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Owner's Distribution Water System Start-Up Plan

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Prepared for

City of Longview
1525 Broadway
Longview, Washington 98632

K/J Project No. 0997003*01

Table of Contents

Table of Contents (cont'd)

List of Tables

List of Figures

List of Attachments

Introduction

Timely response is of the essence in starting up a new potable water supply and treatment plant for the City of Longview (City). Without proactive preparation, there is a chance for regulatory and aesthetic water quality excursions as a new system begins operation. At the Mint Farm Regional Water Treatment Plant (MFRWTP) where treated groundwater enters the distribution system, potential problems include:

- Sediment scouring due to water flowing in different directions and changes in pressures within the distribution system
- Dislodging and release of existing scales
- Taste and odor complaints resulting from the slightly different taste of the new source and disturbance of pipeline environments.

Corrosion control for compliance with the Lead and Copper Rule is also of concern and is addressed under separate cover in the MFRWTP Corrosion Control Plan. This Water System Start-Up Plan (Plan) presents recommendations to avoid water quality issues based upon hydraulic modeling, a review of flushing procedures, water quality data analysis, and the experience of other utilities.

Objective

The objective of this Plan is to ensure consistent distribution system water quality during and after completion of MFRWTP testing and commissioning as specified in Sections 01650 and 01660 of the Project Manual for the MFRWTP.

This Plan is the Owner's Start-Up Plan referenced in Section 01660-2.02 of the Project Manual. This Plan shall be incorporated, as specified in Section 01660, into the Contractor's Commissioning Plan. Any discrepancies between other provisions of Section 01660 and this Plan shall be resolved as determined by the Engineer.

Current Flushing Plan

The City's distribution system is currently divided into eight distinct flushing areas, as presented in Figure 1. The current plan utilizes unidirectional and bidirectional flushing to prepare the distribution system for the MFRWTP's start-up. Unidirectional flushing is flushing in a single direction while bidirectional flushing uses both forward and reverse flushing. Bidirectional and unidirectional flow differ in the attempt to remove scale and remove debris. Bidirectional flushing helps to breakdown scale and sediment otherwise stable in the distribution system. Unidirectional flushing is intended to remove the scale, debris, and particles contained in the distribution system.

Flushing is performed in the spring and fall when system demands are low. A limited flushing is performed in the summer and winter (temperature permitting) that includes only the specific places documented to experience aesthetic water quality issues between flushing cycles. This schedule has eliminated water quality complaints unrelated to specific flow events. The City has improved the efficiency of its flushing program by carefully selecting valves to close during flushing. The total volume of water used annually for flushing has been reduced from 48 million gallons (MG) to the current level of 16 MG.

Within the distribution system, the newer pipes were installed in the 1960s, whereas the older infrastructure was installed in the 1920s. The older infrastructure in Zones 2, 3, and 4 are the most problematic with the highest frequency of water quality complaints. The complaints typically mention dirty water, stagnant water, and red water/corrosion problems. Much fewer complaints are generated in the areas with newer infrastructure.

In the past, the City utilized only unidirectional flushing starting near the RWTP located on Fishers Lane and moving outward through the system. In anticipation of the MFRWTP coming online, the City has implemented bidirectional flushing as the new MFRWTP is more centrally located in the distribution system and directional flow changes will occur in some areas.

Bidirectional flushing takes place in the fall for all mains in Zones 1, 2, 3, and 4. This flush is intended to scour particles, sediment, and scale that may otherwise be released when the MFRWTP begins operation and water flows in different directions compared to current conditions. The City completed bidirectional flushing in 2009 and 2010. Unidirectional flushing was performed in all eight areas spring of 2011 in roughly the direction most pipes will experience flow with the MFRWTP online. In April and May 2011, flushing was performed on water mains in all areas.

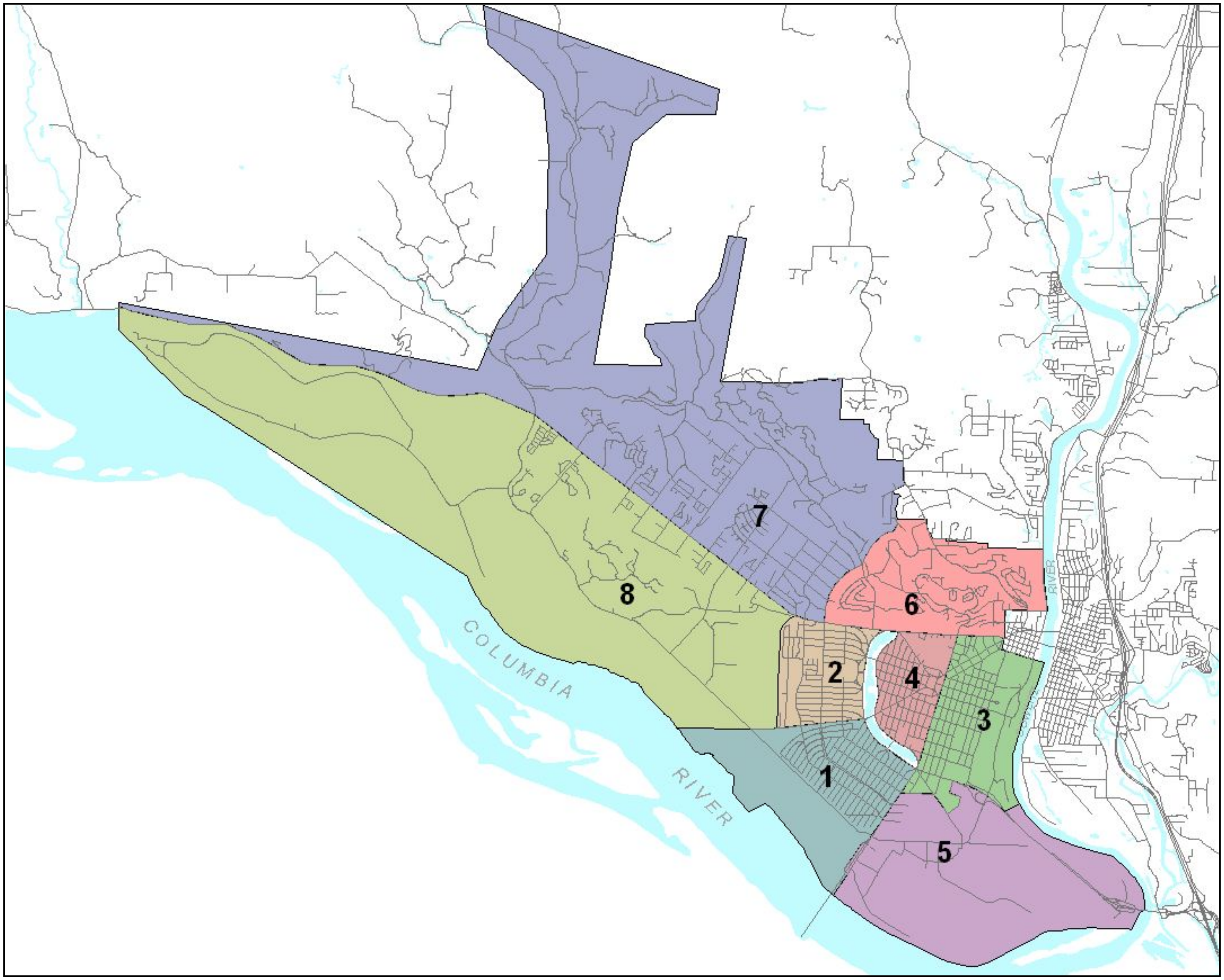


Figure 1: City of Longview's Distribution System Flushing Zones

Reservoir Cleaning

The City cleans the system's reservoirs to remove sediment build up and prevent it from re-entering the City's water system. The Mt. Solo and Hillside reservoirs serve the City's main 244 zone. These reservoirs are all concrete construction and have a combined effective capacity of approximately 12.4 MG. These reservoirs were cleaned in approximately 1997 and again in January 2009. Accurate records to document reservoir cleanings prior to 1997 do not exist.

All of the City's 12 reservoirs were cleaned in 2009 by an outside contractor. The reservoirs were found to be reasonably free of settled solids and relatively clean. The average sediment depth measured in the reservoirs prior to the cleaning was 3 inches. A maximum sediment depth of 9 inches was found at the Hillcrest Reservoir. In summer 2012, City staff noted that sediment had begun to accumulate in the reservoirs ranging from 1 inch plus in the main 244 zone reservoirs to ½ inch in the upper reservoirs. To reduce the possibility of re-entraining and reintroducing sediments from the reservoirs into the distribution system, it is recommended that the main 244 zone reservoirs be cleaned either just prior to or immediately after the new MFRWTP has come online. At a minimum, this cleaning should be completed within 3 to 6 months of continuous MFRWTP operation.

Hydraulic Modeling

Hydraulic modeling was performed using the City's model to identify pipes that would experience a significant change in flow conditions, i.e., a flow reversal or increase in flow rate by a factor of 10 or greater under Average Day Demand (ADD) conditions. These pipes were added to the City's priority list for flushing as they are more likely to generate scoured particles and mobilize sediment and scales in the distribution system when disturbed. An estimated ADD for 2013 of 3,500 gallons per minute (gpm) was used to simulate the highest pressure scenario. A factor of 10 was used to identify pipes that would experience permanent flow changes versus temporary increases due to peak demands. Scale within the pipe will have adapted to peaking observed within the existing flow pattern of the system; therefore, a factor of 10 was used to isolate pipes where scale will be vulnerable to scour.

The demand was assumed to occur uniformly throughout the distribution system. Several MFRWTP well pump combinations were investigated in hydraulic modeling scenarios. Each well pump will operate at a constant rate of approximately 4,000 gpm with one or two well pumps normally operating in parallel at any given time. The following specific scenarios were compared to identify pipes of concern:

- No MFRWTP well pumps running compared to one well pump running
- No MFRWTP well pumps running compared to two well pumps running
- One MFRWTP well pump running compared to two well pumps running.

Table 1 presents the number and size of pipes within the model that were forecast to experience a flow reversal or increase in flow by a factor of 10 when the MFRWTP is brought online. The identified pipes are also marked on a system map included as Attachment 1 of this document. The City has incorporated the pipes identified as experiencing flow reversal or a 10-fold flow increase into their flushing program. Most of the pipes identified in Table 1 are located in Zones 1 through 4 where the City currently conducts a regular flushing program.

Table 1: Pipes Expected to Experience Flow Reversal or Increase in Flow Rate by a Factor of 10

Pipe Diameter (inch)	Number of Pipe Sections with Flow Reversal	Number of Pipe Sections with Increase in Flow Rate by a Factor of 10
30	1	0
24	2	0
20	16	0
16	4	0
14	10	1
12	41	14
8	76	9
6	103	9
4	6	1

The hydraulic model was also used to determine system pressures at specific nodes throughout the distribution system. The results are presented in Table 2 for selected nodes in the vicinity of the MFRWTP with older infrastructure. This evaluation was performed to help the City decide whether pipe replacements should be accelerated in areas surrounding the MFRWTP that may experience higher pressures once the MFRWTP is online.

Table 2: Pressures at Selected Nodes as a Function of Number of Well Pumps Online

Node ID[(a)]	Pressure (psi) with # of Pumps Online[(b)] 0	1	2	3	Existing Pressures with RWTP Online	Description
J-605	98.8	99.9	101.9	105.6	98	Maple St. and 30th Ave.
J-318	96.7	97.6	99.5	102.9	96	Maple St. and 28th Ave.
J-314	96.7	97.6	99.4	102.7	94	Maple St. and Maryland St.
J-313	96.7	97.6	99.3	102.4	94	Maple St. and NW Nichols Blvd.
J-269	101.0	102.1	104.5	108.9	100	30th Ave. and Washington Way
1371	103.1	104.3	106.7	111.1	100	30th Ave and Dover St.
J-270	103.2	104.6	107.8	113.5	101	33rd Ave and Hemlock St.
J-339	103.2	104.3	106.7	111.1	Does not currently exist	30th Ave. and William Ave.
J-16	100.9	101.6	102.6	104.8	98	27th Ave. and Baltimore St.
J-4	98.8	99.5	100.5	102.8	100	27th Ave. and Colorado St.
J-17	100.9	101.6	102.6	104.7	100	26th Ave. and Baltimore St.
120	97.5	98.1	98.6	99.8	98	21st Ave. and Fir St.
J-226	98.9	99.5	100.0	101.2	96	21st Ave. and Hemlock St.
116	98.9	99.4	100.0	101.2	98	20th Ave. and Fir St.
114	98.9	99.4	100.0	101.1	100	20th Ave. and Florida St.
112	98.9	99.4	100.0	101.1	Unknown	On 20th Ave.
108	98.9	99.4	100.0	101.1	100	20th Ave. and Washington Way
J-247	99.1	99.7	100.2	101.4	97	19th Ave. and Delaware St.
J-225	98.9	99.4	99.9	101.1	99	19th Ave. and Washington Way
J-248	99.8	100.3	100.8	102.0	98	18th Ave. and Delaware St.
J-249	96.7	97.3	97.7	98.9	100	18th Ave. and Hemlock St.
J09-301	103.2	105.2	110.1	118.4	Does not currently exist	East of MFRWTP
J09-302	102.8	104.7	109.3	117.1	Does not currently exist	North of MFRWTP
J09-161	103.2	104.7	108.4	114.8	Does not currently exist	East of MWRFTP on Hoehne Ave.
J-PIPEOPTN5B	102.3	104.0	107.8	114.4	Does not currently exist	Northern end of the Mint Farm

Notes:

(a) From Hydraulic Model.
(b) Based on Average Day Demand for 2013.

The nodes identified in Table 2 anticipated to experience 10 percent or greater pressure increases are summarized in Table 3. An increase of 10 percent or more occurred only when three MFRWTP well pumps were brought online at the same time, compared to the scenario where all well pumps are offline. Only two nodes, 1371 and J-270, in the model observed over 10 percent increases in pressure, 11 percent and 12 percent, respectively, with the MFRWTP online compared to the RWTP. It should be noted that nodes the last four nodes indicated in Table 3 will be constructed as part of the MFRWTP project.

Table 3: Nodes with Highest Anticipated Increase in Pressure

Node ID	Increase in Pressure[(a)]
J-270	12%
J-1371	11%
J09-301	15%
J09-302	14%
J09-161	11%
J-PIPEOPTION5B	12%

Note:

(a) Increase in pressure with three MFRWTP well pumps running compared to all well pumps offline. ADD of 3,500 gpm (2013).

Data Logger Summary

A data logger (Dickson model PR300) was installed at two locations at different times in the vicinity of the MFRWTP to collect pressure data for the existing system and to assess the extent of pressure fluctuations. The first location was on a water main in 33rd Avenue near William Street, close to node J-270. The other was on Weber Avenue south of Hoehne Avenue. Pressure data were recorded once per minute on a continuous basis for approximately six days at a time.

The data logger results are presented in Table 4. For the 33rd Avenue location, the measured pressures are generally close to the hydraulic model prediction of 103.2 pounds per square inch (psi) although increases in pressure to 107 to 108 psi regularly occurred (approximately once per day). These maximum pressures correspond to predicted pressures when two MFRWTP well pumps are online and indicate this pipe is sufficiently sound to tolerate these pressures and immediate replacement may not be needed. Extremely low or negative pressure transients were not observed in the data logger results, although the lowest recorded pressures were approximately 10 psi below the average pressure. At the location on Weber Avenue, south of Hoehne Avenue, maximum and average pressures observed were approximately 2 to 4 psi lower than those observed at the 33rd Avenue location. The minimum pressures at this location on Weber Avenue were similar or lower than those at the 33rd Avenue location. Flows during April, May, and June 2010, when the pressure data logging was conducted, were typically close to the ADD for the RWTP.

Table 4: Pressure Data Logger Summary

Observation Dates and Locations	Minimum	Pressure (psi) Average	Maximum
33rd Avenue near William Street:			
April 7-12	93.2	103.3	107.8
April 14-19	94.3	104.4	108.3
April 21-27	95.6	104.1	108.6
April 28-May 4	98.0	104.3	109.2
Weber Avenue south of Hoehne Avenue			
May 23-28	95.8	101.1	105.8
June 2-7	89.3	100.6	106.8

Chlorine Residual Data

Free chlorine residuals were monitored at the City's normal coliform monitoring locations between June and November 2010. The purpose of this sampling was to better understand fluctuations in chlorine residuals under existing conditions and to locate current areas of higher water age, as indicated by a lower chlorine residual. A detectable free chlorine residual in the distribution system in 95 percent of the samples is required by Washington Administrative Code (WAC) 246-290-662. The City will maintain a target residual of 0.5 milligrams per liter (mg/L) in order to remain in compliance and meet treatment goals for the MFRWTP. Sampling was performed approximately every two weeks and the data are presented in Table 5, sorted from lowest to highest average chlorine residual.

Table 5: System Chlorine Residual Monitoring Data Summary

Location	Elevation	Zone	Residual (mg/L) Min	Avg	Max
150 Clark Creek Ln.	395	Upper Clark Creek	0.04	0.27	0.62
16 Clearview	488	Curtis	0.05	0.34	0.88
3170 Ammons	506	N. Ammons	0.06	0.34	0.62
1824 Coal Creek	502	Upper Coal Creek	0.10	0.36	0.69
188 Curtis	660	Columbia View	0.09	0.40	1.12
136 Tanglewood	653	Trella	0.07	0.40	0.78
637 21st	244	Main	0.20	0.41	0.72
346 N. 50th	531	N. 50th	0.12	0.46	0.99
2302 Cedar	286	Cedar	0.20	0.53	0.81
1051 Coal Creek	415	Niemi	0.21	0.53	0.92
2430 Park Hill	481	Hillcrest	0.16	0.56	0.96
1325 23rd	244	Main	0.38	0.64	0.86
2770 48th	244	Main	0.16	0.66	0.94
3747 Sunset	318	Lower Ammons	0.40	0.70	0.86
3341 Washington	244	Main	0.63	0.75	0.85
1041 Industrial	244	Main	0.62	0.75	0.94
105 Terumi	244	Main	0.65	0.77	0.82
3544 Fairway	463	Ammons	0.60	0.80	1.26
5304 Oriole	244	Main	0.56	0.80	0.99
3821 Oak	244	Main	0.64	0.82	0.98
Plant Effluent			1.0	1.2	1.5

Chlorine residuals in the main pressure zone were found to be reasonably stable with only two measurements below 0.2 mg/L (the minimum level required at the entry point to the distribution system) out of 17 sampling events at 21 locations. A chlorine residual below 0.2 mg/L occurred four times at each of the three locations with the lowest average chlorine residual (150 Clark Creek Lane, 16 Clearview, and 3170 Ammons). Only one instance of a chlorine residual below 0.05 mg/L (the typical minimum detectable level) was observed during the sampling period.

The Park Hill area, served mainly by the 1.0 MG concrete Hillcrest Reservoir, has occasionally experienced low chlorine residuals but the average chlorine residual observed during the monitoring period was 0.56 mg/L at 2430 Park Hill in the Hillcrest Zone.

The water level in the Columbia View Reservoir was reduced from nearly full to approximately 70 percent full in fall 2010. This change helped to reduce the water age in the Columbia View Zone and increase chlorine residuals.

Integrating New Sources of Supply and Lessons from Other Utilities

Kennedy/Jenks Consultants looked at the experiences of other utilities that have changed water sources or added dissimilar waters to an existing system. Table 6 presents a brief summary of case studies and the approaches used by several utilities who have changed source waters.

Table 6: Summary of Water Systems Switching or Adding a New Source

System	Water Source Change	Transition Plan
City of Tucson, AZ	Added surface water to existing groundwater source	• Direct delivery of the surface water in 1992 resulted in extreme color, red water, tubercle release, taste and odor, and corrosivity complaints, mainly related to galvanized steel pipe, and was discontinued in 1994. • After direct delivery failed, the City of Tucson conducted bench/pilot and flavor testing and then performed demonstration testing at four neighborhoods to test impact of blending the two waters prior to introduction to the distribution system. • Switched to groundwater recharge in 2001 with recovered water pumped to the system.
San Antonio Water System (SAWS), TX	Studied use of Guadalupe and Trinity Rivers and Carrizo Aquifer to supplement existing Edwards Aquifer supply	• Developed Multiple Source Integration Study. • Participated in bench-scale study of pipe samples, corrosion scales, and pipe loop studies (including new waters and blends). • Hydraulic modeling to identify impact areas. • Carrizo aquifer and Guadalupe waters tended to cause iron release. • Polyphosphate inhibitor recommended for Guadalupe water and alkalinity adjustment with lime and carbon dioxide recommended to control corrosion for Carrizo water.
Fresno, CA	Low-mineral Enterprise Canal surface water added to groundwater system with high mineral content	• Participated in bench-scale study of pipe samples, corrosion scales, and pipe loop studies. • Rigorous pH control found to be main factor for controlling iron release. • Polyphosphate recommended to mitigate red water and stabilize iron-based scales.
Corpus Christie, TX	Added low mineral content Lake Texana water to system with existing high-mineral Nueces River water	• Participated in bench-scale study of pipe samples, corrosion scales, and pipe loop studies. • pH stability found to be key to avoid iron release and control corrosion. • Relatively high pH of 8.5 to 9 recommended to avoid problems.
Brazos River Authority, TX	Planning to add Carrizo-Wilcox Aquifer water to Lake Granger	• Considered conjunctive use, although ground water appears to be added to Lake Granger and is not pumped directly into the system. • Desk-top study to determine acceptable water quality for addition to lake. • No data on full-scale implementation in literature.

System	Water Source Change	Transition Plan
Tampa Bay, FL	Wholesale system introducing treated surface water and desalinated sea water to member systems with existing ground waters	• Participated in bench-scale study of pipe samples, corrosion scales, and pipe loop studies. • Performed multiple studies including water quality modeling studies. • pH control found to be key for controlling corrosion for most source water blends. • Polyphosphate inhibitor also required for some blends. • Modeling identified appropriate blending ratios to meet water quality goals for iron, copper, and lead. • Member governments refined corrosion control (pH and alkalinity targets) to reduce initial complaints.
Modesto, CA	Adding treated low-mineral surface water (from snow melt) to existing groundwater system	• Focused on stabilizing pH and alkalinity. • Lime addition with carbon dioxide added in post-filtration stabilization basin. • Sodium hydroxide addition for final pH trimming downstream of the basin. • Addition of corrosion inhibitor rejected due to need to add at multiple well locations.
Tacoma Water, WA	Green River is main source, added local ground water wells to supplement	• Installed water quality monitoring and developed experience over the long time period in which wells have been used (the City of Tacoma started developing the South Tacoma Wellfield in the early 1900s).
Lakehaven Utility District, Cities of Kent and Covington, WA	Use existing groundwater wells and added treated Green River water with the "Second Supply Project" (SSP)	• Lakehaven: initially isolated a portion of the system for SSP water, later added chlorine to all wells, added orthopolyphosphate to inhibit corrosion, and added pressure filters to remove iron/manganese from well water, then implemented flushing program. • Kent: evaluated corrosion control using water chemistry models, performed hydraulic modeling. • Covington: water quality monitoring at SSP connection, removed pH adjustment from one existing well to better match the water qualities.

Key findings from a review of these cases include:

- The impact (chemical and other) of mixing dissimilar waters in the distribution system must be considered as part of the facilities design and is difficult to address after differing waters have already been introduced into a system.

- Comingling and maintaining multiple sources of supply with differing water qualities with minimal complaints and corrosion issues is possible.

- Of the case studies available, the addition of groundwater wells to an existing system with treated surface water at Tacoma Water is most similar to Longview. However, that system continues to use both sources of supply, co-mingling the waters in their system.

- Adding corrosive surface water to an existing system conditioned with groundwater may be more problematic than adding groundwater to surface water because of the high probability of iron corrosion and the release of iron scales.

- Compliance with a specific pH goal can be an overriding requirement to control iron release and avoid disruption of existing scales.

Factors Effecting Success of Source Transition

There are several factors that will improve the success of the City's transition to groundwater and the MFRWTP. The three main factors are:

1. *Flushing Procedures* – Maintaining current flushing program and long-term flushing program.

2. *Matching Current Water System pH* – Water from the MFRWTP should match the current pH in the system.

3. *Monitoring During Transition* – Organize citizen sentinels or monitor color.

These three factors are discussed in more detail below with recommendations for improving success of the transition.

Flushing Procedures. The City's current flushing program is appropriate with the focused bidirectional flushing of Zones 1 through 4 in the main pressure zone in the fall. These zones contain older pipe and the majority of steel and cast iron pipe. The City should continue to perform the bidirectional flushing in the fall in Zones 1 through 4 to scour pipes in both directions and to remove as much sediment and scale particles as possible prior to start-up of the MFRWTP. Bidirectional fall flushing should be performed in 2012 prior to commissioning of the MFRWTP and introduction of groundwater into the system. **The bidirectional flushing in the fall should be performed in 2013 to continue to scour Zones 1 through 4 as the system becomes conditioned with the new groundwater. This will facilitate removal of existing accumulated material within the pipes as new scales begin to form.**

A full system unidirectional flush should be performed again in September/October 2012 to prepare for the start-up of the MFRWTP. Ensuring that unidirectional flushing activities begin at the MFRWTP and progressing toward the outer limits of the system is important.

Preparations should be made to initiate extra spot flushing in late (December) 2012 and early 2013 and to initiate the system-wide, spring 2013 flush earlier than usual. The December 2012 spot flushing should include the areas identified by the City as hot spots based on historical information as well as the areas identified on Attachment 1 that will experience flow direction and flow rate changes. After the bidirectional flushing in 2013 is completed and MFRWTP operations are stable, the City should implement a long-term flushing plan of unidirectional flushing starting at the MFRWTP and progressing outwards towards the limits of the distribution system. This unidirectional flushing should take place in both spring and fall. Bidirectional flushing will not be utilized in the long-term plan.

Coordination with Beacon Hill Water and Sewer District (BHWSD) should be maintained to ensure they are aggressively flushing their system before the MFRWTP start-up. There are no anticipated flow changes in the BHWSD system because they will continued to be served by the same interties with the City. Unidirectional flushing from the interties outward would provide adequate flushing of the BHWSD system.

Matching System Water pH. The MFRWTP includes sodium hydroxide injection to increase the pH of the groundwater to match the existing surface water in the system. As part of the Commissioning process, the sodium hydroxide dose will be refined to match the average pH within the system at the time production is initiated. This will help match the water quality of the two waters and is anticipated to be adequate for control of copper, lead, iron corrosion, and iron release. This pH should be maintained into the future.

Monitoring During Transition Period. Two approaches are recommended for monitoring water quality in the distribution system during the transition period of the first several weeks following start-up of the MFRWTP and discontinuing operation of the existing RWTP:

1. Use select consumers as sentinels to help identify potential problems.

    - **Consumers as Sentinels**. This approach is recommended if appropriate consumers can be identified to take advantage of their vigilance in reporting potential problems. These sentinel consumers should be coached ahead of time to collect samples of any questionable water that contains visible particles, rust, scale, or off-flavor. The City should collect these samples for inspection and initiate spot flushing at appropriate locations to address the complaint. As much as possible, sentinel consumers should be enlisted throughout the entire distribution system. Sentinels could possibly help during a direct flush at start-up. Direct flushing before start-up is recommended to avoid color and debris in the distribution system.

2. Add Apparent Color monitoring to the regular Coliform Monitoring Plan.

    - **Apparent Color Data**. Collect samples for Apparent Color analysis at the regular locations of coliform monitoring throughout the distribution system. Apparent Color has been shown to correlate to total iron and spectrophotometric testing can provide early warning of iron release in the system. Data collection should begin several months prior to the start-up of the MFRWTP to develop a baseline dataset. The data should be tracked and plotted with time so trends become apparent. Spot flushing should be targeted at those locations where Apparent Color is increasing over time.

BHWSD receives all of its water RWTP via the City's Hillside Reservoirs; therefore, BHWSD should apply the same monitoring program as the City during the transition period. Sentinels for the BHWSD monitoring should be trained along with the sentinels for the City. Coordination with BHWSD should be established so they stay informed about the monitoring approach of the City.

Alternatives for Introducing Groundwater into the System

Four possible start-up alternatives for the MFRWTP have been identified: Gradual Transition, Alternating Transition, Rapid Transition, and Rapid Transition with Aggressive Distribution System and Reservoir Flushing. Table 7 shows the four alternatives and gives the pros and cons of each. As previously discussed in this report, it appears the need to gradually transition the water sources may be unnecessary due to the similarities in water quality. Furthermore, given that the existing RWTP will be completely taken offline following start-up of the MFRWTP, alternatives which introduce the groundwater into the system sooner are preferred.

Analysis of Alternatives

Given the above considerations, Gradual Transition and Alternating Transition were eliminated from further discussion. The two remaining alternatives, Rapid Transition and Rapid Transition with Aggressive Distribution System and Reservoir Flushing are discussed in more detail below.

The goals in transitioning to the MFRWTP are to (1) minimize start-up time and operational workload for the City; and (2) to avoid water quality issues for the customers. One concern with Rapid Transition with Aggressive Distribution System and Reservoir Flushing program is the possibility that sediments in the system and the reservoirs could be agitated and suspended in the water and appear at consumer's taps. Consumers may assume these suspended particles are contaminants in the MFRWTP supply and cause unnecessary public concern. As a result, we recommend the City implement start-up alternative Rapid Transition from the RWTP to the MFRWTP.

Recommended Alternative

The proposed Rapid Transition includes discontinuing operation of the RWTP and beginning operation of the MFRWTP at essentially the same time. To accomplish this, the MFRWTP must be fully commissioned, with all equipment operational and tested and chemical feed systems calibrated. When this transition occurs, the MFRWTP will be operated with one well pump on and other wells coming online to maintain the required elevation in the Hillside Reservoirs. Simultaneously, operations staff should be on hand to restart the RWTP in case major problems with the MFRWTP start-up temporarily prevent its use as the sole source of drinking water supply.

Table 7: Summary of MFRWTP Start-Up Alternatives

Start-Up Alternative	Description	Pros	Cons
1. Gradual Transition	Maintain operation of the existing RWTP while the MFRWTP is gradually brought online, over a period of about one week. Routine distribution system flushing is performed concurrently, and gradually diminished depending on the stability of water quality.	• Allows for immediate shut-down of the MFRWTP and return to the RWTP in the event of an operational or water quality issue during start-up.	• Requires operations crews at both water treatment plants. • Increases the residence time of slightly dissimilar water qualities. • Prolongs start-up.
2. Alternating Transition	Once the MFRWTP is ready to be placed into service, it would be operated on alternate days with the RWTP in operation when the MFRWTP is out of service. After one week, the MFRWTP would operate an increasing number of days with a corresponding reduction in the days the RWTP is operated. Routine distribution flushing is performed throughout this period.	• Allows city crews to focus on the operation of a single treatment facility each day.	• Increases the residence time in the distribution system of slightly dissimilar water qualities. • Prolongs start-up. • Requires significant coordination and flexibility of the City's operations group.
3. Rapid Transition	The MFRWTP is brought online at the conclusion of commissioning. Planned distribution flushing continues. The RWTP is placed on standby.	• Decreases residence time of slightly dissimilar water qualities. • Decreases start-up time.	• Requires the RWTP to remain on standby and "duty ready" throughout start-up of the MFRWTP.
4. Rapid Transition with Aggressive Distribution and Reservoir Flushing	Same as Alternative 3; however, the distribution system and reservoirs are aggressively flushed in order to move water quickly throughout system.	• Significantly decreases distribution system residence time of slightly dissimilar water qualities. • Decreases start-up time.	• Overly aggressive flushing, especially at the low zone reservoirs, may result in re-suspension of silts and sediments. • Requires the RWTP to remain on standby and "duty ready" throughout start-up of the MFRWTP.

Implementation of Recommended Alternative

Under the proposed Rapid Transition, start-up for the MFRWTP will proceed as follows:

Step 1:

Complete the commissioning process for the MFRWTP, including validation of all control settings and treatment requirements prior to pumping treated water into the distribution system.

Step 2:

Complete regularly scheduled unidirectional and bidirectional distribution system flushing in the fall; approximate September/October timeframe. In December or approximately two weeks prior to start-up, City crews will perform “hot spot” bidirectional flushing of the distribution system as identified in this Plan. The “hot spots” will include known trouble areas as well as areas that will experience flow direction change and/or increased flows.

Step 3:

One week prior to start-up, implement Citizen Sentinels Program. Approximately 25 to 30 residences will be selected, 15 in the low zone and the remaining scattered throughout the City’s high zones. Each of these individuals should be available and willing to notify the City in the event they detect some water quality anomaly. A 2-hour training session will be conducted to educate the Citizen Sentinels on methods to identify changes in the water quality from their taps based upon visual observation or odors.

Step 4:

One day prior to plant start-up, the Contractor, Kennedy/Jenks Consultants, and City staff shall assure all chemical set points are properly set and all facilities are duty ready. Reservoirs levels will be adjusted to low level operating conditions. By reducing water in the reservoirs it will reduce the amount of time necessary to transition from the old water to the new, as well as allow the new MFRWTP plant to operate for a longer period of time during the transition to the new facility.

Step 5:

On the morning of start-up, the RWTP will be taken offline and one pump at the MFRWTP will be started. It is anticipated start-up will occur in December 2012 when one well pump can meet typical average day demands for that time period. The MFRWTP and the one pump will run on automatic control for the entire day. The set points for elevation control of the Hillside Reservoir should be set up so only one pump is required to operate unless the Reservoir elevation drops below elevation 243.5 feet. Given the beginning low levels in the reservoirs it may be necessary for more than one well to operate initially. Throughout the day, it is anticipated that one well pump will start and stop, as required to maintain the elevation in the Hillside Reservoir. Should the reservoir elevation drop below 243.5 feet, a second well pump may be required.

On Day 2 of start-up, operations staff will rotate the MFRWTP primary well to a different well pump. Throughout the day, that well pump will supply the City's needs and fill the main reservoirs, turning off and on depending on the elevation of the reservoir.

Day 3 of start-up will be similar to the previous two days except a third different well pump will be operated in the primary position and run throughout the day. Similarly, on Day 4, the fourth well pump would run throughout the day.

At the conclusion of Day 4, the City will switch the plant to an automatic mode to restart and rotate one or more pumps as needed to maintain reservoir levels above a given set point.

Initially, the City will staff the MFRWTP 24 hours a day to ensure correct operation. The RWTP will remain in standby during the initial operations of the MFRWTP. The City will switch back to standard operating hours once operating confidence in the MFRWTP is established.

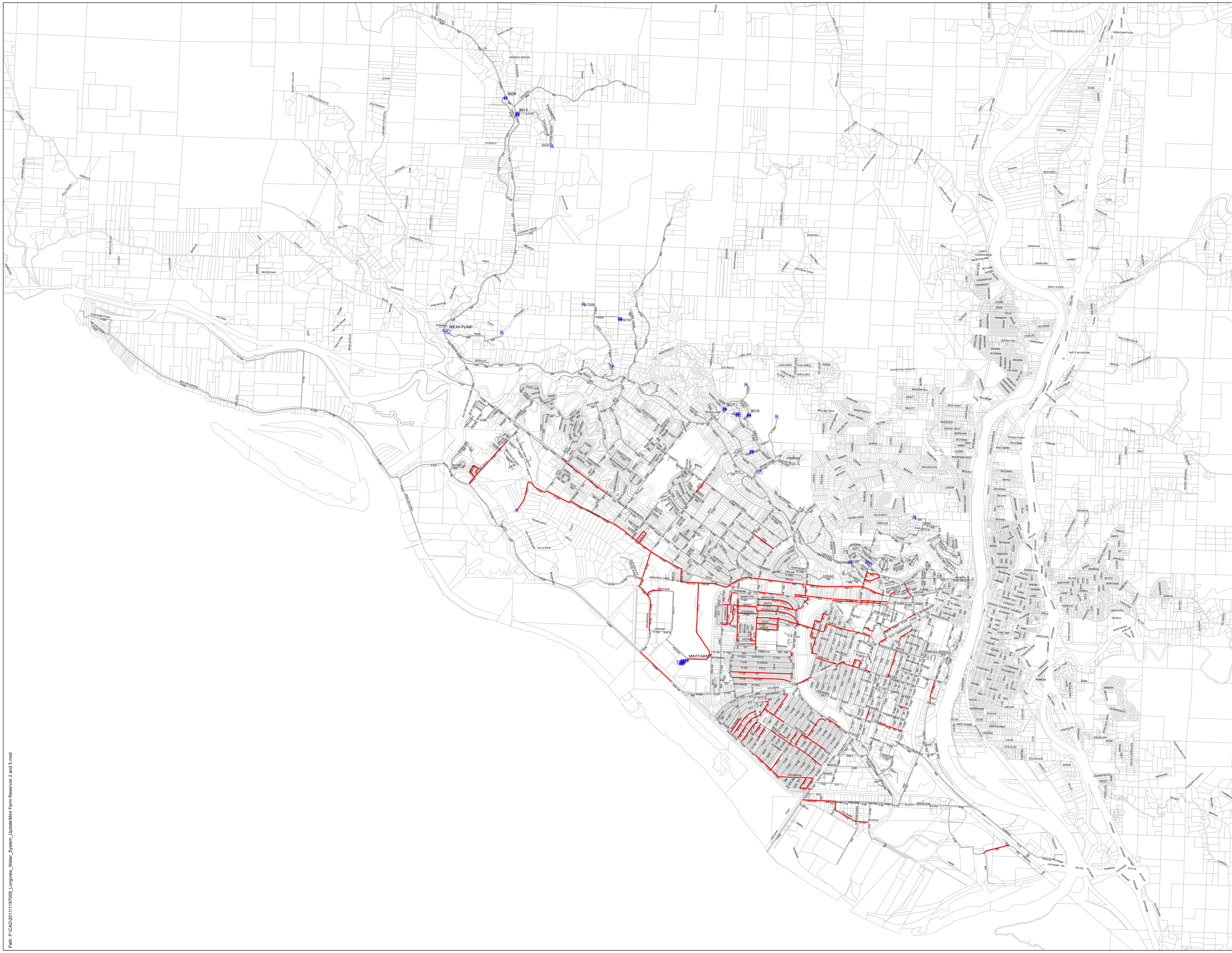
Emergency Operation

Throughout the start-up of the MFRWTP, Citizen Sentinels will periodically monitor tap water quality. The City will have flushing crews available to address anomalies in the distribution system reported by Citizen Sentinels. This approach allows the City to respond to areas of concern with targeted flushing to improve water quality and remove sediments and particles dislodged by the operation of the new MFRWTP facility. Simultaneously, an operations crew should be available to re-start the RWTP should significant problems occur preventing proper operation of the MFRWTP and requiring that it be temporarily taken out of service.

Attachment 1

City of Longview’s Distribution System Pipe Flow Reversal Areas

CITY OF LONGVIEW
WATER MODEL MAP



Legend

Pipe

Pipes Expected to Experience Flow Reversal or Increase in Flow Rate by a Factor of 10

Kennedy/Jenks Consultants
Engineers & Scientists