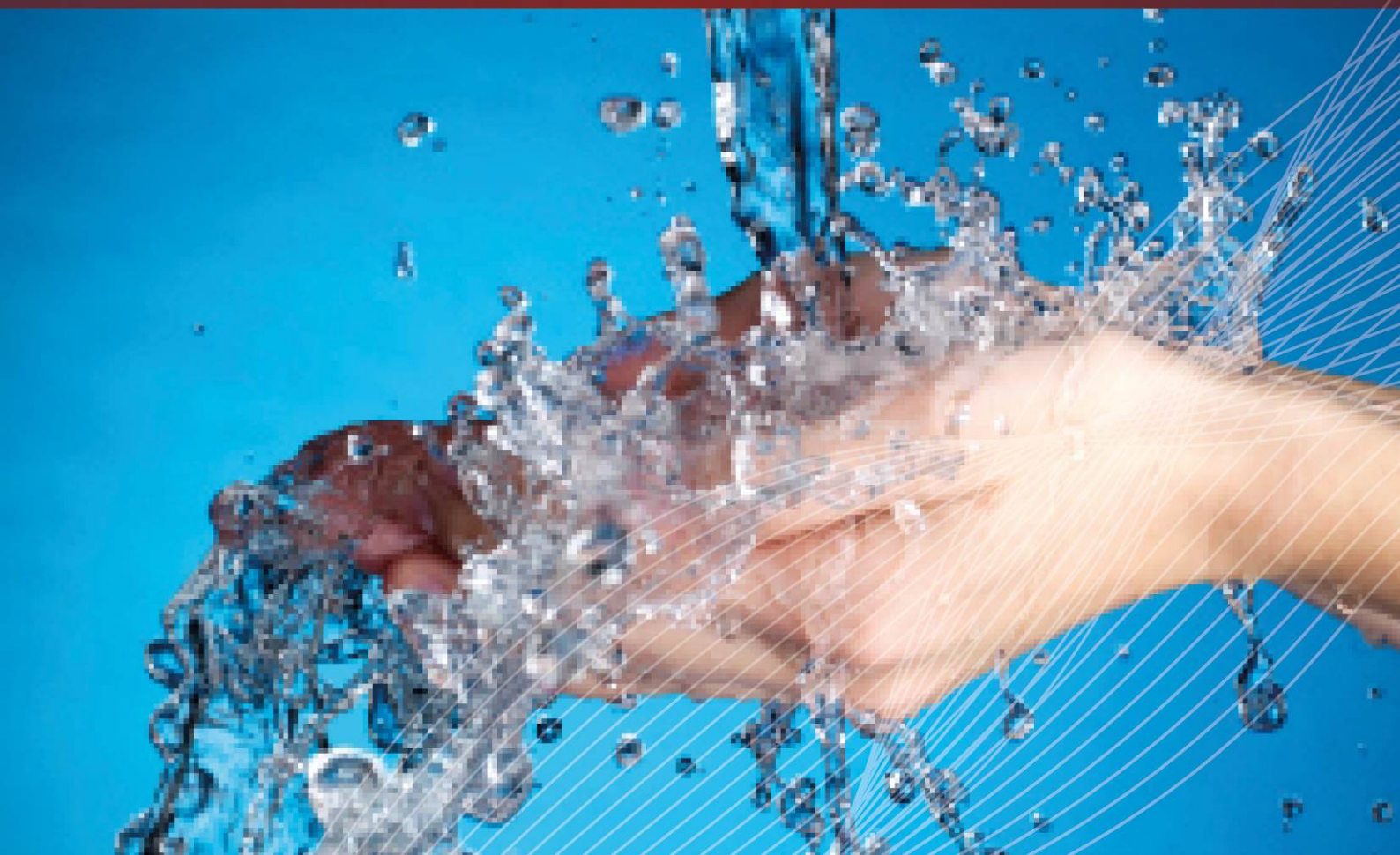
Australian Water Recycling
Centre of Excellence

Project Report

Global Potable Reuse Case Study 2: Upper Occoquan Service Authority

A report of a study funded by the
Australian Water Recycling Centre of Excellence

University of New South Wales, November, 2014



Global Potable Reuse Case Study 2: Upper Occoquan Service Authority

This report has been prepared as part of the National Demonstration Education and Engagement Program (NDEEP). This Program has developed a suite of high quality, evidence-based information, tools and engagement strategies that can be used by the water industry when considering water recycling for drinking purposes. The products are fully integrated and can be used at different phases of project development commencing at "just thinking about water recycling for drinking water purposes as an option" to "nearly implemented". The information contained in this Case Study was first published on the Public Health pages of a University of New South Wales Wiki website in 2012.

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About the Australian Water Recycling Centre of Excellence

The mission of the Australian Water Recycling Centre of Excellence is to enhance management and use of water recycling through industry partnerships, build capacity and capability within the recycled water industry, and promote water recycling as a socially, environmentally and economically sustainable option for future water security.

The Australian Government has provided $20 million to the Centre through its National Urban Water and Desalination Plan to support applied research and development projects which meet water recycling challenges for Australia's irrigation, urban development, food processing, heavy industry and water utility sectors. This funding has levered an additional $40 million investment from more than 80 private and public organisations, in Australia and overseas.

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1. Scheme Overview

Background

During the 1960s, the **Occoquan Watershed** underwent rapid growth transformation from a largely rural to a predominately urban region which resulted in **deterioration of water quality** of the Occoquan Reservoir which supplied drinking water to Northern Virginia. In 1971, the Virginia Water Control Board together with the Virginia Department of Health (DOH), adopted the **Occoquan Policy** mandating the creation of a regional agency - the Upper Occoquan Service Authority (UOSA) - to provide advanced treatment for all wastewater generated in the Occoquan Watershed; and an independent organization, the Occoquan Watershed Monitoring Laboratory (OWML), to continuously **monitor the Watershed** and provide advice on protective measures for the Reservoir.

Figure 1: Upper Occoquan Regional Water Reclamation Plant (RWCP) is located in western Fairfax County, Virginia, USA.

The UOSA Regional Water Reclamation Plant (RWCP), located in western Fairfax County (Figure 1), commenced operations in 1978, servicing Fairfax and Prince William Counties and the Cities of Manassas and Manassas Park, replacing eleven small secondary treatment plants within the region. Since that time, **water quality in the Occoquan Reservoir has steadily improved** and the high-quality effluent produced by the UOSA has increased the safe yield of the Reservoir. Currently, the UOSA practices IPR through **surface water recharge** - treated domestic (90-92%), commercial and industrial (8-10%) wastewater is discharged into the Occoquan Reservoir which is used as influent for the Fairfax County Griffith drinking water plant which provides drinking water to a population of ~321,000 residents.

The original 15 million gallons per day (mgd) plant and collection system cost approximately US$ 80 million (at the time) and was funded through Federal grants (70-80%) and bond issuance (20-30%). All capital, operational and maintenance costs are paid by the four jurisdictions that UOSA serves through quarterly billings. Through several expansions, the initial 15 mgd capacity was increased to the current 54 mgd. After 30 years of highly successful operations, the wastewater treatment processes employed at UOSA have greatly improved the quality of the receiving stream and the Occoquan Reservoir and the reclaimed water is an increasingly important component of the drinking water supply strategy for the Washington metropolitan area. Over the course of its operation, the UOSA has been awarded 35 state and national awards [1].

Further information on the Upper Occoquan Regional Water Reclamation Plant can be found on the Global Connections Map on the *Water360* website.

2. Scheme Infrastructure

Operational Monitoring

The UOSA RWCP operates under two permits that authorize it to discharge under the Virginia Pollutant Discharge Elimination System (VPDES) and the Virginia Water Control Law. The permits are: the General Permit for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Watershed in Virginia; and the Individual Permit to Discharge under VPDES. The permits establish the effluent limitations and monitoring requirements for the operation of the treatment facility.

The RWCP utilizes an on-line system (SCADA) with in situ devices to monitor and automatically control the treatment processes on a real time basis. Process and permit required samples are taken for analysis both automatically (flow weighted composite samplers on primary effluent and final effluent) and manually via grab samples. The samples are analysed at an on-site laboratory for process control and permit compliance.

Treatment

The Critical Control Points (CCPs) at the UOSA RWCP include: primary and secondary clarification, nitrification/denitrification, high lime rapid mix, chemical clarification and phosphorus removal, recarbonation clarification and pH control, activated carbon, final filtration and turbidity control, and chlorination/dechlorination. Each CCP has monitoring and corrective actions associated with variations from normal process operations. If the process varies outside normal operating parameters, a process incident report is written and communicated with staff after each incident. Variations from normal unit operations parameters are corrected prior to discharge as final effluent. The UOSA RWCP has successfully operated over the past 9 years with zero discharge permit violations. The processes and operational records at the UOSA are monitored by regular environmental audits by the Virginia Department of Environmental Quality (VADEQ) as follows:

- Virginia Environmental Lab Accreditation Program (VELAP);
- VADEQ – Monthly Discharge Monitoring Reports; and
- VADEQ Pretreatment Program Audit.

The treatment train for the Upper Occoquan Service Authority Regional Water Reclamation Plant is illustrated in Figure 2.

As a source water protection strategy, the UOSA issues a discharge permit to each industrial discharger. The permit specifies the discharge and monitoring requirements for the industrial discharge. The UOSA also inspects and monitors the industrial discharges under an Industrial User Pretreatment Program. Each discharger is required to monitor their effluent discharge for various parameters, on a daily, weekly, monthly or quarterly basis, depending on the parameter. The results are submitted to the UOSA via monthly or quarterly Self-Monitoring Reports. Costs associated with the industrial user's flows into the UOSA are billed to the jurisdiction in which the industrial user resides based on flows.

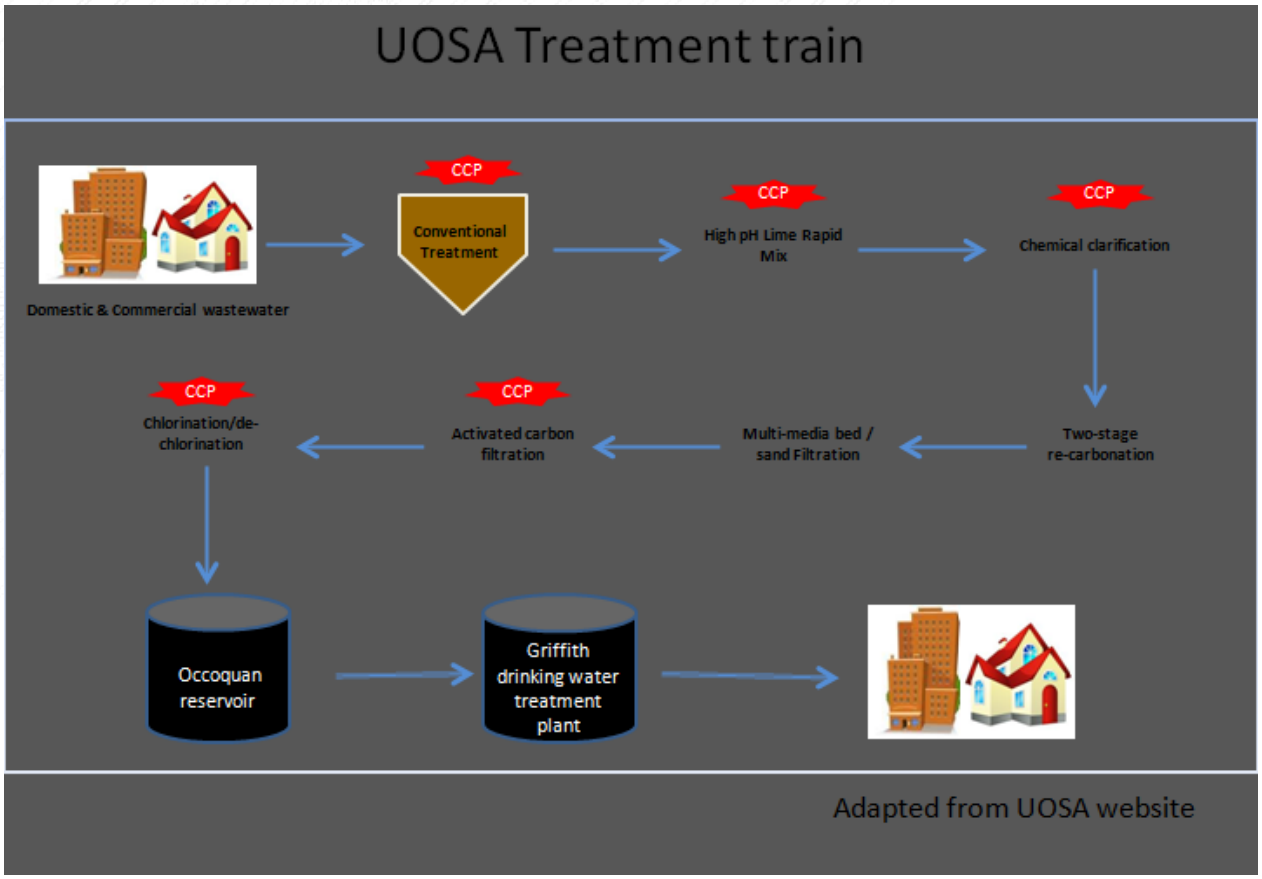

Figure 2: Upper Occoquan Service Authority Regional Water Reclamation Plant treatment train.

3. Water Quality & Public Health

The UOSA monitors and reports all of its effluent parameters. No independent party monitors UOSA's effluent water quality. However, the Occoquan Policy, that established the UOSA, also established the OWML, which independently monitors the health of the Occoquan Reservoir, the ultimate receiver of UOSA's effluent. The UOSA's staff collaborates with the VADEQ and the VDOH in matters of public health. The UOSA has a Spill Prevention, Control and Countermeasures Plan that contains notification procedures for coordination between local, state and federal officials in cases where spills or leaks could compromise quality of state waters. All spills or permit violations are reported to the VADEQ, as per the spill reporting procedures or VPDES permit requirements. The UOSA also has a Stormwater Pollution Prevention Plan. In addition, the UOSA has a Wet Weather Response Plan which provides procedures for declaring a high-flow event (2 inches of rain or flooding or >75 mgd influent) and process responses through stipulated high flow procedures that document all operational requirements during the wet weather event.

Assessments of Water Quality

Water quality data from the UOSA is established, monitored and/or approved by:

- State Water Control Board
- Occoquan Policy
- VADEQ (monitored monthly via self-monitoring reports)
- VPDES permits establish discharge limits for various parameters.

The UOSA analyses a set of 35 essential process parameters that comprise their water quality data. A summary of key parameters is presented in Table 1.

Table 1: Summary of key parameters monitored at the UOSA Regional Water Reclamation Plant.

Water Quality Category	Parameter
Physical & Organoleptic constituents	Chemical Oxygen Demand
	Dissolved Oxygen
	pH
	Turbidity
	Total Suspended Solids
	Methylene Blue Activated Substances
	Alkalinity
Macro Elements	Ammonia
	Total Nitrogen
	Total Kjeldahl Nitrogen (TKN)
	Total Phosphorus
	Nitrate
	Nitrate & Nitrite
	Nitrite
Microbiological Indicators	Total Coliforms
	Escherichia coli

More detailed water quality data from 2009-13 showing permit limits, finished product water and influent data (where available) is presented in Table 2.

Table 2: UOSA RWCP water quality data.

		UOSA influent average					UOSA final effluent average					Permit limits by VADEQ - VPDES
Microbiological Indicators	**Units**	**2009**	**2010**	**2011**	**2012**	**2013**	**2009**	**2010**	**2011**	**2012**	**2013**	
Total coliforms	per 100 ml	-	-	-	-	-	<1.00	<1.00	<1.00	<1.00	<1.00	None
E. coli	per 100 ml	-	-	-	-	-	<1.00	<1.00	<1.00	<1.00	<1.00	Monthly Avg: <2 n/100 mLs
Physical and Organoleptic Constituens	**Units**	**2009**	**2010**	**2011**	**2012**	**2013**	**2009**	**2010**	**2011**	**2012**	**2013**	**Permit Limits**
Chemical Oxygen Demand	mg/l	524.33	441.08	496.50	581.75	460.42	7.26	7.65	7.59	8.38	7.02	Monthly Avg: 10 mg/L; 2000 kg/day Weekly Avg: 25 mg/L; 5100 kg/day
Dissolved Oxygen	mg/L	-	-	-	-	-	9.14	8.72	8.84	8.62	9.02	Minimum: 5.0 mg/L
pH	S.U.	6.92	7.27	7.39	7.46	7.47	7.40	7.38	7.32	7.33	7.33	Minimum: 6.0 Maximimum: 9.0
Turbidity	NTU	-	-	-	-	-	0.12	0.16	0.17	0.19	0.16	Monthly

												Avg: 0.5 NTU
Total Suspended Solids	mg/L	218.31	208.51	206.94	207.91	196.34	0.14	0.12	0.12	0.22	0.20	Monthly Avg: 1 mg/L; 200 kg/day Weekly Avg: 2.5 mg/L; 510 kg/day
Methylene Blue Activated Substances	mg/L	6.80	5.83	5.63	6.10	5.49	0.019	0.023	0.019	0.016	0.018	Monthly Avg: 0.1 mg/L; Weekly Avg: 0.25 mg/L;
Alkalinity	mg/l	-	-	-	-	-	100.83	87.68	91.28	90.98	88.81	None
Macro Elements	**Units**	**2009**	**2010**	**2011**	**2012**	**2013**	**2009**	**2010**	**2011**	**2012**	**2013**	**Permit Limits**
Ammonia	mg/L	26.43	28.72	28.85	30.35	29.13	0.018	0.034	0.012	0.011	0.023	None
Total Nitrogen	mg/L	-	-	-	-	-	11.05	12.56	12.38	13.26	12.85	1.3 MLbs/Yr
Total Kjeldahl Nitrogen (TKN)	N mg/l	38.34	41.60	41.16	43.27	41.75	0.46	0.45	0.39	0.45	0.44	Monthly Avg: 1 mg/L; Weekly Avg: 2.5 mg/L;
Total Phosphorus	mg/L	4.84	5.00	4.73	4.90	4.65	0.084	0.068	0.086	0.080	0.082	Monthly Avg: 0.1 mg/L; Weekly Avg: 0.25 mg/L;
Nitrate	N mg/l	-	-	-	-	-	10.59	12.00	12.25	12.52	12.29	None
Nitrate & Nitrite	mg/L	-	-	-	-	-	10.59	12.08	12.26	12.53	12.29	None
Nitrite	N mg/l	-	-	-	-	-	0.0070	0.0039	<0.0049	<0.0049	<0.0049	None

4. Public Engagement & Education

- Information (including water quality) is available on the UOSA web page
- Site tours and presentations open to the public
- All VA regulations and actions of the State Water Control Board are subject to review and comment by the public
- No new public engagement strategies have been instituted in recent years
- All inquiries/complaints are handled by the executive management team.

5. References

1. ↑ http://uosa.org/