Volume 47
Winter 2013/14

Water Lines

Featured Facility:

Incline Village Water Disinfection Plant

By: Joseph Zalla, BAO CH2M Hill
Brad Johnson, PE, Engineering Manager, Incline Village GID
Harvey Johnson, Utilities Superintendent, Incline Village GID

The Incline Village General Improvement District (IVGID) owns and operates the Burnt Cedar Water Disinfection Plant (BCWDP) located on the north shore of Lake Tahoe. The BCWDP produces 5,900-gallons per minute (gpm) of drinking water for Incline Village, Nevada. The source water is Lake Tahoe and it is currently unfiltered as it meets the U.S. Environmental Protection Agency (EPA) filtration avoidance criteria.

The BCWDP treatment process previously included an ozone system followed by free chlorine residual disinfection. The ozone system was commissioned in 1995 and was one of the earliest installations using sidestream ozone injection with a pipeline contactor. The facility required improvements/modifications to continue reliable operation, as well as additional treatment to comply with the EPA's Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR).

Several treatment approaches were evaluated to achieve compliance with the LT2ESWTR requirements and to meet the overall objectives of the project. Increasing the ozone system capacity, ultraviolet (UV) light disinfection, an advanced oxidation process (AOP), filtration alternatives, and the continued use of ozone as a taste and odor control barrier, with the addition of AOP.

A cost-benefit analysis was conducted to compare the treatment approaches using non-monetary criteria and project costs. UV disinfection was selected as the preferred treatment approach. The ozone system will be used to achieve the required 4-log virus inactivation as well as provide taste and odor control. UV will provide 3-log Giardia inactivation, as well as the Cryptosporidium inactivation required by the LT2ESWTR.

A condition assessment was conducted of the BCWDP to identify the improvements/ modifications required to continue reliable operation and implement the preferred treatment approach. The existing ozone generators were over 15 years old and had a declining production capacity. Parts for the generators were no longer being manufactured so they were replaced with new units to improve the reliability of the ozone operation.

Ozone treatability testing was conducted to establish the parameters required to design the new generators. The ozone demand and residual decay rate were determined from the bench-scale testing. Ozone quenching reaction tests were also conducted to determine the chemical dose and reaction time required to quench ozone using calcium thiosulfate. This testing provided the information to establish the ozone dose and contact time needed to meet the virus CT required.

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Implementation and operation of these new disinfection systems as well as other plant improvements faced a few unique challenges that included the following:

- The regional planning association limits outdoor construction activities around Lake Tahoe to a 5-month window period annually. In addition, the planning association places requirements and restrictions on the construction of new structures near the lake. The project overcame these challenges by maximizing the use of existing infrastructure and utilizing previously occupied footprint at the BCWDP in order to implement these new disinfection systems.
- The BCWDP needed to remain online and operational throughout construction except for strategic shutdown periods for tie-in connections. Installation of the new UV and ozone disinfection processes required close coordination between plant operations staff, the contractor, and the regulatory agencies, to ensure disinfection compliance at all times during construction.
- UV operation and maintenance with extraordinarily high water quality (average UV transmittance of 99 percent) presented challenges with respect to programming the UV control system and performing routine calibration procedures on the equipment.
- The UV system was installed and commissioned during the emergence of issues surrounding the disinfection performance of medium-pressure UV reactors at low wavelengths.

UV lights

The BCWDP treatment process designed by CH2M Hill includes ozone disinfection and ultraviolet (UV) disinfection systems followed by free chlorine residual disinfection. The Ozone Disinfection System provides the required virus inactivation of unfiltered raw water from Lake Tahoe, oxidizes taste and odor causing compounds, and enhances reduction of disinfection byproduct precursors. The UV Disinfection System provides Cryptosporidium and Giardia inactivation to meet regulatory requirements. The Ozone and UV Disinfection

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Systems provide multi-barrier protection and reduce the risks against Cryptosporidium, Giardia, and many other protozoan, bacterial, and viral pathogens. Sodium hypochlorite solution is used to provide a free chlorine residual within the drinking water distribution system.

Raw Water and Low Lift Pump Station

The Raw Water and Low Lift Pump Station convey raw water from Lake Tahoe through the Ozone and UV Disinfection Systems. Raw water is drawn from the lake through a 24-inch intake pipeline that extends approximately 650 feet from the shoreline into the lake. The Raw Water Intake pipeline is connected to the Low Lift Pump Station. The Low Lift Pump Station contains two adjustable speed submersible pumps with a maximum capacity of 3000 gpm each. The pumps are located inside a 12-feet diameter concrete caisson that serves as a wetwell to collect raw water from the Raw Water Intake. Raw water is pumped to the Ozone Eductor Vault prior to the Ozone Injection System and Ozone Contactor. The raw water is pumped through the Ozone Disinfection System and UV Disinfection System. After passing through these treatment systems the water reaches the Treated Water Pump Station. The Treated Water Pump Station pumps treated water from the BCWDP to IVGID's distribution system. Sodium silicate is added to mitigate potential pipe and pipe joint corrosion issues within the water distribution system.

Ozone Disinfection System

The Ozone Disinfection System is comprised of a liquid oxygen (LOX) system, ozone generator system, ozone injection system, ozone contactor, and off-gas destruction units. The Ozone Disinfection System at the BCDWP generates ozone onsite using LOX. Ozone is highly reactive in nature and unstable at high concentrations which make delivery of ozone infeasible. The Ozone Disinfection System uses oxygen that is delivered as liquid oxygen, stored in two 3000 gallon vertical tanks located within the LOX Tank Vault, then converted to oxygen

Ozonia - Ozone Generator

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Work It! Q & A

1. What is the BOD loading in lbs/day when the influent rate of flow is 6.7 MGD and the influent BOD is 195 mg/L?

2. An extended aeration plant has an influent flow of 4.3 MGD with a BOD of 164. If the F/M ratio is to be kept at 0.28 in two aeration tanks, each measuring 40 ft on each side and with a depth of 14 feet, what MLVSS concentration should be targeted?

2.a Using the situation from the above problem, how many pounds of MLVSS should be wasted today if the MLVSS is now 7,788 mg/L ?

3. Each clarifier is 40 ft in diameter, three are in service, influent flow is 15.8 MGD, and MLSS is 3,125 mg/L. What is the surface loading rate, gpd/sq ft. on these clarifiers?

4. What is the detention time used for CT determination in a thirty-five foot diameter clearwell tank with a T10/T Ratio of 0.1 when the minimum tank depth for the day was twelve feet and the maximum flow was 1.7 MGD ?

5. About how many fire hydrants will be installed in a system with 45,400 lineal feet of water mains over six-inches in diameter?

5.a If annual servicing of each hydrant requires an average of 115 minutes including preparation, travel and mobilization/demobilization times, and a full time work year is 2,080 hours, how many full time equivalent (FTE) employees will be needed for this work?

Answers to "Work It!" questions are on page 13

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gas (GOX) through two ambient vaporizers, and is transported via piping to the ozone generators. Dry nitrogen gas is added to the GOX prior to entering the generators to increase ozone production. Ozone is created by applying electrical energy across the GOX as it flows through the generator. The Ozonia Ozone Generators and corresponding control panels produce approximately 8 to 10 percent concentration of ozone gas (by weight) which flows through the ozone pipe to the sidestream Ozone Injection System located in the Ozone Eductor Vault. The injection system includes two Motive Water Pumps (one duty, one standby), two Eductors (one duty, one standby), and one 24 inch Pipeline Flash Reactor. The discharge of the Motive Water Pump flows through an Eductor, pulling ozone gas into a sidestream of ozonated water (OW). The OW stream is then dosed to the raw water through the Pipeline Flash Reactor that is located immediately upstream from the 60-inch cement mortar lined and coated welded steel pipeline Ozone Contactor. Calcium thiosulfate (CT or Captor) is dosed approximately 4 feet downstream of the Ozone Contactor Sample 4 (OCS4) draw off location to quench (eliminate) the dissolved ozone in the OW. Ozone gas within the

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contactor is removed at Off-Gas Box No. 2 to the Ozone Destruction system. The dissolved ozone residual is monitored downstream at OCS6 sample location to confirm that all residual ozone in the process water is quenched.

UV Disinfection System

Ozonated water is conveyed from the Ozone Disinfection System to the UV Disinfection System through a 24 inch OW Pipeline. The UV Disinfection System includes two closed vessel model Sentinel* 18 by Calgon Carbon Corporation UV Disinfection Reactors (UVRs) and corresponding control panels. Each UVR (one duty, one standby) has a peak hydraulic capacity of 10 mgd. Automatic isolation valves, located upstream and downstream of each UVR, provide isolation of the standby reactor and to startup and shutdown the duty reactor. The UVRs are medium-pressure UV lamps enclosed in Type 214A quartz sleeves equipped with automatic mechanical quartz wiper cleaning devices to maintain a high degree of UV efficiency. There are two banks of two lamps for a total of four lamps per UVR. Each lamp has a maximum power capacity of 4.5 KW. An intensity sensor continually measures the absolute UV irradiance in the water to ensure adequate UV dose is maintained. The lamp banks energized and power can be adjusted automatically to accommodate varying conditions.

Cooling water pumps

Treated Water Pump Station

The Treated Water Pump Station pumps treated water from the BCWDP to IVGID's potable water distribution system. The station consists of three 400 HP and one 200 HP constant speed electric driven vertical turbine pumps positioned above an 18 feet diameter Treated Water Clearwell. The 400 HP pumps have a nominal capacity of 2400 gpm and the 200 HP pump has a nominal capacity of 1100 gpm. All four pumps are powered by reduced voltage solid-state motor controllers. A free chlorine residual analyzer and pH probe are located on the pump discharge. The Treated Water is required to have a minimum of 0.2 mg/L free chlorine residual leaving the BCWDP. An online Raw Water Turbidimeter that draws water from the Low Lift Pump Station is located in the Treated Water Pump Station.

Human Machine Interface

The computerized Human Machine Interface (HMI) controls all the processes in the BCWDP from the startup through the various operational modes through the shutdown of the system due to lack of need of water or emergency situation. The HMI is also linked to the Wastewater Treatment Plant telemetry computer and standby operator laptop for operator control and incident response.

Conclusion

The Burnt Cedar Water Disinfection Plant upgrade has been in operation for a year with no violations or breakdowns. The system will provide clean, safe potable water to our customers for future years as long as Lake Tahoe remains in its pristine state. The District spends considerable time and money on defensible space and watershed protection to keep the lake, our valuable water resource, so that we can all "Drink Tahoe Tap".

Kingsbury GID Water Meter Project

By: Eric Johnson, Kingsbury GID

Kingsbury General Improvement District is a small surface water system located on the south shore of Lake Tahoe, and it provides a number of services including water, sewer collection, and road maintenance to just fewer than 3,000 service connections. Most of these are residential, but there are a number of businesses, small and large as well. For many years, virtually all of the commercial accounts were metered, but essentially none of the residential. Residential customers paid on an equal flat rate basis, regardless of whether they were one unit in a four-plex with no irrigation, or an estate with extensive lawn and irrigation consumption.

There were many reasons to make the change to a metered system: having the ability to better determine condition of the distribution system by comparing accounted for water with total production; more equitable billing, as the majority of water was being used in the lower mountain area, while a large proportion of the population are in areas without much consumption; and perhaps the biggest of all, the requirement to be a metered system to be eligible for grant funding for water line replacement, something the District is in serious need of.

The District faced several challenges in starting this project. First, approximately one third of the services were in multi-unit, individually owned dwellings. These buildings were plumbed to a single District-owned valve, and then separated internally. These buildings are from 2 to 30+ units, and a large number are vacation rentals or second homes, which led to similar equitable billing questions for the people who live in the full time vs. those who don't.

The next challenge was a lack of reliable records. The best way to describe the history of the area is as a collection of individual developments, each with infrastructure put in by the developer. Some neighborhoods were fairly well designed, and a few were part of a water company originally, but the majority has been acquired over the years. Records of many areas were sporadic at best, and in some places were nonexistent. There were a large number of valve locations recorded on 3x5 cards, but not all the properties had these, and some were found to be very inaccurate. More disturbingly, there were several properties that no one, not even the retired employees, had ever seen valves or services for.

The sheer size of the project was another issue, as the construction season in the Tahoe Basin is May 1 to October 15. All underground work had to fit into this period.

With that timeframe, and the large number of multi-family buildings, the District planned for a multi-year project, starting with the single family homes in 2010. One great unknown was the size of individual service lines. It was known that they ranged from ¾" to 2", but not where the different sizes were, so the policy chosen was to match existing line size. Thus the contractor had to have a very large inventory of parts on hand at any given time. For the construction work, one water operator was assigned to the project, to handle shutdowns, turn-ons, and similar day to day tasks, as well as emergencies. In addition, other water operators tried to stay ahead of the project looking for missing service lines and/or valves, either with locating equipment or by using a Vactor truck to search. Kingsbury GID has five water operators, so with the routine day to day operations, this did strain the field resources.

The single family portion took approximately one full summer and a month into the next, and had 722 pit installations. Several factors contributed to the success of this phase. One was the use of Mueller meter pits, these allowed the installation of meters at the contractor's yard

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Cont' Kingsbury GID Water Meter Project

as well as batch disinfection of the pits and meters. Another was the use of hydro-excavation trucks wherever possible, which minimized the size of holes, and reduced the risk of damaging water or other utilities. Another important technology for this project was the use of freeze tools for lines without operable valves.

The multi-family properties presented serious questions, first being whether to master meter the buildings or install meters for individual units. To do individual units would require the meters be installed inside the buildings in most cases, so on private property and into the customer's own plumbing. This of course brought up access and maintenance issues. Cost was another big factor, as installing the meters inside the homes would have to be done by a licensed plumber and there was the unknown of how long it would take to do a retrofit installation. There were many discussions, sometimes heated, on how to do this part of the project with all the issues. In the end the decision was made to offer residents the option of having individual meters, subject to the following criteria:

1. All owners of units in a particular building had to sign an agreement with the District, covering access to the meters, the responsibility of the owners to protect the meters from freezing and other damage, and the obligation of the owners to make any plumbing modifications needed for the installations.
2. Representatives of the District would visit all buildings where meters were to be installed internally to determine if the plumbing met requirements of: space (minimum 3' overhead clearance), access (direct access to the meters without having to go through any living space), constructability (18" of straight pipe, or the ability of the homeowners to have the necessary plumbing work dine to create this), and no fixtures upstream of where the install would occur (irrigation systems and drain valves were a nightmare for this).

The preparation for this took up thousands of hours of staff time, both in the office and for the water crew. Many buildings were inspected several times for feasibility of installation, first to determine what would need to be done, and then to verify that the prep work was done correctly.

The multifamily project got underway in May of 2011. Based on lessons learned from the prior phase, the method of inspection was changed to have one inspector covering internal installations and one for external. Each had a digital camera and a form to fill out for each location. Several photographs were taken per meter. External pits were essentially the same as the single family homes but with more complicated plumbing. Also there were many external pits which required hand excavation because of the lack of access for large equipment.

The internal installations began at the same time, and the key to being able to do these was the use of the Ford Kornerhorn system for retrofitting meters. This is a modular system which allows the use of locking ball valves, check valves etc. as needed; and they install into the existing piping by means of restrained

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Cont' Kingsbury GID Water Meter Project

compression couplings. This eliminated the need for custom building meter setters by traditional pipe fitting methods. The time required to install the Kornerhorn is measured in minutes per fitting, and while they were not used in all of the internal installations they were the majority.

Total meters installed in the multifamily areas were 822, and ranged in size from ¾" to 6". The project went much more smoothly than anticipated and was completed by the end of September 2011. Again, one operator handled the day-to-day needs of the contractor, and others searched for any missing valves. One unpleasant surprise was the number of buildings which had white PVC service lines. These slowed down progress considerably both because of the dry time for adhesive and because extreme care had to be taken to not put stress on the pipe when connecting to the meter pits. Another difficulty we had was trying to figure out which line/valve/meter went to which unit in a multiunit building, as they were not always labeled and/or labeled correctly. We also found that the exterior addresses on several of the buildings did not match the District's records or billing system. All of this was compounded by the fact that a large number of the units were empty at the time of installation, so it took quite a long time, after the project installation, to assign the meters to the correct units.

In summary, some things worked very well:

1. Having one operator tasked with facilitating things for the contractor and also serving as an initial point of customer contact.
2. Using prefabricated meter pits but note:
   a. Do not allow more than one 6" extension on a pit because any more makes removing the meters in the future difficult.
   b. The "traffic rated" lids and collars may not stand up to snow removal, especially if the pits are for 1 ½ or 2" meters. We wound up using actual manhole covers/lids on the larger meter pits.
3. Retrosetters, regardless of brand save time and money.
4. Hydro-excavating equipment was a much safer digging method. No utility lines were broken by the contractor.
5. Line freeze equipment was critical as the meters were going in either at property line/ right of way or at the District valves. Sometimes valves were bad or simply non-existent at the meter location. Being able to do a freeze saved having to shut down whole areas of water main.

Things we would do differently:

1. Mark out sections or neighborhoods and have the contractor use them as scheduled work areas. We had a number of places where we had to locate valves and services, and at the start the contractor jumped around a lot, and it was hard to stay ahead with the locating effort. Part way into the first phase we did mark out areas by valve locations for shutdowns, and the contractor worked those areas one at a time, which went well.
2. Use GIS technology more. The inspection, location, meter data for the office and even photographs can all be captured with a good GPS or GPS-enabled computer. In our case, the meters have barcodes for serial and transmitter numbers, and the pertinent inspection information (meter size, depth, pipe type, condition, traffic rated lid or not, etc.) can all be entered with drop-down menus eliminating typos and time spent doing data entry.

TMWA's Truckee River Fund

By: Ron Penrose, Truckee Meadows Water Authority

The Truckee Meadows Water Authority (TMWA) is the primary municipal water supplier in the Reno-Sparks metropolitan area, serving a population of nearly 350,000 over a service area of 110 square miles. TMWA relies on surface water from the Truckee River system for the bulk of its deliveries, about eighty percent, with the remaining twenty percent coming from groundwater production wells utilized for peak demands and drought supply.

Like most water utilities, TMWA has implemented a water quality protection program encompassing all aspects of municipal water quality protection, including state-of-the-art treatment facilities, an aggressive program to maintain quality within the distribution system, a backflow prevention and cross-connection control program, and a source water quality program for its groundwater and surface water sources.

Prior to 2001, TMWA's predecessor, the water division of Sierra Pacific Power Company, had no feasible vehicle to proactively engage in surface water protection projects or programs covering such a wide multi-jurisdictional area as the Truckee River watershed. However, when the Truckee Meadows Water Authority was formed in 2001 as a public utility, an opportunity arose to create a program that could respond to this need. The answer, after much discussion and public input, was the TMWA Board of Directors' decision to create a *501c3* program that could be used for projects and programs to improve or protect Truckee River quality. The Fund was set up such that two percent of water revenue would be set aside for the fund with a third party utilized to invest and administer the funds. A separate advisory committee appointed by the cities of Reno and Sparks and Washoe County was established to solicit projects through an open and competitive process on a semi-annual basis. Strict criteria must be met: direct benefit to water quality or watershed, and the dedication of matching funds.

Financially, the Truckee River Fund (the Fund) provides tremendous financial leverage for water protection projects that TMWA could not ordinarily afford or implement due to jurisdictional boundaries. To date the, the Fund has collaborated with other non-profit groups and public agencies to support 101 projects or programs, with a $9.2 million contribution from the Fund matched by $17.4 million from grantees. The Fund has supported projects in the following areas:

- **Wildfires and Forest Thinning**: Recent wildfires in the watershed surrounding Reno have taken their toll on the local watershed, thereby increasing the likelihood of additional sediment and turbidity loading to the river. The Fund has supported recovery and restoration efforts in these areas and has supported forest thinning designed to reduce the severity of forest fires that could have an adverse impact on water supplies. The Fund helped expedite recovery efforts for the recent Hawken Fire, Caughlin Fire and Washoe Fire.
- **Invasive Species**: The introduction and proliferation of invasive species, both land-based and aquatic, is a major concern to TMWA. As such, the Fund has supported projects to mitigate invasive weeds and has funded the development and implementation of watercraft inspection programs at Lake Tahoe and nearby reservoirs to prevent the introduction of aquatic invasive species, such as the quagga mussel into the waters of Lake Tahoe and other nearby reservoirs.

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Cont' TMWA's Truckee River Fund

- **Erosion due to Past Logging Operations:** Some areas of the bi-state Truckee River watershed have been adversely impacted by past logging practices that neglected reforestation and erosion control. As a result, some of these areas have experienced incising of tributary creeks which have impacted the river system with increased sediment, suspended solids, and TDS loading. TMWA, through the Fund has supported many projects designed and constructed to restore streambeds and watershed to their natural state.

More information about the Truckee River Fund, including a full listing of supported projects, can be found at TMWA's website link at tmwa.com or by contacting Ron Penrose, P.E., TMWA Project Manager at rpenrose@tmwa.com.

Truckee River in the fall

The Need for Earthquake Vulnerability Assessments for Water Systems in Nevada

By: Ron Penrose, Truckee Meadows Water Authority

Within the State of Nevada, many public water suppliers are at risk for major system damage and loss of customer service in the event of a major earthquake. Northern Nevada, including the Reno-Sparks, Carson, and Lake Tahoe geographic areas, lies in a highly active seismic zone. As such, water system infrastructures in these areas are likely to sustain major damage if a major earthquake occurs. Given what is known about the local seismic zone, the occurrence of a large magnitude earthquake inflicting damage seems more of a question of when rather than if.

Some West Coast utilities with an inherent high seismic risk have undertaken detailed vulnerability assessments. These assessments have two components. The first component is an accurate delineation of the seismic area including identification of faults and areas of potential liquefaction, a seismic map if you will. The second component is a detailed analysis of the water system infrastructure within the seismic zones identified on the seismic map.

Because of the risk of earthquake damage, Nevada utilities should seriously consider undertaking earthquake vulnerability assessments of their respective systems. Due to this risk, the Truckee Meadows Water Authority (TMWA), the primary municipal water supplier for the Reno-Sparks community, is in the process of completing a detailed earthquake vulnerability assessment. The assessment will include the following elements:

1. **Seismic Base Map**: TMWA, with assistance and information from the University of Nevada and the USGS, will prepare a geologic seismic base map delineating faults and potential zones of liquefaction. This effort will draw upon existing studies and resources.

2. **Infrastructure Component Analysis:** TMWA staff will conduct an analysis and inventory of the various components of its system with a determination of infrastructure response and failure mode in the various seismic subzones. Elements to be reviewed in a layered methodology include distribution piping, pump stations, production wells, storage tanks, and treatment facilities.

3. **Identification of Resources Required for Response and Recovery:** This will be a specific detailed listing of materials, labor resources, equipment needs and other outside resources that should be readily available during the response and recovery efforts. This list will assist TMWA to better plan for response and recovery and will be shared with regional Emergency Operation Center (EOC) and local emergency response personnel.

4. **Development of Seismic Retrofit Plan**: This would be developed based upon the infrastructure analysis and would provide for a prudent, cost effective plan for hardening critical infrastructure against a major earthquake. The plan could then be incorporated into the overall capital improvement program.

TMWA hopes to complete the Earthquake Vulnerability Assessment in 2014. Questions concerning this effort can be directed to Ron Penrose, P.E., Project Manager, at rpenrose@tmwa.com.

Announcements

Obtaining Contact Hours and Continuing Education Units (CEUs) is a crucial requirement for every Water Operator that works in the State.

These classes allow Water Operators to further develop their skill levels, they will not only be better prepared to provide and protect safe drinking water, but will become more familiar with new developments in their field as technology and regulations change.

The NDEP's Bureau of Safe Drinking Water has a Calendar of Events for approved contact hour classes for certification renewal. The NDEP requires operators to take courses from International Association of Education Training (IACET) authorized providers or accredited colleges in order to apply for the Grade 3 & 4 exams.

Change of Mailing Address Requested:

Operator Certification Administrators have noted that a number of certificates are being returned to the State because Operators have not updated their mailing addresses after moving. Operators are asked to promptly notify the State when they have changed addresses. Please contact Susan Bunch with the Bureau of Safe Drinking Water at: susan_bunch@ndep.nv.gov or 775-687-9477

Wastewater Exam dates for 2014:

LV, Ely, Elko - 3/20/14 & Reno, NV only - TMWRF 3/21/14	**Deadline - 2/20/14**
NWEA Conf - 4/24/14 Reno, NV only	**Deadline - 3/24/14**
Exam date - 6/19/14	**Deadline - 5/19/14**
Exam date - 9/18/14	**Deadline - 8/18/14**
Exam date - 12/18/14	**Deadline - 11/18/14**

The next Drinking Water Exam:

March 21, 2014 (NvRWA conference) — Complete applications must be received by 5:00 p.m. on February 4, 2014 in our Carson City office. Test results will be mailed by the AWWA on or before April 18th. Certificates will be mailed on or before May 5th.

EXCEPTION: Testing that is proctored at the Las Vegas Valley Water District will be on Thursday, March 20th due to a scheduling conflict. Proctors will notify testers of exact locations and times.

Answers to the Work It! questions

1. Lbs / day = ppm x 8.34 x MGD
   Lbs BOD / day = 195 ppm x 8.34 x 6.7 MGD
   Lbs BOD / day = 10,896

2. **Known**
   F/M ratio = BOD, lbs food / MLVSS, Lbs microorganisms = 0.28
   Lbs BOD influent = BOD, mg/L x 8.34 x Flow, MGD
   Lbs MLVSS = MLVSS, mg/L x 8.34 x Aerator tank volume, MG
   Aerator tank dimensions, 2 each, (40 ft x 40 ft) and depth 14 ft
   Influent flow, 4.3 MGD
   Influent water BOD, 163 mg/L
   7.48 gallons / cubic foot

   Unknowns
   MLVSS, mg/L

   Solve
   Lbs BOD = BOD, 164 mg/L x 8.34 x Flow, 4.3 MGD
   Lbs BOD = 5,881
   Aerator Volume = 2 x 40 ft x 40 ft x 14 ft x 7.48 gal/ cu-ft x 1 MG / 1,000,000 gal
   Aerator Volume = 0.335 MG
   F/M ratio, 0.28 = BOD, 5,881 lbs food / (MLVSS, Lbs microorganisms)
   MLVSS, Lbs microorganisms to maintain = BOD, 5,881 lbs food / F/M ratio, 0.28
   MLVSS, Lbs microorganisms = 21,005
   21,005 Lbs MLVSS / (8.34 x Aerator tank volume, 0.335 MG) = MLVSS, mg/L
   21,005 Lbs MLVSS ÷ 8.34 ÷ 0.335 = MLVSS, mg/L
   7,518 = MLVSS, mg/L

2.a (7,788 mg/L now - 7,518 mg/L target) = need to waste an amount equivalent to 270 mg/L
   270 mg/L x 8.34 x 0.335 MG = 754 lb MLVSS to waste

3. total flow to the clarifiers is 15.8 MGD, or 15,800,000 gallons per day
   0.785 x 40 ft x 40 ft x 3 in service = 3,768 ft2 surface area
   15,800,000 gallons per day / 3,768 ft2 = 4,193 gpd/sq ft.

4. [(0.785 x 35 ft x 35 ft x 12 ft x 7.48 gal/cu-ft) gal] x [1,440 min / 1,700,000 gal] x 0.1 = 7.3 minutes

5. Distance between hydrants is typically 400 feet, keeping hose rigging and friction losses in hoses reasonable.
   45,400 ft / 400 ft per hydrant = 114 hydrants

5a. 114 hydrants x 115 minutes per hydrant service x 1 hour/ 60 minutes x 1 FTE / 2,080 hr = 0.105 FTE

Wastewater Operators Certified

Congratulations to the following wastewater professionals for passing their Wastewater Treatment, Wastewater Laboratory, Industrial Waste Inspector and Plant Maintenance exams in September & December of 2013

WASTEWATER TREATMENT GRADES

Grade 1: Jennifer Diamond, Joseph Dodson, David Wood, David Wright

Grade 2: Brianne Accola, Scott Dancz, Jim Kerr, Anthony LaRocca, Jung Shin, Clifford Simpson, Thomas Taflin

Grade 4: Joseph Groves

NEVADA INDUSTRIAL WASTE INSPECTOR

Grade 1: Gregory Alton, Barry Hicks

NEVADA PLANT MAINTENANCE

Grade 1: Taylor Fishell, Kim Laber, Anthony LaRocca, Robert LeVeck, Andrew marshall, Carl Michaelson, Frank Schoenheider, Daniel Szoke

Grade 2: Lee Jaszkowski

Grade 3: Robert Adams

NEVADA WASTEWATER LABORATORY

Grade 1: Amy Egan

Grade 2: Amy Egan

Grade 3: Rita Smith

Grade 4: Mark Lowe

Water Operators Certified

The following water professionals passed their Water Treatment and Water Distribution exams in Sept 2013.

Water Distribution Grades:

Grade 1: Janelle Boelter, Andria Brown, Gregory Brown, Jerry Carter, Kevin Davies, Glen Highfield, Luis Ibarra, Floyd Johnson, Liam Junk, Jim Lawson, Jeffrey Lightfoot, Brooke Long, Robert Magat, Luis Montenegro, Logan Palmer, Kyle Reitnauer, Andrew Storla, Troy Tanner, Kevin Volpa, Uriah Wise.

Grade 2: Richard Beeghly, Christopher Brennan, Paul Carballosa, De Al Dankers, Brian Elliot, Chris Glassburn, Brain Green JR, Jim Karr, Carol Lovell, Byran Moss, Daniel Mueller, Phillip Mullins, Joel Murphy, Edmund Quaglieri, Brooke Winter, Brad Wunderlich.

Grade 3: Ronald Besserer, Timothy Hess, Willard Nusser II.

Grade 4: Bryce Twichell, Dale Johnson, Daniel Dennett.

Water Treatment Grades:

Grade 1: Bryce Twichell, Joseph Arnold, Mario Fernandez JR, Brad Wunderlich, Steven Hampton, Jeffery Collins.

Grade 2: Edmund Quaglieri, Greg Campbell, Mathew Gleason

Grade 3: Tyler Viani

Grade 4: Philip Abbott

TRAINING CALENDAR

Ongoing On Site - Various Management, Board, Wastewater and Water Topics, at your request - NvRWA, http://www.nvrwa.org/
Contact: Bob Foerster at 775-841-4222
Upon Request: Instructor-Lead CSUSac Courses: Distribution or Treatment, 6 - 8 weekly trngs. Contact NvRWA for details and to schedule. Gain the approved post-secondary training while preparing for your exams. Also offering water and wastewater classes powered by SunCoast Learning Systems. Water Courses have been approved for recertification hours. Visit the NvRWA web page and select the SunCoast Learning target.

The NvRWA's Annual Spring Conference is March 17 - 20, 2014 at the GSR, Reno, with exams on-site March 21.
http://www.nvrwa.org/
Contact: Bob Foerster at 775-841-4222

NDEP Bureau of Safe Drinking Water - training calendar for approved classes:
http://ndep.nv.gov/dwo/main/calendar.html

Nevada Section of the American Water Works Association. Visit the web site www.ca-nv-awwa.org for many more education opportunities

American Water College -
http://americanwatercollege.org/

Montana Water Center -
http://watercenter.montana.edu/training/ob2005/default.htm

Office of Water Programs at the California State University, Sacramento -
http://www.owp.csus.edu/courses/catalog.php

Check out ongoing Training from RCAC at:
http://www.rcac.org

Nevada Water Environment Association (NWEA) has an approved course list on their website: http://nvwea.org/ **and they also grant blanket approval for training from the following organizations:**

NWEA online Training Calendar -
http://nvwea.org/certification/training-opportunities

NvRWA's Annual Conferences -
http://www.nvrwa.org/

Tri-State Seminar On-the-River -
http://www.tristateseminar.com/

Water & Wastewater Education and Training -
http://wwet.org/

Water Environment Federation – www.wef.org

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NV Water and Wastewater Operator's Forum Members:	Training Contacts
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