PACIFIC NORTHWEST CLEAN WATER ASSOCIATION
LOWER COLUMBIA SECTION

QUARTERLY E-NEWSLETTER

MESSAGE FROM THE PRESIDENT

"It is great to be us." "We got it all." These are the things I think of when I realize how lucky we are to be able to live in Oregon, with the gorge and mountains on one side and Ocean on the other. So when I heard about the Eagle Creek fire this summer, it broke my heart. The trails I regularly enjoy with my family may not be in there for a significant amount of time to enjoy. I, along with my family and friends, pledged our volunteer time in restoration of the gorge next year. I am excited to be a part of restoration effort and urge my fellow wastewater society members to join and volunteer.

Here at the Section, so much is happening!

- The Section contributed to Adopt-a-School program that supports water science education, involvement and restoration activities by 4th–12th grade students in Oregon who are working toward clean water education goals.
- The microbiology workshop at the Clackamas Community College was well appreciated and attended,
- The Activated Sludge Workshop has been postponed due to low registration numbers. The workshop will address strategies to meet stringent nutrient removal requirements. Let us know if you are interested in attending!

Lastly, as 2017 comes to an end, I would like to thank everyone for their efforts in 2017 and look forward to another successful year! Wishing you all a Happy New Year.

Bhargavi Ambadkar
President of the Lower Columbia Section
(BAmbadkar@carollo.com)

Inside this issue:

What is Pacific Northwest Clean Water Association (PNCWA)?

PNCWA is a professional organization for people in clean water industries in the states of Idaho, Oregon, and Washington. Members include wastewater treatment plant operators, consulting engineers, scientists, water and wastewater treatment equipment manufacturers and representatives, and students.

Mission Statement:

"Pacific Northwest Clean Water Association (PNCWA) is dedicated to preserving and enhancing the water quality in the states of Idaho, Oregon, and Washington. We promote the technical development of our members, the dissemination of information to the public and the advancement of science needed to protect the water environment."

What is Lower Columbia Section (LCS)?

The Lower Columbia Section is one region of the PNCWA encompassing Portland (OR) and surrounding areas of Northwest Oregon.

What's Going On in the Lower Columbia Section?

See what's new, find opportunities for training, and meet your officers at our website. We are always looking for people interested in getting involved. Check out the Lower Columbia Section's website and the PNCWA at http://lowercolumbia.pncwa.org.

What is the Young Professionals (YP) division?

The Young Professionals division of the PNCWA LCS is open to anyone under 35 years of age or with less than 10 years of experience in the clean water industry. LCS's YP events are held quarterly and expose rising professionals to the fundamentals of wastewater treatment technology. Industry professionals are encouraged to attend as well. Each event is designed to promote learning specific to our industry. Events range from touring municipal wastewater treatment plants, breweries or even happy hour events for networking. If you have an event you would like to suggest or to learn more about the PNCWA, please contact the YP Chair:

Hunter Bennett-Daggett (hunter.bennettdaggett@tetratech.com) .

More information on events, as well interesting news bits from around the web can be found on the group's Facebook page at www.facebook.org/LCSYP.

"A young professional is anyone under 35 years of age or anyone with less than 10 years of experience."

Wastewater Lesson of the Quarter: SVI

By Joel Borchers

Let's revisit our last issue on MCRT. This was a case of too many cooks spoiling the broth. I had originally worked up a description of MCRT and John Lewis was kind enough to draft up a description of his own. I looked it over and thought that his did a much better job of conveying the concept of what MCRT was and how to calculate it.

A problem arose however when we combined John's method with my example.

John calculates the secondary clarifier pounds a little differently that I do. He uses a "Sludge Judge" to capture a core sample, but only performs a solids analysis on the solids portion of the sample. Then he determines the volume of the sludge blanket and multiplies the concentration together to get the pounds in the secondary clarifier.

What I normally do is to use a Sludge Judge to capture a core sample of the secondary clarifier, but I perform a solids analysis on the entire sample. I then multiply that concentration with the volume of the entire secondary clarifier to determine the pounds in the secondary clarifier. And that's where the problem showed up. In the example I sent John, I had the Clarifier Core sample as 250 mg/L. John assumed that was the concentration of the blanket and not the entire clarifier. Of course a more realistic number would have been somewhere between the MLTSS and the WASTSS, say 4140 mg/L.

One of the good things about the secondary clarifier is that there usually isn't a whole bunch of pounds in there anyway. My calculations had me on the low side of 5 days while John's was on the high side of 5 days, but they both rounded to a 5 day MCRT.

Let's try something hopefully a little less controversial, the Sludge Volume Index or SVI.

Typically an operator will collect about 3 liters of Mixed Liquor. Back at the lab, they will gently mix the sample before pouring 2 liters into a Mallory Settleometer. A Mallory Settleometer is a two liter container, but is marked with graduations up to 1,000 and the results are read as ml/L. Other containers can be used for the Settleometer test, but avoid those tall graduated cylinders, as the friction created by the wells can slow the settling and give false readings. Wide mouth containers are preferred.

Once the sample is in the Settleometer, a paddle is used to mix the contents into a homogenous mixture and then stop any currents in the Settleometer. The operator will then begin to take timed measurements.

In order to calculate a SVI, an operator only needs to record the Settled Sludge Volume after a 30 minute time period. However, if you record the Settled Sludge Volume every 5 minutes for the first 30 minutes and then every 10 minutes for the next 30 minutes, you can gain a lot of information about your sludge.

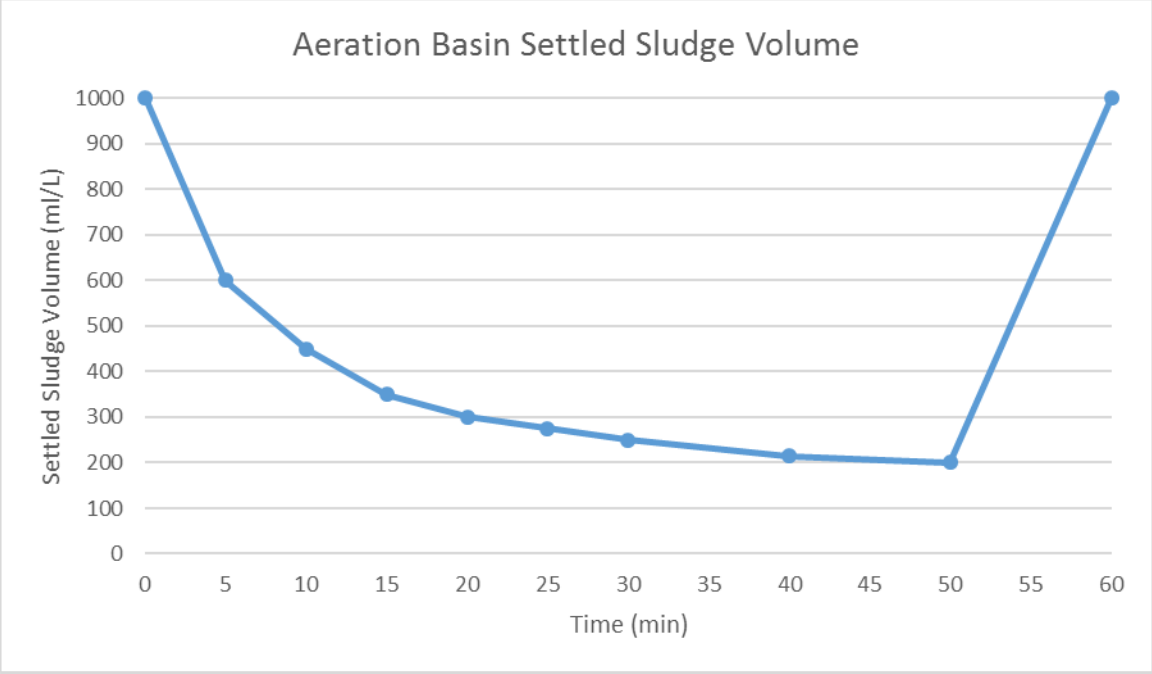
If you took a sample and recorded the readings, you might end up with something that looks like this:

Wastewater Lesson of the Quarter: SVI

By Joel Borchers

Time Period (min)	Settled Sludge Volume (mL/L)
0	1000
5	600
10	450
15	350
20	300
25	275
30	250
40	215
50	200
60	1000

If you graphed those results, it would look like the following:



Wastewater Lesson of the Quarter: SVI

By Joel Borchers

By graphing your results, you generate a settling curve and it's a picture of what might be happening in your clarifier. It also can show the maximum time your solids can stay in the clarifier. This settling curve shows denitrification occurring at around 50 minutes, which causes small little bubbles of nitrogen gas to form, lifting the sludge blanket to the top of the clarifier. You'll want to remove the solids out of the clarifier before that happens.

In order to calculate a SVI, you simply multiply the settled sludge volume reading at the thirty minute mark (SSV_{30}) by 1,000 and divide by the MLSS in mg/L. The day this sample was collected, the lab reported the MLSS was 2,500 mg/L.

$$\text{SVI (mL/g)} = \frac{\text{Settled Sludge Volume}_{30}\text{ (mL/L)}}{\text{Mixed Liquor Suspended Solids (mg/L)}} \times 1{,}000\text{ mg/g}$$

$$\text{SVI (mL/g)} = \frac{250\text{(mL/L)}}{2{,}500\text{ (mg/L)}} \times 1{,}000\text{ mg/g} = 100\text{ mL/g}$$

In this instance the SVI is calculated to be 100 which some consider to be a "textbook good value". A SVI lower than the "textbook good value" can cause faster sinking sludge that may leave behind pin-floc. Lower SVIs indicate a faster sinking sludge and that sludge is sinking away from the effluent launders (which could be a good thing). However, if sludge settles too quickly, there isn't time to capture any of the smaller particles and you can be left with a turbid supernatant.

A higher SVI can cause sludge that settles more slowly, which can be associated with "bulking" sludge. A slower settling sludge tends to form a blanket as it settles and this blanket has a better chance of capturing the smaller particles resulting in a clear supernatant. A higher SVI is reasonable if your clarifier can still capture the solids and not produce denitrification.

In terms of sludge age, usually younger sludge settles slower while older sludge tend to sink faster. However, if you are carrying too many pounds of activated sludge, you won't have any room for the sludge to settle. That's why SVI is an important parameter to track, you need to take into account how much sludge you have and the age of the sludge as well.

CALL for 2017 AWARD APPLICATIONS/NOMINATIONS

PNCWA Lower Columbia section recognizes exceptional service and performance in the wastewater industry every year.

Awards are given for the Plant of the Year, Treatment Plant or Collection Systems Operator of the Year, and the Project of the Year.

The Lower Columbia Section (LCS) of the Pacific Northwest Clean Water Association (PNCWA) is now accepting nominations for the following awards:

A. Wastewater treatment plant of the year,

B. Treatment plant operator of the year,

C. Collection system operator of the year, and

D. Project of the year.

These awards are in recognition of exceptional service and performance in the wastewater industry. Eligible for awards are all treatment plants, collection system and treatment plant operators, and wastewater related capital projects in the counties of: Columbia, Multnomah, Washington, Yamhill, Clackamas, Hood River and Wasco (i.e. the LCS Service Area).

For **Project of the Year** or **Plant of the Year** awards, the facility will have demonstrated one or more of the following: innovation, sustainability, excellence in preserving water quality, safety, and public service.

For **Operator of the Year** (OYA) awards, the Operator will have demonstrated excellence through one or more of the following: section activities, safety, certification, training, plant performance/collections systems performance or public relations.

Please consider nominating your coworker, staff member, plant, or project for an award this year to recognize their hard work and achievement. If you need assistance in completing a nomination packet, please contact Monica Stone assistance. We are happy to help.

How to submit a 2017 AWARD Nomination?

Nominations may be made by PNCWA members or any operator, manager, supervisor, city engineer/official, district board/council member, consulting engineer or manufacturer representative.

How to submit a nomination?

Simple! First, contact Monica for a nomination packet. She will provide you with a template that may facilitate the application process.

monica@olwsd.org

DEADLINE: All award nominations are due to Monica by April 15, 2018.

A. Plant of The Year 2017:

To nominate, demonstrate that the award criteria have been met or supply the following information:

1. NPDES or WPCF permit compliance for 2017.
2. O&M performance (including staff training, certification, safety program, energy conservation, industrial pretreatment, biosolids management, lab management, maintenance management, etc.).
3. Innovative techniques or superior application of established treatment techniques.
4. Significant improvements in operations, maintenance, and plant management made in 2017.
5. Other significant accomplishments.
6. Support of the Lower Columbia Section (e.g. hosting meetings, and allowing employees to attend section meetings, conferences, and workshops).

Nominations should include a Plant Profile that includes a description of the treatment process, design flows and loadings, and current actual flows and loadings. Photos are encouraged but not required. The nomination must include a letter of recommendation from the person nominating the plant that addresses the above criteria and any other relevant factors.

B. /C. Treatment Plant or Collection System Operator of the Year 2017:

Nomination must include the following information:

1. Your full name.
2. Nominee's full name.
3. Which award (WWTP or Collections).
4. Nominee's plant and system information.
5. Your phone number, mailing address, and email address (if available).
6. The daily, weekly, and monthly operations and maintenance duties of the nominee.
7. Operational challenges/problems and how the nominee assisted in solving these problems.
8. Recent Short School courses or participation, correspondence courses, college courses, or other work related training.
9. Nominee's safety involvement.
10. Any other noteworthy activities related to the wastewater field.
11. Any other qualities (job related or otherwise) that make this individual outstanding among his or her peers.

The information submitted should be as detailed as possible. Photos of the nominee, plant, equipment, etc. are not required, but strongly encouraged.

D. Project of The Year 2017:

This award is in recognition of the role capital projects play in the wastewater industry. Awards will be given to the owner (municipality, service district, or other agency), design engineering firm, and prime contractor of the project.

Eligible Projects:

1. Capital projects relating to wastewater collection & treatment, stormwater collection & treatment, effluent reuse, environmental mitigation, or related fields.
2. Project must be within the LCS service area.
3. Projects must have been completed between 1 January and 31 December 2017.

Nominating Criteria:

1. Benefit to the environment
2. Benefit to the public
3. Application of new techniques or innovative application of existing techniques
4. Unique features and/or challenges in design, construction, or financing
5. Stakeholder/public involvement
6. Cost control
7. Quality control
8. Coordination between entities involved (owner/designer/builder/others)

Nominations should include a narrative description of the project, including purpose, scope, history, financial information (engineering estimate, budget, final cost, etc.), and how the project meets the criteria listed above. Nominations should include the names of project owner (municipality, service district, etc.), design engineering firm, prime contractor, and the names of the responsible parties from each entity. Photos are encouraged but not required.

Administration Building Forcemain Replacement, Nehalem Bay Wastewater Agency

Nehalem Bay Wastewater Agency (the Agency) provides wastewater collection and treatment services to the communities of Wheeler, Nehalem, Manzanita, Neah-Kah-Nie Beach, and Nehalem Bay State Park. The collection system includes 19 pump stations to convey wastewater from the farthest reaches to the wastewater treatment plant located on the east side of the Nehalem River. The Administration Building Pump Station conveys about 80% of the wastewater to the treatment plant across the Nehalem River.

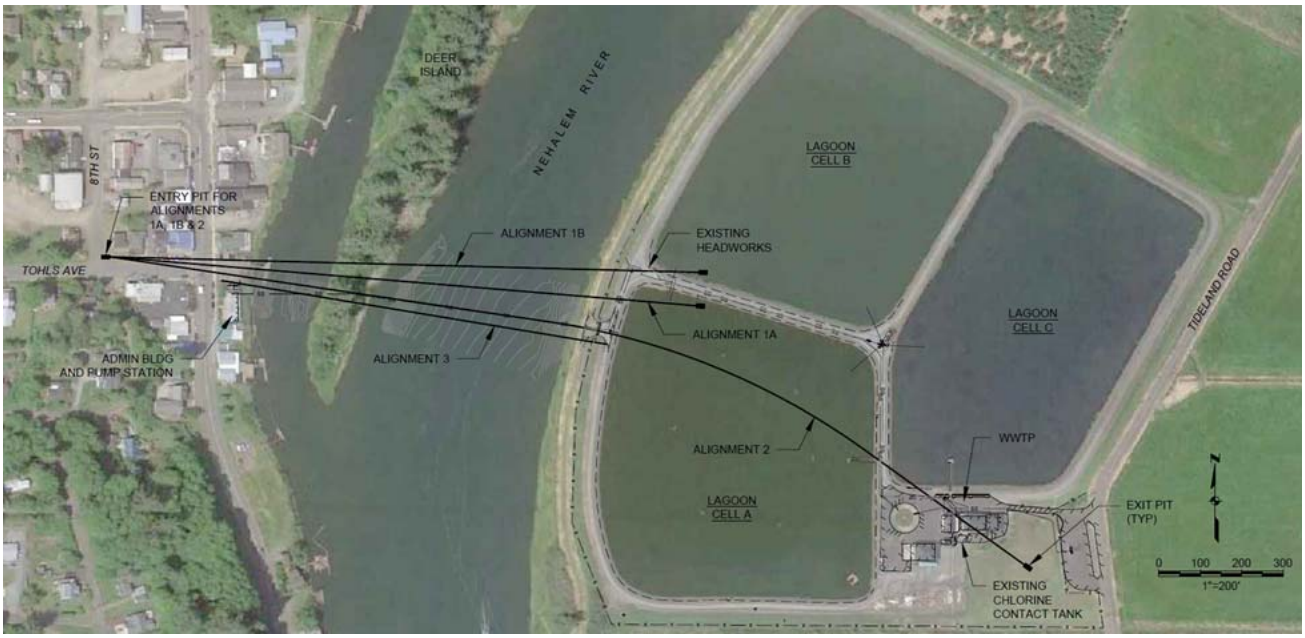
The Administration Building Pump Station was constructed integral to the Agency's Administration Building structure in 1973. The forcemain from the pump station to the treatment plant was constructed at the same time as the pump station using a dragline bucket to excavate the trench. Twelve-inch ductile iron pipe was laid in the excavation and backfilled and the forcemain served for 40 years without issue. In 2014 there was evidence of forcemain leakage at the point where the forcemain entered Administration Building wall. The Agency quickly contained the leak and made a temporary repair consisting of an internal joint seal with a rubber sleeve held in place by stainless steel bands. The forcemain was quickly returned to operation and continued to operate. Based on the observed condition of the pipe during inspection and repair, it was apparent the forcemain needed to be replaced.

Planning and Design of Forcemain Replacement

The Agency contacted Kennedy/Jenks Consultants to assemble a team including Shannon & Wilson geotechnical engineers and Staheli Trenchless Consultants to provide horizontal directional drilling (HDD) expertise. Local engineering firm, Onion Peak Design, provided surveying and construction observation for the project.

Preliminary Alternatives

The team prepared 5 pipeline alignment concepts for screening.



The remaining alternatives were:

Administration Building Forcemain Replacement, Nehalem Bay Wastewater Agency

Alignment 1A – HDD directly into Lagoon Cell A was considered feasible, however, it will require dewatering a portion of Cell A, where most of the BOD removal takes place.

Alignment 1B – HDD directly into Lagoon Cell B was considered feasible, however, it will require dewatering in a portion of Cell B.

Alignment 2 - HDD into Open Yard area was considered feasible, however, routing to the headworks will considerably increase the length of the forcemain.

Alignment 3 – Open cut construction of a new forcemain directly across the river with an air release valve (ARV) in Deer Island would be parallel to the existing forcemain. This method of construction in the river would require considerable permitting that would require a minimum of 12 months, plus mitigation efforts for this salmon bearing stream.

Alignment 4 (not shown above) – Was ruled out early and was the open cut route to the Highway 101 bridge because ODOT indicated there was no available space to lease.

When the feasible alternatives were identified, a geotechnical investigation was completed along the proposed alternative routes.

HDD Construction

HDD construction is a common method of pipeline construction under water bodies because it can be employed with little or no disturbance to sensitive aquatic environments. Two of the major risks in HDD construction are borehole collapse and hydrofracture. Borehole collapse can be mitigated through an understanding of subsurface soil properties, management of drilling mud pressures, and installing conductor casing or similar measure to prevent collapse through soft soils.

Hydrofracture occurs when drilling fluid inadvertently returns to the ground surface because the subsurface soils cannot withstand the pressures required for during drilling. Mitigating risk of hydrofracture also requires an understanding of subsurface soil properties and careful selection of drilling mud pressure. Selection of a borehole alignment that is deep enough below the thalweg of the river is also important to prevent breakout of drilling mud into the river.

Geotechnical Investigation

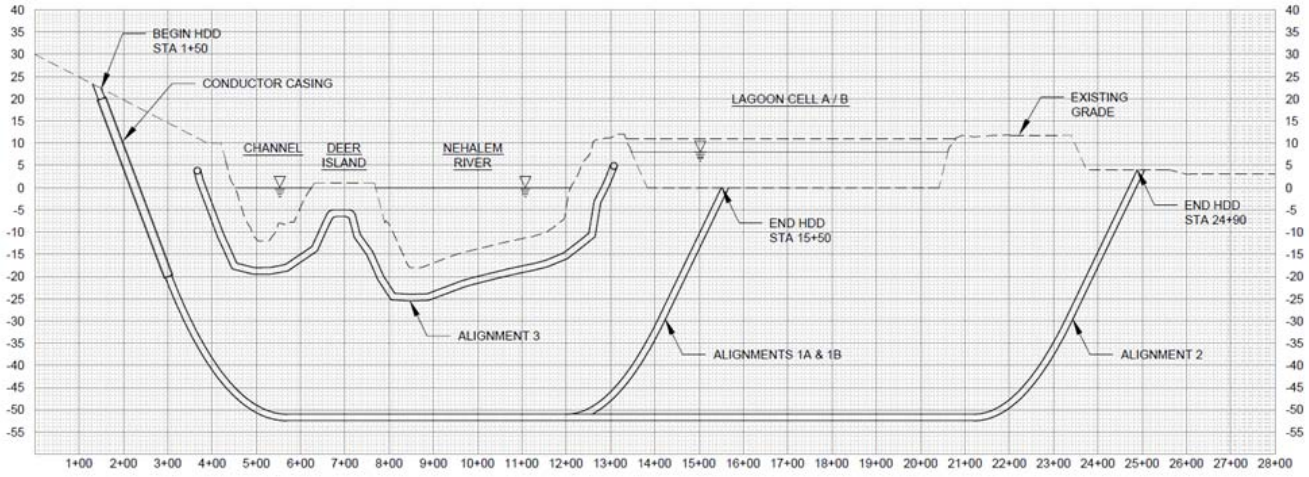
A geotechnical investigation was completed to determine the properties of subsurface soil and rock. The geotechnical conditions were determined to be generally feasible for HDD, but it was anticipated that mitigation measures would be necessary to counteract the very soft soils in the upper portion of the project area. In general, the fine-grained soils encountered during the geotechnical investigation would be easily transportable by the drilling fluid and should drill and ream very quickly.

A portion of the route included a mudstone formation that was expected to be favorable for drilling, as the stiffness of the material will allow for a very stable borehole. However, the near-surface lower strength sands and silts were expected to be prone to borehole collapse, leading to the possibility of settlement and/or hydrofracture above the borehole near the entry and exit points. Additionally, steering the HDD boring machine in softer material is more difficult. To accommodate this condition, the bore could be designed so the curved sections are within the deeper, denser material.

Alignment Alternatives

Administration Building Forcemain Replacement, Nehalem Bay Wastewater Agency

The design team prepared a preliminary design report, including 4 feasible forcemain replacement alternatives (Alternatives 1A, 1B, 2, and 3). HDD Alternatives 1A and 1B are similar in length and complexity, however, Alternative 2 is significantly longer and requires more piping to connect to the headworks. Open cut Alternative 3 is the shortest alignment, however, it comes with the most complicated permitting requirements and difficult construction conditions.



Conceptual Costs

Conceptual layouts for the 4 alternatives under consideration were prepared. From these conceptual designs, the team prepared planning level cost estimates including contingency costs.

Alignment 1A: $2.3M (included $0.90M contingency)
Alignment 1B: $2.2M (included $0.87M contingency)
Alignment 2: $4.9M (included $1.97M contingency)
Alignment 3: $2.9M (included $1.05M contingency)

Based on feasibility of construction and estimated construction cost, Alignment 1B was selected as the preferred alternative. The project included 500 feet of 16-inch C905 PVC pipe installed using open cut methods and 1,000 feet of 18-inch DR11 high density polyethylene (HDPE) pipe installed using HDD methods.

The project was bid in summer 2016 and bids ranged from $1.797M to $1.981M. The Contract was awarded to the team of Emery & Sons and The HDD Company, who was the low bidder.

Construction of the Pipeline

HDD pipeline construction is somewhat complex in set up and execution, however, when properly prepared, an HDD Contractor can construct a 1,000-foot long pipeline quickly.

The HDD drill rig and associated equipment require an area equivalent to a football field on the entry pit side of the boring. One major consideration of construction on the Nehalem-side of the river was preservation of the City's heritage Coast Redwood tree located next to City Hall. The location of the HDD boring entry point was selected to ensure adequate space to prevent damage to the tree.

Administration Building Forcemain Replacement, Nehalem Bay Wastewater Agency

Photo: The HDD Rig and Entry Pit shown working around the Coast Redwood. In this photo, the conductor casing and 18-inch product pipe can be seen.

Construction by HDD consisted of the following steps:

Pilot Boring: The 9-7/8" pilot bore was made with a cutter head, which was smaller than the final boring. The precise position of the head of the drill string was tracked and logged throughout pilot boring. During the pilot bore, drilling mud was pumped to the head under a controlled pressure to convey the displaced soil and rock cuttings to the HDD entry pit. The slurry was pumped from the entry pit to a separator plant that recycled the drilling mud and removed the cuttings. The pilot bore was carefully monitored for location using a position tracking instrument, drilling mud pressure, and flowrate.

Reaming: With the drill string fully extended to the exit pit, a 26-inch diameter reaming head was attached and pulled back toward the entry pit. While the reaming head was pulled through the boring, additional drilling mud was pumped into the boring to remove cuttings.

Swabbing: The final swabbing pass using a barrel reamer from the entry pit to the exit pit was made to reach the final intended diameter of 30 inches. It also sent the drill string to the exit pit where it was needed for pipe pullback.

Administration Building Forcemain Replacement, Nehalem Bay Wastewater Agency

Pullback: A pullback head was attached to the drill string and the pipe, then the pipe was slowly pulled through the boring. As the pipe was pulled into the boring exit pit, it was lofted by an excavator with rollers attached to minimize friction. During the pull-back process, drilling mud was displaced by the pipe and pumped into trucks for hauling and disposal.

The selected pipe material was HDPE due to its flexibility, durability, and ease of assembly. The pipeline was butt-fused using a welding apparatus in the field. The pipeline was completely welded before pullback and laid out on the plant property.

Photo: The HDPE pipeline shown lofted during pullback

Photo: The exit pit with the pipeline installed and the headworks connection underway

Entry and Exit Connections

Construction of an HDD pipeline has limitations on the entry and exit angle of the drill. The maximum angle a conventional HDD drill rig can operate is 12 degrees from horizontal. Because the forcemain was required to be at least 30 feet below the river bed, the limitation on drill angle requires the entry and exit points to extend the pipeline past the pump station and headworks. This means additional piping was required to make connections to the existing structures.

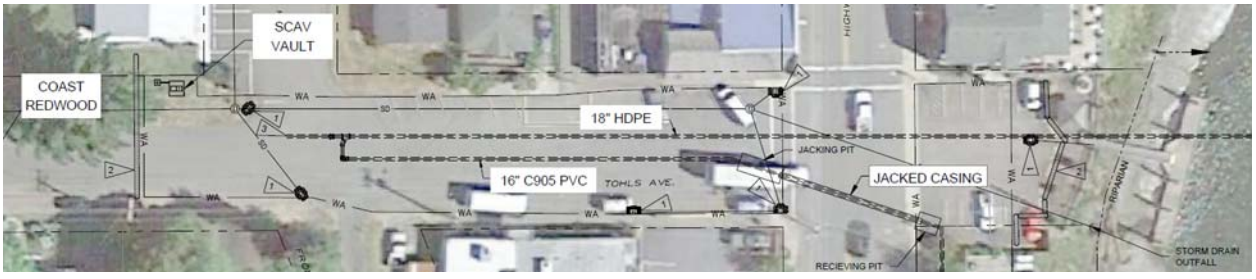


Photo: Pump Station Connection Piping in Nehalem

Due to the topography of Nehalem, a combination air/vacuum release valve was required on the pipeline.

Administration Building Forcemain Replacement, Nehalem Bay Wastewater Agency

Making the connections to the pump station required crossing Highway 101. The 16-inch C905 PVC pipe crossing was made through a 30-inch steel casing installed by jack-and-bore construction completed by Gonzalez Boring & Tunneling. A 2-inch PVC electrical conduit was included in the crossing for future installation of a sump pump.

The forcemain connection from the Lagoon Cell B exit point required the back-tracking shown below.

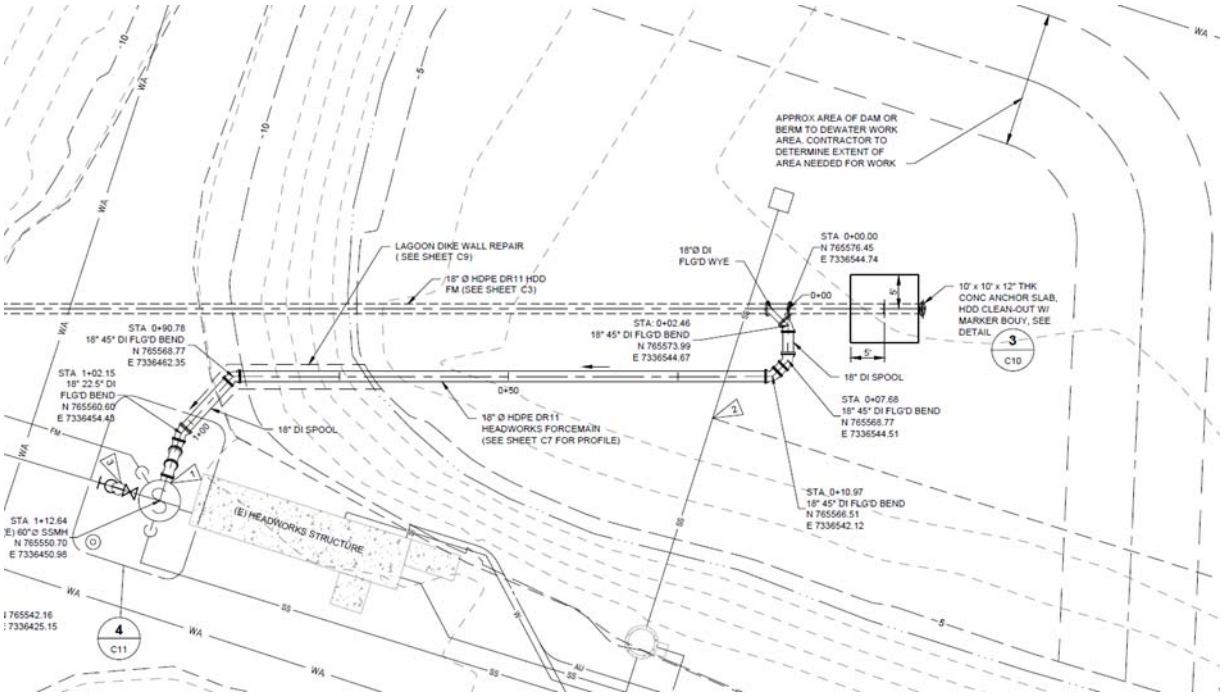


Photo: Headworks Piping Connection at the Wastewater Treatment Plant

The new connection from the new forcemain to the headworks was made by open cut excavation, and tapped into the existing influent manhole with several other connections. The pipeline was pressure tested and placed into operation when the final connections were made.

This project was a collaboration between Nehalem Bay Wastewater Agency and several Engineering and Construction experts. The team effort helped reduce the Owner's risk and made a successful project for all. Many thanks to all involved for this great experience, and thanks to Nehalem Bay Wastewater Agency for trusting us with this important project.

Photo: Pullback of the 18-inch pipe across the lagoon

SUPPORTERS OF PNCWA-LOWER COLUMBIA SECTION

Thanks to these sponsors!

The Lower Columbia Section strives to provide educational opportunities for those in the field of wastewater treatment. We work to do that by offering social events, scholarships, workshops and promoting plant tours around the area. None of this would be possible without the generous support of our sponsors.

On behalf of the entire Lower Columbia Section of the Pacific Northwest Clean Water Association, we would like to thank:

Carollo Engineering

JBI Water & Wastewater

Kennedy/Jenks Consultants

MurraySmith

MWH

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Contact Jeff Hart at JeffHart@KennedyJenks.com

for information on sponsorship and advertising.

PNCWA – Lower Columbia Section CONTACTS

	Name	Officers	E-MAIL
	**Bhargavi Ambadkar**	President	BAmbadkar@carollo.com
	**Jeff Hart**	Vice President	JeffHart@KennedyJenks.com
	**Jeanette DeCastro**	Secretary-Treasurer	decastro.jeanette@gmail.com
	**Joel Borchers**	Website Chair	BorchersJ@CleanWaterServices.org
	**Tim Munro**	Scholarship Chair	Tim.Munro@ci.mcminnville.or.us
	**Hunter Bennett-Daggett**	Young Professionals Committee Chair	Hunter.BennettDaggett@tetratech.com
	**Monica Stone**	Awards Chair	monica@olwsd.org