Welcome and Initial Business
The meeting opened at 6:00 facilitated by Lisa Dennis-Perez, LOTT’s Director of Environmental Planning & Communications. Lisa updated the group on staffing changes since the last meeting:
- Ben McConkey resigned from LOTT.
- Joanne Lind came on board as the new Public Communications Manager.

Each Community Advisory Group (CAG) member and attendee introduced themselves. Lisa then asked if any members of the public wished to make comments.

Bob Jacobs:
It seems the schedule is far behind where we thought it would be. Can you explain why?

The study is behind schedule for multiple reasons. One is the time it takes to sequence and complete many levels of review for each study task. There are many people involved – from the Community Advisory Group, to the Science Task Force, the Peer Review Team, LOTT’s Technical Sub-Committee, and the LOTT Board of Directors. Also, our city partners need to have access to the reclaimed water in the summer for their Woodland Creek Groundwater Recharge Facility. They get credit for water rights from Department of Ecology for the water that is infiltrated at that site. We have had to delay some steps of the study to ensure that the cities had access to reclaimed water during the dry summer months. Finally, it took much longer than expected to identify willing landowners and get easements to drill wells for the monitoring well network.

Janine Gates:
Have the costs gone up as a result of these delays?

No, the project is still within budget. We have added some elements to the study, but shifted some costs to stay within budget.

Presentation: Reclaimed Water Infiltration Study - Review of Phase 3 Implementation Tasks
Wendy Steffensen gave a presentation to reorient members to the study, with a brief overview of study tasks and their status. Work completed included publishing and presenting results from Task 1: Water Quality Characterization to industry professionals. Wendy described progress on Task 2: the Tracer Test Work Plan, including describing the monitoring well network.

Q. Was the Task 1: Summary Fact Sheet sent out to the group?
- Yes, it was sent electronically. It is also available on LOTT’s website. Lisa provided the group with print copies at the end of the meeting.

Presentation: Local Hydrogeology 101
Jeff Hansen, lead consultant from HDR Engineering, Inc., gave a presentation about local hydrogeology and previous studies of the Hawks Prairie site area. He described the study’s recent field work, including installation of new wells in the shallow aquifer (75 – 170 ft.) and deep aquifer (220 – 330 ft.) and lysimeters at depths of 10, 25, and 50 feet into unsaturated soil at the recharge site. This work provided vital information about groundwater flow directions and travel times, which will be a foundation for the tracer test. Previously, we relied on computer models but field data has provided a finer level of detail and important information about movement of the groundwater in the area.

The study confirmed shallow groundwater is flowing to the southwest. There is a confining layer separating the shallow aquifer from the deep aquifer. The deep aquifer flows to the east. The goal of the upcoming tracer test is to measure travel distances in a one to six month time period. Later, we will use computer modeling to estimate where water moves after six months.

- Why does the slide show a question mark in the deeper confining layer?
  - Since we only have a limited number of wells, we are working with limited data points. Question marks indicate where we do not know with great confidence what is happening. It appears the confining layer gets thinner as it moves to the southwest and it flattens out. That shallow water might have more interaction with the deeper aquifer in that area.

- Given that the confining layer is thin, are there places where the aquifers meet?
  - It is not entirely clear. We have shown the level of the water table and also the zone where there is pressure from the deep water. The levels are close. They may be thinly separated. However, the layer does not appear to be completely impermeable. Interaction between the two aquifers is more likely here. Some of the reclaimed water could be mixing with the deep aquifer. The tracer test may help us answer that question.

- What deep well is going to answer the question whether reclaimed water is making its way into the deep aquifer?
  - One of the limitations of study is that we will not be able to study the deep aquifer in great detail. It is expensive to drill deep wells and we have a limited number of deep wells in our network. We will not be able to fully characterize that potential off-site movement in the deep aquifer.

- Why is the deep well near MW21 not a part of the tracer test monitoring plan? This well is located near where the shallow and deep aquifers potentially interact, so there is interest in knowing if tracer will appear in the deep aquifer there.
  - We will take a look at that and reconsider adding that deep well to the monitoring plan.

- Is there a gap in the monitoring well network to be able to answer questions about how the potential shallow/deep aquifer interaction affects water quality? There is no deep well to the east (downgradient) of deep well MW21 to evaluate water quality in the deep aquifer downgradient of where the shallow and deep aquifers potentially meet.
Yes, unfortunately, that is a gap. We were not able to obtain and easement and drill a deep well to the east of where the shallow and deep aquifers potentially meet.

Does the landfill have wells?
- Yes, and we have permission from the County to use them. We are getting data from those landfill wells. However, there are no deep wells there; they are in the shallow zone.

How deep are our drinking water wells?
- That is a complicated question to answer. The City of Lacey has a public well that is very deep in the aquifer. Private wells are not as deep; some are quite shallow, only 50 – 75 feet deep. There are not many drinking water wells near the site.

Are we worried about private shallow drinking water wells to the southwest?
- There are none nearby. There are some quite a distance away, but none within the map boundary.

Deepest lysimeters are 50 feet deep, and the deep aquifer at its shallowest point is how deep?
- The top of the groundwater table is about 80 feet down, but when LOTT starts infiltrating groundwater, that level may rise. It may mound up approximately 15 feet higher. The purpose of looking at the various depths is to understand whether the water quality is changing. We will be sampling water in Basin 4, 10 to 50 feet deep, and the top of the groundwater surface. This will provide information to design the tracer test.

Are you interested in whether there is any cleaning of the reclaimed water while it goes through the soil? And, will the tracer test look at that?
- We are definitely interested in how the subsurface is cleaning and effecting the water quality. The tracer test will measure water movement, but we will also be gathering data about water quality. Questions about how water quality changes and what can we attribute that to are at the heart of the study.

Is the deep aquifer connected to Puget Sound?
- Yes.

What about sea level rise? Does that effect the level of the aquifer?
- Impacts of sea level rise are not part of this study. However, sea level is likely to have an effect on the water table and water pressure. If sea level is changing, that is going to impart some change on the deep aquifer.

Does the movement make a difference if you are adding a million gallons per day vs. 100,000 gallons per day?
It does make a difference. These values that we are using for the study are based on a million gallons per day of infiltration because that is the maximum LOTT has been infiltrating.

I do not understand. Why does it matter how long it takes the water to move? The tracer test is expected to tell us everything we need to know – is that correct?

We do this work to understand how quickly the water moves so we will be looking in the right places at the right times. We need to hone in on where to look for tracer and measure for water quality. We study the water’s movement to help design the tracer test. We need to figure out where and how frequently to sample the groundwater.

Previous information about cleaning effects on water found 20% of it is due to physical processes, and 80% is due to biological actions. We could be in for surprises in those areas where the water moves faster. I will be surprised if the estimated times of travel shown on the diagram are accurate for one month, let alone six.

The examples provided are idealizations, calculated and modeled based on information we have. We expect that the field data were are collecting will be a lot messier than the modeled data for reasons you noted. This is why we are doing the tracer test – to see what actually happens rather than relying on modeling.

Presentation: Draft Tracer Test / Water Quality Monitoring Work Plan

Jeff presented a draft work plan for the next year. The two primary components of the work plan are the tracer test and water quality monitoring.

One of the decisions that needs to be made is whether or not to bypass the constructed wetlands at the Hawks Prairie site during the tracer test and water quality monitoring. Three options are being considered:

- Allow the reclaimed water to flow through the five constructed wetlands before being infiltrated. This is the normal mode of operation.
- Bypass the wetlands and send reclaimed water directly into Recharge Basin 4. This option would better reflect how future infiltration sites would be operated.
- Bypass the wetlands for half of the test so that results with and without wetlands can be compared.

There are pros and cons of each option. The Peer Review Panel will help decide which approach to use.

Jeff also explained about the tracers to be used for the study. Two tracers are planned for redundancy; both are non-toxic, inert, and easily detected at low concentrations. The first is a salt, potassium bromide, and the second tracer is a gas, sulfur hexafluoride that would be bubbled into solution and mixed with reclaimed water.
Jeff explained the wells to be sampled for tracer and water quality and the sampling schedule. He indicated that the plan has flexibility and can be adjusted at key junctures depending on the results obtained along the way.

He also described one new addition to the study that is being considered. The water treatment industry is interested in the transport of pathogens throughout the sub-surface. LOTT’s treated water does not have pathogens, due to their treatment processes. However, we have an opportunity to examine movement of pathogens at LOTT’s site. We can introduce a bacteriophage – a virus that only infects bacteria, so it does not pose a human health risk. This will enable us to see how quickly it moves through the sub-surface.

- If the site is normally operated with the wetlands, why would you NOT use them in the study?
  - As the regional wastewater system grows, additional reclaimed water infiltration sites will be developed to meet capacity needs. Those new sights most likely will not include constructed wetlands, so it is of interest to understand water quality issues in that scenario.

- Reclaimed water is chlorinated. If the wetlands are bypassed, that chlorine could affect conditions in the subsurface. How long does it take for chlorine to dissipate? How long would the effect to groundwater last if you do not go through the ponds?
  - We do not know the full answer to that question. Chlorine would probably remain present as it travels through the vadose zone and we could see some effect on the biology in that vadose zone.

- Why not dechlorinate?
  - That might be an option. To comply with the terms of LOTT’s permit, we need to maintain detectable amounts of chlorine in the reclaimed water in the pipeline as it leaves the plant. However, we might be able to dechlorinate right before it goes into infiltration basin. We will discuss options with the Peer Review Panel.

- We want to know happens in the infiltration system at it exists at the Hawks Prairie site, not what might happen under other conditions, like future sites that do not have wetland ponds.
  - That is why we are proposing conducting the tracer test both ways, running some reclaimed water through the wetlands and evaluating the water quality, and then bypassing the wetlands and comparing the results. Again, this is something we will discuss further with the Peer Review Panel.

- If you bypass the ponds and infiltrate reclaimed water with detectable chlorine, you could be altering the normal pattern.
  - Yes, for that part of the test, but it would be interesting to see those results.

- Is any water from the Martin Way Reclaimed Water plant used for irrigation?
- It is used for irrigation only at the MW plant site and some at the Hogum Bay site. In the future, partner cities might want to use reclaimed water for irrigation. Currently, the cities are using reclaimed water from the Martin Way plant mostly for water rights mitigation.

- Are there purple pipes in Tumwater and along the Deschutes Parkway where the water is used for irrigation? That water is from the Budd Inlet Treatment Plant – right?
  - Yes, that is right. Reclaimed water from the Budd Inlet plant is used for irrigation in multiple places, including Heritage and Marathon Parks, Percival Landing Park, and the Tumwater Valley Golf Course.

- What about purple pipes along Carpenter Road? Is reclaimed water being used to irrigate along that street?
  - That is the City of Lacey’s pipeline to take water from the Martin Way plant to their Woodland Creek recharge facility. They are not using it for irrigation yet.

- Does reclaimed water have to be chlorinated to be put into Woodland Creek?
  - It just needs to be chlorinated in the pipeline that carries the water to the point where it is delivered to the Woodland Creek site.

- If you bypass the wetlands during the acclimation period, could you use the shallow lysimeters to see what the chlorination level is at 10 feet? My thought is there will not be much chlorine there.
  - Right. We could look at that and do a little exploration. Initially, we might want to route water through wetlands during the acclimation process.

- Do you expect to see tracer in the deep well?
  - We do not expect to see it in the deep aquifer because of the confining layer. The deep aquifer is moving much slower than the shallow aquifer. All of the deep wells are within 3500 feet of Basin 4.

- So, the purpose of the tracer is to confirm the hydraulic model we have right now. Is it for anything else?
  - The tracer part of the study is to learn where the water goes and how quickly. It will provide data to improve the hydraulic model and improve our understanding of travel times. It will also help us understand reclaimed water’s potential influence on water quality.

- Is there another deep well, across Marvin, where the confining layer is thin? Why not check that?
  - We could. We do not think tracer will get that far southwest, but we could check for it. Based on today’s conversation, that information could be of value.

- You may need to extend the study and look at the deeper well.
  - The reason for doing the field work is to be as confident as we can, but there are limitations to our sampling well network and the length of time that we can realistically expect to find the
tracer, since it will become more dilute as it travels through the aquifer. Things in the field may change from what we have planned. Both tracers will be introduced over 7 days. The frequency of sampling will range from every other day to once a month, depending on location and month. If we find any anomalies, we will adjust the sampling plan.

- I know you said potassium bromide is non-toxic, but could it change the osmotic pressure of the cells of the biota – could it shrink them by osmosis due to the heavy concentration?
  - Not at that concentration – 50 mg/L. These are typical levels used in groundwater tracer tests.

- When you put that sodium solution at the surface, it will be there for a while. Have you thought about wildlife possibly drinking it? What could that do to the birds hanging out on the water?
  - We have not looked at whether there is a potential issue at these concentrations, but we will.

- Will the plan change if the tracer test shows there is a different flow path than expected?
  - Yes, it would. This is our starting point. If we find the water is moving differently than what we thought, we will change up the water quality sampling.

- In the plan, are you going to be running the tests before the water goes into the infiltration basins? Where is the sampling point?
  - Yes, the sampling point is in the pipe right before the water goes into basin. We are not sampling at the plant because we saw changes in water quality between the plant and the time it gets out to Hawks Prairie. We hypothesize that is due to biological growth in the pipe; we note interesting transformations occurring in the pipe. Our main charge is to look at water quality transformation in the subsurface, so we will look at it right before it goes into the subsurface. We will test on a seasonal basis at all of our chosen locations.

- A lot of bacteria are good. Bacteria are one of the things that clean stuff in the soil. Are these phages going to disarm or kill bacteria? Or are they just going to hang out and not harm them?
  - This will not adversely impact beneficial bacteria. The bacteriophage just introduces itself into bacterial cell, hangs out and is transported. The main question is how quickly it moves through the sub-surface. We can compare how quickly residual chemicals and viruses move; we think the viruses will move more slowly.

- Have you considered what the action of the potassium bromide is in the bacterial constituents of the subsoil?
  - We have not looked at that, but we can.

- Is the bacteriophage effort a chance to collect some data to look at the 100 foot Sanitary Control Area (SCA)? Is Department of Health or County Health getting any input here on how this is being structured?
  - They will next week. We discussed this at a high level previously, but it never came back to looking at the SCA. This is a great opportunity. They will be at the table and part of the
discussion next week. This was not part of the primary objective of the study but it is an opportunity to look at this at very low cost and add to the value of the study.

- I want to reiterate that for everything that is introduced, the bromides, the phages, etc., you need to look at what effects it might have when it is sitting in the water and when it is down in the vadose zone and further.
  - Yes, that is a very good point. We cannot do this without regulatory approval and we are following formal steps. We need to follow protocols of Department of Ecology and secure their approval to inject the tracer chemicals. We have been in discussions and we are compiling that application.

- You mentioned absorption. Are there going to be any efforts to quantify that?
  - Not at this stage; it is not within scope of this study. We are scoped with figuring out what is in the water before infiltration and what is in the water after various amounts of time.

- I am wondering if this is just a snapshot of how fast different constituents might be moving through.
  - We will speak to that as we compile results and discuss it relative to what other studies have found. Other studies have evaluated to what extent you exhaust the absorptive capacity for certain chemicals. For instance, flame retardants have been looked at and they have seen the advancement of exhaustion, but it goes slowly. The study is not designed to fully answer that question, but to the extent we can draw comparisons, we will.

- If you bypass the ponds and put the water directly into the basins for absorption, there will be chlorine in it. Will that affect the bacteria that break down residual chemicals?
  - As we discussed the chlorine may off-gas, in which case it would not have a significant impact. We could also remove chlorine through a de-chlorination process.

- Why do they need to put chlorine into the reclaimed water?
  - For uses other than infiltration, where there is the potential for human contact chlorine is used for disinfection to maintain the level of safety. And chlorine is also introduced to maintain clean pipes. It prevents algal growth that can foul up the distribution system.

- Chlorine does not completely kill the biofilm in the pipes, and the biofilm seems to reduce some of the contaminants in transport.
  - That is correct, at these levels the chlorine does not completely kill biological growth.

- If you do not know whether your predictions are correct about flow then you cannot properly monitor water quality. If it is going in a different pattern, there is no reason to test water quality while you figure that out.
  - We get results back from the tracer test fairly quickly, so if things look radically different than what we expect them to, then we will adjust the water quality monitoring. We spent a lot of time over the past year to learn about the flow patterns to minimize potential for miscalculating
where to test water quality. It is still possible for that to happen, but that is the nature of these hydrogeologic studies.

- Are you going to put the potassium bromide tracer in one of the two sides of Basin 4?
  - Yes. We want to concentrate the tracer as much as possible, so during that week-long period we will be infiltrating the 1 million gpd of water with the tracer addition into just half of the basin.

- What if you put the water with tracer in one half and continued to infiltrate water into the other half? Then the lysimeters would give you an idea whether there were changes to the microbiology due to the tracer.
  - We want to concentrate as much of this water as we can in one basin. At that site, the water moves quickly downward, so we do not get a lot of standing water. We want to be able to compare our results to results from studies that have been done elsewhere. So, we are trying to replicate conditions as much as possible so we can make those kinds of comparisons.

- When you talked about not testing for estrogen because it was not showing up, you need to consider public trust. It might be worth testing to make results more believable to the public.
  - For clarification, we are still looking at estrogen and other hormones. There are many ways to look for hormones, and we are not planning to use all of the ways. But we could, so we need to discuss this with the scientific team.

- There are other types of pollutants that have been in the press and people are aware of that you might want to include.
  - We are tried to include some of those key chemicals. For example, that is why we added perfluorinated compounds. Others may be added as we move ahead.

**Presentation: Next Steps: Task 2 and Beyond**

Wendy Steffensen provided a recap of Task 2: the tracer test, water quality monitoring, and other updates on the study. She talked about the Science Task Force and their activities and provided information about the Peer Review Panel from the National Water Research Institute. She also provided an update on reclaimed water rule-making. The draft Rule now includes a new category of reclaimed water - Class A+ for direct potable re-use.

The study work products are being developed and reviewed on a tight schedule. When this current task (Task 2) of the study is complete, we will prepare a fact sheet and technical memo with the results. These results are not expected until at least a year from now, due to the time required to complete the tracer test and water quality monitoring.

As we start getting results from Task 2, we will begin the risk assessment in mid-2018. By then, we will have a lot of information about what chemicals we should be tracking. The risk assessment will take 6 to 9 months and will have both a human health and ecological component.
The next meeting of the Community advisory group will be about a year from now. However, things are expected to ramp up in 2019, when we will have a lot of this data and will be engaging the advisory group and the public.

- Can we see the Peer Review Panel’s comments from December? Are they public?
  - Yes. We usually get a report, and that document is posted to our website. Responses to comments are also prepared and posted. All comments are evaluated and many will be advanced and incorporated into the work plan. There are some comments that are not incorporated for various reasons—there is a rational for those that are not used. Peer Review is meant to provide oversight and offer comments and constructive criticism, but not all of their suggestions are possible or appropriate.

- Who makes the decision about which recommendations you take?
  - The final decision would come from LOTT, heavily weighing the consultants’ expertise, and what the Peer Review Panel and the Science Task Force suggest. If there is a serious discrepancy on how to proceed, the Technical Sub-committee for LOTT is the steering committee for the study. That group includes Public Works Directors from each of our four local jurisdictions, and from LOTT: the Executive Director, Operations Director, and Engineering Director. That group is advisory to the Board of Directors and the steering committee for the study. For example, if there was a decision that involved added costs, both the Technical Sub-committee and the Board might get involved.

- Is that decision making process is documented?
  - Yes. The Peer Review report will come out, then there is a response to comments document that is put together by the project team, and all of that information gets posted on the website. We will repeat that process every time there is a new report.

- Is the new reclaimed water rule under the Department of Health?
  - The rule was written by a rule-writer at Department of Ecology, and it is under Department of Ecology but both agencies have a role in the rule. Sometimes Department of Ecology is the lead agency and other times Department of Health is.

- Is there currently any municipality or entity in Washington pushing for the option to use reclaimed water for potable use?
  - We do not know of any actively pushing for that. A few utilities have demonstration projects to brew beer using reclaimed water that has been further purified through reverse osmosis and other technologies. LOTT does not currently use those technologies.

- Are you going to want us to help with public meetings?
  - Yes, absolutely. In 2019, this group will be active in helping us develop ways to explain study results and engage the public in community conversations.
➢ I am sure the Reclaimed Water Infiltration Study is not on most people’s minds. Has there been an attempt to work with the media?
   o Yes, we can be reaching out to the media and reminding people that the study is going on. The challenge is the length of the study; we may not have momentum to keep people interested year to year. We are going to ramp up that effort to engage the public when we have more results to keep people interested, so we will concentrate that effort in 2019.

➢ Any chance that there could be quarterly updates on the preliminary 2018 data as it comes in? It would be useful to this group and the general public.
   o We can certainly be looking at how to share information as it is gathered.

➢ You have a check-in scheduled at 6 months, so maybe you could give an update sometime after that.
   o Yes, we can certainly increase the frequency of our email distribution list updates.

Wendy thanked the advisory group members for coming and let them know that if they had additional questions for the Peer Review Team, they could email her and they would be forward to the Team. The meeting was adjourned.