PUBLIC HEALTH DIVISION
Office of Environmental Public Health, Drinking Water Program
Kate Brown, Governor

July 18, 2018

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Andrey Chernishov, PE
HBH Consulting Engineers
501 E First Street
Newberg, OR 97132

Re: City of Yamhill (PWS #00968) Water Master Plan (PR #68-2018) Concurrence with Master Plan/Need for Seismic Risk Assessment and Mitigation Plan

Dear Mr. Chernishov:

The Drinking Water Services (DWS) received a copy of the "April 2018" City of Yamhill Water System Master Plan (HBH Job No. 2017-003, DWS Plan Review #68-2018) and a check for $4,125 (check #13093) on May 9, 2018. The Master Plan serves as an update to the March 1, 1996 Water Master Plan and May 1998 Water System Master Plan Addendum, and represents a 20-year planning horizon for the City to the year 2037 (2017-2037).

After reviewing the April 2018 master plan, I e-mailed comments to Rob Henry on 5/23/18, who in a phone conversation about my comments on 5/24/18 said that he would forward my comments to you. The comments in my 5/23/18 e-mail were mostly addressed in an updated Master Plan dated "June 2018", which I received from your office on 6/14/18. The June 2018 Master Plan still lacked information regarding the Water Management and Conservation Plan and information related to seismic risk assessments and mitigation planning. Information regarding the Water Management and Conservation plan was included in an updated "June 2018" Master Plan received in our office on 7/17/18. **Upon review of the updated June 2018 Master Plan, it appears the criteria listed in Oregon Administrative Rules (OAR) 333-061-0060(5)(A through H) have been met and we concur with these findings, however, the updated plan did not fully address the seismic risk assessment and mitigation planning requirements under OAR 333-061-0060(5)(J).**

Since the seismic considerations provided in the updated June 2018 Master Plan do not meet the requirements in OAR 333-061-0060(5)(J), **a scope of work for the seismic risk assessment and mitigation plan must be submitted by September 19, 2018 along with a schedule for when the work will be completed.** I have enclosed a frequently asked questions document to provide some clarity on these requirements.

In summary, the updated June 2018 Master Plan included:

1. Planning criteria including fire flow requirements, distribution system pressures, and projected future population and related demands for a 20-year period to 2037;
2. An assessment of the water system's ability to meet the planning criteria;
3. Alternatives of projects to meet the criteria;
4. A list of Capital Improvement Projects (CIPs) and construction schedule recommended for the next 20 years along with costs in 2017 dollars, indexed to the May 2017 Engineering News Record (ENR) Construction Cost Index; and
5. Options available to finance the recommended projects.

More information about the contents of the master plan is provided on pages 5-10 of this letter.

Please note that OAR 333-061-0060 and -0050 contains plan submission, review, and construction requirements for all major water system additions or modifications. Construction plans and specifications should be submitted to and approved by DWS before construction begins for new facilities or major modifications of treatment facilities, tanks, and pump stations. The City of Yamhill currently has an exemption from plan review for waterline projects, which needs to be renewed annually. More information for renewing the waterline exemption can be found on our website at:
http://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/PLANREVIEW/Pages/exemption.aspx

Thank you for your cooperation in the plan review process and if you have any questions or would like this information in an alternate format, please feel free to contact me at any time at 971-673-0419 or via e-mail at: evan.e.hofeld@state.or.us.

Sincerely,

Evan Hofeld, Regional Engineer
Oregon Health Authority – Drinking Water Services

cc: Kenneth Cannaday-Shultz, MS, EIT, HBH Consulting Engineers
Richard Howard Sr. Public Works Superintendent, City of Yamhill

Encl. Seismic Risk Assessment and Mitigation Plan FAQ document

Seismic Risk Assessment and Mitigation Plan

Frequently Asked Questions

Oregon Health Authority Drinking Water Services

1. Why do community water systems with more than 300 connections need to conduct a seismic risk assessment and mitigation plan?

   The Oregon Resilience Plan was developed in 2013 and provides the state's road map for earthquake preparedness. The goal is to identify critical infrastructure needed to supply water during an emergency, and identify projects to be completed in the next 50 years to ensure that piped water can be provided in the event of a strong earthquake. The plan and related information can be found at www.oregon.gov/gov/policy/orr. Water supply infrastructure is addressed in Section 8 beginning on page 203.

2. Which systems need to submit a seismic risk assessment and mitigation plan?

   Every community water system with more than 300 connections that intends to submit a master plan after January 10, 2018 is required to conduct a seismic risk assessment and mitigation plan if any of their facilities are located in Areas VII through X of Plate 7. Plate 7 is available at http://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/PLANREVIEW/Documents/seismic-map.pdf.

3. What must be included in a seismic risk assessment?

   The seismic risk assessment must identify critical facilities needed to supply key community needs, including at a minimum: fire suppression, essential health care and first aid, emergency response, and drinking water supply points. The result would be a list of infrastructure backbone components including supply, treatment, distribution, and storage elements that are needed in order to continue to supply water for essential community needs immediately after a Cascadia subduction zone earthquake.

   The assessment must also evaluate the likelihood and consequences of seismic failures for each facility identified as critical. General information for assessing various facilities by construction date and material can be found in the Oregon Resiliency Plan, which also references the American Lifelines Alliance (2001) Seismic Fragility Formulations for Water Systems, www.americanlifelinesalliance.org.

April 2018

4. What must be included in the mitigation plan?

   Based on the critical facilities identified to form the backbone, the mitigation plan consists of projects that will be completed over the next 50-year time period to upgrade, retrofit, or rebuild these facilities so that they will continue to provide water following a Cascadia subduction zone earthquake. The mitigations would include planned capital improvement projects, upgrades to minimize water loss from each critical facility, or recommendations for further study or analysis. The mitigation plan must also include a schedule as to when these mitigation efforts will be completed, within the 50 year planning horizon.

5. Are other formats of Plate 7 available?

   Yes. Labels in pdf files (such as city names) can be turned off on the toolbar on the left hand side of the Adobe Acrobat Reader screen.

   GIS files can be downloaded at http://www.oregongeology.org/pubs/ofr/p-O-13-06.htm. Under Publication Preview, click on "Download zip file (1.85 GB). Refer to "Read me" file for instructions. Open the Appendix folder. Click on the .rar file (a zip utility such as WinZip is needed to open this GIS data file). The GIS layer for Plate 7 is "Oregon_M_9_Scenario_Site_PGV." This file has the raw data and will need to be classified into the Mercalli rankings as shown on Plate 7. Remember that the Area X category includes the tsunami inundation zone.

6. Is any funding available to assist in development of this assessment and plan?

   After July 1, 2018, systems serving 3,300 connections or less will be eligible for up to $20,000 from the Drinking Water State Revolving Fund to complete the seismic risk assessment and mitigation plan. Funds will be awarded on a first-come, first-serve basis with submittal of a Letter of Interest. Funds cannot be used for mitigation activities (design or construction).

7. Are there additional technical resources to help develop the seismic risk assessment and mitigation plan?

   Yes. Technical resources have been compiled in a document located at http://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/PLANREVIEW/Documents/seismic-references.pdf.

For more information, contact Drinking Water Services at 971-673-0405

April 2018

Summary of Water System and Deficiencies identified in the Master Plan:

- Planning Horizon: 20 years (20170-2037)
- Service Area:
  - City of Yamhill within UGB
  - 7 local districts
- Population:
  - 2016 population = 1,070
  - 2037 population = 1,690
- Source:
  - Turner Creek (SRC-AA) – a tributary of the North Yamhill River
  - New intake in 2014
  - 575 gpm (1.28 cfs) water right (T11097, which consolidated 2 previous certificates with/new point of diversion for new intake location)
  - Raw water pumps convey intake water to treatment plant
  - Source Deficiencies:
    - Quantity – during the summer of dry years, the creek level drops to where the flow through the intake is barely able to keep up with demand due to the vertical intake screen (placing the screen in a horizontal configuration would help)
- Treatment:
  - Conventional plant constructed in 2001
  - 694 gpm (1 MGD)
  - Flows limited to 440 gpm due to tracer study conditions (tracer study flow of 400 gpm + 10% = 440 gpm).
  - Treatment Deficiencies:
    - No fire suppression at the WTP (fire alarms only)
    - Flocculation and filter basins are open and outside close to road, susceptible to having something thrown into them from the road – a security issue.
    - Clearwell is the only treated water storage, which may limit contact time.
- Storage:
  - 1959 Concrete Tank (0.5 MG)
  - 2002 Welded Steel Tank (0.5 MG)
  - Storage Deficiencies:
    - Capacity – 1.556 MG of additional storage are needed to meet future demands, emergency, and fire flow storage requirements.
    - Seismic – unlikely that any reservoirs would survive Cascadia earthquake.
- Distribution:
  - Gravity fed from treatment plant
  - One pressure zone
  - Pipes installed prior to 2000 are generally undersized
  - Fair condition based on 20% + leaks
  - Insufficient fire flow throughout town
  - Many meters are > 20 years old
  - AC pipe under Pike Rd is main transmission main from treatment plant and in poor condition (vulnerable due to age) and was a top priority for replacement.
  - Distribution Deficiencies:

        - Condition – Age, size, condition, and material vary throughout the system and leaks are common in asbestos cement pipe.
        - Leaks
        - Performance – system does not have sufficient fire flow capacity anywhere in town.
        - Service meters – many of the systems water meters are over 20 years old (typical life is 10-15 yrs). This results in inaccurate water accounting and possibly lost revenue.
        - Seismic – A Cascadia earthquake would completely cripple the existing distribution system. In particular, the asbestos cement transmission main under Pike Road and cast iron main lines under Olive Street and Main Street would sustain sever, damage due to their seismically vulnerable materials, resulting in a complete and prolonged interruption of service.
- Demands:
    - 30% of the demand is for 9 districts or PW shops/construction/bulk haulers
    - 26.5% unaccounted for water (20.4% loss 2012-2016)
    - See chart on following page for more information
- Design Life Criteria:
    - Motorized equipment – 20 years
    - Buildings/major structures – 50 years
    - Steel components – 10-15 years (20 years if painted and maintained)
    - Flowmeters – 10-15 years
    - Chlorine feed systems and turbidimeters – 15-20 years
    - Transmission lines – 40-60 years
    - Storage tanks – 60 years (painted steel construction)
- Capacity/Level of Service Design Criteria:
    - Treatment plant – 20-year MDD + 5% for BW
    - Storage:
        - 25% ADD Equalization + 300% of MDD emergency + 495,000 gallons fire storage
        - Fire storage of 495,000 gallons provides 2,750 gpm x 3 hrs for non-residential fire.
        - Reservoir levels to provide pressures of 40-80 psi.
        - Minimum of 20 psi even during fire flow.
    - Distribution mains:
        - Meet 20-year demands
        - Provide peak hour and fire flows with at least 20 psi
        - 6” minimum lateral water mains for looped system and dead-end mains
        - 8” minimum size for permanently dead-ended mains supplying fire hydrants and for minor trunk mains.
        - 10” for trunk feeder mains (based on hydraulic analysis using WaterCAD)
        - 1,500 gpm fire flow for residential areas and 2,750 gpm for commercial as well as on HWY 240 from S. Ash Street east.

Capital Improvement Projects:

Capital improvement projects primarily addressed developing redundant storage facilities and addressing vulnerable/undersized distribution/transmission lines in order to improve fire flows, meet the needs of future demands, and to mitigate some of the damage resulting from a Cascadia Subduction Zone earthquake.

Cost estimates for the Proposed CIP Summary contained are project costs indexed to May 2017 Engineering News Record Construction Cost Index (ENR CCI). More on cost estimates and assumptions are as follows:

- Cost Estimates:
  - Costs indexed to May 2017 ENR CCI
  - Construction cost based on bid tabulations, published cost guides, and experience
  - 20% Contingency
  - 15-25% Engineering Design
  - 5% Legal and Administration
  - Costs associated with purchasing land or easements not included in CIP costs

- Recommended CIP Assumptions:
  - CIP was developed using demand estimates developed with the following assumptions:
    - Water loss is relatively proportional to the number of people served during the 20-year planning period, according to an average rate from 2014-2016 of 20.4% loss.
    - Future population growth rate is constant at 2.2%
    - Average urban water consumption is equal to 102 gallons per capita per day (gpcd) across all water uses, excluding external and rural users.
    - Demand from non-urban sources will not grow during the 20-year planning period.
  - It was recommended that the system carefully monitor future demands and update the Master Plan if there is a large discrepancy between projected and actual demands.

Table 8-1 - Recommended Projects Costs Summary

No.	Project Name	Preliminary Estimated Cost
Priority 1A Projects(0-5 years)		
1A-1	Transmission Line Under Pike Road	$ 6,830,200
1A-2	New Storage Tank South of Town (off of Highway 47)	$ 6,201,650
1A-3	Water Plant SCADA Upgrades	$ 79,000
Sub Total of Priority 1A Projects		*$ 13,110,850*
Priority 1B Projects(0-10 years)		
1B-1	Olive Street (Camellia Street to Main Street)	$ 254,150
1B-2	Main Street (Olive Street east to end of line)	$ 1,492,400
1B-3	Olive Street (Main Street to Third Street)	$ 183,300
1B-4	New Storage Tank at the Water Treatment Plant	$ 174,850
1B-5	Hemlock Street Water Improvements	$ 484,000
Sub Total of Priority 1B Projects		*$ 2,588,700*
Priority 2 Projects(10-15 years)		
2A	Tualatin Valley Highway	$ 364,650
2B	Maple Street (Tualatin Valley Highway to Main Street)	$ 306,150
2C	Downtown System Improvement and Simplification	$ 310,700
2D	First Street (Laurel Street to Balm Street)	$ 369,038
2E	Third Street (Olive Street to Balm Street)	$ 1,159,600
2F	Cedar Street Water Improvements	$ 366,000
2G	Elm Street Water Improvements	$ 222,000
2H	N Larch Place Water Improvements	$ 69,000
2I	Water Plant Basin Covers	$ 53,000
Sub Total of Priority 2 Projects		*$ 3,220,138*
Priority 3 Projects(15-20 years)		
3A	Third Street (West of Olive Street)	$ 62,075
3B	Erica Street	$ 103,513
3C	Dahlia Street	$ 107,900
3D	Maple Street, Second Street, and Behind City Hall	$ 131,463
3E	Azalea Street (Hemlock Street to Drainage Channel)	$ 73,450
3F	N Balm Street and Buttercup Street (Balm Street to Cedar Street)	$ 143,325
3G	Water Meter Replacements	$ 244,400
3H	Treatment Plant to Reservoirs Water Main	$ 4,759,000
3I	Alternate Water Source	$ 264,000
Sub Total of Priority 3 Projects		*$ 5,889,125*
Total Recommended Improvement Project Costs		**$ 24,808,813**

Seismic Evaluation:

The April 2018, June 2018, and revised June 2018 master plan (received 7/17/18) did not fully address seismic requirements under OAR 333-061-0060(5)(J). A separate document will be sent in the future to address this deficiency.

The following seismic considerations were included in the master plan and a CIP addressed some of the factors that mitigated seismic risks in the 0-20 year time frame.

There are three main components of the water source that raise concerns during a Cascadia 9.0 magnitude subduction zone earthquake: the Turner Creek Reservoir earthen dam, the intake screen, and the transmission line from the intake to the WTP. City staff will likely need to make minor repairs to the intake and transmission line before the intake can resume supplying water [to] the WPT. – pg 4-4

The intake structure may shift and be damaged as the result of lateral earth motion during the earthquake, but it would likely remain serviceable with some basic on-site emergency repairs. However, Turner Creeks' water quality will likely be drastically reduced immediately after the quake,

especially if the reservoir is partially or fully drained by a dam failure as mentioned previously. Turner Creek would be subject to much higher sediment loadings as a result of mass-action (landslides) in addition to potential dam failures. – pg 4-5.

Equipment sufficient to manually remove sediment at the screen and repair damaged pipe connections without the need for heavy equipment or outside assistance should be stockpiled on site. – pg 7-10.

…the treatment plant is not in a liquefaction zone (see Appendix G). However, the joints where the pipe connects to any rigid structures, such as the treatment plant or raw water pump, will likely sustain severe damage and possibly break, severing the connection from the intake to the treatment plant. – pg 4-5.

There are very few seismic concerns specific to the treatment plant. As the plant is outside of the liquefaction zone (See Appendix G), sever structural damage to the buildings is not expected. The treatment train should remain in operational condition after the earthquake, and the plant has a backup generator, allowing the plant to continue functioning so long as the City has fuel to run the generator and chemicals to treat the water. Two possible concerns are the pipes that transmit water from one treatment process to the next, and the clearwell… – pg 4-8.

Project 3I to be completed sometime within the 20-year planning horizon was to investigate the possibility of an interconnection with the Joint Water Commission and execute an IGA for emergency water supply.

Project 1A-1 included replacing the line under Pike Rd between the two reservoirs and the City within the 0-5 year timeframe.

Project 3H included replacing the line from the treatment plant to the existing reservoirs within the 20 year timeframe.

The resiliency of the underground clearwell tank is not currently known and may not be fully sufficient to withstand the Cascadia 9.0 magnitude subduction zone earthquake. – Pg 4-8. CIP project 1B-4 included construction of a new 68,000 gallon clearwell in the 5-10 year timeframe.

The existing [500,000 gallon] concrete reservoir is old (built in 1959 with no major retrofits since then), and already exhibiting some signs of compromised structural capacity, and may be at increased risk of failure during the Cascadia 9,0 magnitude subduction zone earthquake. It was also not designed to withstand earthquake loading, so it is likely that it will sustain severe earthquake damage requiring its replacement. The damage may even be severe enough to render it unable to store water; a seismic analysis will be needed to adequately predict the response of this tank during a severe earthquake. – Pg 4-10.

The [500,000 gallon] steel tank is relatively new (built in 2002); however, as previously stated, recent studies (as early as 2012) have found that previous methodologies for assessing the impact of seismic loadings on storage tanks substantially underestimated the negative impacts. As such, it will be difficult to assess how the tank will perform under the influence of the Cascadia 9.0 earthquake until a new seismic assessment is performed. – Pg 4-10.

Both tanks are within a zone of moderate liquefaction risk (Appendix G), so it is also possible that the tanks may sink into the ground, or overturn due to loss of soil bearing capacity. The tanks are somewhat buoyant when compared to the surrounding ground, to the distance they would sink is minimal: the risk of overturning is far more severe. – Pg 4-10.

Both existing storage tanks should receive a seismic analysis. – pg 7-12

Project 1A-2 included the construction of a new 1.6 MG tank to the south of town to be served by a pump station. This new tank would provide water from the south side of the town, however, the treatment plant would not be able to re-fill this tank should it fail.

One location would be approximately 1.5 miles to the south of town approximately 0.5 miles west of HWY 47 on the bluff between Yamhill and Carlton, and would sit at an elevation of approximately 360-ft. An additional benefit of this location would be the possibility of an intertie with the Carlton water system. – pg 7-5.

A Cascadia earthquake would completely cripple the existing distribution system. In particular, the asbestos cement transmission main under Pike Road and cast iron main lines under Olive Street and Main Street would sustain sever, damage due to their seismically vulnerable materials, resulting in a complete and prolonged interruption of service. – pg 7-9. Project 1A-1 to replace transmission line under Pike Rd between the tanks and town (within 0-5 years), Project 3H included replacing the line from the treatment plant to the existing reservoirs within the 20-year timeframe.

Potential mitigation measures in the CIP included:
Project 1A-1 (within the next 0-5 years): Transmission Line Under Pike Road – pg 8-2
Project 1A-2 (within the next 0-5 years): Construct new 1.6 MG Storage Tank South of Town – pg 8-2
Project 1B-4 (within the next 0-10 years) – Construct new 68,000-gallon clearwell – pg 8-3.

Other recommendations identified in the Master Plan:

1) Develop a redundant supply source by investigating an intertie to be served by the Joint Water Commission in the future.
2) Monitor water loss as meter replacements occur and re-evaluate storage needs periodically to reflect the water losses.
3) Identify materials and parts needed to clean the intake screens and repair damage to fixed joints in the treatment plant following a Cascadia Subduction Zone seismic event.
4) Complete projects included in the CIP.
5) Conduct a seismic evaluation to determine the risk of failure for the clearwell and storage reservoirs.
6) An update to the Water Management and Conservation Plan (WMCP) will need to be done to justify the full water right.