



# ***Trees To Tap: Forest Management and Community Drinking Water Supplies***

Progress Report #1, 5/17/2018



**Overview of Progress:** The contract period for this project is from 1/1/2018 to 12/31/2018, although recruitment of the Steering Committee began prior to the official start. We will provide detailed information on the status of the tasks outlined in the Scope of Services (SOS) of 11/7/2017. Briefly:

- We have made substantial progress on the tasks outlined in the SOS, and are on track in terms of our timeline and product delivery dates with a couple of exceptions noted in the narrative below.
- The Steering Committee convened for the project has provided significant benefits; they have worked well together, focused on problem solving, and have engaged beyond just the science review.
- The Steering Committee discussed tradeoffs between in-depth science review of a single narrow topic, and broader, less rigorous review of a wider range of topics. They ultimately recommended four focus areas: sediment/turbidity; water quantity; forest chemicals; and natural organic matter and disinfection by-products. Each topic is fairly complex; together they represent a broad scope.
- Our literature searching has, to date, identified 700 publications with potentially relevant content. Reviewing and extracting this content, and synthesizing coherent, scientifically defensible narratives for each topic will require substantial effort. This range of topics and volume of available literature indicates that we will likely not be able to conduct a comprehensive review in any one of the four focus areas.
- Working with the Oregon Health Authority (OHA) and Department of Environmental Quality (DEQ) we identified 157 community water suppliers (CWS) who rely on surface water or groundwater directly influenced by surface water as their primary raw water source. The Steering Committee recommended using these 157 as the target for Task 2 of this project.
- Instead of the structured interviews in Task 2 of the SOS, we recommended using a survey of CWS to generate the data to support Task 2. The Steering Committee (and our OFRI Project Manager) agreed to this approach. The survey was drafted, reviewed by the Steering Committee, and is presently being administered.
- The Institute for Natural Resources (INR) established a project website to provide information on the project (<http://inr.oregonstate.edu/treestotap>). The website includes a description of the project; mini-bios of staff and Steering Committee members; agendas and minutes of the meeting; and project resources such as the original 2001 study, the CWS survey, and the Excel literature database.

## **Activities to date based on Scope of Services:**

Task 1. *Systematic Review of the Effects of Forest Management on Municipal Water Supplies from Forested Watersheds in Oregon.*

- a. Establish Steering Committee. A 10 member, well-balanced, Steering Committee has been established (<http://inr.oregonstate.edu/treestotap/steering-committee-science-team>) and

has met three times (<http://inr.oregonstate.edu/treestotap/agendas-meeting-notes>). All sub-components (1-5) in this section have been addressed to the degree appropriate for this stage in the project. Originally, the Steering Committee was chartered just to focus on the science review; at its first meeting, the members also expressed interest in working on the water provider survey. The meeting notes reflect the Committee's decisions related to the sub-components.

The significant result of the Steering Committee was to achieve a consensus on sub-component (1), defining the questions to be evaluated. Four topics were identified:

- Sediment/turbidity;
- Water quantity;
- Forest chemicals; and
- Natural organic matter (NOM) and disinfection by-products (DBP).

The Committee was informed during their discussions that due to the broader scope that a formal systematic evidence review could not be conducted, but that systematic review techniques would be employed.

- b. Develop report outline. Version 1.1 of the report outline was discussed by the Steering Committee at their 4/2/2018 meeting and their suggestions have been incorporated into version 2.1. The resulting chapter headings are:

1. Introduction and Context
2. Methods
3. Community Drinking Water Systems in Oregon
4. Active Forest Management and Community Water: Issues and Interactions
5. Water Quantity
6. Sediment and Turbidity
7. Forest Chemicals
8. Natural Organic Matter (NOM) and Disinfectant By-Products (DPB)
9. Case Studies of Community Water Systems
10. Findings and Conclusions
11. Information Gaps and Next Steps

Version 2.1 is being reviewed by the Science Team, and will be provided to the Steering Committee for their review by the end of May, 2018.

- c. Create systematic review matrix. The Steering Committee reviewed a draft matrix based on an INR Excel template at their second meeting on 3/13/2018. The consensus of the Committee was to use this template for the project. The template is structured into three major sections, with a total of 16 sub-components in the three sections:

1. Search Criteria
  - Person searching or entering
  - Today's date
  - Source of document
  - Source NOTES
  - Database
  - Keywords used to locate reference, if applicable

2. General Reference Information
    - Reference Citation
    - Location URL
    - Publication Type
    - Publication year
  3. Study Details
    - Location, Geographic Area
    - Type of study
    - Topic Area
    - Keywords/Descriptors/Identifiers
    - Abstract, key findings; or conclusions
    - Notes, comments, rationale for inclusion
- d. Identify and screen pertinent literature. Systematic review techniques require adhering to clear protocols for literature searches and screening. This includes:
1. Identifying how the reference was obtained (classes = systematic search, science team, committee, stakeholders, traditional search, journal website, other);
  2. What database was used for the search (TreeSearch, CAB Direct, EBSCOhost, OSU 1Search, Google, GoogleScholar, Web of Science, Proquest); and,
  3. The type of publication (i.e., agency report book, discussion paper, gray literature, peer reviewed publication, etc.). Most of the acquired references were obtained through the systematic process, but Steering Committee members were also invited to submit any publications that they felt would be valuable in the review; three members provided suggestions.

The Committee agreed to the following criteria for inclusion and ranking in the literature review:

1. Geographic focus will be Pacific Northwest (OR, WA, ID, BC, Canada, and northern CA). Where good resources are limited in the focus area, the geographic range will be expanded to include temperate forests in other areas, including Europe.
2. Temporal focus will be on literature published after 2000, with exceptions for classic studies used for context and contrast. The rationale for this limit is to focus on effects resulting from contemporary forest management practices.
3. Credibility of published literature will be in the following hierarchy:
  - Peer-reviewed journal articles and book chapters, with a preference for those with strong study designs (i.e., BACI). Where current, credible, reviews exist, these will be utilized so as to reserve effort for areas without this coverage;
  - Peer-reviewed agency and institute reports, such as USFS General Technical Reports (GTRs); USGS Professional Papers, Scientific Investigations Reports, and Open-File Reports; and USEPA Research Reports, Project Reports, and Manuals and Handbooks.
  - Dissertations and theses (under the assumption that they are “peer-reviewed” by the graduate student’s Committee). If available, the published version will be preferred over the theses since this represents an additional level of review.
  - Other agency and NGO publications will be primarily used for background and contextual information.

Each piece of literature found during the search is included in the matrix and evaluated according to the criteria established by the Steering Committee. To date, we have entered 700 publications into the following categories:

- Synthesis, general (34)
- Water yield, peak flows (74)
- Forest roads (62)
- Stream and riparian buffers, SMZs (20)
- Best management practices (26)
- Turbidity, sediment – general (140)
- Landslides and debris flows (32)
- Forest fertilizers (8)
- Forest herbicides and pesticides (71)
- Natural organic matter (NOM) and Disinfection By-products (DBP)(45)
- Nutrients (nitrogen, nitrates, phosphates, potassium, etc.) (34)
- Forest management and water chemistry (3)
- Wildfire and fuels reduction effects on community water (37)
- Climate change effects on community water supplies (33)
- Policy, social science, economics (50)
- Older literature (pre-1990) (31)

We will continue to organize and filter these references. While we feel that the search process has largely concluded, we expect that additional publications may surface during the course of the project; these will be incorporated if relevant. We will meet with the two science reviewers on 5/31 to discuss additional filtering and ranking procedures to assist in their review. The literature matrix will be provided to the Steering Committee during the week of June 11<sup>th</sup> for review prior to their 4<sup>th</sup> meeting on 6/27.

## Task 2. *Catalog and Survey of Municipal Water Supplies from Forest Watersheds in Oregon.*

- a. Use OHA list of municipal water systems to identify those with forested lands. There are approximately 2,500 public water systems in Oregon (i.e., those serving at least 10 people year round). The Steering Committee felt that we should focus on the 157 community water suppliers (CWS)—defined as those with 15+ hookups that serve 25+ people year-round—that rely either on surface water, or utilize groundwater that is directly under the influence of surface water. We anticipate that the majority of these CWS have some portion of their source watersheds that are forested. Even if the source watersheds are not forested, we think these may provide a suitable contrast to those CWSs that are forested.

Working with OHA we have obtained contact information (names, addresses, phone numbers, and some e-mail addresses) for the 157 utilities in our target audience. Through additional legwork, we were successful in obtaining e-mails for all but one of the 157 CWS (Mapleton has no internet access and requested a paper copy of the survey).

- b. Use DEQ Source Water Assessment data to describe these forested water systems. We have obtained geodatabases and Excel spreadsheet information on the 157 CWS from the DEQ. We will work with their representative on the Steering Committee to insure that the

information we use for the Atlas is consistent with their dataset. We have begun work on an Atlas report template. This task took less priority than the Science Review and CWS survey tasks once we determined that the needed data was readily accessible. We anticipate providing this to the Steering Committee in advance of their 6/27 meeting.

- c. Develop structured interview methodology and questionnaire to seek additional information for water suppliers. In consultation with our OFRI project manager and the Steering Committee, we chose to conduct a survey of CWS rather than a smaller number of structured interviews. The earlier Adams and Taratoot (2001) report contained survey responses from 37 water utilities. We will be surveying all 157 CWS that utilize surface water or groundwater influenced by surface water. To date, we have:
1. Drafted the CWS survey; presented it to the Steering Committee at its 3/13 and 4/2 meetings; and incorporated their suggestions in the final questionnaire;
  2. Obtained OSU Institutional Review Board (IRB) approval to administer the survey;
  3. Converted the questionnaire into Qualtrics software so that it can be administered through a web interface;
  4. Conducted pre-tests to confirm e-mail addresses;
  5. Launched the survey on 5/9 to the 156 CWS with valid email addresses with a request to complete it by May 31, 2018 (Mapleton's was mailed);
  6. Provided technical support to survey respondents who had questions or difficulty; and
  7. Sent out an e-mail reminder on 5/17 to those CWS who had not yet responded.

The survey comprises 25 questions grouped into three major areas: basic information on the surface water supply watershed; issues and concerns on the part of CWS and any existing partnerships that they have; and how they are organized. For many of the questions, there are defined answers (to ease analysis), and some have "if yes, explain" options.

The following is the list of the 25 questions in the survey:

***Basic CWS information***

- Q1. What is the name of your drinking water utility?
- Q2. Please provide a contact name, phone number, and email address.
- Q3. What is your primary raw surface water supply watershed called?
- Q4. What percent of your annual water supply comes from this primary source?
- Q5. Do you have other sources and/or backup raw water supply watersheds?

***Management context***

- Q6. What kind of public access is allowed onto your primary source watershed?
- Q7. Do you have an updated Source Water Assessment (USWA)?
- Q8. Do you have an approved Drinking Water Source Protection (DWSP) plan?
- Q9. Do you fund or participate in any forest health, fuels reduction, or other restoration work in the watershed for source water protection?
- Q10. Of the partners you work with in your source watershed, which FIVE do you interact with most closely?
- Q11. Do you work together with other landowners in your watershed?
- Q12. Do you collect optional raw water quality data beyond what is required by law?
- Q13. Please rank the following general activities/issues from 1 to 10 in order of current concern to your raw water source supply. [List provided]

- Q14. Please rank your LEVEL OF CONCERN about each of the following source water protection issues as they may affect your raw water supply. [List provided]
- Q15. Now, please rank your LEVEL OF CONTROL over each of the same following source water protection issues as they may affect your raw water supply. [List provided]
- Q16. Of all of the management issues above, which are your top two concerns?
- Q17. Please tell us more about why these two issues are happening, when they started occurring, why they concern you, and what, if anything, you do to manage them?
- Q18. The Oregon Department of Forestry e-Notification (FERNS) online system allows users to search, query, and subscribe to receive notifications of proposed forest operations upstream of your raw water intake. How do you use this system?
- Q19. Have you received any information about forest operations upstream of your raw water intake from any sources other than ODF e-Notification in the past four years?

***CWS organizational management.***

- Q20. How is your utility organized?
- Q21. How many staff does your utility employ in drinking water provision?
- Q22. What's been your utility's average annual operating budget for the past four years for drinking water supply?
- Q23. What has been a key lesson learned for your utility about managing a forested watershed for drinking water supply?
- Q24. Is there anything else you would like to share with us?
- Q25. Would you be willing to be contacted if we have follow up questions?

We have begun receiving survey responses. We anticipate that the pace will pick up as the 5/31 deadline approaches, but may have to invest time in personally contacting non-responsive CWS. Our goal is to have a 100% response rate; however, that is unlikely to be realized.