum		45,271
Temporary facilities	1.2%	Lump Sum		10,865
Temporary utilities	0.8%	Lump Sum		7,243
Equipment rental & misc.	1.0%	Lump Sum		9,054
Total - General Requirements				$90,542

Cottonwood Pipeline - Alt 1 - Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at Western Pipeline Connection				
Pipeline				
Western Pipeline to Well D4-A, 16"	2,800	lin ft	136.00	380,800
Well D4-A to Cottonwood Tank, 12"	560	lin ft	102.00	57,120
Breakpoint Chlorination Building				
Building, 20 ft x 15 ft	300	sq ft	200.00	60,000
Sodium Hypochlorite Equipment (Tanks, Metering Pumps, Pipe, Valves, Analyzers)	1	each	165,000.00	165,000
Sodium Bisulfite Equipment (Tanks, Metering Pumps, Pipe, Valves, Analyzers)	1	each	130,000.00	130,000
Sitework	1	each	30,000.00	30,000
Yard Piping	1	each	30,000.00	30,000
Electrical	1	each	35,000.00	35,000
I&C	1	each	10,000.00	10,000
Static mixer, 12"	3	each	2,500.00	7,500
Subtotal - Cottonwood Pipeline - Alt 1 - Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at W				905,420
30% Contingencies Class 5				271,626
19% Engineering and Construction Phase Services				240,842
Land/Easement - Pipeline	3,360	lin ft	25.00	84,000
Land - Connection	0	sq ft	2.00	0
Total - Cottonwood Pipeline - Alt 1 - Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at Wes				1,592,430

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Cottonwood Connection

Cottonwood Pipeline - Alt 2 - Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at Existing Well

General Requirements				
Mobilization	2.0%	Lump Sum		18,312
Supervision	5.0%	Lump Sum		45,781
Temporary facilities	1.2%	Lump Sum		10,987
Temporary utilities	0.8%	Lump Sum		7,325
Equipment rental & misc.	1.0%	Lump Sum		9,156
Total - General Requirements				$91,562
Cottonwood Pipeline - Alt 2 - Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at Existing Well				
Cottonwood Pipeline Alt 1 (no contingencies or gen requirements)				905,420
Deduct Western Pipeline to Well D4-A, 16"	2,800	lin ft	(136.00)	(380,800)
Western Pipeline to Well D4-A, 10"	2,800	lin ft	85.00	238,000
Contact Time Pipe, 36"	500	lin ft	306.00	153,000
Subtotal - Cottonwood Pipeline - Alt 2 - Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at E:				915,620
30% Contingencies Class 5				274,686
19% Engineering and Construction Phase Services				243,555
Land/Easement - Pipeline	3,360	lin ft	25.00	84,000
Land - Connection	0	sq ft	2.00	0
Total - Cottonwood Pipeline - Alt 2 - Long Alignment Around Apartments / Breakpoint Chlorination (In Pipe) at Exist				1,609,423

Cottonwood Pipeline - Alt 3 - Alignment South of Apartments / Breakpoint Chlorination (In Pipe) at Existing Well

General Requirements				
Mobilization	2.0%	Lump Sum		17,227
Supervision	5.0%	Lump Sum		43,069
Temporary facilities	1.2%	Lump Sum		10,336
Temporary utilities	0.8%	Lump Sum		6,891
Equipment rental & misc.	1.0%	Lump Sum		8,614
Total - General Requirements				$86,137
Cottonwood Pipeline - Alt 3 - Alignment South of Apartments / Breakpoint Chlorination (In Pipe) at Existing Well				
Cottonwood Pipeline Alt 1 (no contingencies or gen requirements)				905,420
Deduct Western Pipeline to Well D4-A, 16"	2,800	lin ft	(136.00)	(380,800)
Western Pipeline to Well D4-A, 10"	1,950	lin ft	85.00	165,750
Contact Time Pipe, 36"	500	lin ft	306.00	153,000
Tree removal and replacement (move each tree twice)	120	each	150.00	18,000
Subtotal - Cottonwood Pipeline - Alt 3 - Alignment South of Apartments / Breakpoint Chlorination (In Pipe) at Existir				861,370
30% Contingencies Class 5				258,411
19% Engineering and Construction Phase Services				229,124
Land/Easement - Pipeline	2,510	lin ft	25.00	62,750
Land - Connection	0	sq ft	2.00	0
Total - Cottonwood Pipeline - Alt 3 - Alignment South of Apartments / Breakpoint Chlorination (In Pipe) at Existing \				1,497,792

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Cottonwood Pipeline - Alt 4 - Alignment South of Apartments / Breakpoint Chlorination (In Tank) at Existing Tank

General Requirements				
Mobilization	2.0%	Lump Sum		14,435
Supervision	5.0%	Lump Sum		36,088
Temporary facilities	1.2%	Lump Sum		8,661
Temporary utilities	0.8%	Lump Sum		5,774
Equipment rental & misc.	1.0%	Lump Sum		7,218
Total - General Requirements				$72,176
Cottonwood Pipeline - Alt 4 - Alignment South of Apartments / Breakpoint Chlorination (In Tank) at Existing Tank				
Cottonwood Pipeline Alt 1 (no contingencies or gen requirements)				905,420
Deduct Western Pipeline to Well D4-A, 16"	2,800	lin ft	(136.00)	(380,800)
Deduct Well D4-A to Cottonwood Tank, 12"	560	lin ft	(102.00)	(57,120)
Western Pipeline to Breakpoint Chlor Tank, 10"	1,500	lin ft	85.00	127,500
Tree removal and replacement (move each tree twice)	120	each	150.00	18,000
Breakpoint Chlorination Tank, 30,000 gallons (21 ft x 24 ft x 10 feet tall) (Tank is above grade)				
Earthwork for Tank				
Structural excavation	20	cu yd	25.00	509
Compacted fill	20	cu yd	12.00	244
Waste	0	cu yd	5.00	0
Concrete, cast in place				
Slab on Grade	19	cu yd	650.00	12,133
Walls	43	cu yd	800.00	34,370
Suspended Slab	28	cu yd	1,050.00	29,400
Embedded accessories		Lump Sum		2,100
Overflow Box	1	each	5,000.00	5,000
Metal				
Access Hatch, 2.5'x2.5' with ladder	2	each	5,000	10,000
Inlet and Outlet Pipes / Connections	2	each	7,500	15,000
Subtotal - Cottonwood Pipeline - Alt 4 - Alignment South of Apartments / Breakpoint Chlorination (In Tank) at Existi				721,756
30% Contingencies Class 5				216,527
19% Engineering and Construction Phase Services				191,987
Land/Easement - Pipeline	1,500	lin ft	25.00	37,500
Land - Connection	0	sq ft	2.00	0
Total - Cottonwood Pipeline - Alt 4 - Alignment South of Apartments / Breakpoint Chlorination (In Tank) at Existing				1,239,945

Cottonwood Pipeline - Alt 5 - Alignment Through Apartments / Breakpoint Chlorination (In Tank) at Existing Tank

General Requirements				
Mobilization	2.0%	Lump Sum		15,426
Supervision	5.0%	Lump Sum		38,564
Temporary facilities	1.2%	Lump Sum		9,255
Temporary utilities	0.8%	Lump Sum		6,170
Equipment rental & misc.	1.0%	Lump Sum		7,713
Total - General Requirements				$77,128
Cottonwood Pipeline - Alt 5 - Alignment Through Apartments / Breakpoint Chlorination (In Tank) at Existing Tank				
Cottonwood Pipeline Alt 4 (no contingencies or gen requirements)				721,756
Deduct Western Pipeline to Breakpoint Chlor Tank, 10"	1,500	lin ft	(85.00)	(127,500)
Deduct Tree removal and replacement (move each tree twice)	120	each	(150.00)	(18,000)
Western Pipeline to Breakpoint Chlor Tank, 10"	1,965	lin ft	85.00	167,025
Difficult construction through apartment complex	700	lin ft	40.00	28,000
Subtotal - Cottonwood Pipeline - Alt 5 - Alignment Through Apartments / Breakpoint Chlorination (In Tank) at Existi				771,281
30% Contingencies Class 5				231,384
19% Engineering and Construction Phase Services				205,161
Land/Easement - Pipeline	1,000	lin ft	25.00	25,000
Land - Connection	0	sq ft	2.00	0
Total - Cottonwood Pipeline - Alt 5 - Alignment Through Apartments / Breakpoint Chlorination (In Tank) at Existing				1,309,954

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Cottonwood Pipeline - Alt 6 - Breakpoint Chlorination (In Pipe) at Existing Western Pipeline Tee

General Requirements				
Mobilization	2.0%	Lump Sum		12,495
Supervision	5.0%	Lump Sum		31,238
Temporary facilities	1.2%	Lump Sum		7,497
Temporary utilities	0.8%	Lump Sum		4,998
Equipment rental & misc.	1.0%	Lump Sum		6,248
Total - General Requirements				$62,475
Cottonwood Pipeline - Alt 6 - Breakpoint Chlorination (In Pipe) at Existing Western Pipeline Tee				
Cottonwood Pipeline Alt 1 (no contingencies or gen requirements)				905,420
Deduct Western Pipeline to Well D4-A, 16"	2,800	lin ft	(136.00)	(380,800)
Deduct Well D4-A to Cottonwood Tank, 12"	560	lin ft	(102.00)	(57,120)
Additional Pipe, 10"	50	lin ft	85.00	4,250
Contact Time Pipe, 36"	500	lin ft	306.00	153,000
Subtotal - Cottonwood Pipeline - Alt 6 - Breakpoint Chlorination (In Pipe) at Existing Western Pipeline Tee				624,750
30% Contingencies Class 5				187,425
19% Engineering and Construction Phase Services				166,184
Land/Easement - Pipeline	500	lin ft	25.00	12,500
Land - Connection	0	sq ft	2.00	0
Total - Cottonwood Pipeline - Alt 6 - Breakpoint Chlorination (In Pipe) at Existing Western Pipeline Tee				1,053,334

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SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives
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Southern Participants Connection

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Summary				
Southern Participants Connection				68,216
Chambers Pipeline				0
Southern Participants Connection				
General Requirements				
Mobilization	2.0%	Lump Sum		819
Supervision	5.0%	Lump Sum		2,047
Temporary facilities	1.2%	Lump Sum		491
Temporary utilities	0.8%	Lump Sum		328
Equipment rental & misc.	1.0%	Lump Sum		409
Total - General Requirements				$4,095
Southern Participants Connection				
Yard Work				
Yard Pipe / Mechanical				
54"x42" Tee with 2 butt straps	1	each	5,000.00	5,000
42" Pipe	5	lin ft	630.00	3,150
Thrust block, concrete	4	cu yd	650.00	2,600
Yard Valves				
42" BFV with manual actuator	1	each	6,300	6,300
Earthwork for Manhole for Valve Actuator				
Structural excavation	208	cu yd	25.00	5,200
Compacted fill	139	cu yd	12.00	1,664
Waste	69	cu yd	5.00	347
Surface restoration		Lump Sum		2,500
Concrete, cast in place, for MH				
Slab on Grade	3	cu yd	650.00	1,685
MH Riser and Lid, 60" Diameter	1	each	7,500.00	7,500
Metal				
Access Hatch, 2.5'x2.5' with ladder	1	each	5,000	5,000
Subtotal - Southern Participants Connection				40,946
30% Contingencies Class 5				12,284
19% Engineering and Construction Phase Services				10,892
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	0	sq ft	2.00	0
Total - Southern Participants Connection				68,216

SMW Authority
SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives
Conceptual Opinion of Construction Cost
Southern Participants Connection

Chambers Pipeline

General Requirements				
Mobilization	2.0%	Lump Sum		0
Supervision	5.0%	Lump Sum		0
Temporary facilities	1.2%	Lump Sum		0
Temporary utilities	0.8%	Lump Sum		0
Equipment rental & misc.	1.0%	Lump Sum		0
Total - General Requirements				$0
Chambers Pipeline				
Pipeline				
Cost Included in Connection	0	lin ft	0.00	0
Subtotal - Chambers Pipeline				0
30% Contingencies Class 5				0
19% Engineering and Construction Phase Services				0
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	0	sq ft	2.00	0
Total - Chambers Pipeline				0

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SMW Authority
SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives
Conceptual Opinion of Construction Cost
Meridian Connection

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Summary				
Meridian Alt 1 - RPZ/FM Structure to Well Supply Pln				1,388,657
Meridian Alt 1A - Alt 1 Plus Booster Pump				1,546,282
Meridian Alt 2 - FM Structure to Tank/Pump to Well Supply Pln				1,478,412
Meridian Alt 3 - FM Structure and WISE Pln to 3 MG Tank				2,079,083
Meridian Alt 4 - Breakpoint Chlorinate to Pump to Potable Water System				1,541,724
Meridian Alt 5 - FM Structure to Potable Water System (Existing System Converted to Chloramines)				564,849
Meridian Alt 1 - RPZ/FM Structure to Well Supply Pln				
General Requirements				
Mobilization	2.0%	Lump Sum		16,536
Supervision	5.0%	Lump Sum		41,339
Temporary facilities	1.2%	Lump Sum		9,921
Temporary utilities	0.8%	Lump Sum		6,614
Equipment rental & misc.	1.0%	Lump Sum		8,268
Total - General Requirements				$82,678
Meridian Alt 1 - RPZ/FM Structure to Well Supply Pln				
Yard Work				
Yard Pipe / Mechanical				
10" Pipe	450	lin ft	85.00	38,250
6" Pipe	20	lin ft	90.00	1,800
54"x10" Tap	1	each	2,000.00	2,000
Tee to Well Supply Pipeline	1	each	2,000.00	2,000
10"x6" Reducer	2	each	1,000.00	2,000
6" Dismantling Joint	1	each	1,500.00	1,500
6" Magmeter Flowmeter	1	each	2,500.00	2,500
6" Flow Control Valve	1	each	6,000.00	6,000
6" RPZ (Reduced Pressure Zone Assembly)	1	each	11,900.00	11,900
RPZ Hotbox and concrete slab	1	each	5,000.00	5,000
Air release valve	2	each	750.00	1,500
Thrust blocks, concrete	4	cu yd	650.00	2,600
Yard Valves				
10"	2	each	1,500	3,000
Earthwork for Valve Vault				
Structural excavation	200	cu yd	25.00	5,000
Compacted fill	133	cu yd	12.00	1,600
Waste	67	cu yd	5.00	333
Landscape allowance		Lump Sum		7,500
Concrete, cast in place, for Valve Vault				
Slab on Grade	9	cu yd	650.00	5,778
Walls	33	cu yd	800.00	26,074
Suspended Slab	5	cu yd	1,050.00	5,600
Embedded accessories		Lump Sum		1,100
Metal				
Access Hatch, 4'x6'	1	each	7,500	7,500
Access Hatch, 2.5'x2.5' with ladder	2	each	5,000	10,000
Wall and Ceiling Insulation	296	sq ft	2.50	740
Finishes				
Painting				
Piping		Lump Sum		5,000
Heating and Ventilating				
Heat (Unit Heater) and ventilation (vent pipe fan)		Lump Sum		10,000
Electrical				
Lighting - Indoor fluorescent		Lump Sum		5,000
Misc. conduit, Wiring, Hardware & Labor		Lump Sum		10,000
I&C				
RTU		Lump Sum		10,000
PLC		Lump Sum		15,000

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Phase 1 - Identify, Evaluate, and Select Connection Alternatives
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Meridian Connection

Pressure guages and transmitters		Lump Sum		2,500
Breakpoint Chlorination Building				
Building, 20 ft x 15 ft	300	sq ft	200.00	60,000
Sodium Hypochlorite Equipment (Tanks, Metering Pumps, Pipe, Valves, Analyzers)	1	each	165,000.00	165,000
Sodium Bisulfite Equipment (Tanks, Metering Pumps, Pipe, Valves, Analyzers)	1	each	130,000.00	130,000
Sitework	1	each	30,000.00	30,000
Yard Piping	1	each	30,000.00	30,000
Electrical	1	each	35,000.00	35,000
I&C	1	each	10,000.00	10,000
Static mixer, 12"	2	each	2,500.00	5,000
Contact Time Pipe, 36"	500	lin ft	306.00	153,000
Subtotal - Meridian Alt 1 - RPZ/FM Structure to Well Supply Pln				826,775
30% Contingencies Class 5				248,033
19% Engineering and Construction Phase Services				219,922
Land/Easement - Pipeline	450	lin ft	25.00	11,250
Land - Connection		sq ft	2.00	0
Total - Meridian Alt 1 - RPZ/FM Structure to Well Supply Pln				1,388,657

Meridian Alt 1A - Alt 1 Plus Booster Pump

General Requirements				
Mobilization	2.0%	Lump Sum		18,428
Supervision	5.0%	Lump Sum		46,069
Temporary facilities	1.2%	Lump Sum		11,057
Temporary utilities	0.8%	Lump Sum		7,371
Equipment rental & misc.	1.0%	Lump Sum		9,214
Total - General Requirements				$92,139
Meridian Alt 1A - Alt 1 Plus Booster Pump				
Meridian Alternative 1 (no contingencies or gen requirements)				826,775
Adder for 7 ft longer vault (50% larger)	0.50	each	46,225.00	23,113
6" Dismantling Joint	1	each	1,500.00	1,500
Booster Pump	1	each	50,000.00	50,000
Pump electrical starter	1	each	10,000.00	10,000
Additional electrical for pump	1	each	10,000.00	10,000
Subtotal - Meridian Alt 1A - Alt 1 Plus Booster Pump				921,388
30% Contingencies Class 5				276,416
19% Engineering and Construction Phase Services				245,089
Land/Easement - Pipeline	450	lin ft	25.00	11,250
Land - Connection		sq ft	2.00	0
Total - Meridian Alt 1A - Alt 1 Plus Booster Pump				1,546,282

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Meridian Connection

Meridian Alt 2 - FM Structure to Tank/Pump to Well Supply Pln

General Requirements				
Mobilization	2.0%	Lump Sum		17,433
Supervision	5.0%	Lump Sum		43,582
Temporary facilities	1.2%	Lump Sum		10,460
Temporary utilities	0.8%	Lump Sum		6,973
Equipment rental & misc.	1.0%	Lump Sum		8,716
Total - General Requirements				$87,165
Meridian Alt 2 - FM Structure to Tank/Pump to Well Supply Pln				
Yard Work				
Yard Pipe / Mechanical				
10" Pipe	450	lin ft	85.00	38,250
6" Pipe	60	lin ft	90.00	5,400
54"x10" Tap	1	each	2,000.00	2,000
Tee to Well Supply Pipeline	1	each	2,000.00	2,000
10"x6" Reducer	2	each	1,000.00	2,000
6" Dismantling Joint	2	each	1,500.00	3,000
6" Magmeter Flowmeter	1	each	2,500.00	2,500
6" Flow Control Valve	1	each	6,000.00	6,000
Air release valve	2	each	750.00	1,500
Thrust blocks, concrete	4	cu yd	650.00	2,600
Booster Pump	1	each	50,000.00	50,000
Yard Valves				
10"	2	each	1,500	3,000
Earthwork for Valve Vault				
Structural excavation	259	cu yd	25.00	6,481
Compacted fill	173	cu yd	12.00	2,074
Waste	86	cu yd	5.00	432
Landscape allowance		Lump Sum		7,500
Concrete, cast in place, for Valve Vault				
Slab on Grade	15	cu yd	650.00	9,630
Walls	44	cu yd	800.00	35,556
Suspended Slab	10	cu yd	1,050.00	10,267
Embedded accessories		Lump Sum		1,600
Metal				
Access Hatch, 4'x6'	1	each	7,500	7,500
Access Hatch, 2.5'x2.5' with ladder	2	each	5,000	10,000
Wall and Ceiling Insulation	440	sq ft	2.50	1,100
Finishes				
Painting				
Piping		Lump Sum		10,000
Heating and Ventilating				
Heat (Unit Heater) and ventilation (vent pipe fan)		Lump Sum		10,000
Electrical				
Lighting - Indoor fluorescent		Lump Sum		10,000
Misc. conduit, Wiring, Hardware & Labor		Lump Sum		10,000
Pump electrical starter	1	each	10,000.00	10,000
Additional electrical for pump	1	each	10,000.00	10,000
I&C				
RTU		Lump Sum		10,000
PLC		Lump Sum		15,000
Pressure guages and transmitters		Lump Sum		2,500
Tank, 30,000 gallons (21 ft x 24 ft x 10 feet tall) (Tank is above grade)				
Earthwork for Tank				
Structural excavation	20	cu yd	25.00	509
Compacted fill	20	cu yd	12.00	244
Waste	0	cu yd	5.00	0
Concrete, cast in place				
Slab on Grade	19	cu yd	650.00	12,133

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Walls	43	cu yd	800.00	34,370
Suspended Slab	28	cu yd	1,050.00	29,400
Embedded accessories		Lump Sum		2,100
Overflow Box	1	each	5,000.00	5,000
Metal				
Access Hatch, 2.5'x2.5' with ladder	2	each	5,000	10,000
Inlet and Outlet Pipes / Connections	2	each	7,500	15,000
Breakpoint Chlorination Building				
Building, 20 ft x 15 ft	300	sq ft	200.00	60,000
Sodium Hypochlorite Equipment	1	each	165,000.00	165,000
(Tanks, Metering Pumps, Pipe, Valves, Analyzers)				
Sodium Bisulfite Equipment	1	each	130,000.00	130,000
(Tanks, Metering Pumps, Pipe, Valves, Analyzers)				
Sitework	1	each	30,000.00	30,000
Yard Piping	1	each	30,000.00	30,000
Electrical	1	each	35,000.00	35,000
I&C	1	each	10,000.00	10,000
Static mixer, 12"	2	each	2,500.00	5,000
Subtotal - Meridian Alt 2 - FM Structure to Tank/Pump to Well Supply Pln				871,646
30% Contingencies Class 5				261,494
19% Engineering and Construction Phase Services				231,858
Land/Easement - Pipeline	450	lin ft	25.00	11,250
Land - Connection	7,500	sq ft	2.00	15,000
Total - Meridian Alt 2 - FM Structure to Tank/Pump to Well Supply Pln				1,478,412

Meridian Alt 3 - FM Structure and WISE Pln to 3 MG Tank

General Requirements				
Mobilization	2.0%	Lump Sum		24,959
Supervision	5.0%	Lump Sum		62,397
Temporary facilities	1.2%	Lump Sum		14,975
Temporary utilities	0.8%	Lump Sum		9,984
Equipment rental & misc.	1.0%	Lump Sum		12,479
Total - General Requirements				$124,795
Meridian Alt 3 - FM Structure and WISE Pln to 3 MG Tank				
Yard Work				
Yard Pipe / Mechanical				
10" Pipe	20	lin ft	150.00	3,000
6" Pipe	20	lin ft	90.00	1,800
54"x10" Tap	1	each	2,000.00	2,000
10"x6" Reducer	2	each	1,000.00	2,000
6" Dismantling Joint	1	each	1,500.00	1,500
6" Magmeter Flowmeter	1	each	2,500.00	2,500
6" Flow Control Valve	1	each	6,000.00	6,000
Air release valve	2	each	750.00	1,500
Thrust blocks, concrete	4	cu yd	650.00	2,600
Yard Valves				
10"	2	each	1,500	3,000
Earthwork for Valve Vault				
Structural excavation	200	cu yd	25.00	5,000
Compacted fill	133	cu yd	12.00	1,600
Waste	67	cu yd	5.00	333
Landscape allowance		Lump Sum		7,500
Concrete, cast in place, for Valve Vault				
Slab on Grade	9	cu yd	650.00	5,778

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Walls	33	cu yd	800.00	26,074
Suspended Slab	5	cu yd	1,050.00	5,600
Embedded accessories		Lump Sum		1,100
Metal				
Access Hatch, 4'x6'	1	each	7,500	7,500
Access Hatch, 2.5'x2.5' with ladder	2	each	5,000	10,000
Wall and Ceiling Insulation	296	sq ft	2.50	740
Finishes				
Painting				
Piping		Lump Sum		5,000
Heating and Ventilating				
Heat (Unit Heater) and ventilation (vent pipe fan)		Lump Sum		10,000
Electrical				
Lighting - Indoor fluorescent		Lump Sum		5,000
Misc. conduit, Wiring, Hardware & Labor		Lump Sum		10,000
I&C				
RTU		Lump Sum		10,000
PLC		Lump Sum		15,000
Pressure guages and transmitters		Lump Sum		2,500
Pipeline				
Western Pipeline to 3 MG Tank, 10"	4,270	lin ft	85.00	362,950
Belford Ave Crossing, Asphalt, 30 feet x 10 ft	33	sq yd	50.00	1,667
Belford Ave Crossing, Asphalt, 30 feet x 10 ft	33	sq yd	50.00	1,667
E-470 Crossing, Tunnel, 24" Casing	340	lin ft	306.00	104,040
Connection to 3 MG Tank		Lump Sum		5,000
Breakpoint Chlorination Building				
Building, 20 ft x 15 ft	300	sq ft	200.00	60,000
Sodium Hypochlorite Equipment (Tanks, Metering Pumps, Pipe, Valves, Analyzers)	1	each	165,000.00	165,000
Sodium Bisulfite Equipment (Tanks, Metering Pumps, Pipe, Valves, Analyzers)	1	each	130,000.00	130,000
Sitework	1	each	30,000.00	30,000
Yard Piping	1	each	30,000.00	30,000
Electrical	1	each	35,000.00	35,000
I&C	1	each	10,000.00	10,000
Static mixer, 12"	2	each	2,500.00	5,000
Contact Time Pipe, 36"	500	lin ft	306.00	153,000
Subtotal - Meridian Alt 3 - FM Structure and WISE Pln to 3 MG Tank				1,247,949
30% Contingencies Class 5				374,385
19% Engineering and Construction Phase Services				331,954
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	0	sq ft	2.00	0
Total - Meridian Alt 3 - FM Structure and WISE Pln to 3 MG Tank				2,079,083

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Phase 1 - Identify, Evaluate, and Select Connection Alternatives
Conceptual Opinion of Construction Cost
Meridian Connection

Meridian Alt 4 - Breakpoint Chlorinate to Pump to Potable Water System

General Requirements				
Mobilization	2.0%	Lump Sum		18,079
Supervision	5.0%	Lump Sum		45,197
Temporary facilities	1.2%	Lump Sum		10,847
Temporary utilities	0.8%	Lump Sum		7,232
Equipment rental & misc.	1.0%	Lump Sum		9,039
Total - General Requirements				$90,395
Meridian Alt 4 - Breakpoint Chlorinate to Pump to Potable Water System				
Meridian Alt 2 (no contingencies or gen requirements)				871,646
Additional 10" Pipe to get to Potable Water System	380	lin ft	85.00	32,300
Subtotal - Meridian Alt 4 - Breakpoint Chlorinate to Pump to Potable Water System				903,946
30% Contingencies Class 5				271,184
19% Engineering and Construction Phase Services				240,450
Land/Easement - Pipeline	830	lin ft	25.00	20,750
Land - Connection	7,500	sq ft	2.00	15,000
Total - Meridian Alt 4 - Breakpoint Chlorinate to Pump to Potable Water System				1,541,724

Meridian Alt 5 - FM Structure to Potable Water System (Existing System Converted to Chloramines)

General Requirements				
Mobilization	2.0%	Lump Sum		6,532
Supervision	5.0%	Lump Sum		16,330
Temporary facilities	1.2%	Lump Sum		3,919
Temporary utilities	0.8%	Lump Sum		2,613
Equipment rental & misc.	1.0%	Lump Sum		3,266
Total - General Requirements				$32,659
Meridian Alt 5 - FM Structure to Potable Water System (Existing System Converted to Chloramines)				
Yard Work				
Yard Pipe / Mechanical				
10" Pipe	830	lin ft	85.00	70,550
6" Pipe	20	lin ft	90.00	1,800
54"x10" Tap	1	each	2,000.00	2,000
Tee to Well Supply Pipeline	1	each	2,000.00	2,000
10"x6" Reducer	2	each	1,000.00	2,000
6" Dismantling Joint	2	each	1,500.00	3,000
6" Magmeter Flowmeter	1	each	2,500.00	2,500
6" Flow Control Valve	1	each	6,000.00	6,000
Air release valve	2	each	750.00	1,500
Thrust blocks, concrete	4	cu yd	650.00	2,600
Booster Pump	1	each	50,000.00	50,000
Yard Valves				
10"	2	each	1,500	3,000
Earthwork for Valve Vault				
Structural excavation	259	cu yd	25.00	6,481
Compacted fill	173	cu yd	12.00	2,074
Waste	86	cu yd	5.00	432
Landscape allowance		Lump Sum		7,500
Concrete, cast in place, for Valve Vault				
Slab on Grade	15	cu yd	650.00	9,630
Walls	44	cu yd	800.00	35,556
Suspended Slab	10	cu yd	1,050.00	10,267
Embedded accessories		Lump Sum		1,600
Metal				
Access Hatch, 4'x6'	1	each	7,500	7,500

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Conceptual Opinion of Construction Cost
Meridian Connection

Access Hatch, 2.5'x2.5' with ladder	2	each	5,000	10,000
Wall and Ceiling Insulation	440	sq ft	2.50	1,100
Finishes				
Painting				
Piping		Lump Sum		10,000
Heating and Ventilating				
Heat (Unit Heater) and ventilation (vent pipe fan)		Lump Sum		10,000
Electrical				
Lighting - Indoor fluorescent		Lump Sum		10,000
Misc. conduit, Wiring, Hardware & Labor		Lump Sum		10,000
Pump electrical starter	1	each	10,000.00	10,000
Additional electrical for pump	1	each	10,000.00	10,000
I&C				
RTU		Lump Sum		10,000
PLC		Lump Sum		15,000
Pressure guages and transmitters		Lump Sum		2,500
Subtotal - Meridian Alt 5 - FM Structure to Potable Water System (Existing System Converted to Chloramines)				326,590
30% Contingencies Class 5				97,977
19% Engineering and Construction Phase Services				86,873
Land/Easement - Pipeline	830	lin ft	25.00	20,750
Land - Connection	0	sq ft	2.00	0
Total - Meridian Alt 5 - FM Structure to Potable Water System (Existing System Converted to Chloramines)				564,849

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SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives
Conceptual Opinion of Construction Cost
Inverness Connection

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Summary				
Inverness Connection				267,607
Inverness Pipeline - Alt 1 (East Alignment)				351,414
Inverness Pipeline - Alt 2 (Central Alignment)				315,758
Inverness Pipeline - Alt 3 (West Alignment)				400,343
Inverness Connection				
General Requirements				
Mobilization	2.0%	Lump Sum		3,033
Supervision	5.0%	Lump Sum		7,581
Temporary facilities	1.2%	Lump Sum		1,820
Temporary utilities	0.8%	Lump Sum		1,213
Equipment rental & misc.	1.0%	Lump Sum		1,516
Total - General Requirements				$15,163
Inverness Connection				
Yard Work				
Yard Pipe / Mechanical				
10" Pipe	20	lin ft	150.00	3,000
6" Pipe	20	lin ft	90.00	1,800
36"x10" Tap	2	each	2,000.00	4,000
10"x6" Reducer	2	each	1,000.00	2,000
6" Dismantling Joint	1	each	1,500.00	1,500
6" Magmeter Flowmeter	1	each	2,500.00	2,500
6" Flow Control Valve	1	each	6,000.00	6,000
Air release valve	2	each	750.00	1,500
Thrust blocks, concrete	4	cu yd	650.00	2,600
Yard Valves				
10"	2	each	1,500	3,000
Earthwork for Valve Vault				
Structural excavation	200	cu yd	25.00	5,000
Compacted fill	133	cu yd	12.00	1,600
Waste	67	cu yd	5.00	333
Landscape allowance		Lump Sum		7,500
Concrete, cast in place, for Valve Vault				
Slab on Grade	9	cu yd	650.00	5,778
Walls	33	cu yd	800.00	26,074
Suspended Slab	5	cu yd	1,050.00	5,600
Embedded accessories		Lump Sum		1,100
Metal				
Access Hatch, 4'x6'	1	each	7,500	7,500
Access Hatch, 2.5'x2.5' with ladder	1	each	5,000	5,000
Wall and Ceiling Insulation	296	sq ft	2.50	740
Finishes				
Painting				
Piping		Lump Sum		5,000
Heating and Ventilating				
Heat (Unit Heater) and ventilation (vent pipe fan)		Lump Sum		10,000
Electrical				
Lighting - Indoor fluorescent		Lump Sum		5,000
Misc. conduit, Wiring, Hardware & Labor		Lump Sum		10,000
I&C				
RTU		Lump Sum		10,000
PLC		Lump Sum		15,000
Pressure guages and transmitters		Lump Sum		2,500
Subtotal - Inverness Connection				151,625

SMW Authority
SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives
Conceptual Opinion of Construction Cost
Inverness Connection

30% Contingencies Class 5				45,488
19% Engineering and Construction Phase Services				40,332
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	7,500	sq ft	2.00	15,000
Total - Inverness Connection				267,607

Inverness Pipeline - Alt 1 (East Alignment)

General Requirements				
Mobilization	2.0%	Lump Sum		4,219
Supervision	5.0%	Lump Sum		10,547
Temporary facilities	1.2%	Lump Sum		2,531
Temporary utilities	0.8%	Lump Sum		1,687
Equipment rental & misc.	1.0%	Lump Sum		2,109
Total - General Requirements				$21,093
Inverness Pipeline - Alt 1 (East Alignment)				
Pipeline				
Connection to Inverness, 10"	2,060	lin ft	85.00	175,100
Liberty Blvd Crossing, Asphalt, 65 feet x 10 ft	72	sq yd	50.00	3,611
Inverness Drive South, Asphalt, 580 feet x 10 ft	644	sq yd	50.00	32,222
Subtotal - Inverness Pipeline - Alt 1 (East Alignment)				210,933
30% Contingencies Class 5				63,280
19% Engineering and Construction Phase Services				56,108
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	0	sq ft	2.00	0
Total - Inverness Pipeline - Alt 1 (East Alignment)				351,414

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SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives
Conceptual Opinion of Construction Cost
Inverness Connection

Inverness Pipeline - Alt 2 (Central Alignment)

General Requirements				
Mobilization	2.0%	Lump Sum		3,623
Supervision	5.0%	Lump Sum		9,056
Temporary facilities	1.2%	Lump Sum		2,174
Temporary utilities	0.8%	Lump Sum		1,449
Equipment rental & misc.	1.0%	Lump Sum		1,811
Total - General Requirements				$18,113
Inverness Pipeline - Alt 2 (Central Alignment)				
Pipeline				
Connection to Inverness, 10"	1,760	lin ft	85.00	149,600
Liberty Blvd Crossing, Asphalt, 65 feet x 10 ft	72	sq yd	50.00	3,611
S Jamaica Street, Asphalt, 265 feet x 10 ft	294	sq yd	50.00	14,722
Sidewalk Replacement, 475 feet x 10 ft	528	sq yd	25.00	13,194
Subtotal - Inverness Pipeline - Alt 2 (Central Alignment)				181,127
30% Contingencies Class 5				54,338
19% Engineering and Construction Phase Services				48,180
Land/Easement - Pipeline	560	lin ft	25.00	14,000
Land - Connection	0	sq ft	2.00	0
Total - Inverness Pipeline - Alt 2 (Central Alignment)				315,758

Inverness Pipeline - Alt 3 (West Alignment)

General Requirements				
Mobilization	2.0%	Lump Sum		4,806
Supervision	5.0%	Lump Sum		12,015
Temporary facilities	1.2%	Lump Sum		2,884
Temporary utilities	0.8%	Lump Sum		1,922
Equipment rental & misc.	1.0%	Lump Sum		2,403
Total - General Requirements				$24,030
Inverness Pipeline - Alt 3 (West Alignment)				
Pipeline				
Connection to Inverness, 10"	2,265	lin ft	85.00	192,525
S Jamaica Street, Asphalt, 265 feet x 10 ft	294	sq yd	50.00	14,722
Liberty Blvd Crossing, Asphalt, 65 feet x 10 ft	72	sq yd	50.00	3,611
Inverness Parkway, Asphalt, 530 feet x 10 ft	589	sq yd	50.00	29,444
Subtotal - Inverness Pipeline - Alt 3 (West Alignment)				240,302
30% Contingencies Class 5				72,091
19% Engineering and Construction Phase Services				63,920
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	0	sq ft	2.00	0
Total - Inverness Pipeline - Alt 3 (West Alignment)				400,343

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SMW Authority
SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives
Conceptual Opinion of Construction Cost
Centennial Connection

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Summary				
Centennial Connection				618,101
Centennial Pipeline				0
Centennial Connection				
General Requirements				
Mobilization	2.0%	Lump Sum		7,406
Supervision	5.0%	Lump Sum		18,516
Temporary facilities	1.2%	Lump Sum		4,444
Temporary utilities	0.8%	Lump Sum		2,963
Equipment rental & misc.	1.0%	Lump Sum		3,703
Total - General Requirements				$37,032
Centennial Connection				
Yard Work				
Pipe / Mechanical				
16" Pipe	575	lin ft	136.00	78,200
12" Pipe	20	lin ft	180.00	3,600
16" Pipe Crossing of Drainage Channel, Additional Cost	120	lin ft	120.00	14,400
54"x16" Tap	1	each	2,000.00	2,000
16" Tee	1	each	2,000.00	2,000
16" x 8" Tee	2	each	2,000.00	4,000
16"x12" Reducer	2	each	1,000.00	2,000
12" Dismantling Joint	1	each	2,000.00	2,000
12" Magmeter Flowmeter	1	each	5,000.00	5,000
12" Flow Control Valve	1	each	15,000.00	15,000
Air release valve	2	each	750.00	1,500
Thrust blocks, concrete	4	cu yd	650.00	2,600
Valves				
16"	2	each	2,400	4,800
8"	2	each	1,200	2,400
Earthwork for Valve Vault				
Sheet piling around entire vault, 104 feet long x 12 feet deep	1,248	sq ft	30.00	37,440
Structural excavation	237	cu yd	25.00	5,926
Compacted fill	237	cu yd	12.00	2,844
Waste	0	cu yd	5.00	0
Landscape allowance		Lump Sum		7,500
ECCV PS, Asphalt, 150 feet x 10 ft	167	sq yd	50.00	8,333
Concrete, cast in place, for Valve Vault				
Slab on Grade	27	cu yd	650.00	17,526
Walls	59	cu yd	800.00	47,407
Suspended Slab	19	cu yd	1,050.00	19,833
Embedded accessories		Lump Sum		2,300
Metal				
Access Hatch, 4'x6'	1	each	7,500	7,500
Access Hatch, 2.5'x2.5' with ladder	1	each	5,000	5,000
Wall and Ceiling Insulation	684	sq ft	2.50	1,710
Finishes				
Painting				
Piping		Lump Sum		10,000
Heating and Ventilating				
Heat (Unit Heater) and ventilation (vent pipe fan)		Lump Sum		10,000
Electrical				
Lighting - Indoor fluorescent		Lump Sum		10,000
Misc. conduit, Wiring, Hardware & Labor		Lump Sum		10,000
I&C				
RTU		Lump Sum		10,000
PLC		Lump Sum		15,000

SMW Authority
SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives
Conceptual Opinion of Construction Cost
Centennial Connection

Pressure guages and transmitters		Lump Sum		2,500
Subtotal - Centennial Connection				370,319
30% Contingencies Class 5				111,096
19% Engineering and Construction Phase Services				98,505
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	575	sq ft	2.00	1,150
Total - Centennial Connection				618,101

Centennial Pipeline

General Requirements				
Mobilization	2.0%	Lump Sum		0
Supervision	5.0%	Lump Sum		0
Temporary facilities	1.2%	Lump Sum		0
Temporary utilities	0.8%	Lump Sum		0
Equipment rental & misc.	1.0%	Lump Sum		0
Total - General Requirements				$0
Centennial Pipeline				
Pipeline				
Cost Included in Connection	0	lin ft	0.00	0
Subtotal - Centennial Pipeline				0
30% Contingencies Class 5				0
19% Engineering and Construction Phase Services				0
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	0	sq ft	2.00	0
Total - Centennial Pipeline				0

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SMW Authority
SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives
Conceptual Opinion of Construction Cost
Stonegate Connection (16" Diameter for 1,000 AF)

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Summary				
Stonegate Connection				293,264
Stonegate Pipeline Alternative 1 - West 470 Bore, Along Jordan				1,910,964
Stonegate Pipeline Alternative 2 - West 470 Bore, Along Keystone Blvd				1,838,696
Stonegate Pipeline Alternative 3 - East 470 Bore, Along Jordan				1,739,842
Stonegate Pipeline Alternative 4 - No Bore, Along Jordan				1,647,667
Stonegate Connection				
General Requirements				
Mobilization	2.0%	Lump Sum		3,341
Supervision	5.0%	Lump Sum		8,351
Temporary facilities	1.2%	Lump Sum		2,004
Temporary utilities	0.8%	Lump Sum		1,336
Equipment rental & misc.	1.0%	Lump Sum		1,670
Total - General Requirements				$16,703
Stonegate Connection				
Yard Work				
Yard Pipe / Mechanical				
16" Pipe	20	lin ft	240.00	4,800
12" Pipe	20	lin ft	180.00	3,600
54"x16" Tap	1	each	2,000.00	2,000
16"x12" Reducer	2	each	1,000.00	2,000
12" Dismantling Joint	1	each	2,000.00	2,000
12" Magmeter Flowmeter	1	each	5,000.00	5,000
12" Flow Control Valve	1	each	15,000.00	15,000
Air release valve	2	each	750.00	1,500
Thrust blocks, concrete	4	cu yd	650.00	2,600
Yard Valves				
16"	2	each	2,400	4,800
Earthwork for Valve Vault				
Structural excavation	200	cu yd	25.00	5,000
Compacted fill	133	cu yd	12.00	1,600
Waste	67	cu yd	5.00	333
Landscape allowance		Lump Sum		7,500
Concrete, cast in place, for Valve Vault				
Slab on Grade	9	cu yd	650.00	5,778
Walls	33	cu yd	800.00	26,074
Suspended Slab	5	cu yd	1,050.00	5,600
Embedded accessories		Lump Sum		1,100
Metal				
Access Hatch, 4'x6'	1	each	7,500	7,500
Access Hatch, 2.5'x2.5' with ladder	1	each	5,000	5,000
Wall and Ceiling Insulation	296	sq ft	2.50	740
Finishes				
Painting				
Piping		Lump Sum		5,000
Heating and Ventilating				
Heat (Unit Heater) and ventilation (vent pipe fan)		Lump Sum		10,000
Electrical				
Lighting - Indoor fluorescent		Lump Sum		5,000
Misc. conduit, Wiring, Hardware & Labor		Lump Sum		10,000
I&C				
RTU		Lump Sum		10,000
PLC		Lump Sum		15,000
Pressure guages and transmitters		Lump Sum		2,500
Subtotal - Stonegate Connection				167,025

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Conceptual Opinion of Construction Cost
Stonegate Connection (16" Diameter for 1,000 AF)

30% Contingencies Class 5				50,108
19% Engineering and Construction Phase Services				44,429
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	7,500	sq ft	2.00	15,000
Total - Stonegate Connection				293,264

Stonegate Pipeline Alternative 1 - West 470 Bore, Along Jordan

General Requirements				
Mobilization	2.0%	Lump Sum		22,941
Supervision	5.0%	Lump Sum		57,352
Temporary facilities	1.2%	Lump Sum		13,764
Temporary utilities	0.8%	Lump Sum		9,176
Equipment rental & misc.	1.0%	Lump Sum		11,470
Total - General Requirements				$114,704
Stonegate Pipeline Alternative 1 - West 470 Bore, Along Jordan				
Pipeline				
Western Pipeline to Booster PS Suction, 16"	6,795	lin ft	136.00	924,120
E-470 Crossing, Tunnel, 30" Casing	500	lin ft	382.50	191,250
Road Crossings, Asphalt, 570 feet x 10 ft	633	sq yd	50.00	31,667
Subtotal - Stonegate Pipeline Alternative 1 - West 470 Bore, Along Jordan				1,147,037
30% Contingencies Class 5				344,111
19% Engineering and Construction Phase Services				305,112
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	0	sq ft	2.00	0
Total - Stonegate Pipeline Alternative 1 - West 470 Bore, Along Jordan				1,910,964

Stonegate Pipeline Alternative 2 - West 470 Bore, Along Keystone Blvd

General Requirements				
Mobilization	2.0%	Lump Sum		22,073
Supervision	5.0%	Lump Sum		55,183
Temporary facilities	1.2%	Lump Sum		13,244
Temporary utilities	0.8%	Lump Sum		8,829
Equipment rental & misc.	1.0%	Lump Sum		11,037
Total - General Requirements				$110,366
Stonegate Pipeline Alternative 2 - West 470 Bore, Along Keystone Blvd				
Pipeline				
Western Pipeline to Booster PS Suction, 16"	6,570	lin ft	136.00	893,520
E-470 Crossing, Tunnel, 30" Casing	500	lin ft	382.50	191,250
Road Crossings, Asphalt, 340 feet x 10 ft	378	sq yd	50.00	18,889
Subtotal - Stonegate Pipeline Alternative 2 - West 470 Bore, Along Keystone Blvd				1,103,659
30% Contingencies Class 5				331,098
19% Engineering and Construction Phase Services				293,573
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	0	sq ft	2.00	0
Total - Stonegate Pipeline Alternative 2 - West 470 Bore, Along Keystone Blvd				1,838,696

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SMW Connections to the Western Pipeline
Phase 1 - Identify, Evaluate, and Select Connection Alternatives
Conceptual Opinion of Construction Cost
Stonegate Connection (16" Diameter for 1,000 AF)

Stonegate Pipeline Alternative 3 - East 470 Bore, Along Jordan

General Requirements				
Mobilization	2.0%	Lump Sum		20,886
Supervision	5.0%	Lump Sum		52,216
Temporary facilities	1.2%	Lump Sum		12,532
Temporary utilities	0.8%	Lump Sum		8,355
Equipment rental & misc.	1.0%	Lump Sum		10,443
Total - General Requirements				$104,432
Stonegate Pipeline Alternative 3 - East 470 Bore, Along Jordan				
Pipeline				
Western Pipeline to Booster PS Suction, 16"	6,321	lin ft	136.00	859,656
E-470 Crossing, Tunnel, 30" Casing	400	lin ft	382.50	153,000
Road Crossings, Asphalt, 570 feet x 10 ft	633	sq yd	50.00	31,667
Subtotal - Stonegate Pipeline Alternative 3 - East 470 Bore, Along Jordan				1,044,323
30% Contingencies Class 5				313,297
19% Engineering and Construction Phase Services				277,790
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	0	sq ft	2.00	0
Total - Stonegate Pipeline Alternative 3 - East 470 Bore, Along Jordan				1,739,842

Stonegate Pipeline Alternative 4 - No Bore, Along Jordan

General Requirements				
Mobilization	2.0%	Lump Sum		19,780
Supervision	5.0%	Lump Sum		49,450
Temporary facilities	1.2%	Lump Sum		11,868
Temporary utilities	0.8%	Lump Sum		7,912
Equipment rental & misc.	1.0%	Lump Sum		9,890
Total - General Requirements				$98,900
Stonegate Pipeline Alternative 4 - No Bore, Along Jordan				
Pipeline				
Western Pipeline to Booster PS Suction, 16"	6,790	lin ft	136.00	923,440
Road Crossings, Asphalt, 1180 feet x 10 ft	1,311	sq yd	50.00	65,556
Subtotal - Stonegate Pipeline Alternative 4 - No Bore, Along Jordan				988,996
30% Contingencies Class 5				296,699
19% Engineering and Construction Phase Services				263,073
Land/Easement - Pipeline	0	lin ft	25.00	0
Land - Connection	0	sq ft	2.00	0
Total - Stonegate Pipeline Alternative 4 - No Bore, Along Jordan				1,647,667