University of Alberta

Evaluation of Water Reuse Approaches for Potable Water and Domestic Wastewater in Alberta

by

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ABSTRACT

The objective of this thesis was to identify water reuse program management strategies, obtain a sample of accepted water reuse permitting practices, and establish program development strategies from selected US jurisdictions with a history of industrial reuse in order to assist industry stakeholders in the development of a water reuse initiative in Alberta.

Seven US jurisdictions were selected and studied (California, Arizona, Florida, Texas, Washington, Colorado, and Oregon). The results suggest that a single permitting agency with a public health agency assuming a role of consultant on an as-need basis was the favoured water reuse program management strategy. Accepted reuse permitting practices were separated between water quality and water quantity. Water quality permitting did not vary with each reuse application and water quantity permitting practices were dependent on a utilities ownership of effluent prior to discharge. Important program development strategies include public education, identifying reusable waters, and establishing industry partnerships.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (CONT'D)

LIST OF TABLES (CONT'D)

LIST OF TABLES (CONT'D)

LIST OF ABBREVIATIONS

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AENV	Alberta Environment
AER	Alberta Energy Regulator
APP	Aquifer Protection Permit
BADCT	Best Available Demonstrated Control Technology
CDPH	California Department of Public Health
CDPHE	Colorado Department of Public Health and Environment
CDWR	California Department of Water Resources
COGCC	Colorado Oil and Gas Conservation Commission
CUP	Consumptive Use Permit (Florida)
DEP	Florida Department of Environmental Protection
DEQ	Oregon Department of Environmental Quality
DHS	California Department of Health Services
DOE	Washington State Department of Ecology
DOH	Washington Department of Health
DWR	Colorado Division of Water Resources
USEPA	United States Environmental Protection Agency
ESRD	Alberta Environment and Sustainable Resource Development
FWMD	Florida Water Management District
IR	Industrial Reuse of reclaimed domestic wastewater
LACSD	Sanitation District of Los Angeles County
MOA	Memorandum of Agreement
NOA	Notice of Authorization
NPDES	National Pollutant Discharge Elimination System
NRC	National Research Council
OHA	Oregon Health Authority
OSHA	Occupational Safety and Health Administration
RCW	Revised Code of Washington
RRC	Texas Railroad Commission
RWQCB	Regional Water Quality Control Board
SWFWMD	Southwest Florida Water Management District
SWRCB	State Water Resources Control Board
TCEQ	Texas Commission on Environmental Quality
TMDL	Total Maximum Daily Loading
US	United States
WBMWD	West Basin Municipal Water District
WHO	World Health Organization
WWTP	wastewater treatment plant

CHAPTER 1 INTRODUCTION

In Alberta, reuse of treated domestic wastewater (reclaimed water) for industrial or other beneficial purposes has a limited history. Water reuse initiatives are typically driven by a need for water conservation, alternative water sources, advancements in technology, and/or economic growth (National Research Council [NRC], 2011). The two former drivers for water reuse initiatives have been hitherto unnecessary based on Alberta's relatively abundant water resources. Disparities exist, however, in that there are regions (e.g. southern Alberta) that encounter water shortages due to minimal rainfall and/or over allocation of available water resources (Alberta Environment and Sustainable Resource Development [ESRD], 2013). Increased demand for water, coupled with advancements in treatment technology and economic stability have begun a transition in Alberta where reuse is becoming a more viable option for regulators and utilities.

From a regulatory perspective, this transition from raw water to reclaimed water resources brings with it a departure from conventional permitting practice. Existing regulatory mechanisms are often unfit to answer certain quality and quantity related questions that arise in the practice of water reuse initiatives. Regarding quality: maintaining public and environmental health while safely distributing non-potable water supplies creates a need to consider appropriate management systems, end user specific quality criteria, and public perception. Regarding quantity: reuse related diversions of effluent from rivers towards alternate end uses raises questions as to impact on water license holders, downstream environments, and established water rights. These issues, coupled with Alberta's minimal reuse history and conventional permitting structure, introduce a regulatory uncertainty that can stall and potentially cease an intended reuse initiative.

From a utilities perspective, this increased viability for water reuse presents an opportunity to meet the water resource needs of Alberta's growing population and industry, implement new technological advancements, and grow in economic stability. Yet, based on limitations to existing regulatory mechanisms, realization of these opportunities has been effectively diminished.

Lessening regulatory uncertainty in regards to a water reuse initiative in Alberta represents the purpose of this research. Specifically, this uncertainty refers to aspects of industrial reuse (IR) permitting as related to how quality and quantity considerations are approached in practice, and IR management as related to initiation and development of a reuse program.

1.1 Statement of Objectives

The objectives of this thesis were to:

- survey and identify water reuse program management approaches potentially applicable in Alberta

- obtain a sample of accepted reuse permitting practices from selected United States (US) jurisdictions with a history of industrial reuse, and
- propose program development strategies for use in Alberta.

The results of this thesis will assist industry stakeholders and regulatory agencies in developing a water reuse initiative in Alberta.

1.2 Report Organization

This research report has been presented in the following sections:

- Chapter 2, *Background* includes related information regarding terminology, drivers, applications, issues, and regulatory considerations related to water reuse industry.
- Chapter 3, *Methodology* outlines steps taken in preparation of this research including survey method selection, identification of the current state of IR in Alberta and the US (from a national perspective), and development of the survey template. In addition, this chapter outlines how participant selection was conducted and how the survey was implemented.
- Chapter 4, *Results* includes information provided by practitioners and regulatory respondents who participated from selected US jurisdictions including California, Arizona, Texas, Washington, Colorado, and Oregon. Results offered for each of these jurisdictions includes respondent comments on topics of IR management, summary of permitting processes, commentary on respective reuse programs, recommendations for initiation of a reuse program, and example resources or projects.
- Chapter 5, *Discussion* offers a summary and comparison of the results from US jurisdictions surveyed in relation to the survey topics of interest as mentioned.
- Chapter 6, *Conclusion and Recommendations* summarizes research outcomes as they relate to stated objectives as well as to identify water reuse program management strategies, recommend accepted reuse permitting practices and reuse program development strategies discovered in the US jurisdictions surveyed.

CHAPTER 2 BACKGROUND

This chapter details the background concepts related to the field and practice of domestic water reuse used for industrial and/or other applications. Topics include a discussion of terminology (Section 2.1), drivers (Section 2.2) applications (Section 2.3), issues (Section 2.4) and regulatory settings (Section 2.5) in the field of water reuse.

2.1 Terminology

The relatively recent growth of the water reuse field, the many sectors involved, and its international character have led to confusion in relation to terminology (Asano 2007). Table 2-1, while providing a summary of common terminology and definitions, also serves as an example of the multifaceted nature of domestic and/or IR (NRC 2011).

Table 2.1: Terminologies Related to Water Reuse (Modified from Crook 2010; Exall 2004; USEPA 2012)

Term	Definition
Reclaimed Water	• Domestic or industrial wastewater that has been treated to meet specific water quality criteria with the intent of being used for some beneficial purpose
Water Reuse	• The use of treated domestic or industrial reclaimed water (or wastewater) for a beneficial purpose
Direct Potable Reuse	• The introduction of reclaimed water directly into a potable water distribution system downstream of a water treatment plant
Indirect Potable Reuse	• Augmentation of a drinking water source (surface water or groundwater) with recycled water followed by an environmental buffer that precedes normal drinking water treatment
Industrial Reuse (IR)	• Municipally treated wastewater (reclaimed water) that is used for any industrial activity

Among other purposes, water reuse is performed as a means of creating a "new" source of water (for various applications) and/or for the purpose of minimizing environmental liability via reducing discharge into raw water sources (NRC 2011). Elements that drive the field of water reuse are discussed in Section 2.2.

2.2 Drivers for Water Reuse

The drivers for water reuse discussed include water conservation, new water sources, technology, and economics.

2.2.1 Water Conservation

In principle, water conservation attempts to reduce consumptive use of water through various practices in a given sector (Seneviratne 2007). In a report produced by NRC in 2011, water conservation in the US is explained.

In terms of water conservation in industrial and agricultural/irrigation industries, factors such as improved or alternate technologies have led to increased water use efficiency (NRC 2011). Other factors which have led to the decrease in industrial water use can be attributed to an increase in water and energy pricing as well as an increase in out-of-country manufacturing (NRC 2011). Water conservation in the public sector continues to hold the most potential for improvement (NRC 2011).

As a driver for water reuse, water conservation provides a principle motivation not only based on the ethic of sustainability but on other inherent benefits. Alternate usages such as utilizing lower quality water for non-potable applications such as landscape watering and car washes provide some examples (Asano 2007). Other benefits include a reduction in treatment costs (energy and raw inputs) and a decreased need for expansion of water treatment facilities (Asano 2007).

Water conservation is not a new concept in the US or in Canada. Initiatives such as the "Water for Life" program promoted through Alberta Environment and Sustainable Resource Development (ESRD) provide one example.

2.2.2 New Water Sources

The desire to develop new water supplies stems from projected water demands, the duty for efficient water use, and the principles of water resource management/sustainability (NRC 2011). Examples of new water supplies currently being explored include desalinized sea water, contaminated groundwater, water stored from previous surpluses, and rain or storm water runoff (NRC 2011).

Besides desalinization of brine and/or sea water, treated wastewater is considered to be one of the most important new sources of water as well as one of the biggest challenges of this century (Asano 2007). In Canada, the raw water extraction rate is approximately 343 L/capita/day with approximately 312 L/capita/day being discharged as wastewater (Exall et al. 2004; Statistics Canada 2012). Statistics Canada (2012) suggests that of these volumes entering wastewater treatment plants (WWTPs), the largest contributor comes from residential sources (~65%) followed by industrial/commercial/institutional (~18%). Remaining water inputs include storm water (9%) and infiltration (8%). Based on potential for reuse, domestic water can be considered a substantial source for non-potable applications (Chen et al. 2012).

The practice of utilizing treated wastewater as an alternate source of water for (mainly) non-potable applications is in keeping with the principles of water conservation and management (Exall 2006; Asano 2007).

2.2.3 Technology

As technology advances, so too does the potential to utilize waters that have been historically deemed as "waste" (NRC 2011). Recent advancements in equipment, technology and system design have all contributed in various ways to make water reuse more possible (USEPA 2012).

Examples of advanced technologies or processes that have increased the potential for water reuse include (USEPA 2012):

- Biological Nutrient Removal (BNR): processes are increasingly efficient
- Membrane technology: able to process at higher rates and efficiencies due to higher flux rates and lower pressures
- Membrane Bioreactors (MBRs): have the ability to produce effluent of excellent quality at lower cost due to the relatively small treatment plant size
- Microfiltration: has, in some cases, replaced media filtration due to its ability to effectively remove pathogens such as Giardia and Cryptosporidium
- Ultraviolet (UV): widely used since these systems enable efficient reduction in pathogenic organisms while maintaining relatively low costs

These and other advancements in the field of wastewater treatment enable the field of water reuse to expand its scope and become more economically feasible (Schaefer et al. 2004; USEPA 2012; NRC 2011). In certain cases, a regulator may drive the use of modern treatment technologies for tertiary treatment to ensure that reclaimed water meets a high standard of quality. One example of this is the Best Available Demonstrated Control Technology (BADCT) provisions specified by the Arizona Department of Environmental Quality (USEPA 2012). BADCT provisions are intended to put the onus on the WWTP to provide the highest level of treatment possible, which will reduce the risks posed by reclaimed water and lessen the needed rigour for permitting processes (USEPA 2012).

2.2.4 Economics

Under certain circumstances, economic benefits may be derived from water reuse, partly from a reduced need to expand raw water supply and wastewater treatment infrastructures (Exall et al. 2004). Economic benefits resulting from the implementation of water reuse may also include potential elimination of select treatment processes, the reduced use or elimination of sewer systems and revenue generated from the sale of recycled water (Lazarova et al. 2001).

2.3 Water Reuse Applications

In relation to water reuse, sources of reclaimed water may vary from industrial to municipal sources (USEPA 2012; Asano 2007). Municipal wastewater generally consists of sanitary sewage (grey and black water) from domestic, commercial and industrial sources as well as and storm water runoff (Asano 2007; Statistics Canada 2012). The treatment of domestic wastewater for reuse will be the main topic of discussion in this report.

This section will look at the various applications that can be considered for reclaimed domestic wastewater and will include agricultural (Section 2.3.1), non-potable and recreational (Section 2.3.2), groundwater recharge (Section 2.3.3) and industrial (Section 2.3.4). As non-potable usage dominates current practice (NRC, 2011), water reuse for potable applications will not be discussed.

2.3.1 Agricultural Reuse

Agriculture represents a significant field for water reuse based on the potentially large quantities of water used for irrigation practices (USEPA 2012). Also known as "effluent irrigation", the use of treated domestic wastewater for irrigation falls under two main categories: restricted and unrestricted applications (Exall 2004).

Restrictions with respect to effluent irrigation for agriculture attempt to reduce the potential for contact with human receptors (Asano 2007). As such, restricted applications use lower quality water under specified agricultural conditions (i.e. non-spray applications, soil type, topography, etc.) (Exall 2004; Asano 2007). For example, surface spreading of reclaimed water requires soil that enables adequate infiltration (coarse soil) and topography that allows passive and even water flow distribution (EPA 2012). Potential restricted agricultural applications are summarized in Table 2.2. Restricted effluent irrigation typically requires secondary treatment at a minimum (Asano 2007).

Table 2.2: Restricted Agricultural Effluent Irrigation Applications (Exall, 2004)

• Fodder	• Pastures	• Turf grass
• Fibre	• Commercial nurseries	• Commercial aquaculture
• Seed Crops	• Sod farms	

Unrestricted applications for effluent irrigation, because of the likelihood of contact with humans, use wastewaters that have received higher levels of treatment (i.e. tertiary treatment) (Exall 2004; Asano 2007). Potential unrestricted applications include irrigation of food crops intended for human consumption (Exall 2004; USEPA 2012; Asano 2007). Limitations imposed on this approach include a requirement to process/clean food prior to sale and irrigation practices that do not promote drift of aerosols or contact with edible portions of plants (Exall 2004; Asano 2007).

Whether for restricted or unrestricted use, effluent irrigation (pre- and post-application) requires water quality monitoring and characterization prior to usage (Exall 2004; Asano 2007). Constituents such as pathogenic organisms, salinity, nutrients, and/or heavy metals may severely limit the potential of wastewater reuse for agricultural application.

2.3.2 Non-potable Urban and Recreational Reuse

Restricted and unrestricted categories also apply for non-potable urban and recreational applications (Exall 2004; Asano 2007). As noted in Section 2.3.1, restricted application infers limitations either on the application of reclaimed water or on public access to areas where water reuse has occurred (Exall 2004). Table 2.3 summarizes both restricted and unrestricted applications.

Table 2.3: Example Non-potable Urban and Recreational Reuse Applications (Adapted from Exall 2004 and Asano 2007)

Restricted	Unrestricted
• Non-contact recreational activities such as fishing or boating ponds	• Vehicle washing
• Augmentation of wetlands	• Fire protection
• Irrigation (e.g. golf courses, cemeteries, greenbelts and highways)	• Ornamental water features

Landscape irrigation, as distinct from agricultural irrigation, is the second most common use of reclaimed water in the US (Asano 2007). Reclaimed water use at golf courses has increased in particular due to the potential for savings in fertilizer costs as a function of the higher nutrient loads (Exall 2004; Asano 2007). Other applications may include the use of reclaimed water as a heat source or sink in heating, cooling, or snow melt applications (Exall 2004). Surface water augmentation, as another application, imports reclaimed water into an established water supply for the purpose of offsetting upstream water extraction or supplementing surface water shortages (USEPA 2012).

The above examples of nonpotable urban and recreational water reuse are increasing in popularity in many regions of the US and Canada (Exall 2004). Although allowing for conservation of high quality water for potable usage, there may be limitations with these applications due to logistics, public perception, and in certain cases, the need for dual distribution systems and cross-contamination control (NRC 2011).

2.3.3 Groundwater Recharge – Nonpotable Reuse

The intent of groundwater recharge is the replenishment of nonpotable groundwater aquifers (USEPA, 2004). Other purposes for groundwater recharge may include the creation of barriers for saltwater intrusion, prevention of subsidence, and reclaimed water storage for future reuse

(USEPA 2012). Reclaimed water may be used for this purpose by introducing it into the water table through injection wells or surface spreading (Asano 2007; NRC 2011).

Important considerations regarding the application of groundwater recharge include composition of reclaimed water and receiving aquifer physical and chemical characteristics (NRC 2011). Remaining constituents of concern found in reclaimed water may include particulate matter, dissolved organics, nitrogen, and pathogenic microorganisms (USEPA 2012). Also, since recharge rate is a function of aquifer characteristics, attention must be paid to components such as soil texture, (hydro) geology, soil moisture, and topography should be considered (Exall 2004).

2.3.4 Industrial Reuse

Treated domestic wastewater (reclaimed water) for industrial usage has been practiced successfully in Canada, US and internationally for decades (Exall 2004; USEPA 2012; Asano 2007; NRC 2011). The principal industries that may benefit from reuse practices include utility power plants, petroleum refineries, chemical plants, pulp and paper mills, and metal or concrete working facilities (Exall 2004; USEPA 2012).

The major uses of reclaimed domestic water for industrial use include cooling water, boiler make-up water and industrial process water (USEPA 2012; NRC 2011). Other non-essential uses may include stack scrubbing, dust control, washing, or as a transport medium, or component of industrial products (Exall 2004; NRC 2011). Application of reclaimed water for industrial purposes may have inherent limitations which are summarized in Table 2.4.

Another type or category of IR is through the recirculation of a given industry's own process water (Exall 2004). Recirculation may be applied to cooling (make-up) water; consequently, additional treatment such as reverse osmosis, chemical precipitation, ion exchange, or others is often necessary (NRC 2011). Exall (2004) reports that of the 80% of the total water intake of industries, approximately 40% of that is recycled. Fluctuations between industrial practices and treatment requirements weigh heavily on the applicability of industrial recirculation (Asano 2007; NRC 2011).

Table 2.4: Example Limitations Associated with Industrial Reuse (Adapted from Exall 2004; Asano 2007; NRC 2011)

• Regulatory constraints or absence of regulations	• Management of residuals
• End use dependent treatment variations	• Quantity and compositional variations
• Retrofitting costs for existing facilities	• Dual distribution system (i.e. potable and reclaimed water piping) costs
• Biological stability of water	• Legal and administrative costs

2.4 Issues Affecting Water Reuse

Among such factors as environmental/human health risks and public acceptance, Exall et al. (2006) state that the degree to which water reuse is implemented is mainly a function of water availability. These three issues will be discussed in the following sections.

2.4.1 Water Availability

Locating alternate source waters, as mentioned in Section 2.2.2, compliments the goals of sustainability and conservation. Sources of reclaimed water, used for reuse purposes, could potentially range from industrial process waters to domestic wastewaters (USEPA 2012). Effluents generated from domestic WWTPs, depending on the area, typically represent the more significant source (USEPA 2012).

As mentioned in Table 2.4, factors such as retrofitting and dual distribution systems must be considered when using reclaimed domestic waters. New developments may incorporate water reclamation considerations directly into designs whereas existing facilities must factor in retrofitting costs and feasibility (USEPA 2012; NRC 2011). The Guidelines for Water Reuse (USEPA 2004) state that for existing facilities, factors such as proximity, sewer type (industrial or residential, combined or single use), treatment facility type, areas/types of potential development, and locations of water users must all be considered.

In addition to factors as system reliability and storage and/or pumping requirements, the quality and quantity of water for beneficial reuse is of equal consideration.

Quality

Effluent water quality from a WWTP is typically monitored for parameters that ensure the health and water quality of the receiving environment (e.g. Biological Oxygen Demand, suspended solids, nutrients etc.) (USEPA 2012). However, based on the reuse application, monitoring for parameters in addition to those required by discharge permits may be required (USEPA 2012; NRC 2011). In water reuse scenarios, water quality may need to be tailored depending on receiving environment, or application. Phosphorus or nitrogen, for example, can be beneficial for agricultural purposes but may result in biological fouling in industrial applications (USEPA 2012).

Due to the varied range of reclaimed water customers, and subsequent range of water quality needs, water reuse planning typically focuses on the end user (USEPA 2012). As a remedy, as mentioned in the Guidelines for Water Reuse (USEPA 2012), certain water providers have created customized water quality grades to service potential reclaimed water customers. These grades of reclaimed water quality are summarized in Table 2.5.

Table 2.5: Reclaimed Water Grades with Example Reuse Applications (USEPA 2012)

Grade	Treatment	Example End-Use
1	Tertiary	Landscape; Golf course irrigation
2	Nitrified	Cooling tower
3	Pure RO	Low pressure boiler feed for refineries
4	Softened RO	Indirect potable reuse
5	Ultra-Pure RO	High pressure boiler feed for refineries

Additional methods to ensure proper water quality include Quality Assurance/Quality Control (QA/QC) measures such as technical controls, monitoring devices able to react to effluent variability, and multiple barriers as an environmental buffer (NRC 2011).

Quantity

Variations in supply (from WWTP) and demand (from end users) lead to a need for consideration of water quantity and reliability. Design of conventional WWTPs take into account factors such as peak flows or seasonal variations (Asano 2007). Difficulties arise when peak flows, or seasonal variations of a WWTP do not compliment the demands of reuse customers (e.g. agriculture) (USEPA 2012; NRC 2011). Though attempting to provide ability to consistently meet water demands, storage designers must consider alternate effects of water storage (Exall 2006; NRC 2011). Evaporation, odour issues, biological growth, and insect/pest population growth may affect storage viability if not properly managed (Exall, 2006).

Besides seasonal storage requirements, diurnal flow variations must also be considered in order to manage quantity constraints (USEPA 2012; NRC 2011). Reclaimed water storage requirements are heavily influenced by local, or site specific, factors such as end users and supply quality/quantity (USEPA 2012). Storage requirements also effect costs and hence a feasibility assessment is typically recommended (NRC 2011).

2.4.2 Risk

While the principles of sustainability and economic feasibility are fundamental to a successful wastewater reclamation practice, attention to safety concerns is of primary importance (Asano 2007). Risks intrinsic to water reuse, with dependence on source water composition, level of treatment, and end use can be related to human health and ecological health.

Human Health

As mentioned in Sections 2.3.1 and 2.3.2, reuse applications with their varying potentials for human health risk dictate the degree to which their use is restricted. For risk to occur, a source, pathway, and receptor must be present (Asano 2007).

Sources of risk relate to substances or chemicals of potential concern. Water reuse in its essence implies that substances and/or chemicals excreted and/or produced by humans have the potential to be present in the reclaimed product (NRC 2011). Some of the main water quality constituents of concern related to human health are summarized in Table 2.6.

Table 2.6: Example Wastewater Constituents of Concern Related to Human Health (NRC 2011)

Category	Example Sub-Categories
Pathogens	Helminthes, Protozoa, Bacteria, Viruses, Prions
Inorganic Chemicals	Metals and metalloids, salts, oxyhalides, nutrients
Organic Chemicals	Pesticides, pharmaceuticals, personal care products, industrial chemicals

For risk to occur, the source must come into contact with the receptor (humans). The pathway, or route of exposure, relates to the means by which the chemical or constituent of concern comes into contact with humans (NRC 2011). Depending on the application of the reclaimed water, exposure may occur through ingestion (directly via water or indirectly through food), inhalation (of volatile components) and/or adsorption (via skin and eye contact) (NRC 2011). Applications that have the highest potential to result in exposure to humans are urban and agricultural reuse (Asano 2007; NRC 2011).

It is notable, however, that a constituent that is of concern in one reuse application may not be of consequence in another (NRC 2011). Chemicals, based on their physical properties (i.e. solubility, volatility), may only be of concern via specific exposure pathways. For example, a constituent of high volatility may be an inhalation hazard but due to its low solubility may be of less concern via the ingestion pathway (NRC 2011). Based on this, a chemical which may be of concern when in potable water may not be of concern when used for industrial purposes where ingestion is minimal (NRC 2011). Also, a chemical which may pose a risk to aquatic species may have no effect on humans at the same concentration (NRC 2011).

Through engineering practices and risk mitigation, constituents of concern can be removed and routes of exposure can be minimized. However, human error and/or system failure can render risk predictions obsolete and lead to increased potentials for exposure and subsequent risk (NRC 2011). As such, comprehensive risk assessments are typically performed prior to reuse implementation (NRC 2011).

Ecological Health

Ecological health can be considered in relation to potential for adverse effects via constituents present in reclaimed water and environmental impacts via diversion of waters away from a disposal site. Because ecological risks from water reuse are unlikely to be significantly different

than those already experienced from conventional discharge of wastewater (NRC 2011), former aspect (b) will be considered.

The USEPAs 2012 document, Guidelines for Water Reuse, states that water reuse systems could potentially produce unintended effects on land use, stream flow and groundwater quality from reuse applications (USEPA 2012). Regarding land use impacts, water balance shifts have the potential to alter riparian vegetation or subtle characteristics of riparian ecosystems (USEPA 2012). Other than these direct changes, indirect effects from an increased supply of (reclaimed) water may inspire greater industrial or residential development and hence an effect on associated ecosystems (USEPA 2012; Asano 2007).

In-stream flows have potential to both increase or decrease as a result of reuse applications (USEPA 2012). These fluctuations in stream flow, due to changes in the water balance, have the ability to affect current downstream land use, esthetics, and habitat for both flora and fauna (USEPA 2012). Contributing factors, such as the groundwater's contribution to and from surface water bodies can likely influence the degree to which water reuse practices effect water and riparian conditions (USEPA 2012). As a result, it is has been recommended that hydrologic assessments be conducted to understand local and regional watershed flows (USEPA 2012).

Groundwater quality and/or hydrogeological impacts represent a topic of concern for water reuse planners (Asano 2007). Nitrates or other contaminants pose a threat for groundwater contamination especially when effluent results from high inputs from industry (USEPA 2012). Due to its mobility, nitrate is typically of greatest concern when the water reuse application stems from agricultural irrigation or groundwater recharge (Asano 2007). Groundwater monitoring and modeling is typically performed in order to detect and mitigate risks related to groundwater contamination (Asano 2007).

2.4.3 Public Perception

The issue of public perception plays a pivotal role in the use of reclaimed water (Exall et al. 2004; Schaefer et al. 2004; NRC 2011). In Canada, it has been argued that the barrier of public perception may rank among the highest of all other barriers related to water reuse (Schaefer et al. 2004). Internationally, public perception is varied (NRC 2011). Differing opinions are complicated by location, social backgrounds etc., but in general may be attributed to the perceived need for alternate supplies (Exall et al. 2004). In areas where fresh waters are abundant, water reuse may be looked upon unfavourably, and vice versa (Exall et al. 2004).

Foundational to public concern is the fear of exposure to contaminants. Reclaimed water, having once been contaminated, carries a stigma that can be difficult to overcome (NRC 2011). Degree of acceptance, however, may be alleviated depending on the application. The California

Department of Water Resources reported that the public is most opposed to the use of reclaimed water for drinking, bathing and swimming (Schaefer et al. 2004). People are generally less opposed to reuse for such applications as irrigation, toilet flushing, or other limited contact uses such as industrial applications (Schaefer et al. 2004). Another factor contributing to the negative perception of water reuse is related to the waters proximate origin (NRC 2011). Typically the more "natural" the source, even though it may be of a lesser quality than polished wastewater effluent, the more acceptable (NRC 2011)

Researchers have long established that the remedy for a successful reuse development in the wake of public opinion is the need for communication and education (Schaefer et al. 2004; NRC 2011). Exall et al. (2004) reports that the purpose for increasing communication and education for the public are for the purposes of:

- implementing input from the public into the final project or development;
- bringing to the forefront concerns at early planning stages; and
- identifying early on in the project, those opposed to the project and their particular issues.

Other factors that may increase public acceptance may include the terminology that is used (e.g. recycled water vs. treated wastewater) or how the project is portrayed or implemented (NRC 2011). Due to the likelihood for confusion and misunderstanding between the public and the industry, the need for a common glossary of terms has been identified and its development has been underway for some time (NRC 2011).

2.5 Regulatory Setting

2.5.1 Background

Currently in Alberta, ESRD functions as a single agency for water reuse projects with separate departments overseeing water quality and water quantity permitting (ESRD 2013). The legal and regulatory framework required to accommodate the growing and evolving field of water reuse is complex (NRC 2011). This is mainly due to the multiple sectors involved and the intricacies inherent with risk management (Asano 2007; NRC 2011). As such, the regulation of the water reuse field must meet local needs yet consider national and international settings (Jiménez 2008).

Water quality criteria in general (Section 2.5.2), the national (Section 2.5.3) and international (Section 2.5.4) regulatory settings will be examined as necessary components of water reuse application. IR guidelines will be considered in Section 2.5.5.

2.5.2 Water Quality Criteria

Establishment of water quality criteria, dependent on source water and reuse application, are established in terms of protection to human and environmental health (Exall 2006). Water quality

standards in various jurisdictions provide the target concentrations for each constituent of concern that is allowable for discharge into the environment (Jiménez 2008).

In Canada, conventional WWTPs take into consideration local drinking water quality standards and the National Guidelines for Canadian Drinking Water Quality that are put forth by Health Canada (Exall 2006). In addition, as is the case with Alberta, ESRD regulates utility providers with an Approval to operate which typically makes provisions that are more stringent than federal requirements (EPCOR 2009). Removal of pathogens is of primary importance for utilization of reclaimed water as is the removal of other organic and inorganic constituents based on the intended application (Exall 2006).

In the US, the federal National Pollutant Discharge Elimination System (NPDES) permit program is applied to WWTPs discharging to surface water bodies (USEPA 2012). The NPDES program is initiated through the federal Clean Water Act and constitutes the primary discharge permit regulating quality throughout the US (USEPA 2012). It is the USEPA that has primary jurisdiction under the Clean Water Act but enforcement and administration of the act and the associated NPDES program is typically delegated to the respective state agencies (USEPA 2012).

2.5.3 National (Domestic) Regulations

In Canada, there are no national guidelines for water reuse in existence at present (Exall 2006; Asano 2007; Jiménez 2008). Provincial jurisdictions such as Alberta and British Columbia have produced water reuse guidelines focusing on specific applications.

For instance, the Guidelines for Municipal Wastewater Irrigation produced by Alberta Environment (AENV) in 2010 provide guidance in applying reclaimed waters for irrigation and only when appropriate (AENV 2000). In this document, particular crops such as forages, coarse grains, etc., are recommended for irrigation with reclaimed water as dependent on the appropriate level of treatment (AENV 2000). Minimum required treatment processes include primary treatment and seven months of storage, which will increase as the application increases in proximity to human receptors (e.g. golf courses, etc.) (AENV 2000; Exall 2006).

Guidelines for water reuse in British Columbia are provided through the 2001 Code of Practice for Use of Reclaimed Water which is a companion document to the Municipal Sewage Regulation (British Columbia Ministry of Environment, Lands and Parks [MELP] 2001). This document overviews and provides guidance for various reuse applications including irrigation, domestic, commercial and industrial uses (MELP 2001).

2.5.4 International Regulations

According to Exall et al. (2006), the World Health Organization (WHO), the USEPA and the State of California are among the main providers of water reuse guidelines. Other US jurisdictions with

water reuse guidance include Arizona, Colorado, Florida, Utah, Texas and Washington (NRC 2011). Outside the US and Canada, Australia, China, Saudi Arabia, Egypt and Mexico rank as some of the leading countries for wastewater reuse (Jiménez 2008).

WHO has published several documents since the 1980s regarding the practice of water reuse. In 1989, the document entitled Health Guidelines for the Use of Wastewater in Agriculture and Aquaculture was produced (WHO 1989). Ultimately, after many editions, in 2006 four separate volumes were published. The Guidelines for the Safe Use of Wastewater, Excreta and Greywater deal with various aspects of water reuse practice in four volumes. These volumes are listed as follows:

- Volume 1: Policy and regulatory aspects (WHO 2006a)
- Volume 2: Wastewater use in agriculture (WHO 2006b)
- Volume 3: Wastewater and excreta use in aquaculture (WHO 2006c)
- Volume 4: Excreta and Greywater use in agriculture (WHO 2006d)

The USEPA's document entitled Guidelines for Water Reuse (2004 and 2012) is intended to provide guidance for regulatory agencies and utility companies (NRC 2011). The US federal government, which delegates the regulation of water reuse to the individual states, has no official federal regulations regarding water reuse (Exall 2006). The USEPA (2012) document acts as a supplement for jurisdictions that have guidelines in place and as a point of reference for state agencies without water reuse guidelines of their own (Exall 2006). Various criteria are suggested for applications referenced to in Section 2.3 and also include suggestions for wastewater treatment processes, monitoring and possible setback distances to human receptors (USEPA 2012).

While many states throughout the US have some degree of reuse program in place, there are four states that stand out as the most experienced in reuse programing which include California, Arizona, Florida and Texas (USEPA 2012). These four states are notable in that they have well established regulations with a mature reuse program that includes all of the reuse applications referenced in Section 2.3 (USEPA 2012). In addition, there are six other states noted for their experience in reuse regulating which include Hawaii, Nevada, New Jersey, North Carolina, Virginia, and Washington (USEPA 2012). The state that has been used as a model for jurisdictions wishing to develop a reuse system has been California due to its history and the Title 22 regulations (Exall 2006).

The California Code of Regulations Title 22 is a fundamental piece of legislation as it has been used as a foundation for standard development worldwide (Exall 2006). The legislation deals with wastewater treatment techniques and microbiological content in assessing water quality criteria (California Department of Health Services [CDHS] 2000). Having been in place in one form or

another since 1918, Title 22 provides a reference for regulatory agencies and utility companies developing standards (Exall 2006).

2.5.5 Industrial Reuse Regulations

Due to the fact that IR involves the private sector, which is complete with customized needs and their own internal standard (or preferred) operating procedures, it is fundamentally different from domestic or agricultural water reuse (Jiménez 2008). In the U.S., there are five states (California, Florida, Hawaii, Texas and Washington) that have regulatory guidance in place for IR of reclaimed domestic wastewater (USEPA 2012).

In Canada, however, there are limited guidelines pertaining to IR. Schedule 2 of the B.C. Municipal Wastewater Regulation (April, 2012), formerly the Municipal Sewage Regulation (2001), has inclusion of industrial uses including cooling towers, process water, stack scrubbing and boiler feed water (MELP 2012). Regulations in Alberta pertaining to industrial uses of wastewaters are virtually non-existent. In 1989, the Energy Resources Conservation Board (ERCB), now called Alberta Energy Regulator (AER), produced an information letter regarding water recycle guidelines and reporting of water use information for in situ oil sands facilities in Alberta (ERCB 1989).

CHAPTER 3 METHODOLOGY

The purpose of this chapter is to outline the methods used in order to accomplish the objectives of this research (Section 1.1). Preliminary investigation into possible methodologies revealed many ways to conduct this research. Rationale for procedures used to plan this investigation is discussed in Section 3.1 and details of implementation of the investigation are summarized in Section 3.2.

3.1 Research Preparation

Planning for this research consisted in determining survey research method selection (Section 3.1.1), investigating the current state of IR (Section 3.1.2), and developing a survey template (Section 3.1.3).

3.1.1 Survey Research Method Selection

Fowler (2009) and Marsden and Wright (2010) discuss important aspects when selecting the appropriate survey research method; these include consideration of sample population, sampling design, and data collection mode.

Sample Population

Determining sample population can be understood as assessing which individuals might be eligible for participation in a particular survey (Fowler 2009). In terms of this research, this step was initiated by first defining what may be considered as an eligible participant. Based on the research objectives (Section 1.1), attributes of the population of interest for each jurisdiction investigated should include professionals who are involved from permittee and permitter perspectives, and thus would include both practitioners and regulators, respectively. Since these are broad categories, narrowing the definition of eligible candidates is necessary to exclude individuals who work in the reuse industry, but have limited exposure to the overarching process. For the purposes of this research, practitioners were defined as including permittees who manage projects or are involved in the planning or implementation process. Regulators were defined as including permitters who plan, oversee or authorize the permitting process itself.

In regard to population size (i.e. how many eligible candidates there are for a given jurisdiction), the literature recommends the use of lists or records from agencies affiliated with the subject of interest (Marsden and Wright 2010). For example, a survey sponsored by the WateReuse Foundation of all water recycling facilities in California used national databases and affiliated association membership lists to determine the sample population for their study (Leiby and Carpenter 2008).

Based on the purpose of this research, which involved soliciting accepted practices and strategies from various jurisdictions in the US in order to assist in development of a reuse initiative in

Alberta, the ability to obtain a list of appropriate individuals presented a challenge. Associations such as the WateReuse Association were approached for the purpose of obtaining a membership list. The WateReuse Association includes in its membership both practitioners and regulators from across the US. Since corporate membership in the association was required in order to obtain access to membership information, this option was not possible. This inability to define a clear population size had a direct impact on the choice of sampling design.

Sampling Design

In general, survey research design can employ either probability sampling or nonprobability sampling (Fowler and Mangione 1990). Probability, or statistical sampling methods may include random, systematic, stratified or a combination thereof (Babbie 1990). These methods are described in Table 3.1.

Table 3.1: Examples of Common Statistical Sampling Methods (modified from Fowler 2009 and Babbie 1990)

Sampling Type	Description
Random	Allows possibility for every combination of sample units to be selected in a prescribed population
Systematic	A scheme in which selected participants are chosen based on a planned system (e.g. 1 sample every 10 individuals)
Stratified	Division of a known sample population into sub-populations of which each is then sampled either randomly or systematically

Implicit in the above probability sampling methods in a given study is the requirement of a clear estimate of sampling population. An understanding of the sampling population gives the researcher the ability to create a meaningful sample frame (Fowler and Mangione 1990).

The sampling frame is often employed in survey research where the given population is known (Marsden and Wright 2010). A sampling frame is the group of individuals that has the chance of being included in a study based on the sampling approach that is selected (Fowler 2009). In terms of this research, development of a sampling frame would require a list of practitioners and regulators that meet the requirements of what was defined as an eligible participant. Since a comprehensive list of this nature could not be located, an ability to create a true sample frame was not possible. In the absence of a sampling frame or defined population, sampling methods listed in Table 3.1 were not employed.

A judgemental sampling approach was chosen for implementation in this research project. Judgemental sampling is a nonprobability based research method that allows the researcher to focus their study based on their judgement of who or what constitutes an appropriate subject (Marsden and Wright 2010). This judgment is based on a specified criteria or definition of what

would constitute an eligible participant, as previously discussed. Benefits to judgemental sampling include the ability to focus the survey on individuals that, in the judgement of the researcher, are suitable candidates. Another advantage to this sampling method is the ability to include referrals made by respondents when considered appropriate. This modification to strict judgemental sampling may be referred to as Chain Referral Sampling or "Snowball Sampling" (Biernacki and Waldorf 1981). Referral sampling is employed, as may be ascribed to the field of water reuse, when test populations are relatively specialized or localized (Biernacki and Waldorf 1981). Limitations to judgemental sampling include introduction of bias and the inability to apply statistical methods for quality verification (Marsden and Wright 2010).

Data Collection Mode

Approaches to the implementation of a survey may include, but are not limited to postal, personal (face to face), telephone or via internet (Alreck and Settle 1995; Babbie 1990). A brief description of these survey methods is included in Table 3.2 and the advantages and disadvantages of potential data collection modes are summarized in Table 3.3.

Decision on data collection mode involved consideration of information provided in Table 3.2, Table 3.3 and factors previously discussed such as:

- Target sample population
    - industry practitioners involved in permitting, management or planning for IR projects and
    - regulators involved who plan, oversee or authorize the permitting process itself
- Location of target sample population
    - i.e. US jurisdictions across North America

Based on these considerations, and due to constraints in obtaining up to date contact lists with addresses of known practitioners and regulators, the postal and internet mode of data collection did not appear feasible. Low response rates associated with postal surveys also presented a potential complication (Table 3.3) due to the fact that in a given jurisdiction there may be few individuals who oversee a reuse program (i.e. a specialized group). In terms of the internet mode for data collection, the long development time and variable response rate success reduced the applicability of this option. Due to the potential for a limited population in a given jurisdiction the requirement for a higher response rate was given primary importance. As such the postal and internet data collection modes were rejected.

Table 3.2: Description of Standard Survey Research Data Collection Modes (modified from Fowler 2009)

Collection Mode	Description
Postal	Prepared survey on paper that is sent by regular postal delivery to selected respondents for completion
Face to Face	Prepared survey that is presented to respondents (individually or in a group) and completed in person by the interviewer
Telephone	Prepared survey that is presented to an individual respondent by an interviewer over the telephone
Internet	Prepared survey that is completed on the internet through email or a website link that is sent to individual respondents for completion

Table 3.3: Advantages and Disadvantages of Various Methods of Survey Data Collection (Fowler 2009; Fowler Jr and Mangione 1990; Kelly et al. 2003)

Collection Mode	Advantages	Disadvantages
Postal	• Time for thorough responses • Potential wide range of access	• Degree of separation with response data • Low response rate
Face to Face	• Good cooperation based on delivery • Easier to build rapport than other methods	• Dependent on interviewer • Duration longer than telephone procedures
Telephone	• Better access to specific populations • Good response rate	• Limitations based on availability • Not appropriate for sensitive topics
Internet	• Relatively low cost • Potentially high return speed	• Comparatively long development time • Response rate

Logistical constraints due to location of potential survey respondents rendered face to face interviewing unfeasible. Although disadvantages exist with respect to telephone interviewing (Table 3.3), it was chosen as the data collection mode for this research due to the following considerations:

- Higher response rate in comparison to other data collection modes
- Proximity/logistical constraints are overcome through telephone interviewing
- Limited time frame for completion of research
- Easily accessible contact information via websites and industry publications

In order to mitigate the disadvantages and limitations inherent with telephone interviewing, quality control measures were implemented and are discussed in Section 3.1.3 and 3.2.2.

3.1.2 Current State of IR

Due to the limitation of bias inherent in a judgemental sampling scheme, other elements that affect survey quality were given closer consideration. One definition of survey quality is that results should be "fit for use" (Marsden and Wright 2010). Besides having minimal error, the definition implies that results of a survey should be suitable, or responsive, to a defined group. For the purpose of this research, the target group is assumed to be practitioners and regulators with involvement and authority in the IR industry and/or with interest in development of a reuse program. In order to craft a survey template that would accomplish the objectives of this research and satisfy the needs of local industry, Alberta and US markets were approached through preliminary telephone interviews (Appendix A).

Alberta

Preliminary interviews were conducted with local IR practitioners and regulators for the following purposes:

- Characterize the current system employed in the approval and permitting of IR projects
- Identify issues inherent in the current IR permitting system from the industry and regulator's perspective
- Develop an investigative survey that would provide useful information for local practitioners and regulators for development of a water reuse program

Preliminary interviews were accomplished by contacting municipal (for example, City of Calgary) and provincial agencies involved in permitting of water reuse projects (for example ESRD, Alberta Health and Alberta Health Services). Individuals contacted from each of these agencies are summarized in Table 3.4. Table 3.4 also provides the corresponding appendix that contains a summarized transcript of the telephone conversation.

Table 3.4: Preliminary Alberta Interview Respondents and Associated Appendices

Category	Respondent	Appendix
Practitioner	Phillips, E. Regulatory Affairs and Compliance, City of Calgary, Calgary, AB.	A1
Regulator (Quality)	Aidun, B. Municipal Wastewater Specialist, Alberta Environment and Sustainable Resource Development (ESRD), Edmonton, AB.	A2
Regulator (Quantity)	Bullis, K. Water Administration Engineer, Alberta Environment and Sustainable Resource Development (ESRD), Edmonton, AB.	A3
Regulator (Health)	Mooney, D. Environmental Health Consultant, Alberta Health, Edmonton, AB.	A4
Regulator (Health)	Fok, N. Provincial Manager; Scientific Advisory Team, Alberta Health Services (AHS), Edmonton, AB.	A5

United States

Preliminary interviews were also conducted with US practitioners involved federally in the water reuse industry for the following purposes:

- To assist in selection of US jurisdictions to approach with the survey research,
- To characterize current trends in the practice of IR permitting from an overarching industry perspective; and
- To identify potential key contact persons that might be solicited for a more in depth survey.

Selection of US practitioners for preliminary interviewing was accomplished by contacting the WateReuse Association. WateReuse Association is an organization whose membership consists of practitioners and regulators throughout the US (WateReuse Association 2013). Based on their website, the WateReuse Association appeared to have a large membership of affiliated practitioners and the existence of membership sections/divisions in multiple states (WateReuse Association 2013). As such, this association was selected as the first point of contact in order to identify US participants for preliminary interviewing.

An initial telephone conversation with the WateReuse Association (J. Minton, personal communication, 2012) was conducted in order to provide background for the scope of this research and for the purpose of soliciting referrals. Table 3.5 contains a list of individual's contacted based on suggestions by the WateReuse Association. Table 3.5 also provides the corresponding appendix that includes a summarized transcript of the telephone conversation.

Table 3.5: Preliminary US Interview Respondents and Associated Appendices

Category	Respondent	Appendix
Practitioner	Cotruvo, J. President; Regulatory Committee Chair (WateReuse Association), Joseph Cotruvo and Associates LLC, Washington, DC.	A6
Practitioner	Rosenblum, E. President; Co-Chair Industrial WateReuse Committee (WateReuse Association), Envirospectives Inc., San Jose, CA.	A7

3.1.3 Survey Template Development

A synthesis of findings from preliminary interviews of Alberta and US respondents was used to develop the survey template. The survey template was designed to mitigate inherent weaknesses and capitalize on the strengths (Table 3.3) associated with the chosen data collection mode of telephone interviewing while including input from preliminary interviews of Alberta and US respondents. Due to the fact that telephone interviewing was selected as the data collection mode, the final survey template was designed to avoid yes/no responses. Open ended questions were

adopted in order to grant participants the opportunity to expand on water reuse program components more openly (Fowler 2009; Marsden and Wright 2010). Initial implementation of the survey template showed weaknesses in the preliminary design (E. Rosenblum, E. Hartling and E. Goldman, personal communication, 2013). The survey template was modified and the final survey that was eventually developed and utilized in this research is presented in Appendix B.

As mentioned, content reflected in the final survey template included input from preliminary interviews with Alberta IR and US respondents with exposure to the IR industry (Appendix A1-A7). Due to the practical nature of the study objectives and the desire to use the findings to help develop an Alberta regulatory framework, particular attention was given to comments of Alberta interviewees. Rationale for inclusion of particular questions in the investigative survey is also presented in Appendix B.

3.2 Survey Implementation

Implementing the survey consisted in the selection of US jurisdictions for participation (Section 3.2.1) and formalizing the method for implementation (Section 3.2.2).

3.2.1 Participant Selection

The literature review revealed that in the US there are 10 states noted for having experience of regulating water reuse projects (Section 2.5.4). Of these 10 states, eight have guidelines or regulations associated with IR including California, Florida, Hawaii, Nevada, North Carolina, Texas, Virginia, and Washington (USEPA 2012). The two states excluded from this list are Arizona and New Jersey who regulate IR on a case-by-case basis. It should also be noted that this list does not imply that no other US state has reuse guidelines. On the contrary, based on the USEPAs *Guidelines for Water Reuse* (2012) there are a total of 22 states that have a regulatory interest in IR practices.

Due to the total number of states involved and the varying degree of reuse regulatory history, a practical approach was taken to assist in selection of states for inclusion in this research. Information from preliminary interviews of the two US practitioners having involvement in IR at the national level was considered (Appendix A6-A7; Table 3.5). A brief history of reuse in Alberta was given to the respondents as well as a summary of current regulatory processes. Based on this information, the recommendation of US respondents was to include California, Arizona, Florida, Texas, Washington and Colorado in this research. In comparison with the list originating from the USEPA (2012), there is the addition of the state of Colorado.

Based on experience and knowledge of US respondents questioned during the preliminary interview, and similarity to states identified by USEPA as having a long history of reuse regulations, US jurisdictions selected for inclusion in this survey research were:

- California
- Arizona
- Florida
- Texas
- Washington
- Colorado
- Oregon[1]

3.2.2 System of Implementation

In order to implement the survey for each of the US jurisdictions selected, the following system was employed:

Step 1. Identification of the first participant was accomplished through the WateReuse Association website (WateReuse Association 2013)
- Since the objective of this research is focused on approaches to IR in practice, industry reuse practitioners were approached first
- It was assumed that regulatory agencies would be best identified through the proponents of IR projects themselves

Step 2. Respective "Section and/or Division" was selected:
- Example: "WateReuse California"

Step 3. Each Section/Division of the WateReuse Association details a list of representatives and contacts. Along with individuals listed for each position is name of municipality, agency, business or district with which they are employed. Preference for selection was given to:
- Leaders (e.g. chairs, co-chairs, or presidents), and/or
- Committee members (e.g. regulatory and/or industrial)

Step 4. After selecting appropriate individuals, an internet search was conducted to determine their contact information, including phone number and email address

Step 5. Each individual was contacted according to the following sequence:
- Phone call:
  - If individual answered, investigation was conducted immediately
  - If individual was not available, a voice message was left which included:
    - Introduction and explanation of research

[1] It should be noted that the state of Oregon was suggested by K. Patrick (personal communication, 2013) during the research process. Reasoning included the complementarity with which Oregon's water quality and quantity programs interact.

        - Personal contact information
        - Implication that an email with personal contact information would be forthcoming
- Email:
    - If a voice message had been left, the message included the following components:
        - Indication that the email was a follow-up to a voice message that had been left
        - A request to respond to the email indicating when the participant might be available for a discussion
        - An indication that there would be a follow up phone call in two days
        - Inclusion of personal contact information in the signature block
        - A post script (PS) providing a brief description of the objective of the research
- Repetition of process:
    - If no response:
        - Repetition of the contact process did not exceed two phone calls and two emails total
    - If participant emailed a response:
        - A meeting time was determined until the investigation could be conducted
    - If the participant returned the telephone call:
        - The investigation was conducted

Step 6. Implementation of the Investigation

- The survey was solely administered through telephone conversation
- Telephone conversations were carried out as follows:
    - Introduction and explanation of research
    - Delivery of survey (Appendix B)
    - Solicitation of contact people either in industry or government (i.e. municipal, county, or state) who may be included in survey
    - Conclusion of interview
- Email follow-up indicating appreciation for respondent participation
- Transcription of interview

Implementation of the investigation for each jurisdiction began, as mentioned in Step 1, with a practitioner of the IR industry. After a practitioner was interviewed from each jurisdiction, subsequent regulators were contacted based on information either provided by the practitioner themself, the WateReuse Association, or the respective state agency website. Table 3.6 summarizes the approach that was attempted for each jurisdiction.

Table 3.6: Investigation Approach for US Jurisdictions

Participant	Category
1	Practitioner (e.g. Utility)
2	Regulator - Quality
3	Regulator - Quantity
4	Regulator – Health (if applicable)

Approach shown in Table 3.6 assumes that each state had organized their reuse program to include divisions as understood from literature review and from discussions with local regulators.

CHAPTER 4 RESULTS

Presented in this chapter are the results of the survey that was given to seven US states for the purpose of obtaining a sample of accepted reuse permitting practices and identifying program development strategies in order to assist in development of a reuse initiative in Alberta.

Results of the investigations for each jurisdiction were organized to provide a summary of respondent information and a summary of results for each of the topics included in the investigation template (Appendix B). Accordingly, the subsections for each jurisdiction include:

- Respondents
- IR Management
- Permitting Process Summary (from respondent perspective)
- Commentary of IR Program in Practice
- Respondent Recommendations
- Examples of IR in Practice

Individual responses to survey questions can be viewed in summarized transcripts located in Appendix C (California), Appendix D (Arizona), Appendix E (Florida), Appendix F (Texas), Appendix G (Washington), Appendix H (Colorado) and Appendix I (Oregon).

4.1 California

4.1.1 Respondents

Several practitioners and regulators were contacted in the state of California. Not all individuals contacted were able to respond to the survey invitation. A comparison of the number of individuals contacted as compared to the actual number of participants is presented in Table 4.1.

Table 4.1: California Survey Participant Summary

Category	Contacted	Interviewed
Practitioner	2	2
Regulator - Quality	3	2
Regulator - Quantity	2	2
Regulator - Health	1	1
Sub-total	8	7

California respondents associated with each category presented in Table 4.1 are summarized in Table 4.2. Summarized transcripts from each of the interviews are provided in the appendix listed beside each corresponding participant in Table 4.2.

Table 4.2: Survey Respondents for California and Associated Appendices

Category	Respondent	Appendix
Practitioner	Goldman, E. Water Efficiency Specialist, West Basin Municipal Water District (WBMWD), Carson, CA. Hartling, E. Water Recycling Coordinator, Sanitation District of Los Angeles County (LACSD), Whittier, CA.	C1
Regulator (Quality)	Innes, G. Senior Water Resources Control Engineer, State Water Resources Control Board (SWRCB), Sacramento, CA.	C2
Regulator (Quality)	Medina, R. Water Resources Control Engineer, Regional Water Quality Control Board (RWQCB), Los Angeles, CA.	C3
Regulator (Quantity)	Mills, R. Chief, California Department of Water Resources (CDWR), Sacramento, CA.	C4
Regulator (Quantity)	Mrowka, K. Senior Water Resources Control Engineer, State Water Resources Control Board (SWRCB), Sacramento, CA.	C5
Regulator (Health)	Barnard, R. Senior Sanitary Engineer; CDPH Recycled Water Treatment Specialist, California Department of Public Health (CDPH), San Diego, CA.	C6

4.1.2 IR Management

California respondents were questioned on various aspects of IR Management including permitting agencies, interagency communication, water sources, water reuse applications, and management of WWTPs within their state.

Permitting Agencies for IR

There was consensus among all respondents regarding the permitting agencies involved in water reuse and IR projects. Agencies cited as having involvement in the IR program in California include the State Water Resources Control Board (SWRCB), the Regional Water Quality Control Board (RWQCB), the California Department of Water Resources (CDWR) and the California Department of Public Health (CDPH). Table 4.3 provides a list of these agencies with the key department and key responsibilities of the agency relative to water reuse projects.

Interagency Communication

Table 4.4 summarizes the various methods cited for interagency communication in California.

Water Source

Raw water sources vary throughout the state (R. Barnard, personal communication, 2013). In the LA region, groundwater or imported water is utilized with no surface water use (E. Hartling, personal communication, 2013). Northern California has increased the use of runoff (from precipitation) and surface water as a raw water source (R. Barnard, personal communication, 2013).

Table 4.3: California State Agencies Cited as having Involvement in IR (Appendix C1-C6; USEPA 2012)

Agency	Department	Responsibilities and Operation
SWRCB	Water Quality	• Establish water quality rules and framework (based on the NPDES) to be implemented by the RWQCB • Act as an appellant if disputes occur between a permittee and the Regional Board • Manage and maintain funding programs for water reuse • Establish state policies where required (e.g. Recycled Water Policy to create consistency between RWQCBs)
RWQCB	Municipal Permitting Unit	• Oversee environmental health and water quality concerns through nine regional boards each with a governing body and semi-autonomous status • Permit and enforce CDPHs water reuse document (Title 22) in relation to quality and operational parameters with no involvement in water rights allocations • Operates under the SWRCB (Department of Water Quality)
CDWR	Water Use Efficiency Branch	• Planning of State wide water resources; publishes a "California Water Plan Update" every five years; public information source • Supplier of water through State Water Project • Allocate state funds to local agencies to plan, design, and construct various types of facilities
SWRCB	Water Rights	• Allocation of water rights (surface water, riparian etc.) • Assists in management and maintenance of funding programs for water reuse
CDPH	Drinking Water and Environment	• Provides a consultancy role for RWQCB with respect to public health (i.e. may include provisions in RWQCB permit • Writes regulations (Title 22) regarding public health issues for recycled water

Table 4.4: Methods for Enhancing Interagency Communication in California

Method	Details
Memorandum of Agreement	• Clarifies roles and responsibilities related to governance of water reuse projects between the SWRCB and CDPH
Ad hoc Basis	• Case by case basis on specific projects
Notices	• Issued to other agencies with 30 days to state objections

State Reuse Applications Cited

Reuse applications cited by various California respondents are summarized in Table 4.5.

Table 4.5: California Water Reuse Applications

Industrial & Commercial	Municipal
• Power plant (cooling towers) • Re-pressurization of oil zones • Carpet and textile dying • Metal plating • Dust control, Soil Compaction • Concrete manufacturing	• Irrigated medians • Parklands

Management of WWTPs

California respondents (Appendix C1-C6) noted that water reclamation facilities or WWTPs are not built or implemented directly by the state but are typically initiated by local water districts, wastewater districts or municipalities.

4.1.3 Permitting Process Summary

Each of the respondents provided feedback on the reuse permitting process in California. In particular, this topic included discussion on water quality, water quantity, and water rights, which are each discussed in the following subsections.

Water Quality

The process for reuse permitting in California is well-defined. RWQCB (consisting of nine regional boards) is the regulatory authority and lead agency for water reuse in California with respect to environmental quality and public health (R. Mills and E. Hartling, personal communication, 2013). SWRCBs Department of Water Quality is the parent agency of RWQCB and not routinely involved in specific projects (R. Barnard, personal communication, 2013). CDPH provides a consultancy role to RWQCB and SWRCB (R. Barnard and R. Medina, personal communication, 2013).

The water quality permitting process for water reuse projects is summarized in Table 4.6. The water reuse permitting process does not vary based on end use; therefore, domestic reuse and IR would follow the same permitting mechanisms.

Water Quantity

The lead agency from a water quantity standpoint is the SWRCBs Department of Water Rights (K. Mrowka, personal communication, 2013). The water quantity permitting process for reclaimed water projects is summarized in Table 4.7.

Water Rights

The *Doctrine of Prior Appropriation* underlies water rights legislation in California (E. Hartling and K. Mrowka, personal communication, 2013). Based on interviews with California respondents (Appendix C1-C6), the water rights issue has been partially negated for two reasons:

- Wastewater is the property of the WWTP owner (K. Mrowka, E. Hartling, R. Mills, personal communication, 2013) unless there are contractual agreements stating otherwise (R. Mills, personal communication, 2013)
- There are no requirements to return non-native flow (K. Mrowka, E. Hartling, R. Mills, personal communication, 2013) based on "Guaranteed uncertainty" clause with respect to a water rights (K. Mrowka, personal communication, 2013). This clause, included in new water rights, states that there is no guarantee (i.e. guaranteed uncertainty) that sufficient flow may continue due to the fact that stream flow consists of treated wastewater or agricultural runoff.

Particular water rights issues discussed by California respondents are summarized in Table 4.8.

Additionally, if a downstream user has become dependent on a WWTPs flow, and there is no "guaranteed uncertainty" clause in the water rights, then the case would be resolved via intervention of the SWRCB (E. Hartling, personal communication, 2013), or contracts between the private entities affected by the water rights dispute (R. Mills, personal communication, 2013).

4.1.4 Commentary of IR System in Practice

This section includes feedback regarding the operation of California's water reuse program in practice. A summary of responses is presented in Tables 4.9 and 4.10.

Table 4.6: Summary of Reclaimed Water Quality Permitting in California

Step	Details
1	• WWTPs apply to the RWQCB for the NPDES permit o The NPDES permit typically applies to discharges of a specified quality to surface water or groundwater o The permit will specify what end uses the recycled water can be used for o The CDPH sets the water quality requirements (Title 22) which are taken by the RWQCB and entered into a permit
2	• WWTP would create a recycled water distribution list o End customer names and locations o End user consumption rate/year • End users must comply with end use specifications outlined in original NPDES permit obtained by the WWTP • WWTP and third party end user enter into private contracts regarding reclaimed water supply (end user does not hold permit)
3	• Prior to issuing a permit, RWQCB may consult with CDPH who would send recommendations to be incorporated in the water recycling permit o No consultation may be required if end use is routine and has been pre-approved in Title 22[1] o Deferral to the CDPH may include matters of technology as well as quality requirements o Example items for CDPH consideration include dual plumbing etc.
4	• Once a permit is granted and independent contracts are in place, reclaimed water can be supplied to the third party/end user[2] • Process is similar for industrial or municipal end users

Notes:

[1] If an end use is not included in Title 22, the RWQCB will approve an "equivalent" use. For example, the permit may say that the use of recycled water for carpet dying shall meet the criteria for Unrestricted Recreational Impoundments (E. Hartling, personal communication, 2013).

[2] Permit for the use of reclaimed water is attached to the WWTP and not the end user. For example, if two treatment plants supply reclaimed water to one cooling tower then two permits are required (E. Hartling, personal communication, 2013).

Table 4.7: Summary of Reclaimed Water Quantity Permitting in California

Step	Details
1	• If a water utility wishes to divert its discharge from a stream to another beneficial use then the petition process is triggered o End user does not initiate the process o Effectively, the WWTP is applying for a change in the point of discharge o Reduction in discharge to a stream initiates Step 2
2	• Owner of the WWTP files a Wastewater Change Petition[1] o Only if there is a reduction in flow/water rights issues[2] o SWRCB may stipulate completion of environmental work[3] and public disclosure
3	• Once completed, SWRCB will contact the proponent granting their signoff of the project (or not) o Entity will then submit the signoff with their application in order to receive state funding for the reclaimed water project o Cannot obtain funding without SWRCB approval as per grant/loan program specifications

Notes:

[1] Legislature produced this method so that WWTPs could perform their own reuse projects (K. Mrowka, personal communication, 2013)

[2] Imported/non-native water can be consumed to extinction (E. Hartling, personal communication, 2013)

[3] Environmental work noted in Step 2 would be dependent on specifications of the Environmental Quality Act that requires completion of a checklist and guidance on how involved (or detailed) the report must be (K. Mrowka, personal communication, 2013).

Table 4.8: Specific Water Rights Topics of Interest in California

Topic	Response
Inter-basin Transfer	• If water is diverted to another basin, the review process of the SWRCB will be triggered and assessed on a case by case basis • Water loss is not an issue (due to ownership rights); the main issue is distribution of funds generated from sale of water in another basin
Third-Party Security of Supply	• Security of supply to the third party is assured via contracts between the utility and the end user • A "Anti-paralleling statue" protects the entity providing reclaimed water with respect to capital investments ("only one company allowed pipe in the ground per area") (E. Hartling, personal communication, 2013)

Table 4.9: Efficiencies Cited Regarding the IR Program in California

Category	Comments
Management	• Recycled water will not be rationed in time of drought • The case for water reuse is improved with public support • State agencies provide dedicated staff that specialize in water reuse
Permit Process	• Quick to obtain approval (if project is routine) • Not a "hassle" once system understood • End users approach utilities directly for recycled water

Table 4.10: Inefficiencies Cited Regarding the IR Program in California

Category	Comments
Management	• Difficult system to implement based on complexities of reuse projects (e.g. dual distribution systems, cross connection control etc.) • Communication challenges even with a Memorandum of Agreement (MOA)
Permit Process	• Inconsistencies based on multiple agencies (example: nine RWQCBs and 20 CDPH offices) • Turnaround time can be slow because of multiple agency involvement • Out of date permits and regulations do not reflect current uses

4.1.5 Respondent Recommendations

Recommendations made by California respondents regarding implementation and/or management of a recycled water program are summarized in Table 4.11.

Table 4.11: Recommendations from California Respondents for the Development of an IR Program

Category	Recommendation
Management	• Reuse framework should be simple o Single agency responsibility o Maintain relationships between the regulator and the utilities • Incorporate a loan/grant system o Make regulatory review/signoff a requirement in order to access state funds and increase coordination between agencies and provide financial incentives
Permit Process	• Maintain consistency in permitting o Provide template documents for all field offices

4.1.6 Examples of IR in Practice

Respondents provided feedback on practical examples of IR practices in California. In particular, this feedback provided information on specific documents or resources used in practice (Table 4.12) and actual IR projects in California (Table 4.13).

Table 4.12: Resources Recommended by California Respondents

Item	Document	Details	Relevance for:
Guidance Document	DHS (2001b)	*Guidelines for the Preparation of an Engineering Report for the Production, Distribution and Use of Recycled Water* • Engineering Reports submitted to the RWQCB for each new reuse applications	Regulator
Regulation	SWRCB (2013a)	*Porter-Cologne Water Quality Control Act* • Ch. 7, Sections 13552.6 and 13552.8 include information on cooling, Ch. 7.5: Definitions and Info.	Regulator
Regulation	DHS (2001a)	*California Health Laws Related to Recycled Water* (a.k.a. The Purple Book) • Page 51, 53 and 54: use of recycled water for cooling and other purposes	Regulator
Policy	SWRCB (2013b)	*Recycled Water Policy* • Example for the development of a reclaimed water policy	Regulator
Permit	RWQCB (2007b)	*Water Recycling Requirements for Title 22 Recycled Water* • Issued by the RWCB to a utility delivering recycled water	Practitioner and Regulator
Monitoring Report	RWQCB (2007a)	*Monitoring and Reporting Program No 9198 for Water Recycling Requirements of Title 22 Recycled Water* • Companion document to the Water Recycling Requirements permit	Practitioner and Regulator
Change Order(s)	SWRCB (2012a)	*City of Corona: Order Canceling Protest, Approving Change in Purpose of Use, Place of Use, and Discharge Quantity* • Example of petition for a change in water discharge	Practitioner and Regulator
Letter of Approval	SWRCB (2012b)	*Transmittal letter: Wastewater Change Petition WW-56 of City of Corona, Butterfield Drain in Riverside County* • Example email approval of wastewater petition	Practitioner and Regulator

Table 4.12: Resources Recommended by California Respondents (continued)

Item	Document	Details	Relevance for:
MOA	DHS and SWRCB (1996)	*Memorandum of Agreement between the Department of Health Services and the State Water Resources Control Board on Use of Reclaimed Water* • Communicates responsibilities between the two agencies	Regulator
Statutes	CDPH (2001)	*Statutes Related to Recycled Water and the California Department of Public Health* • Laws sanctioning regulations such as Title 17 and 22	Regulator
Recycling Criteria	CDPH (2009)	*Regulations Related to Drinking Water* • Title 17: Pertains to backflow preventions and cross connections (Sections 7083-7605) • Title 22: Regulations pertaining to recycled water use (Sections 60,001-60,355)	Regulator
Website	CDPH (2013)	*Recycled Water: Regulations and Guidance* • Acts as a portal to all recycled water related regulations, statutes and guidance and recycled water information	Regulator

Table 4.13: Examples of IR in Practice as Cited by California Respondents

Category	Description
Utility	• Water Reclamation Facilities practicing IR o West Basin Municipal Water District (Designer Water) o Sanitation District of Los Angeles County o Las Virgenes Municipal Water District o Long Beach Water Department
Industry	• Oil Island (Long Beach, CA) o Use recycled water for process and for oil zone re-pressurization

4.2 Arizona

4.2.1 Respondents

Several practitioners and regulators were contacted in the state of Arizona. Not all individuals contacted were able to respond to the survey invitation. A comparison of the number of individuals contacted as compared to the actual number of participants is presented in Table 4.14.

Table 4.14: Arizona Survey Participant Summary

Category	Contacted	Interviewed
Practitioner	2	1
Regulator - Quality	3	2
Regulator - Quantity	1	1
Regulator - Health	NA	NA
Sub-total	6	4

Arizona respondents associated with each category are summarized in Table 4.15. Summarized transcripts from each of the interviews are provided in the appendix listed beside each corresponding participant in Table 4.15.

Table 4.15: Survey Respondents for Arizona and Associated Appendices

Category	Respondent	Appendix
Practitioner	Thomure, T. Associate & Arizona Water Business Group Manager, HDR Engineering, Tucson, AZ.	D1
Regulator (Quality)	Graf, C. Associate Director, Arizona Department of Environmental Quality (ADEQ), Phoenix, AZ.	D2
Regulator (Quality)	Mullins, M. Environmental Programs Specialist, Arizona Department of Environmental Quality (ADEQ), Phoenix, AZ.	D3
Regulator (Quantity)	Lacey, M. Deputy Director, Arizona Department of Water Resources (ADWR), Phoenix, AZ.	D4

4.2.2 IR Management

Arizona respondents were questioned on various aspects of IR Management including permitting agencies, interagency communication, water sources, water reuse applications, and management of WWTPs within their state.

Permitting Agencies for IR

Permitting agencies cited as having involvement in the IR program in Arizona include Arizona Department of Environmental Quality (ADEQ) and Arizona Department of Water Resources (ADWR). Table 4.16 provides a list of these agencies with the key department and key responsibilities of the agency relative to water reuse projects.

Table 4.16: Arizona State Agencies Cited as having Involvement in IR (Appendix D1-D4; USEPA 2012)

Agency	Department	Responsibilities and Operation
ADEQ	Water Quality Division	• Permitting agency related to water quality and public health • Inspection and enforcement of permits
ADWR	Water Management Division	• Administers water resources and water rights • Advisory role rather than regulatory (no enforcement authority)

Interagency Communication

Based on respondent feedback, there is no formal process guiding interagency communication in Arizona (C. Graf and M. Lacey, personal communication, 2013). Table 4.17 summarizes the various methods cited for interagency communication in Arizona.

Table 4.17: Methods for Enhancing Interagency Communication in Arizona

Method	Details
Blue Ribbon Panel	• Panel of stakeholders including ADEQ, ADWR, Universities etc. • Panel met to make recommendations on use of reclaimed water and communication
Ad hoc Basis	• Case by case basis on specific projects specifically groundwater recharge projects • Meetings between ADEQ and ADWR on particular projects
Organizational Structure	• Same Governor and communication flows from that office • ADWR assisted in the development of the ADEQ so there are natural linkages

Water Source

Raw water sources vary throughout the state and consist of both surface and groundwater (T. Thomure, M. Lacey and C. Graf, personal communication, 2013). Arizona surface water laws create a complex legal framework centered on two large trans-boundary river systems in Arizona called the Salt River System and the Colorado River System (T. Thomure, personal communication, 2013).

State Reuse Applications Cited

Reuse applications cited by Arizona respondents include the following:

- Golf course irrigation
- Wood processing
- Power generation (including nuclear power)
- Mining

Management of WWTPs

Arizona respondents noted that WWTPs are not built or implemented directly by the state. WWTPs are mainly publically owned (by counties or municipalities) but some are owned by private entities. Of the 300 WWTPs, 195 (65%) distribute reclaimed water.

4.2.3 Permitting Process Summary

Each of the respondents provided feedback on the reuse permitting process in Arizona. In particular, this topic included discussion on water quality, water quantity, and water rights, which are each discussed in the following subsections.

Water Quality

There is a well-defined process for reuse permitting in Arizona. The ADEQ is the state regulatory authority and lead agency with respect to environmental quality and public health concerns as related to water quality. The ADEQ is also the sole agency for recycled water in Arizona (T. Thomure and C. Graf, personal communication, 2013). The water quality permitting process for water reuse projects is summarized in Table 4.18. Water reuse permitting does not vary based on end use; therefore, domestic reuse and IR would follow the same permitting process.

The permitting process is divided into two programs called the Aquifer Protection Permit (APP) program and the Reuse Program (T. Thomure, personal communication, 2013). A more detailed explanation of the permitting system is described by C. Graf (Appendix D2, Question 2a) who was involved in original development of this legislation (C. Graf, personal communication, 2013).

Table 4.18: Summary of Reclaimed Water Quality Permitting in Arizona

Step	Details
1	• The WWTP owner applies for an Aquifer Protection Permit (APP) from the ADEQ as part of the APP program (in addition to the typical NPDES permit that all WWTPs have) o All wastewater treatment plants fall under the APP program o The APP program stipulates five classes (i.e. qualities) of water[1] o A WWTP engineers their system to become classified and permitted so as to provide one of the five classes of water (e.g. B+ water) o A WWTP must adhere to the Best Available Demonstrated Control Technology (BADCT) premise o Once discharge designation (e.g. B+) is given by the ADEQ, a "Water Reuse Agent Permit"/APP is then granted o With the APP in place, a WWTP can deliver reclaimed water to any end user who possesses an End User (B+) permit
2	• The end user (i.e. an industry) applies separately for an "End User Permit" through ADEQ's "Reuse Program" o The Reuse Program is designed to interface with the APP program o The Reuse Program designates acceptable end uses based on a certain quality of water (e.g. B+ water)[2, 3] o Based on the end use that the permittee is applying for, they will only be permitted to accept the appropriate class of water (e.g. B+) o To obtain the End User Permit, the permittee will have to meet certain best management practices (e.g. cross connection controls) o With an End User Permit in place (e.g. B+), the permittee may accept reclaimed water from a WWTP with an Agent Permit for the same class of water (e.g. B+ Agent Permit)
3	• A WWTP may obtain an "Agent End User Permit" and act on behalf of ADEQ in scenarios with multiple end users o For example, the City of Tucson has one "Agent End User Permit" to supply 60 parks, 100 schools, and 700 residences o Agent End User Permit saves the ADEQ from issuing multiple separate permits by permitting a WWTP to act on their behalf o The WWTP would have separate contracts with each end user and ensure that ADEQ end use standards are being met o The WWTP, in this case, would hold a APP and Agent End User Permit simultaneously

Notes:

[1] Classes include A+, A, B+, B, and C. The highest quality water is A+, meaning it is pathogen free and denitrified (C. Graf, personal communication, 2013)

[2] If an end user wishes to provide further treatment to reclaimed water then an individual permit would be required (T. Thomure, personal communication, 2013)

[3] If end use is not included in regulations (i.e. a new type of end use), then the ADEQ is able to develop site specific quality standards under a separate permit (C. Graf, personal communication, 2013)

Water Quantity

The lead agency in Arizona from a water quantity (mainly groundwater) permitting standpoint is the ADWR (M. Lacey, personal communication, 2013). Due to water right laws in Arizona (see "Water Rights" section below) there is no formal administrative process in place if a water utility wishes to divert its discharge from a stream to another beneficial use (M. Lacey, personal communication, 2013). If a downstream user is affected by a reduction in flow due to the diversion by a WWTP, then the court system is initiated (T. Thomure and M. Lacey, personal communication, 2013). Surface water is largely governed by the court system and groundwater is handled administratively through the ADWR (M. Lacey, personal communication, 2013).

Water quantity programs related to reclaimed water usage in Arizona, and administered by the ADWR, consists of:

- Debiting/Crediting system: related to groundwater recharge and recovery (M. Lacey, personal communication, 2013)
    - An accounting system is used to monitor flows "returned" to a basin and "extracted" from a basin
    - If an aquifer is being recharged with reclaimed water, then the ADWR would become involved. The ADWR would issue a "Recharge Permit" to document recharge rates and calculate groundwater mounding. Based on recharge amount, credits/offsets are determined and thus ADWR can permit a groundwater pumping activity in another location (C. Graf, personal communication, 2013)

Water Rights

The *Doctrine of Prior Appropriation* underlies water rights legislation in Arizona (T. Thomure and M. Lacey, personal communication, 2013). Based on interviews with respondents (Appendix D1-D4), water rights in Arizona take on the following characteristics:

- Wastewater is the property of the WWTP owner until it is discharged (T. Thomure, C. Graf and M. Lacey, personal communication, 2013). Once discharged, then water becomes water of the state
    - As a result of a case in 1989 (Arizona Public Service Co. vs. Long, 773 P. 2d 988 – Arizona: Supreme Court 1989), there are no obligation to return flow from a WWTP

Particular water rights issues discussed by Arizona respondents are summarized in Table 4.19.

4.2.4 Commentary of IR System in Practice

This section includes feedback regarding the operation of Arizona's water reuse program in practice. A summary of responses is presented in Tables 4.20 and 4.21.

Table 4.19: Specific Water Rights Topics of Interest in Arizona

Topic	Response
Inter-basin Transfer	• There is no requirement for water to remain within a basin • The sale of reclaimed water across a particular boundary is allowed unless there is violation of any other jurisdictional boundaries or laws
Third-party Security of Supply	• Contractual agreements between utility and end user establishes security with the supply of reclaimed water

Table 4.20: Efficiencies Cited Regarding the IR Program in Arizona

Category	Comments
Management	• No comments
Permit Process	• Straightforward if proposed end use is established and permitted by state law and the water has a "+" designation (i.e. denitrified) • Classes of water without the "+" designation (meaning they are not denitrified) have more involved End User Permits • Separation of the APP program and the Reuse program provides efficiency

Table 4.21: Inefficiencies Cited Regarding the IR Program in Arizona

Category	Comments
Management	• Fostering public acceptance of reclaimed water use is difficult • Reporting differences between the ADWR and the ADEQ create difficulties in combining permitting data
Permit Process	• Lack of current acceptable end uses makes permitting unnecessarily difficult

4.2.5 Respondent Recommendations

Recommendations made by Arizona respondents regarding implementation and/or management of a recycled water program are summarized in Table 4.22.

Table 4.22: Recommendations from Arizona Respondents for the Development of an IR Program

Category	Recommendation
Management	• Current and accurate information regarding the safety of recycled water would help discussions between the public and industry • An advocacy program is needed to promote reuse as much as possible • Regulatory backing/incentives are needed to help promote reclaimed water use • Stakeholders should meet to discuss reuse program implementation
Permit Process	• Offset water conservation strategies should be developed o E.g. If not economically feasible for an industry to use recycled water they could help develop a reclaimed water supply in a city to offset their use of freshwater in a rural location • An APP program and Reuse program (see Table 4.18) should be developed • Debiting/crediting (offset) system is more successful than direct reuse in Arizona

4.2.6 Examples of IR in Practice

Respondents provided feedback on practical examples of IR practices in Arizona. In particular, this consisted of feedback on specific documents or resources used in practice and feedback on actual IR projects in Arizona. A summary is provided in Tables 4.23 and 4.24.

Table 4.23: Resources Recommended by Arizona Respondents

Item	Document	Details	Relevance for:
Website	ADEQ (2013)	*Water Quality Division: Permits: Reclaimed Water* • Provides a model for practitioners, regulators, and users • Gives examples of permits (APP and End User)	Regulator and Practitioner
Court case	Arizona (1989)	*Arizona Public Service Co. v. Long* • Provides case law determining effluent to be the property of the WWTP	Practitioner
Report	USEPA (2012)	*Guidelines for Water Reuse* • Guidance document for jurisdictions planning and managing a water reclamation program	Practitioner and Regulator
Regulation	ADEQ (2005)	*Arizona Administrative Code (AAC). Title 18, Ch. 9* • Provides an example of standard definitions [Article 7 (R18-9-701) 1] and End user permits [Article 7 (R18-9-706 and 708]	Regulator
Regulation	ADEQ (2008)	*Arizona Administrative Code (AAC). Title 18, Ch. 11* • Defines reclaimed water quality standards and describes/defines reclaimed water classes [Article 3 (R18-11-301 through 309)]	Regulator
Report	ADWR (2010)	*Final Report of the Governor's Blue Ribbon Panel on Water Sustainability* • Documents issues and recommends solutions	Regulator
Website	ADWR (2013)	*Colorado River Management: Law of the River* • Provides an example of trans boundary agreements related to river crossings between states	Regulator

Table 4.24: Examples of IR in Practice as Cited by Arizona Respondents

Category	Description
Utility	• Water Reclamation Facilities practicing IR o 91st Ave WWTP, Phoenix, AZ. ▪ B+ plant; half of discharge goes to Palo Verde Nuclear Generating Station o Wildcat Hill WWTP, Flagstaff, AZ. ▪ A+ plant; supplies paper mill
Industry	• Palo Verde Nuclear Generating Station, Maricopa, AZ. o Supplied with reclaimed water from 91st Ave WWTP, Phoenix, AZ. o Highly contested project and led to Arizona Public Service Co. v. Long court case • Intel Corp. Chip-making Plant, Chandler, AZ. o City of Chandler supplies the Intel plant with reclaimed water • City of Scottsdale, AZ. o Multi-contract agreement with 21 golf courses o Example of large contracts regarding supply, quality, reliability etc.

4.3 Florida

4.3.1 Respondents

Several practitioners and regulators were contacted in the state of Florida. Not all individuals contacted were able to respond to the survey invitation. A comparison of the number of individuals contacted as compared to the actual number of participants is presented in Table 4.25.

Table 4.25: Florida Survey Participant Summary

Category	Contacted	Interviewed
Practitioner	4	1
Regulator - Quality	3	2
Regulator - Quantity	1	1
Regulator - Health	NA	NA
Sub-total	8	4

Florida respondents associated with each category are summarized in Table 4.26. Summarized transcripts from each of the interviews are provided in the appendix listed beside each corresponding participant in Table 4.26.

4.3.2 IR Management

Florida respondents were questioned on various aspects of IR Management including permitting agencies, interagency communication, water sources, water reuse applications, and management of WWTPs within their state.

Table 4.26: Survey Respondents for Florida and Associated Appendices

Category	Respondent	Appendix
Practitioner	Elorfi, A. Engineering Specialist II, Hillsborough County: Reclaimed Water Planning Team, Tampa, FL.	E1
Regulator (Quality)	Speas-Frost, S. Reuse Coordinator, Florida Department of Environmental Quality (DEP), Phoenix, FL.	E2
Regulator (Quality)	Squitieri, J. Environmental Manager, Florida Department of Environmental Quality (DEP), Temple Terrace, FL.	E3
Regulator (Quantity)	Andrade, A. Reuse Coordinator, Southwest Florida Water Management District (SWFWMD), Brooksville, FL.	E4

Permitting Agencies for IR

Permitting agencies cited as having involvement in the IR program in Florida include the Florida Department of Environmental Quality (DEQ) and the Florida Water Management Districts (FWMDs). Table 4.27 provides a list of these agencies with the key department and key responsibilities of the agency relative to water reuse projects.

Table 4.27: Florida State Agencies Cited as having Involvement in IR (Appendix E1-E4; USEPA 2012)

Agency	Department	Responsibilities and Operation
DEP	Water Quality	• Single regulator for reclaimed water reuse • Govern water quality issues as they relate to public health • Permitting agency • Inspect and enforce permits
FWMDs	Water Supply	• Five Florida Water Management Districts (FWMDs) corresponding to five watershed divisions acting semi-autonomously • Manage consumptive use permits • Provide funding for alternative supplies

Interagency Communication

Table 4.28 summarizes the various methods cited for interagency communication in Florida.

Table 4.28: Methods for Enhancing Interagency Communication in Florida

Method	Details
Committee	• Reuse Coordinating Committee • Organized by DEP • Multiple stakeholders involved including DEP, FWMDs, Department of Health, Agriculture
Ad hoc Basis	• Case by case basis when needed

Water Source

Raw water sources mainly consist of groundwater with some larger industries using surface water and groundwater sources (A. Andrade, J. Squitieri and S. Speas-Frost, personal communication, 2013).

State Reuse Applications Cited

Reuse applications cited by Florida respondents includes the following:

- Golf course irrigation
- Wallboard manufacturing
- Power generation (cooling towers)
- Phosphate mining

Management of WWTPs

Florida respondents noted that WWTPs are mainly owned and operated by the county or municipality and some are owned by large private entities. Tampa and Orlando districts conduct the majority of water reuse projects in the state (J. Squitieri, personal communication, 2013)

4.3.3 Permitting Process Summary

Each of the respondents provided feedback on the reuse permitting process in Florida. In particular, this topic included discussion on water quality, water quantity, and water rights, which are each discussed in the following subsections.

Water Quality

There is a well-defined process for water reuse permitting in Florida. The DEP is the state regulatory authority and lead agency with respect to environmental quality and public health concerns as they relate to water quality in Florida (S. Speas-Frost and J. Squitieri, personal communication, 2013). The state's Department of Health is not involved in water reuse projects as public health is considered through DEP (S. Speas-Frost, personal communication, 2013).

The water quality permitting process for water reuse projects is summarized in Table 4.29. Water reuse permitting does not vary based on end use; therefore, domestic reuse and IR would follow the same permitting mechanisms.

Water Quantity

The lead agency in Florida from a water quantity permitting standpoint is one of the five FWMDs (A. Andrade and S. Speas-Frost, personal communication, 2013). Water quantity management approaches managed through the FWMDs and related to reclaimed water usage is described in Table 4.30.

Table 4.29: Summary of Reclaimed Water Quality Permitting in Florida

Step	Details
1	• WWTP owner applies for a "Public Access Reuse" permit that is added to the NPDES permit from the DEP[1] o The DEP is the sole permitting agency for reuse applications in regards to quality and operations permitting o The purpose of Public Access Reuse application is to add a particular application (or place of use) to their existing permit[2] o The WWTP would designate their service area and reuse customers (e.g. 10 golf courses, three parks, etc.)
2	• DEP reviews applications and will make recommendations o The focus of DEP review is that "no harm will be caused to the environment", either directly or indirectly o The DEP would consider factors such as total quantity, hydraulic loading rates, storage, etc. o In certain cases, the DEP may require the end user to conduct groundwater monitoring programs (depending on consumptive use) o If project is large in scope, DEP would involve all stakeholders in permitting process (e.g. public meetings, workshops etc.) o Environmental Impact Assessments (EIAs) may be required depending on scope of project
3	• The DEP approves the reuse project and issues a permit o Permit granted only when regulatory requirements are met o Permit acts as a certificate allowing the supply reclaimed water and a guideline of how facility must operate[3] o The DEP reserves the right to inspect facilities to ensure that requirements are being met

Notes:

[1] A WWTP approaches the regulator for a permit and not the individual customer, or perspective end user (A. Elorfi, personal communication, 2013)

[2] Each utility that supplies reclaimed water would have a list associated with their permit, stipulating location, quantity, equipment used and quality of all their reuse customers (J. Squitieri, personal communication, 2013)

[3] An example of a provision of the standard operating procedure (SOP) might be that if turbidity or chlorine values exceed specification, then that water must be rejected from reuse system and sent to a specified alternate location (J. Squitieri, personal communication, 2013)

Table 4.30: Approaches to Water Quantity Management in Florida

Approach	Details
Consumptive Use Permit (CUP)	• Change in discharge location to a reclaimed water end user would require a modification of CUP • Address potential for negative impacts from diversions based on "minimum flows and levels" • May stipulate a certain percentage of reclaimed water use in order to conserve potable supplies
Co-operative Funding	• Provide 50% funding for projects that develop "alternative water supplies" • Goal is reduction of potable usage and reduction of effluent discharge • FWMDs receive funding through Ad Valorem taxes

Water Rights

Minimal water rights issues were reported in Florida as a result of their current framework (A. Andrade, personal communication, 2013). Based on interviews with respondents (Appendix E1-E4), wastewater is the property of the WWTP owner until it is discharged (A. Andrade, personal communication, 2013). For groundwater and surface water, if flow levels decrease past a minimum point, then CUPs are adjusted accordingly until water levels recharge (also applies to surface waters)

Particular water right issues discussed by Florida respondents are summarized in Table 4.31.

Table 4.31: Specific Water Rights Topics of Interest in Florida

Topic	Response
Inter-basin Transfer	• Water should not be transferred from basin; must seek local water first • FWMD boundaries coincide with watershed boundaries; as such, approvals are granted based on agreements between FWMDs • Florida Statutes address this issue (No. 373 and 40-2)
Third-Party Security of Supply	• Managed through 20 year contracts between utility and end user • Cooperative program and CUP assist in managing this issue • Alternate (raw) water supply is accessible if reclaimed water source fails

4.3.4 Commentary of IR System in Practice

This section includes feedback regarding the operation of Florida's water reuse program in practice. A summary of responses is presented in Tables 4.32 and 4.33.

4.3.5 Respondent Recommendations

Recommendations made by Florida respondents regarding implementation and/or management of a recycled water program are summarized in Table 4.34.

Table 4.32: Efficiencies Cited Regarding the IR Program in Florida

Category	Comments
Management	• Reuse Coordinating committee: allows improved communication • Co-operative funding grants provide an incentive for reuse
Permit Process	• Stringent numeric nutrient criteria provides an incentive for reuse • Minimum Flows and Levels criteria force end users to seek alternate supplies when their water allocation is decreased

Table 4.33: Inefficiencies Cited Regarding the IR Program in Florida

Category	Comments
Management	• Industry acceptance can be difficult based on water quality concerns
Permit Process	• Separation between FWMDs and DEP: may be approval from water resource perspective without due attention to environmental quality • The CUP is set up in such a way that if a city does not own the WWTP (and cannot recharge groundwater as an offset), then they have difficulty increasing their CUP • Alternatively, a private WWTP will spend millions in treatment costs to discharge to groundwater, while others can draw a CUP based on their recharge

Table 4.34: Recommendations from Florida Respondents for the Development of an IR Program

Category	Recommendation
Management	• Should target industries for reclaimed water: good customers due to year round use and efficiency • Should utilize the Reclaimed Water Guide (document) as it outlines how to build a reclaimed water system (not a current document, but relevant) • Should develop a Basin Management Action Plan (BMAP): planning document that considers inputs/outputs, TMDLs, allocations etc. • Conduct a Reuse Feasibility Study that is performed by any surface water discharger to uncover more opportunities for practicing reuse
Permit Process	• Should develop Minimum Flows and Levels criteria and stringent numeric nutrient criteria for major rivers and groundwater systems as it may provide an incentive for seeking reclaimed water

4.3.6 Examples of IR in Practice

Respondents provided feedback on practical examples of IR practices in Florida. In particular, this consisted of feedback on specific documents or resources used in practice and feedback on actual IR projects in Florida. A summary is provided in Tables 4.35 and 4.36.

Table 4.35: Resources Recommended by Florida Respondents

Item	Document	Details	Relevance for:
Website	DEP (2013)	*Coordination for Reuse Projects* • Explains Reuse Coordination committee to assist with interagency communication	Regulator
Regulation	DEP (2012)	*Florida Administrative Code 62-610* • Section: 62-610.652 – relates to water quality contracts between industry and utility	Regulator
Permitting Form	DEP (2010)	*Wastewater Facility or Activity Permit Application, Form 1, General Information* • General information for dischargers	Regulator
Permitting Form	DEP (2001)	*Wastewater Permit Application Form 2A for Domestic Wastewater Facilities* • Permit to be submitted by the utility to DEP • Indicates specifications that utilities must report (e.g. place of use, quantity, etc.)	Regulator
Cooperative Funding Initiative	SWFWMD (2012)	*Cooperative Funding Initiative: FY 2014 – Reclaimed Water* • Provides information of the program and guidance to funding applicants	Practitioner and Regulator
Map Viewer	SWFWMD (2013)	*Reclaimed Water Map Viewer* • GIS viewer showing infrastructure: useful as a planning tool	Practitioner and Regulator
Document	DEP (1999)	*Reclaimed Water Guide* • Provides information on how to start and operate a reclaimed water system	Practitioner and Regulator

Table 4.36: Examples of IR in Practice as Cited by Florida Respondents

Category	Description
Utility	• Emerald Coast Utility Authority (ECUA). o Supplies Crist Power Plant • Palm Beach County Regional Facility o Supplies Crist Power Plant
Industry	• TECO Energy Company, Tampa, FL. o Three utilities provide reclaimed water o TECO stipulates requirements of water quality, quantity and purpose of use (i.e. industrial) o WWTP will provide what is possible based on their capacity o WWTP reports to the DEP about water quality, quantity, and end user/purpose of use o TECO supplies infrastructure up to the county's water meter (water meter marks where the jurisdictions change from private to public) • Gulf Power: Crist Power Plant, Pensacola, FL. o Accepts reclaimed water from ECUA and Palm Beach County Regional Facility o The river adjacent to ECUA plant had an "impairment" status so Gulf Power had to seek alternate disposal • CF Industries: Phosphate Mine, Wauchula, FL. o City of Tampa supplies reclaimed water for phosphate mining

4.4 Texas

4.4.1 Respondents

Several practitioners and regulators were contacted in the state of Texas. Not all individuals contacted were able to respond to the survey invitation. A comparison of the number of individuals contacted as compared to the actual number of participants is presented in Table 4.37.

Table 4.37: Texas Survey Participant Summary

Category	Contacted	Interviewed
Practitioner	5	2
Regulator - Quality	2	1
Regulator - Quantity	2	1
Regulator - Health	NA	NA
Sub-total	9	4

Texas respondents associated with each category are summarized in Table 4.38. Summarized transcripts from each of the interviews are provided in the appendix listed beside each corresponding participant in Table 4.38.

Table 4.38: Survey Respondents for Texas and Associated Appendices

Category	Respondent	Appendix
Practitioner	Rochelle, M. Principal, Lloyd Gosselink Rochelle & Townsend, P.C., Austin, TX.	F1
Practitioner	McDonald, E. Principal, Alan Plummer Associates, Inc., Fort Worth, TX.	F2
Regulator (Quality)	Centeno, J. Engineer, Texas Commission on Environmental Quality (TCEQ), Austin, TX.	F3
Regulator (Quantity)	Alexander, K. Technical Specialist, Texas Commission on Environmental Quality (TCEQ), Austin, TX.	F4

4.4.2 IR Management

Texas respondents were questioned on various aspects of IR Management including permitting agencies, interagency communication, water sources, water reuse applications, and management of WWTPs within their state.

Permitting Agencies for IR

The permitting agency cited as having involvement in the IR program in Texas is the Texas Commission on Environmental Quality (TCEQ). Table 4.39 provides a list of the key departments and their responsibilities relative to water reuse projects.

Table 4.39: Texas State Agencies Cited as having Involvement in IR (Appendix F1-F4; USEPA 2012)

Agency	Department	Responsibilities and Operation
TCEQ	Water Quality Division	• Single regulator for reclaimed water reuse • Water quality and public health • Implement and permit 210-rules for reclaimed water
TCEQ	Water Supply Division	• Permit water rights for State of Texas • Manage water resources and supply

The Texas Railroad Commission (RRC) was contacted since they are the oil and gas regulator in the state of Texas (M. Rochelle and E. McDonald, personal communication, 2013). This entity was contacted and a discussion was carried out with Mr. L. Garza who is a Drilling Permits Program manager with RRC. Based on the discussion with the RRC (L. Garza, personal communication, 2013) and interviews with Texas survey respondents, the following was determined:

- The RRC operates independently from the TCEQ with internal codes and practices (L. Garza personal communication, 2013)

- A MOA exists between the RRC and the TCEQ defining their respective boundaries (M. Rochelle, personal communication, 2013).
- The RRC is considered an industrial end user in and of itself with reclaimed water being delivered to a holding pond and once there, entering the jurisdiction of RRC (L. Garza and E. McDonald, personal communication, 2013)

Based on these findings, interviewing of the RRC was discontinued.

Interagency Communication

In relation to the TCEQ, a single agency, management of communication would occur between the Water Quality Division and the Water Supply Division (see Table 4.38). Based on interviews with Texas respondents, there is a minimal need for communication between departments since there are rules related to direct or indirect reuse (E. McDonald and J. Centeno, personal communication, 2013). There is a clear separation as to who permits each activity: direct reuse is permitted by Water Quality Division and indirect reuse is permitted by Water Supply Division (K. Alexander, personal communication, 2013)

Water Source

Raw water sources consist of surface and groundwater dependent on the region (M. Rochelle and E. McDonald, personal communication, 2013).

State Reuse Applications Cited

Reuse applications cited by Texas respondents include the following:

- Golf course irrigation
- Hydraulic fracturing (fracking) for shale gas
- Power generation (cooling towers)

Indirect reuse is more common than direct reuse in the state of Texas (E. McDonald, personal communication, 2013).

Management of WWTPs

Texas WWTPs are owned and operated both privately and publically (M. Rochelle, personal communication, 2013). Facilities are rated by the TCEQ in the following terms (M. Rochelle, personal communication, 2013):

- Producers
- Providers (often one and the same as the producer)
- Users

4.4.3 Permitting Process Summary

Each of the respondents provided feedback on the reuse permitting process in Texas. In particular, this topic included discussion on water quality, water quantity, and water rights, which are each discussed in the following subsections.

Water Quality

There is a well-defined process for reuse permitting in Texas. The Water Quality Division of the TCEQ is the state regulatory authority and lead agency as well as the sole agency for recycled water in Texas with respect to environmental quality (M. Rochelle, E. McDonald and J. Centeno, personal communication, 2013). The TCEQ differentiates two types of reuse into two different permitting programs (K. Alexander, personal communication, 2013). Direct reuse is permitted by the Water Quality Division of the TCEQ and indirect reuse is permitted by the Water Supply Division of the TCEQ.

The water quality permitting process for water reuse projects is summarized in Table 4.40. The water reuse permitting process does not vary based on end use; therefore, domestic reuse and IR would follow the same permitting mechanisms.

Water Quantity

The lead agency in Texas from a water quantity permitting perspective is the Water Supply Division of the TCEQ (E. McDonald and J. Centeno, personal communication, 2013). Generally, there is no limit to the direct use of reclaimed water (M. Rochelle, personal communication, 2013). The Water Supply Division will only become involved in indirect reuse projects (K. Alexander, personal communication, 2013). Water quantity management approaches related to reclaimed water usage as managed through the TCEQ are described in Table 4.41.

Table 4.40: Summary of Reclaimed Water Quality Permitting in Texas

Step	Details
1	• A WWTP owner applies for a "210-Authorization" in addition to a NPDES permit from the ADEQ[1, 2] o "Provider" (if different than the "Producer") and "user" are included in a single authorization (no need for multiple authorizations)[3] o 210-Authorizations would state the proposed end uses
2	• The Water Quality Division of the TCEQ would review the application for the 210-Authorization o 30 Texas Administrative Code (TAC), Chapter 210 contains a list of acceptable uses[4] o Quality standards that must be met by the Producer and/or Provider are set by TCEQ o If the proposed use is pre-approved in Chapter 210, then approval would occur in timely fashion
3	• The TCEQ approves the reuse project and issues a 210-Authorization o Permit granted only when requirements of the TAC Chapter 210 are met o Discharge permit (NPDES) and 210-Authorization must be in place for a Producer or Provider to deliver reclaimed water o 210-Authorization holder must comply and ensure that the User (i.e. industry) complies with stipulations of the authorization

Notes:

[1] A WWTP must have a water quality discharge permit before applying for the reclaimed water authorization (J. Centeno, personal communication, 2013)

[2] It is common that the WWTP operator (as the Producer) will obtain the authorization (M. Rochelle, personal communication, 2013)

[3] The end user (i.e. industry) would approach the authorization holder for reclaimed water and enter into contract with them directly (M. Rochelle and J. Centeno, personal communication, 2013)

[4] The 30-TAC, Ch. 210 regulations are split between effluent originating from domestic waste treatment and wastes originating from industrial treatment (M. Rochelle, personal communication, 2013)

Table 4.41: Approaches to Water Quantity Management in Texas

Approach	Details
Term/Tenure Permits	• Term permits allow an end user to take advantage of another user's water right that is not being fully consumed • Limited time permit • The TCEQ must consider a WWTP discharge in the issuing of term permits
Adjudication Process	• If downstream users have become reliant on flow then a discharger would have to enter the Water Rights Adjudication Process if they wanted to divert flow • The discharger would amend the base water right to add a new "place of use" • "Water Rights Amendment" may stipulate a "minimum flow" or discharge from the facility depending on the water rights that may be affected • The quantity of discharge would be determined on a case by case basis

Water Rights

The *Doctrine of Prior Appropriation* underlies water rights legislation in Texas (M. Rochelle and E. McDonald, personal communication, 2013). Based on interviews with respondents (Appendix F1-F4), water rights in Texas take on the following characteristics:

- Wastewater is the property of the WWTP owner until it is discharged (M. Rochelle and E. McDonald, personal communication, 2013)
    - The TCEQ has an underlying assumption that when water is diverted for municipal purposes then it is considered fully consumed and is thus not considered as flow available for another user (K. Alexander, personal communication, 2013)
- Downstream dependency on WWTP discharge is only considered when a WWTP has discharged their flow to a river and wants to divert it again (K. Alexander, personal communication, 2013)
- Certain water right permits will state that quantity allotment is based on continual discharge from a certain WWTP and that if flow diminishes or stops, so too does the water right (K. Alexander, personal communication, 2013)
- Provision that reclaimed water must go to a "beneficial use" as stipulated in the Texas Water Code, Section 11.046 (M. Rochelle, personal communication, 2013)
- Alteration of "Purpose of Use" is needed if a discharger holds a municipal use surface water right and is approached by an industry for reclaimed water (M. Rochelle, personal communication, 2013)
    - The utility would have to amend their base water right to add a "Purpose of Use"

Particular water rights issues discussed by Texas respondents are summarized in Table 4.42.

Table 4.42: Specific Water Rights Topics of Interest in Texas

Topic	Response
Inter-basin Transfer	• Mainly occur with raw water and infrequently with reclaimed water • If raw water has been imported, it is exempt from any water right and can be consumed to extinction
Third-Party Security of Supply	• Provisions to ensure security with supply of reclaimed water are done through contractual arrangements and not through the TCEQ • If a reclaimed water source fails, an alternate (raw) water supply can be used

4.4.4 Commentary of IR System in Practice

This section includes feedback regarding the operation of Texas' water reuse program in practice. A summary of responses is presented in Tables 4.43 and 4.44.

Table 4.43: Efficiencies Cited Regarding the IR Program in Texas

Category	Comments
Management	• Reclaimed water is viewed positively by industry as a drought proof water supply and as a water conservation strategy • Legislation has backed studies of in stream flows for all major river basins. Information will guide water rights amendments • The Texas Water Development Board assists in funding water reuse initiatives under certain circumstances • Utilities collaborate to increase water supply in certain areas
Permit Process	• Support for reuse systems from regulators and the TCEQ enable progress and backing during projects • Authorizations are granted in three to four months

Table 4.44: Inefficiencies Cited Regarding the IR Program in Texas

Category	Comments
Management	• Industry acceptance can be difficult based on water quality concerns • There is a disconnect between Water Quality and Water Supply Divisions
Permit Process	• 210-Authorization does not include notice to third parties or "contest a case" hearing process

4.4.5 Respondent Recommendations

Recommendations made by Texas respondents regarding implementation and/or management of a recycled water program are summarized in Table 4.45.

Table 4.45: Recommendations from Texas Respondents for the Development of an IR Program

Category	Recommendation
Management	• Inclusion of a mechanism for public comment or "contest a case" provisions • Clear communication between entities and clear contractual agreements since industrial applications require more stringent water requirements
Permit Process	• No comments

4.4.6 Examples of IR in Practice

Respondents provided feedback on practical examples of IR practices in Texas. In particular, this consisted of feedback on specific resources used in practice. These include:

- *Texas Administrative Code, Title 30, Part 1, Chapter 210* (TCEQ 1997)
    - Outlines the reuse system in Texas
    - Relevance for regulators
- *Texas Administrative Code, Title 16, Part 1, Chapter 3, Rule 3.30* (TCEQ 2010)
    - Example of a memorandum of agreement between agencies
    - Relevance for regulators

Respondents did not recommend specific examples of IR projects in Texas.

4.5 Washington

4.5.1 Respondents

Several practitioners and regulators were contacted in the state of Washington. Not all individuals contacted were able to respond to the survey invitation. A comparison of the number of individuals contacted as compared to the actual number of participants is presented in Table 4.46.

Table 4.46: Washington Survey Participant Summary

Category	Contacted	Interviewed
Practitioner	2	1
Regulator - Quality	2	1
Regulator - Quantity	3	1
Regulator - Health	1	1
Sub-total	8	4

Washington respondents associated with each category are summarized in Table 4.47. Summarized transcripts from each of the interviews are provided in the appendix listed beside each corresponding participant in Table 4.47.

Table 4.47: Survey Respondents for Washington and Associated Appendices

Category	Respondent	Appendix
Practitioner	Fowler, K. Community Relations and Environmental Policy Director, LOTT Clean Water Alliance, Olympia, WA.	G1
Regulator (Quality)	Howie, D. Stormwater Engineer, Washington State Department of Ecology (DOE), Olympia, WA.	G2
Regulator (Quantity)	Gregory, G. Technical Unit Supervisor, Washington State Department of Ecology (DOE), Spokane, WA.	G3
Regulator (Health)	Lahmann, D. Supervisor, Washington Department of Health (DOH), Olympia, WA.	G4

4.5.2 IR Management

Washington respondents were questioned on various aspects of IR Management including permitting agencies, interagency communication, water sources, water reuse applications, and management of WWTPs within their state.

Permitting Agencies for IR

Permitting agencies cited as having involvement in the IR program in Washington include the Washington State Department of Ecology (DOE) and the Washington State Department of Health (DOH). Table 4.48 provides a list of these agencies with the key department and key responsibilities of the agency relative to water reuse projects.

Interagency Communication

Table 4.49 summarizes the various methods cited for interagency communication in Washington.

Water Source

Raw water sources consist of surface and groundwater with the following qualifications (K. Fowler and D. Howie, personal communication, 2013):

- Western Washington uses mainly surface water with Tacoma also having groundwater fields
- Olympia (west coast) uses solely groundwater
- Eastern Washington uses exclusively groundwater with the exception of users along Columbia River

Table 4.48: Washington State Agencies Cited as having Involvement in IR (Appendix G1-G4; USEPA 2012)

Agency	Department	Responsibilities and Operation
DOE	Water Quality Section	• Single "super agency" for permitting reclaimed water permits • Water quality considerations • Implement and enforce Washington Administrative Code (WAC)
DOE	Water Resources Section	• Concerned with water resources and water rights • Administer state's water resource rule: "The Water Supply Code" • Pass judgment on potential for "impairment" from an IR project
DOH	Wastewater Management Section	• Concerned with public health related to potable water/aquifers • Provides input on reclaimed water permits as needed • Provides feedback and guidance in rule making processes related to reclaimed water

Table 4.49: Methods for Enhancing Interagency Communication in Washington

Method	Details
Dedicated staff	• DOH has dedicated staff (two individuals) assigned to communicate and handle reclaimed water projects • Individuals will decide if the DOE will become involved in particular applications
Working group	• The Reclaimed Water Working Group is chaired by the DOE • DOH individuals are invited to regular meetings
Ad hoc Basis	• The DOE will contact the DOH if an application for a project presents potential public health concerns

State Reuse Applications Cited

Respondents noted that there is minimal IR in Washington State (K. Fowler and D. Howie, personal communication, 2013). Reuse applications cited by Washington respondents include the following:

- Golf course irrigation
- Power generation (cooling towers), no human contact
- Gravel washing (quarries)
- Glass manufacturing

- Aquifer storage and recovery (in winter)

Management of WWTPs

Washington WWTPs are owned and operated both privately and publically with the majority owned by municipalities, cities or counties (K. Fowler personal communication, 2013). There are approximately 30 reclaimed water facilities operating in Washington State (K. Fowler, personal communication, 2013).

4.5.3 Permitting Process Summary

Each of the respondents provided feedback on the reuse permitting process in Washington State. In particular, this topic included discussion on water quality, water quantity, and water rights, which are each discussed in the following subsections.

Water Quality

There is a moderately-defined process for reuse permitting in Washington State. State guideline for reclaimed water programs has been in place since 1997 (K. Fowler and D. Howie, personal communication, 2013). New rules have been drafted called the Washington Administrative Code (WAC) 173-219 (D. Lahmann, personal communication, 2013). WAC would potentially become official regulations and streamline current reuse permitting process (D. Lahmann and D. Howie, personal communication, 2013). Due to a moratorium on rule making imposed by Washington's Governor, this process is currently at a standstill and may not be finalized until 2014 (D. Howie, personal communication, 2013).

The Water Quality Section of the DOE is the state regulatory authority and lead agency for recycled water permitting in Washington with respect to environmental quality (K. Fowler, D. Howie and D. Lahmann, personal communication, 2013). Reclaimed water permits are issued jointly by the DOE and the DOH; however, the DOH has practical involvement on an "as need" basis (K. Fowler and D. Lahmann, personal communication, 2013).

The water quality permitting process for water reuse projects is summarized in Table 4.50. The water reuse permitting process does not vary based on end use; therefore, domestic reuse and IR would follow the same permitting mechanisms.

Water Quantity

The lead agency in Washington State from a water quantity permitting perspective is the Water Resources Section of the DOE, (G. Gregory and D. Howie, personal communication, 2013). Water quantity management approaches related to reclaimed water usage as managed through the DOE are described in Table 4.51.

Table 4.50: Summary of Reclaimed Water Quality Permitting in Washington

Step	Details
1	• A WWTP owner applies for a "Reclaimed Water Permit" (this is in addition to the NPDES permit from the DOE that should be in place)[1, 2] o Guidance for this process based on the 1997 Water Reclamation and Reuse Standards that functions as a guideline (not a regulation) o Initiation of application to provide reclaimed water allows review by the Water Quality (with potential for DOH review) and Water Resources Sections
2	• The Water Quality Section of the DOE reviews applications for Reclaimed Water Permits o In the absence of the WAC, emphasis is put on other legislation to place limits on quality and treatment technology (i.e. The Clean Water Act)[3] o If the proposed project has the potential to impact potable water or potable water aquifers, then the DOH would be involved in the permitting process[4]
3	• The DOE approves the reuse project and issues a Reclaimed Water Permit o Permit granted only when requirements of the permit are met o Water Reclamation and Reuse Standards are not legally binding and only have enforcement power when permit is administered

Notes:

[1] A WWTP will have an NPDES permit prior to applying for Reclaimed Water Permit (D. Lahmann, personal communication, 2013)

[2] An industry or end user seeking reclaimed water would first approach a WWTP (G. Gregory, personal communication, 2013)

[3] Absence of a WAC provides a challenge in approving and streamlining the approval process (D. Howie, personal communication, 2013)

[4] The DOH has internal checklists for permit reviews that confirm provisions in a project related to reliability assurances such as cross connection control, alarms, duplicate disinfection etc. (D. Lahmann, personal communication, 2013)

Table 4.51: Approaches to Water Quantity Management in Washington

Approach	Details
Determination of Impairment	• Review of Reclaimed Water Permit to determine if anyone will be impaired by diversion
Aquifer Storage and Recovery	• Pumping of reclaimed water into aquifers in summer to use in winter during season lows
"Clean Flowing Waters" Motto	• Effluent waters being reclaimed instead of being discharged into a steam may provide a net benefit

Water Rights

The *Doctrine of Prior Appropriation* underlies water rights legislation in Washington State (G. Gregory and K. Fowler, personal communication, 2013). Based on interviews with respondents (Appendix G1-G4), water rights in Washington State take on the following characteristics:

- A WWTP has exclusive rights to the water according to state statues (K. Fowler and G. Gregory, personal communication, 2013)
- According to the *Growing Communities Doctrine* (G. Gregory, personal communication, 2013), municipal use of water is whatever a municipality chooses to use water for
- Water rights are negated for WWTPs that discharge into Puget Sound or Columbia River because a reduction in effluent discharge is seen as a net benefit due to the minimal water flow in Puget Sound and the Columbia River (G. Gregory, personal communication, 2013)
- The WAC will devote a section to water rights impairment

Particular water rights issues discussed by Washington`s respondents are summarized in Table 4.52.

Table 4.52: Specific Water Rights Topics of Interest in Washington

Topic	Response
Inter-basin Transfer	• Not currently an issue in Washington State • Cost prohibitive due to expense of purple (reclaimed water) piping
Third-Party Security of Supply	• Provisions to ensure security with supply of reclaimed water are done through contractual arrangements and not through the DOE • The DOE approves alternate (raw) water supply if reclaimed water source fails; however, increases costs due to need for dual piping
Return Flow Stipulation	• Concern for waters not returning to a stream (i.e. a decrease in flow) are minimized by the concern for water quality impacts

4.5.4 Commentary of IR System in Practice

This section includes feedback regarding the operation of Washington's water reuse program in practice. A summary of responses is presented in Tables 4.53 and 4.54.

Table 4.53: Efficiencies Cited Regarding the IR Program in Washington

Category	Comments
Management	• Utilities may conduct public involvement work when planning new facilities • Local jurisdictions offer financial incentives for water reuse projects (e.g. City of Olympia) • Reclaimed Water Working Group helps communication and consistency between offices • Reclaimed water projects for beneficial use has backing of the DOE • One agency approach with the DOE
Permit Process	• Water Resources Section allows applicants to move to front of approval line up if they pay a third party contractor to conduct the review; otherwise, they wait their turn • Writing health considerations into law makes input from the DOH less critical • If someone is "impaired" by a proponents project, proponent can approach them individually to reach a resolution

Table 4.54: Inefficiencies Cited Regarding the IR Program in Washington

Category	Comments
Management	• Industry acceptance can be difficult based on water quality concerns • Inter-department disconnect (between water quality & water supply) • Promoting reuse system has natural impediments such as cost and seasonality • There are no state wide incentives for practicing reuse • Economic downturn has slowed the process
Permit Process	• Rules not responsive to innovative reclaimed water proposals • Regulators need to review applications for reuse with a "system wide" perspective • 210-Authorization does not include notice to third parties or "contest a case" hearing process

4.5.5 Respondent Recommendations

Recommendations made by Washington respondents regarding implementation and/or management of a recycled water program are summarized in Table 4.55.

Table 4.55: Recommendations from Washington Respondents for the Development of an IR Program

Category	Recommendation
Management	• Encourage public involvement and education with respect to reclaimed water projects • Define roles of departments such that those with minimal involvement (DOH) are not eliminated from the process completely • Involve DOH to help communication with DOE on reuse projects • Need legislation to provide the push: Revised Code of Washington (RCW), authorizing water reclamation, gives a preamble stating importance of a reuse system
Permit Process	• Develop standards first before incorporating a water reclamation and reuse program • Use a system wide approach to review of applications for approval • Have health considerations included in the rule so DOH involvement is less critical

4.5.6 Examples of IR in Practice

Respondents provided feedback on practical examples of IR practices in Washington State. In particular, this consisted of feedback on specific documents or resources used in practice and feedback on actual IR projects in Washington State. A summary is provided in Tables 4.56 and 4.57.

Table 4.56: Resources Recommended by Washington Respondents

Item	Document	Details	Relevance for:
Website and Example Permit	DOE (2013a)	*Permit and Reporting Information System (PARIS)* • Links to active permits for facilities. Example: Cardinal Float Glass, Winlock, WA.	Regulator
Website	DOE (2013b)	*Reclaimed Water Permitting* • Includes, application forms, water rights provisions, permit writers manual, and a reclaimed water resources guidance information	Practitioner and Regulator
Website	DOE (2013c)	*Reclaimed Water Use Rule Development Process* • Provides background on rule making process in Washington	Regulator
Standards	DOH and DOE (1997)	*Water Reclamation and Reuse Standards* • Current standards used in permitting and management of reclaimed water projects	Regulator
Draft Rule	DOE (2010)	*Reclaimed Water, Chapter 173-219 WAC* • Example of a draft rule for a reclaimed water program	Regulator
Legislation	WSL (2013)	*Chapter 90.46 RCW, Reclaimed Water Use* • Revised Code of Washington (RCW) is what directed the DOE to develop rules and set out some of the requirements that should be incorporated	Regulator
Memo to DOE	DOH (2013)	*Internal letter Re: DOH Feedback for Modification of WAC Draft Rule* • Internal letter from the DOH to the DOE communicating recommended changes to the WAC	Regulator

Table 4.57: Examples of IR in Practice as Cited by Washington Respondents

Category	Description
Utility	• King County o Supply 30 different affiliated cities, sewer districts, and other entities. o Some IR projects • Kitsap County o Sewer districts supplying reclaimed water with the water district being the user o Example of inter-local agreements • LOTT Clean Water Alliance o Affiliation of four government partners (Lacey, Olympia, Tumwater, Thurston County) o Two reclaimed water plants with plans to build satellite plants and groundwater infiltration basins
Industry	• Cardinal Float Glass, Winlock, WA. o Example of an IR permit

4.6 Colorado

4.6.1 Respondents

Several practitioners and regulators were contacted in the state of Colorado. Not all individuals contacted were able to respond to the survey invitation. A comparison of the number of individuals contacted as compared to the actual number of participants is presented in Table 4.58.

Table 4.58: Colorado Survey Participant Summary

Category	Contacted	Interviewed
Practitioner	4	2
Regulator – Quality/Health	2	1
Regulator - Quantity	1	1
Sub-total	7	4

Colorado respondents associated with each category are summarized in Table 4.59. Summarized transcripts from each of the interviews are provided in the appendix listed beside each corresponding participant in Table 4.59.

4.6.2 IR Management

Colorado respondents were questioned on various aspects of IR Management including permitting agencies, interagency communication, water sources, water reuse applications, and management of WWTPs within their state.

Table 4.59: Survey Respondents for Colorado and Associated Appendices

Category	Respondent	Appendix
Practitioner	Patrick, K. Principal, Water Law, Aspen, CO.	H1
Practitioner	Murray, J. Recycled Water Program Manager, Denver Water, Denver, CO.	H2
Regulator (Quality)	Lemonds, E. Permit Writer, Colorado Department of Public Health and Environment (CDPHE), Denver, CO.	H3
Regulator (Quantity)	Rein, K. Deputy State Engineer, Colorado Division of Water Resources (DWR), Denver, CO.	H4

Permitting Agencies for IR

Permitting agencies involved in water reuse/IR, as cited by Colorado respondents include the Colorado Department of Public Health (CDPHE) and the Division of Water Resources (DWR). Table 4.60 provides a list of these agencies with the key department and key responsibilities of the agency relative to water reuse projects.

Table 4.60: Colorado State Agencies Cited as having Involvement in IR (Appendix H1-H4; USEPA 2012)

Agency	Department	Responsibilities and Operation
CDPHE	Water Quality Control Division	• Water quality permitting agency for treaters and end users • Issues Notices of Authorization for use of reclaimed water • Oversees discharge permits under federal Clean Water Act
DWR	Water Resources Section	• Administrative agency charged with implementing decrees of Water Court • Administer diversions • Administers water rights and protects injury of water rights • Assesses water to be deemed reusable

The Colorado Oil and Gas Conservation Commission (COGCC) is the oil and gas regulator in the State of Colorado (K. Patrick, personal communication, 2013). This entity was contacted and a discussion was carried out with an Environmental Manager with COGCC. Based on this discussion and interviews with Colorado survey respondents, the following was determined:

- The COGCC has internal rules entitled 907 Rules, Management of E&P (Exploration and Production) Waste promoting water reuse in the oil and gas industry (J. Milne, personal communication, 2013)

- The COGCC is considered an industrial end user in and of itself with reclaimed water being delivered to holding tanks or other suitable locations (J. Milne, personal communication, 2013)

Based on these findings, it was determined that the COGCC was outside the scope of this research. An informal interview was carried out (Appendix H5); however, further investigation of COGCC was discontinued.

Interagency Communication

Table 4.61 summarizes the various methods cited for interagency communication in Colorado.

Table 4.61: Methods for Enhancing Interagency Communication in Colorado

Method	Details
Ad hoc Basis	• Correspondence in matters where right to reuse a water may be in question
Permitting	• A letter from DWR stating that a permittee has a right to use water is required before approval can be granted by the CDPHE

Water Source

Raw water sources mainly consist of surface water and groundwater (K. Rein, personal communication, 2013). Groundwater is becoming less useable in Colorado due to increasing natural metal concentrations of arsenic and selenium (E. Lemonds, personal communication, 2013). As such, surface water is becoming more in demand.

State Reuse Applications Cited

Reuse applications cited by Colorado respondents include the following:

- Golf course irrigation
- Co-generation, coal-gasification
- Oil and Gas sector/hydro-fracking

Management of WWTPs

Colorado WWTPs are owned and operated both privately and publically with the majority owned by municipalities, cities or counties (J. Murray, personal communication, 2013). The majority of WWTPs conduct both wastewater treatment and water reclamation (J. Murray, personal communication, 2013).

4.6.3 Permitting Process Summary

Each of the respondents provided feedback on reuse permitting in Colorado. In particular, this topic included discussion on water quality, water quantity, and water rights, which are each discussed in the following subsections.

Water Quality

There is a well-defined process for reuse permitting in Colorado. The Water Quality Control Division of the CDPHE is the state regulatory authority and lead agency for recycled water permitting in Colorado with respect to environmental quality and public health (K. Patrick, J. Murray and E. Lemonds, personal communication, 2013). The CDPHE issues a Notice of Authorization (NOA) to both treaters and users through separate permits (E. Lemonds, personal communication, 2013). Both the treater and the end user require a NOA before reclaimed water can be delivered (J. Murray, personal communication, 2013).

The water quality permitting process for water reuse projects is summarized in Table 4.62. Water reuse permitting process does not vary based on end use; therefore, domestic reuse and IR would follow the same permitting mechanisms.

Water Quantity

The lead agency in Colorado from a water quantity permitting perspective is the Water Court. The Water Court functions through the Office of the State Engineer also known as the Division of Water Resources (DWR) (K. Patrick and K. Rein, personal communication, 2013). In Colorado, there is no defined process or protocol for water quantity aspects of reuse projects since directives for these projects stem from statutory and case law (K. Rein, personal communication, 2013). Based on what is called a permitting or decree program, which is implemented by the Water Court, water quantity considerations are handled as follows (K. Patrick and K. Rein, personal communication, 2013):

Table 4.62: Summary of Reclaimed Water Quality Permitting in Colorado

Step	Details
1	• A WWTP owner applies to the Water Quality Control Division[1] of the CDPHE for a Treater-"Notice of Authorization (NOA)" o NOA process is initiated when the treater completes a "Letter of Intent" which is effectively an application to the CDPHE[2] o The Letter of Intent would include specifications on treatment processes and information on how the treater's program will help end users in their ability to comply with Regulation 84 o The Letter of Intent must include a letter from DWR stating that they have a right to use the water for reuse
2	• The CDPHE reviews Letter of Intent and grants a Treater-NOA/permit to the treater within 30 days of reception of application o If there are issues with the treaters' management strategies stated in the Letter of Intent, they would have 30 days to resolve any problems o Once a WWTP obtains a Treater-NOA then they are authorized to deliver reclaimed water to an end user[3]
3	• If an end user or customer wishes to obtain reclaimed water from a treater, then they must first approach the treater to obtain a User-NOA[4] o The treater would provide the potential end user with a copy of Regulation 84 and an application, or Letter of Intent o The end user will document in the letter what they intend to use the reclaimed water for and what their best management practices will be o The treater reviews the user's Letter of Intent to ensure that it fits with the treater's program o Once reviewed and approved by the treater, it is forwarded to the CDPHE with a request to amend their Treater-NOA/permit
4	• The CDPHE approves the User-NOA and amends the Treater-NOA o The CDPHE has 30 days to review the letter and reply with questions o Once approved, the CDPHE will send a copy of the permit (NOA) to both the treater and the user o The NOA is specific to a particular site and a particular end use

Notes:

[1] The process for permitting is mandated through Regulation 84 (J. Murray, personal communication, 2013)

[2] The letter of intent is also referred to as a "User Plant to Comply" and is similar to a questionnaire (E. Lemonds, personal communication, 2013)

[3] As end users are added, the WWTP does not need additional NOAs but must get their original NOA amended (E. Lemonds, personal communication, 2013)

[4] User-NOA is a separate permit that allows an end user to obtain reclaimed water (J. Murray, personal communication, 2013)

- If a proponent applied to divert water from a WWTP, the DWR would inquire what the "source" of the water was so as to determine if it is reusable. For example:
    - Unless it is otherwise allowed in a water right through a decree, water can only be used once and discharged for appropriation by downstream rights holders, or
    - If water is imported from another basin or from deep groundwater aquifers then it can be reused and successively used to extinction
- A proponent seeking to obtain water would retain a water lawyer to offer guidance as to provisions of existing water rights or how they may proceed to obtain a water right
    - If necessary, the proponent would file a new water court case
- There are seven Water Courts that correspond to the seven water divisions and major rivers in Colorado
    - Judges and referees have expertise on water issues and only hear water cases
    - A referee process proceeds court hearings if the parties involved can reach an understanding

Water Rights

In Colorado, the water quantity system is based on the *Doctrine of Prior Appropriation* (K. Patrick and K. Rein, personal communication, 2013). Based on interviews with respondents (Appendix H1-H4), water rights in Colorado take on the following characteristics:

- A WWTP does not have the exclusive right to the water it treats (K. Rein, personal communication, 2013)
- Individuals seeking a water right do so through the analysis and decision of the Water Court (K. Patrick, personal communication, 2013)
- Case law has established which waters are deemed "reusable" so the Water Court process may not always be necessary (J. Murray, personal communication, 2013)

Particular water rights issues discussed by Colorado respondents are summarized in Table 4.63.

Table 4.63: Specific Water Rights Topics of Interest in Colorado

Topic	Response
Inter-basin Transfer	• Water appropriated in the state from a particular basin is only for use in that basin
Return Flow Stipulation	• Water can only be used once and must be discharged unless it is considered foreign water or there is provision in the base water right

4.6.4 Commentary of IR System in Practice

This section includes feedback regarding the operation of Colorado's water reuse program in practice. A summary of responses is presented in Tables 4.64 and 4.65.

Table 4.64: Efficiencies Cited Regarding the IR Program in Colorado

Category	Comments
Management	• Water shortages are driving the water reuse market • Industrial customers provide consistent demand • Specific terminology regarding Use, Reuse, and Successive Use provides clarification to stakeholders • Linking the potential for reuse to the origin (or source) of the water provides opportunity for growth in the reuse industry
Permit Process	• Quantity programs are well established

Table 4.65: Inefficiencies Cited Regarding the IR Program in Colorado

Category	Comments
Management	• Concern that IR will negatively impact downstream users • Reuse of greywater could impact WWTP yields for reclaimed water usage and reclaimed water plants
Permit Process	• Water court system can be burdensome • Requirements for uses/applications of water are too prescriptive and should include flexibility • Approval of new applications is burdensome • Permit stipulations are present in both NOA and Regulation 84 o NOAs never expire but Regulation 84 changes o Differences in permits and regulations causes confusion • There is no renewal process in place for NOAs that are submitted • Insufficient resources are allocated to adequately operate the reuse system

4.6.5 Respondent Recommendations

Recommendations made by Colorado respondents regarding implementation and/or management of a recycled water program are summarized in Table 4.66.

Table 4.66: Recommendations from Colorado Respondents for the Development of an IR Program

Category	Recommendation
Management	• Affiliation to an association will increase communication between industry and practitioners (e.g. WateReuse Association) • Colorado should be used as a template for development of a reclaimed water program • Utility companies can approach State Legislature to make a statement in law regarding importance of water reuse
Permit Process	• In development of uses/applications for reclaimed water, broad categories and descriptions should be used for flexibility • Potential to remove state regulator from permitting process and grant authority for permitting to WWTP (similar to an MS4 program that allows cities to manage their own stormwater rules) • Do not implement a reuse program without resources to operate it

4.6.6 Examples of IR in Practice

Respondents provided feedback on practical examples of IR practices in Colorado. In particular, this consisted of feedback on specific documents or resources used in practice. These include:

- *Regulation NO. 84 Reclaimed Water Control Regulation* (CDPHE 2013a)
    - Reclaimed water guidelines provide a template for other jurisdictions
    - Defines which waters are reusable and uses/applications of reclaimed water
    - Relevant to practitioners and regulators
- *User Plan to Comply for the use of Reclaimed Water* (Denver Museum 2012)
    - Example Letter of Intent filled out by Denver Museum of Nature and Science
    - Relevant to practitioners and regulators
- *Users Notice of Authorization for the Use of Reclaimed Water* (CDPHE 2013b)
    - Example NOA permit for use of reclaimed water
    - Relevant to practitioners and regulators
- *900 Series Exploration and Production of (E & P) Waste Management* (COGCC 2011)
    - Section 907(a) 3 provides encouragement for water reuse and recycling and also states that a management plan must be submitted when proposing plans for beneficial reuse.

Feedback on IR projects in Colorado is summarized in Table 4.67.

Table 4.67: Examples of IR in Practice as Cited by Colorado Respondents

Category	Description
Utility	• Denver Water o Supply reclaimed water to approximately 80 customers • City of Fort Luptin, CO. o City is seeking to provide reclaimed water for oil and gas purposes • City of Greely, CO. o Various water sources in their portfolio with some designated as foreign water o Freely able to reuse water without consult of DWR since it is intrinsic in the water right
Industry	• Xcel Energy, Denver, CO. o Provided with 2,600 acre/feet for cooling tower use

4.7 Oregon

4.7.1 Respondents

Several practitioners and regulators were contacted in the state of Oregon. Not all individuals contacted were able to respond to the survey invitation. A comparison of the number of individuals contacted as compared to the actual number of participants is presented in Table 4.68.

Table 4.68: Oregon Survey Participant Summary

Category	Contacted	Interviewed
Practitioner	3	1
Regulator - Quality	1	1
Regulator - Quantity	2	2
Regulator - Health	1	1
Sub-total	7	5

Oregon respondents associated with each category are summarized in Table 4.69. Summarized transcripts from each of the interviews are provided in the appendix listed beside each corresponding participant in Table 4.69.

Table 4.69: Survey Respondents for Oregon and Associated Appendices

Category	Respondent	Appendix
Practitioner	Glick, R. Partner, Davis Wright Tremaine LLP, Portland, OR.	I1
Regulator (Quality)	Doughten, R. Program Coordinator, Oregon Department of Environmental Quality (DEQ), Portland, OR.	I2
Regulator (Quantity)	French, D. Water Right Services Division Administrator, Oregon Water Resources Department (WRD), Salem, OR.	I3
	Jaramillo, L. Water Management and Conservation Analyst, Oregon Water Resources Department (WRD), Salem, OR.	
Regulator (Health)	Leland, D. Program Manager, Oregon Health Authority (OHA), Portland, OR.	I4

4.7.2 IR Management

Oregon respondents were questioned on various aspects of IR Management including permitting agencies, interagency communication, water sources, water reuse applications, and management of WWTPs within their state.

Permitting Agencies for IR

Permitting agencies cited as having involvement in the IR program in Oregon include the Oregon Department of Environmental Quality (DEQ), Oregon Water Resources Department (WRD) and the Oregon Health Authority (OHA). Table 4.70 provides a list of these agencies with the key department and key responsibilities of the agency relative to water reuse projects.

Interagency Communication

Table 4.71 summarizes the various methods cited for interagency communication in Oregon.

Table 4.70: Oregon State Agencies Cited as having Involvement in IR (Appendix I1-I4; USEPA 2012)

Agency	Department	Responsibilities and Operation
DEQ	Biosolids and Water Reuse	• Issues reuse permits • Involved in treatment, reuse activities and health and safety
WRD	Water Rights Services Division	• Regulate water use • Concerned with water rights and distribution of water rights, as well as water resources such as impact on stream flows etc.
OHA	Drinking Water Program	• Minimal involvement in Oregon reuse program • Involved in specific applications only (i.e. irrigation) • Consultant role on an as need basis

Table 4.71: Methods for Enhancing Interagency Communication in Oregon

Method	Details
Ad hoc Basis	• The DEQ will contact the OHA if an application for a project presents potential public health concerns as in with irrigation • No formalized process
Documents	• Working documents, such as registration forms, may state what capacities of each department are
Equal access database	• The WRD and the DEQ can access each agencies databases for information

Water Source

Raw water sources consist of surface and groundwater (R. Doughten, personal communication, 2013). Two-thirds of the state is high desert with the exception of the Willamette Valley (D. French and L. Jaramillo, personal communication, 2013).

State Reuse Applications Cited

Reuse applications cited by Oregon respondents include the following:

- Approximately 95% irrigation
    - Golf course and agricultural
- Aggregate operations (rock crushing/concrete)
- Power companies (i.e. cooling)

Management of WWTPs

Oregon's WWTPs are mainly owned publically by municipalities with some small private utilities (R. Glick, personal communication, 2013). Approximately 30% of the treatment facilities in Oregon practice reuse (R. Doughten, personal communication, 2013).

4.7.3 Permitting Process Summary

Each of the respondents provided feedback on the reuse permitting process in Oregon. In particular, this topic included discussion on water quality, water quantity, and water rights, which are each discussed in the following subsections.

Water Quality

There is a moderately-defined reuse program for recycled water in Oregon (R. Doughten, personal communication, 2013). However, the process for reuse permitting is not a settled program (R. Glick, personal communication, 2013). The Biosolids and Water Reuse Department of the DEQ is the state regulatory authority and lead agency for recycled water permitting in Oregon with respect to environmental quality (R. Doughten and R. Glick, 2013). The OHA has minimal involvement in reuse permitting applications except in terms of irrigation with lower grade waters (D. Leland, personal communication, 2013).

The water quality permitting process for water reuse projects is summarized in Table 4.72. Water reuse permitting process does not vary based on end use; therefore, domestic reuse and IR would follow the same permitting mechanisms.

Water Quantity

The lead agency in Oregon from a water quantity permitting perspective is the WRD (R. Doughten and R. Glick, personal communication, 2013). End user approaches the WRD seeking permission to use reclaimed water in the form of a registration process (D. French and L. Jaramillo, personal communication, 2013). Water quantity management approaches related to reclaimed water usage and managed through the DEQ are described in Table 4.73.

Table 4.72: Summary of Reclaimed Water Quality Permitting in Oregon

Step	Details
1	• A WWTP owner approaches the DEQ with proposed application (given in conjunction with NPDES permit)
2	• The Biosolids and Water Reuse Department of the DEQ reviews the application with the proponent o The review process is outlined in Administrative Rule o If the proposed use is specified in the Administrative Rules (Division 55) then the permitting process is straight forward[1] o If not, the permitting process will require more information to ensure there are no public health or environmental impacts[2] o Success of the application would be dependent on the level of reclaimed water treatment[3] o Depending on the level of treatment, the OHA may become involved[4]
3	• Approval of reuse project by the DEQ o The permit would instruct the treatment plant as to what they must do to provide recycled water to a customer for reuse o The permit holder (i.e. WWTP) must write a "Recycled Water Use Plan" upon receiving permit[5]

Notes:

[1] List of approved uses is limited (R. Doughten, personal communication, 2013)

[2] Information would include: background (where has this use been practiced), what public health controls would be in place, and environmental considerations (R. Doughten, personal communication, 2013)

[3] Four classes of water quality are permitted to be reused (A, B, C and D). (D. Leland and R. Doughten, personal communication, 2013)

[4] The OHA is concerned with class C and D waters and irrigation practices. The OHA may permit certain uses: e.g. in small remote municipalities, proponents may be permitted to irrigate with non-disinfected water in pasture lands with fields (R. Doughten, personal communication, 2013)

[5] Recycled Water Plan would outline how the end user will meet the requirements of the permit and mitigate health concerns (for the OHA) if using class C or D waters (R. Doughten, personal communication, 2013)

Table 4.73: Approaches to Water Quantity Management in Oregon

Approach	Details
Registration	• In addition to the DEQ process, the proponent must file with the WRD and complete a Registration of Recycled Water Use • The end user seeks permission to use reclaimed water • Registration allows the WRD to manage water quantity and rights component of project
Percentage flow	• If diversion from a stream is >50% of the total stream flow then the WRD will notify downstream users of change • Downstream users are given first preference for use of reclaimed water at their own expense
Assessment of Impact	• In some cases, a diversion of flow from a river may increase the health of a stream

Water Rights

The *Doctrine of Prior Appropriation* underlies water rights legislation in Oregon (G. Gregory and K. Fowler, personal communication, 2013). Based on interviews with respondents (Appendix I1-I4), the water rights in Oregon take on the following characteristics:

- Once a WWTP treats water, it is theirs to control and sell (R. Doughten and R. Glick, personal communication, 2013)
    - If a city owns base water rights for a potable system and the WWTP then the WWTP has the right to reuse that water
    - Reuse in urban activities is not challenged by the WRD since water right belongs to the city and use is still occurring in the city (R. Doughten, personal communication, 2013)
    - Examples where this scenario may become complicated are given in Appendix I1, Question 2c (R. Glick, personal communication, 2013)
- The Water Conservation Statute (R. Glick, personal communication, 2013) states that if an entity becomes more efficient, then they have the ability to use 75% of water for whatever is consistent with their water right and the remaining 25% must be returned to stream

Particular water rights issues discussed by Oregon respondents are summarized in Table 4.74.

Table 4.74: Specific Water Rights Topics of Interest in Oregon

Topic	Response
Inter-basin Transfer	• Not currently an issue so no processes have been developed
Third-Party Security of Supply	• Security of supply is based on contractual agreement between utility customer

4.7.4 Commentary of IR System in Practice

This section includes feedback regarding the operation of Oregon's water reuse program in practice. A summary of responses is presented in Tables 4.75 and 4.76.

Table 4.75: Efficiencies Cited Regarding the IR Program in Oregon

Category	Comments
Management	• Every few years, law requires that streams be evaluated for quality and a list of impaired streams is generated; from this, TMDLs are generated and discharge permits are adjusted accordingly • Internal Management Directives (IMDs) for recycled water use offer guidance for permit writers and applicants
Permit Process	• There is a legal framework and process that works but it is in its infancy

Table 4.76: Inefficiencies Cited Regarding the IR Program in Oregon

Category	Comments
Management	• No comments
Permit Process	• Multiple agencies make communication challenging

4.7.5 Respondent Recommendations

Recommendations made by Oregon respondents regarding implementation and/or management of a recycled water program are summarized in Table 4.77.

Table 4.77: Recommendations from Oregon Respondents for the Development of an IR Program

Category	Recommendation
Management	• Look to the Washington State's one agency system as a template • Single agency managing water quantity and quality is more efficient • Revisit how Prior Appropriation operates so that "conservation of water" and "lack of use" is rewarded more than "use of water" • Approach potential end users adjacent to WWTPs (e.g. golf courses) once government oversight system is developed and tested • Incorporate state grants to conduct feasibility studies on water reuse • Develop Internal Management Directives to assist permit writers
Permit Process	• Integrate water quality permitting with water quantity system to ensure the best level of protection

4.7.6 Examples of IR in Practice

Respondents provided feedback on practical examples of IR practices in Oregon. In particular, this consisted of feedback on specific documents or resources used in practice and feedback on actual IR projects in Oregon. A summary is provided in Tables 4.78 and 4.79.

Table 4.78: Resources Recommended by Oregon Respondents

Item	Document	Details	Relevance for:
Permit Template	DEQ (2013)	*National Pollutant Discharge Elimination System Waste Discharge Permit Template* • Sample permit template including conditions for recycled water use	Practitioner and Regulator
NPDES permit	DEQ (2012b)	*NPDES Waste Discharge Permit, Nehalem Bay Wastewater Agency* • Example of appropriate operating conditions for a WWTP	Practitioner and Regulator
End user plan	Kennedy / Jenks (2012)	*Recycled Water Use Plan, Nehalem Bay Wastewater Agency* • Companion document to the *NPDES Waste Discharge Permit* providing an example of management plans that a WWTP must have in place to discharge reclaimed water	Practitioner and Regulator
Report/Fact Sheet	DEQ (2012a)	*NPDES Permit Evaluation Report and Fact Sheet, Nehalem Bay Wastewater Agency* • Example communication tool to provide information and education to the public	Practitioner and Regulator
Administrative Rules	DEQ (2008a)	*Oregon Administrative Rules (OAR) 340, Division 55-Recycled Water Use* • Rules for reclaimed water use in Oregon • policy and uses of water based on class of treatment	Regulator
Internal Directive	DEQ (2009a)	*Internal Management Directive – Implementing Oregon's Recycled Water Use Rules* • Overview of system in Oregon: rules overview, communication, permitting	Regulator
Form	DEQ (2009b)	*Recycled Water Use Plan Summary* • Filled out by permit holder to ensure that end user will comply with DEQ permit	Regulator
Recycled Water Use Chart	DEQ (2008b)	*Recycled Water Beneficial Purposes* • Example of classes of water with corresponding approved uses	Regulator
Registration Form	WRD (1996)	*Registration of Reclaimed Municipal Waste Use* • Registration of reclaimed water use document to WRD	Regulator
Registration permit	WRD (2013)	*Registration of Reclaimed Municipal Water Use: LNG Development Company* • Example registration form that would be submitted by an end user to WRD	Practitioner and Regulator

Table 4.79: Examples of IR in Practice as Cited by Oregon Respondents

Category	Description
Utility	• Clean Water Services, Hillsboro, OR. o Wastewater and storm water management utility in Washington County o Supplier of reclaimed water • Nehalem Bay Wastewater Agency, Nehalem, OR. o Supplier of reclaimed water
Industry	• LNG Development Company, Warrenton, OR. o Proposed project for delivery of reclaimed water to a LNG facility for cooling water and construction

CHAPTER 5 DISCUSSION

5.1 Respondents

The method of approach that was chosen for each US state/jurisdiction included an attempted interview with a practitioner, regulator of water quality, a regulator of water quantity, and a regulator of health (if applicable) with respect to recycled water. As such, average total number of respondents for each state would consist of four categories of professionals including one practitioner and three regulators. A summary of individuals contacted vs. respondents for all of jurisdictions surveyed is presented in Table 5.1.

Table 5.1: Summary of Individuals Contacted vs. Interviewed

Jurisdiction	Contacted	Interviewed
California subtotal (Table 4.1)	8	7
Arizona subtotal (Table 4.14)	6	4
Florida subtotal (Table 4.25)	8	4
Texas subtotal (Table 4.37)	9	4
Washington subtotal (Table 4.46)	8	4
Colorado subtotal (Table 4.58)	7	4
Oregon subtotal (Table 4.68)	7	5
Subtotal	53	32

As can be seen in Table 5.1, the proposed target number of four respondents per jurisdiction did not hold true. Factors such as further divisions within departments (e.g. California), health department that was not directly involved in the reuse program (e.g. Arizona, Florida, Texas), or referrals to other professionals led to variations in the total number interviewed for each jurisdiction.

5.1.1 California

Based on interviews conducted with California respondents, as summarized in Section 4.1, a representative coverage of the reuse industry in that jurisdiction was accomplished. Investigation of the state of California resulted in seven interviews in total with two interviews per category except in the case of the health department that consisted of one interview (Table 5.1 and Table 4.1).

California has a comparatively complex system with divisions within departments that did not conform to the assumed organizational structure. Thus, to capture a representative of each department/division in their organizational structure, an increased number of respondents were necessary. For example, Table 4.2 shows this added complexity in that the SWRCB oversees the

RWQCB. Both entities are involved in water quality considerations of reclaimed water while possessing different functions. Due to the fact that assessing functionality of a particular jurisdiction's reuse system was the objective of this research, additional interviews were deemed necessary in California.

Another cause for variation in the number of respondents, as seen in Table 4.1 with two practitioners being presented with the interview, is because this particular interview was conducted simultaneously via conference call (Table 4.2; Appendix C1).

5.1.2 Arizona

A total of four interviews were conducted in Arizona with all applicable categories being represented (Table 5.1). Observation of Table 4.14 reveals that two respondents were interviewed in the Regulator-Quality category. Interviewing Arizona's regulator for quality began with attempts to contact the Associate Director who had been recommended by another respondent (T. Thomure, personal communication, 2013). The Associate Director (Mr. Graf) recommended an interview of the ADEQ's Environmental Program Specialist (M. Mullins). After conducting the interview with M. Mullins, certain questions arose that could not be answered and thus C. Graff was eventually contacted and interviewed resulting in two interviews for one category.

Since the health department in Arizona is not directly related to the reuse program, it was not included in the investigative survey (T. Thomure and C. Graff, personal communication, 2013).

5.1.3 Florida

A total of four interviews were conducted in Florida with all applicable categories being represented (Table 5.1). Two respondents were interviewed in terms of the Regulator-Quality category due to the division in roles and responsibilities that was evident upon interviewing Florida respondents (Table 4.26; Appendix E1-E4).

Based on the recommendation of a practitioner interviewed (A. Elorfi), the Environmental Manager (J. Squitieri) was questioned due to his involvement in permitting and oversight of reuse facilities and their practice. Through the course of the interview, it was mentioned that the DEP in Florida has, within the quality department, a Reuse Coordinator who is not closely involved in the permitting process (J. Squitieri, personal communication, 2013). The Reuse Coordinator role was described as one that provides an overseer function within the reuse program and across the various DEP offices in the State of Florida (S. Speas-Frost, personal communication, 2013). While this position is not involved in the practice of reuse in a practical sense, it was seen as having importance in understanding complexities of the reuse program and interagency functionality in Florida.

Since the health department in Florida is not directly related to the reuse program, it was not included in the investigative survey (J. Squitieri and S. Speas-Frost, personal communication, 2013).

5.1.4 Texas

A total of four interviews were conducted in the State of Texas, with all applicable categories being represented (Table 5.1). Two respondents were interviewed in the Practitioner category based on recommendation of the initial respondent (M. Rochelle, personal communication, 2013; Table 4.37).

M. Rochelle (personal communication, 2013), who is a solicitor involved in water reuse projects and chair of the Legislative committee (WateReuse Association), recommended an additional practitioner who was heavily involved in water reuse projects (E. McDonald). Based on the level of experience of the recommended contact, this individual was included in the survey.

Since the health department in Texas is not directly related to the reuse program it was not included in the investigative survey (E. McDonald and J. Centeno, personal communication, 2013).

5.1.5 Washington

A total of four interviews were conducted in the state of Washington, with all applicable categories being represented (Table 5.1). Multiple interviews were not conducted in any one category as the framework in Washington State was adequately researched based on interviews conducted.

5.1.6 Colorado

A total of four interviews were conducted in the state of Colorado, with all applicable categories being represented (Table 5.1). Two respondents were interviewed in the Practitioner category based on the recommendation of the initial respondent (K. Patrick, personal communication, 2013; Table 4.58-4.59).

K. Patrick (personal communication, 2013), a water lawyer specializing in water rights cases, recommended Denver Water, a utility company, that has involvement in multiple water reuse applications. Initial contact was attempted with Denver Water's Director of Planning with no response. Through another contact at the WateReuse Association, the Recycled Water Program Manager at Denver Water was contacted (J. Murray). Based on the portfolio of projects and experience in water reuse projects, this additional contact was included in the survey.

5.1.7 Oregon

A total of five interviews were conducted in the State of Oregon, with all applicable categories being represented (Table 5.1). The additional Regulator-quantity respondent, as seen in Table 4.68, is the result of a teleconference that included two individuals with Oregon's Water Resources Department.

5.2 IR Management

5.2.1 Organization and Interaction of IR Agencies

Single vs. Multiple Agency Involvement in Water Reuse

Among states surveyed, there was a consistent division between a water quality related reuse framework and a water quantity related reuse framework. While there was consistency in this division from an operational standpoint, there was variation in how agencies themselves were organized.

Two of the states investigated, Texas and Washington State, have what is termed a "super agency" (G. Gregory, personal communication, 2013). Both Texas and Washington State function with single agencies that handle both water quality and water quantity components of IR projects (Table 4.39 and Table 4.48, respectively). In both cases, the TCEQ (Texas) and the DOE (Washington State) have separate departments that handle water quality and water supply/water resources. The advantage of this type of arrangement is difficult to gauge. One respondent commented on the presence of some disconnect between the two departments of the same agency (E. McDonald, personal communication, 2013) and another spoke of the system's efficiencies (G. Gregory, personal communication, 2013). K. Patrick (personal communication, 2013) was an advocate of the one agency approach but added that no organizational structure is free from problems.

The remaining five states investigated, that is California, Arizona, Florida, Colorado and Oregon, operate their reuse programs with water quality and quantity considerations being managed by separate agencies. A clear example of this is the State of California which has multiple boards or departments all with varying levels of involvement (Table 4.3). Involvement related to water reuse policy making and program funding initiatives are handled by the CDWR while management and maintenance or water reuse programs and projects are conducted by the SWRCB. Further divisions within the SWRCB occur with water quality and water quantity divisions. These divisions within the SWRCB operate as the Water Rights and Water Quality Departments. The Water Quality Department of the SWRCB further delegates its authority for permitting to the various RWQCBs of which there are nine semi-autonomous regions (R. Mills, personal communication, 2013). In addition to these agencies is the inclusion of the CDPH that

functions as a consultant and author of the reclaimed water regulations (R. Barnard, personal communication, 2013).

The organization of departments in California's framework serves as a good comparison to the "super agency"/one agency model. In between these extremes is the dual agency approach. This model, shared by Arizona (Table 4.16), Florida (Table 4.27), Colorado (4.60) and Oregon (Table 4.70), has completely separate government agencies regulating and permitting water quality and water quantity aspects of IR projects via dedicated water quality or water quantity departments or divisions.

The single, dual or multiple agencies approach for governing the two aspects of water quality and water quantity are typically established organizational structures that exist prior to the water reuse industry. As understood from interviews with various respondents, water reuse applications (e.g. IR) and the regulation of their activities have evolved over time and within the existing regulatory framework for permitting conventional wastewater discharge (R. Mills and C. Graf, personal communication, 2013). As such, the division of agencies regulating water quality and water quantity for any given jurisdiction practicing water reuse should be understood as something unchangeable.

As mentioned in Section 2.5.1, Alberta's ESRD (as a single agency permitting the water quality and water quantity aspects of a reuse framework) provides an example of an established regulatory structure. As the water reuse industry grows in Alberta, it must evolve within this organizational structure. Based on findings from the US jurisdictions surveyed, Alberta's single agency (ESRD) appears to have close similarities with single agencies found in Texas and Washington State.

Agency Responsibilities in Water Reuse

Independent of how an agency may be organized (i.e. single agency or dual agency), regulatory responsibilities inherent for water quality and water quantity departments are almost identical between jurisdictions. Water quality divisions or departments function as the lead agency for water reuse/IR permitting in terms of water quality parameters and best management practices (E. Hartling, J. Murray, C. Graf, personal communication, 2013). Implicit with being the lead agency, the water quality departments of a given jurisdiction would also be in charge of permitting, inspection and enforcement (J. Squitieri, personal communication, 2013).

Water quantity divisions or departments function to administer water rights and water resources. Variance within these departments appeared to exist in the aspect of authority and function (M. Lacey, personal communication, 2013). Arizona's Water Resources Agency (ADWR) has no regulatory authority but merely acts as an advisor and promoter of water resource management at the state level (M. Lacey, personal communication, 2013). Other water resource departments, as in California and Florida, manage funding programs that promote water reuse initiatives. The goal

of these funding programs is to promote water reuse as an alternate water source thereby lowering the demand on potable supplies (R. Mills and A. Andrade, personal communication, 2013).

Involvement of a Public Health Agency in Water Reuse

The level at which a public health agency was integrated into the water reuse permitting framework varied among the US jurisdictions interviewed. Four jurisdictions, including California (Table 4.3), Washington (Table 4.48), Colorado (Table 4.60) and Oregon (Table 4.70) use the public health agency in different ways. Common among all of these jurisdictions is the role of public health agency as a consultant on a case by case basis; or, as a matter of policy on specific reuse applications (e.g. irrigation). Of the four jurisdictions mentioned, California's public health agency (i.e. the CDPH), has the most involvement. The CDPH, while also acting as a consultant on particular applications, is responsible for writing regulations that are implemented by the SWRCB and RWQCBs (i.e. Title 22). Other health agencies such as Washington's DOH and Oregon's OHA provide input on new regulations but are not the principle authors. In general, these two latter agencies mainly fulfil a consultancy role on an as need basis (D. Lahmann and D. Leland, personal communication, 2013).

Colorado's public health agency, called the CDPHE, shows another variation regarding public health involvement in a reuse program. The CDPHE may be categorized as a single agency, or "super agency"; however, not in the aforementioned manner with water quality and water quantity divisions together. Instead, CDPHE has health and water quality departments under the same purview (Table 4.60). Arizona (Table 4.16), Florida (Table 4.27) and Texas (Table 4.39) are similar in that public health considerations are handled within the water quality department of their respective agencies.

Overall, the function of a public health agency acting as an advisor/consultant on particular projects, or in development of regulations/protocols appeared most often in jurisdictions interviewed.

Involvement of Oil and Gas Sector in Water Reuse

The jurisdictions of Texas and Colorado have active upstream oil and gas sectors that use reclaimed water in their exploration and production operations (e.g. fracking). In both cases, these State agencies handle oil and gas sector use of reclaimed water with the same permitting mechanisms as municipal, commercial and/or industrial end users. Also, both oil and gas sectors are given autonomy to regulate reclaimed water once it is delivered into their jurisdiction from a municipality. In Texas, the Railroad Commission (RRC) is the oil and gas regulator and the TCEQ is the state agency responsible for permitting reclaimed water use. The RRC has internal codes and practices for the use of reclaimed water once it has entered its jurisdiction. The TCEQ

permits the transfer of reclaimed water to a stipulated location, and once there, the RRC assumes responsibility.

In Colorado, the Colorado Oil and Gas Conservation Commission (COGCC) is the oil and gas regulator and the CDPHE is the state agency responsible for permitting reclaimed water use. Similar to the RRC, the COGCC has internal codes and practices governing the use of reclaimed water within their jurisdiction. Both the Texas and Colorado oil and gas sectors are considered industrial end users with reclaimed water being delivered to a holding location at an oil and gas site and once there entering RRC and COGCC jurisdiction and governance, respectively. Both the RRC and the COGCC must comply with "end user permits" issued from respective state agencies, but are given the ability to manage the water internally, as with any industrial end user.

Interagency Communication and Responsibility

Communication between agencies in relation to both the establishment of their respective roles in a water reuse program and their function at the project level was investigated in each of the US jurisdictions surveyed. Results showed various ways to manage interagency communication and responsibility in a water reuse permitting program.

A Memorandum of Agreement (MOA) was established in California between the SWRCB and the CDPH in order to clarify roles and responsibilities in managing reclaimed water use (R. Barnard and G. Innes, personal communication, 2013). This MOA is an eight page document that defines agency authority, areas of particular concern, such as public health and water rights, and enforcement (Department of Health Services [DHS] and State Water Resources Control Board [SWRCB] 1996).

Another facet of interagency communication exists when two agencies must interact due to water quality and quantity aspects of a reuse project. A practical approach cited by Colorado respondents included a method of due process wherein water supply/water rights obligations have to be signed off and completed prior to approaching the water quality agency for a reuse permit (E. Lemonds, personal communication, 2013). This inclusion of Colorado's DWR office in the CDPHE's process allows for confirmation that proper process is being followed without there being a need for direct communication. California has a similar process in place between the SWRCBs Water Rights and Water Quality departments. In order to access funding for a reuse project from the Water Quality department, a sign off from the Water Rights department is required stating there are no water right impairments related to the project (K. Mrowka, personal communication, 2013).

5.2.2 Contributing Factors in an IR Management Framework

R. Mills (personal communication) commented that every reuse program will evolve differently based on a jurisdictions' existing regulatory framework and local factors. The management framework has been discussed in Section 5.2.1. Local factors that contribute to initiation of a reuse program include water source, current reuse applications and management of WWTPs.

For comparison purposes, feedback on predominant raw water sources from each state was solicited in order to understand regulatory procedures for a given IR system. Alberta's North Saskatchewan and South Saskatchewan rivers, being trans-boundary rivers with their headwaters in the province of Alberta, are highly protected and regulated (K. Bullis, personal communication, 2013). The jurisdictions of Colorado and Arizona also have trans-boundary rivers with regulations that reflect the same standard of care as Alberta. In Arizona, T. Thomure (personal communication, 2013) mentioned that there exist regulatory complexities surrounding the trans-boundary river systems of the Salt River and Colorado River. The Colorado River, whose head waters begin in Colorado, is heavily regulated by case law, statutes and Supreme Court decisions that are amalgamated into what is known as the *Law of the River* (K. Rein, personal communication, 2013). The presence of these highly regulated rivers in Colorado and Arizona provide a good comparison tool with Alberta for similarities in water rights and water resource administration (as will be discussed in Section 5.3).

Based on respondent feedback, IR is practiced to some degree in all jurisdictions interviewed. California and Texas appeared to have the most robust reuse portfolios, supplying reclaimed water to a variety of commercial and industrial practices. Colorado, Texas and California all have similarities in that the oil and gas sector is among their customer base. Hydraulic fracturing (or fracking) and oil zone formation re-pressurization were among the common oil and gas applications (E. Goldman and E. Hartling, personal communication, 2013).

In an attempt to understand how the WWTP business framework exists in relation to respective permitting systems, the management and organization of WWTPs was investigated in all US jurisdictions surveyed. Based on respondent comments, similarities appear to exist in structure and management across the US. Whether publically (county or municipality) or privately owned, there is a common distinction between the producer, purveyor/provider, and user of reclaimed water in jurisdictions such as California and Texas.

Texas for example, in TAC Chapter 210 rules, differentiates between producers of effluent, providers of effluent, and users of effluent. The example cited by M. Rochelle (personal communication, 2013) is where there may be a regional WWTP (i.e. a producer) piping treated effluent to the City of Dallas (the provider) who then further treat and deliver reclaimed water to various golf courses (users). This distinction between "stages" in supply of reclaimed water is

required for permitting purposes (M. Rochelle, personal communication, 2013). With this distinction in title (i.e. producer/user), jurisdictions like Texas and California are attempting to ensure that proper handling and best management practices are being performed and managed with each stage of distribution.

5.3 Permitting Process Summary

5.3.1 Water Quality Permitting

Each of the jurisdictions surveyed had a defined "lead agency" overseeing reuse permitting. The agency tasked with this role was almost unanimously the state's environmental agency. The environmental agency from each jurisdiction, with their respective departments of water quality, was given authority over permitting and enforcement. It is also noted that with all jurisdictions surveyed, the IR permitting process is the same for any other reuse application/end use. Numeric criteria for water quality or best management practices may vary between end uses, but the permitting process is similar for all water reuse applications.

The NPDES permit, which is overseen by the USEPA under the federal Clean Water Act, has been delegated to various states for administration (R. Mills, personal communication, 2013). The NPDES permit represents a surface water quality discharge permit that WWTPs (or dischargers) must have to operate their facility (E. Goldman and E. Hartling, personal communication, 2013). As such, this permitting tool has in many cases been modified to include and manage reuse applications. This utilization of existing mechanisms creates efficiency in the system as protocols are already in place to handle discharge permitting.

Water reuse permitting systems, as understood from the investigative survey, also have the following similarities:

- The WWTP initiates water reuse projects by approaching the water quality permitting agency with a proposed end use(r)
- The water quality permitting agency approves acceptable end use numeric water quality criteria and best management practice for the proposed use(r)
- The water quality permitting agency will grant a reuse discharge permit to the WWTP based on the quality of their discharge and adherence to certain best management practices

All jurisdictions that were surveyed reported that the reuse permitting process is initiated by the WWTP operator/owner. The end user is involved in the permitting process but it is the producer/provider, based on their function as a producer/provider that the highest degree of responsibility rests. It was evident from survey responses that a WWTP maintains some liability

even once reclaimed water has passed to the end user (M. Rochelle and T. Thomure, personal communication, 2013).

Processes used in Arizona and Colorado for management of the end user provide a model for consideration. Both jurisdictions have a separate permit for the end user informing them of what their responsibilities are as end users of reclaimed water. In Arizona, for example, an end user applies to the ADEQ for a permit to accept a certain quality, or class of water (e.g. B+). Based on the quality of water they are requesting, the end user must meet certain best management practices such as signage or cross connection controls. The lower the quality of water, the more safety checks will be imposed. Public health considerations may be taken into account based on class/quality of water being requested and proposed use. It is in this instance where a jurisdictions public health department may be included for consultation. Once the end user can demonstrate their ability to accept that class of water safely, and all public health concerns are mitigated through best management practices, they are granted the End User Permit. End User Permit that is granted establishes that the user is able to accept a certain class of (e.g. B+) reclaimed water (C. Graf, personal communication, 2013). Without the End User Permit, a WWTP is unable to provide them with reclaimed water. The End User Permit that is granted is part of a larger program called the Reuse Program (C. Graf and M. Mullins, personal communication, 2013).

Once the permitting agency is assured that quality of effluent from the WWTP will be accepted safely by the end user, and that the quality of water and practices of the WWTP are approved, they will grant the WWTP a permit to deliver reclaimed water. This reclaimed water permit, which as mentioned is typically associated with the NPDES permit, is only issued once (C. Graff, personal communication, 2013). What the permit effectively means is that based on the quality of water that a particular WWTP produces, they are permitted to provide that water to a specified end user. With every additional application for reclaimed water, the WWTPs base permit must be amended adding a new “place of use”. Referring again to the Arizona model as an example, if a WWTP wished to supply reclaimed water, they would apply to the TCEQ for what is called an APP (effectively a reclaimed water permit). The TCEQ would review the quality of water being generated by the WWTP and grant them a rating (e.g. B+). Once they are given the permit with the assigned B+ rating, then they are permitted to deliver reclaimed water only to end users who have been granted an End User Permit with an equivalent B+ rating. This system of permitting WWTPs is part of a larger program called the APP program.

The reuse permitting system in Arizona, as described, has two components that work together to form one complete system (C. Graf, personal communication, 2013). The APP program component, that ascribes a particular class/category to a WWTPs effluent, and the Reuse Program component, that rates the acceptable class of water that can be delivered for the specific end use. Colorado has adopted a similar system in that the CDPHE issues separate permits for the treater

(i.e. *Treater NOA*) and the end user (*User NOA*) (L. Lemonds, personal communication, 2013). The State of Oregon has also adopted components of Arizona's system in virtue of the DEQ's rating system for qualities of treated effluent (R. Doughten, personal communication, 2013).

5.3.2 Water Rights and Water Quantity Permitting

Water Rights

With the exception of the State of Colorado, WWTPs throughout the US jurisdictions surveyed have ownership of their effluent prior to discharge into the environment (K. Rein, personal communication, 2013). This fact is properly understood in circumstances where a utility owns the water right for the potable system which in turn feeds a municipality's wastewater treatment system (K. Alexander, M. Rochelle, and A. Andrade, personal communication, 2013). In certain cases, based on the dependency of downstream users and the proposed quantity of the diversion, the "impairment" of downstream water rights may be considered (G. Gregory, personal communication, 2013). However, in most cases this ownership of effluent by a WWTP lessens many of the water right issues that would commonly be encountered in jurisdictions with return flow obligations (K. Mrowka, personal communication, 2013).

The *Doctrine of Prior Appropriation* underlies water rights law in all of the US jurisdictions surveyed. As is the case in Alberta, interpretation of prior appropriation means that junior water users can only access water to a quantity that ensures the needs of senior water users (M. Lacey, personal communication, 2013). Another definition of prior appropriation is "first in time, first in right" (C. Graf, personal communication, 2013). The connection between this doctrine and water reuse projects occurs when a WWTP seeks to divert flow from a river for some other beneficial use. Diversion of discharge for reuse purposes may, on occasion, impact a senior downstream user who claims a right to that discharge from the WWTP (G. Gregory, personal communication, 2013). Junior water right licensees may also stake claim to a WWTPs effluent if there is impairment to their water right from which they have become dependent (G. Gregory, personal communication, 2013). Diversion of flow for reuse initiatives was noted by all US jurisdictions surveyed as a perennial issue that must be managed on a case by case basis.

Particular water rights issues that were discussed with US survey respondents included inter basin transfers and the rights of third parties. Regarding inter-basin transfers, this issue was not considered an issue with respect to reclaimed water projects *per se*. The states of Colorado and Florida were the only two states interviewed that held a definitive rule against inter-basin transfers of water. Colorado's policy is that any water that has originated from a particular basin is only for use in the same basin (K. Rein, personal communication, 2013). In the case of Florida, the rule for inter-basin transfers is that local water should be sought first (A. Andrade, personal communication, 2013). In general, however, the issue of inter-basin transfer with recycled water

projects is minimized due to the capital investment that would be necessary to transfer the recycled water across a basin (G. Gregory, personal communication, 2013).

Third party rights refer to a prospective end user who may commit to a reclaimed water source through investments and placement of infrastructure (K. Bullis, personal communication, 2013). In US jurisdictions surveyed, this issue was unanimously settled between the utility and the end user through contractual agreements. All respondents agreed that this type of matter was outside the purview of the state. In certain situations where an industry commits to a reclaimed water source, there may be provisions to access potable water sources in the event of a decrease or cessation of flow (K. Fowler, personal communication, 2013). The mechanism for handling this issue would be the Consumptive Use Permit. This permit would include a provision authorizing use of potable water in the event of a slowdown in reclaimed water flow (S. Speas-Frost, personal communication, 2013).

Water Quantity Permitting

Since in most jurisdictions the WWTP essentially owns the water it treats, water reuse is rarely considered by a state's water quantity agency and/or department. A water quantity department's focus in most reuse scenarios is on the end user as opposed to the utility (D. French and L. Jaramillo, personal communication, 2013). As is the case with all jurisdictions surveyed, any proposed consumptive user of water must apply to the state for authorization. The water resource agency involved would then attempt to assess what impact this diversion of water will have. The following points reflect common responses from US jurisdictions in regards to the water quantity perspective of a reuse project:

- In terms of the End User:
    - The user would file for what may be called a *Notice of Appropriation* (Arizona) or *Consumptive Use Permit* (Florida)
    - The water quantity agency would require information on the point of diversion, place of use, maximum quantity, and annual volume required (M. Lacey, personal communication, 2013)
    - The water quantity agency would require confirmation that water quality parameters are in place through signoff or a letter from the quality control agency (D. French and L. Jaramillo, personal communication, 2013)
- In terms of the WWTP:
    - Based on the quantity of a proposed diversion, a review may be triggered to determine the level of impairment of downstream users (G. Gregory, personal communication, 2013)
    - Based on water right of downstream users, or the condition of a stream, certain percentages of discharge may be required to remain in stream

- In certain cases, diversion of flow may be considered as a benefit to the quality/health of the receiving water (G. Gregory, personal communication, 2013)

Based on the WWTPs ownership of water prior to discharge, respondents communicated that water reuse is only an issue when it impedes on water rights of other users. The question in many of these projects is not so much a matter of "if" the reuse will happen but "how" the reuse will happen. As previously mentioned, Colorado was the only state surveyed that holds a similar water rights rule to what is found in Alberta. In Colorado the WWTP does not have an exclusive right to the water they treat (K. Rein, personal communication, 2013). The State of Colorado has established through their water courts (and associated case law) a process to define which waters are deemed "reusable" (K. Patrick, personal communication, 2013). In Colorado, a WWTP wishing to divert flow must demonstrate to the DWR where the "source" of the water originates in order to determine if it was reusable or not (J. Murray, personal communication, 2013). Case law in Colorado has determined that reusable water is defined as water from a deep groundwater aquifer or water that has been imported (K. Rein, personal communication, 2013). Reusable waters, as defined by the court, can be reused to extinction. If a potential end user wanted to obtain a water right, then a water lawyer would be retained and if necessary, the case would be taken to litigation (K. Patrick, personal communication, 2013). If the source of water can be determined to be "reusable" then the WWTP has the right to reuse it with no water quantity agency involvement. It should also be noted that other jurisdictions such as California and Texas exempt foreign or non-native water from a water right and thus it can be used to extinction (E. Goldman, E. Hartling and K. Alexander, personal communication, 2013).

5.4 Commentary of IR System in Practice

Respondents from each of the jurisdictions were asked to comment on the efficiencies and inefficiencies in the practice of their respective reuse systems. The intention of including this question into the survey was to gather insight into potential strengths or weaknesses of a reuse program.

5.4.1 Management

Comments made by US survey respondents with respect to management efficiencies and inefficiencies of their respective reuse systems can be categorized in terms of program support, structure, and perception.

Program Support

Multiple jurisdictions commented on the importance of proper support of the reuse program. Support of the program, as understood from US respondents was, in part, related to appropriate staffing (R. Barnard and L. Lemonds, personal communication, 2013). Adequate staffing does not

only refer to the number of individuals required to administer a program, but refers to the staff's technical ability. Staff involved in a reuse program should have a technical capacity to lead the program successfully through ability to field technical questions and have adequate understanding of the permitting process (R. Barnard, personal communication, 2013). A second part of program support is in terms of financial backing (R. Mills, personal communication, 2013). Multiple jurisdictions including Florida, Washington and Texas mentioned that the success of their programs was related to the state providing funding for reuse initiatives (A. Andrade, G. Gregory, and K. Alexander, personal communication, 2013). Florida's use of cooperative funding, that offers 50% reimbursement for reuse projects, is a prime example (A. Andrade, personal communication, 2013).

Structure

Structure of a reuse program, in terms of agency organization and interactions, was mentioned by respondents in California, Arizona and Washington. California and Arizona have more than one agency that oversees water quality and quantity aspects of reuse permitting (G. Innes and C. Graff, personal communication, 2013). Comments made by respondents from these jurisdictions related to differences in reporting and communication between offices and agencies (R. Barnard, personal communication, 2013). One respondent from the DOE in Washington vouched for the overall efficiency of a single regulator (G. Gregory, personal communication, 2013).

Perception

Five of the seven jurisdictions surveyed mentioned the perceptions of the public and industry as important components of a successful reuse program. Arizona and Washington respondents spoke of the need for public involvement and the need to foster public acceptance (T. Thomure and K. Fowler, personal communication, 2013). Florida, Texas and Colorado respondents spoke about the importance of program perception from the end user perspective (i.e. industry). Perception factors such as quality of water (seen as the largest concern) and diversion effects of downstream users were cited to have an impact on a reuse system (S. Speas-Frost, personal communication, 2013). Seen in a positive sense, industries in Texas are observing that reclaimed water is "drought proof" since it will not be among water sources rationed in time of drought (M. Rochelle, personal communication, 2013).

5.4.2 Permitting

Comments regarding strengths and weaknesses of various permitting programs provided emphasis on key aspects including the clarity of the process, and the need for a "contest a case" process (M. Rochelle, personal communication, 2013). Reference to the clarity of a permitting process can be understood with respect to both practitioners and regulators. In relation to practitioners, a clear approach on how to obtain recycled water (that is not overly restrictive) was seen as important to the success of a program (J. Murray, personal communication, 2013). The presence of a clear and

streamlined permitting process will also increase speed of approval which was seen as another factor of importance (E. Goldman and E. Hartling, personal communication, 2013).

The inclusion of a process whereby the public or public entities can contest cases or seek assistance in resolving disputes was another comment offered by select respondents (M. Rochelle and R. Glick, personal communication, 2013). A process such as this will make it possible for individuals or entities to voice concerns related to health and safety or water resources.

5.5 Respondent Recommendations

Respondents from participating jurisdictions were asked to provide their recommendations on the resolution of potential inefficiencies of a reuse system, and/or to offer ideas in the development of a reuse program.

5.5.1 Management

Previous comments made in Section 5.4.1 mentioned the need for proper support, structure and a positive perception of the reuse industry. Support regarding staffing and funding were noted as key to a successful reuse system. Other recommendations made to enhance support of a program consisted in a loan/grant system and regulatory/legislative backing to support the program. Both California and Florida have strong funding programs in place to support and drive the reuse industry in their jurisdictions (R. Mills and A. Andrade, personal communication, 2013). Loans and grants in California and the cooperative funding program in Arizona, which provides 50% reimbursement of water reuse projects, both diminish the capital investment costs that often deter reuse initiatives (A. Andrade, personal communication, 2013).

Legislative support of a reuse program was mentioned as important by reuse respondents in Washington and Colorado. In the case of these two jurisdictions, a statement of support of the reuse program was included in the preamble of state regulations. This statement of support by legislators called for an increase in reclaimed water use and consideration of reclaimed water as a valuable water resource (J. Murray, personal communication, 2013).

US survey respondents also made recommendations to maximize existing regulatory mechanisms and structures when initiating a reuse system. R. Mills (personal communication, 2013) had extensive advice on the initiation of a reuse system that can be viewed in Appendix C4. Of particular note was the advice to maintain current relationships when developing a reuse system. For example, the observation was made that if a utility is accustomed to dealing with a particular agency or department, then that relationship should be maintained. As opposed to establishing new departments to permit a water reuse project, working with what is in place would increase the simplicity and ease of transition for all involved stakeholders (R. Mills, personal communication, 2013).

The presence of a coordinating committee or working group in Florida and Washington, respectively, was also mentioned by respondents. These groups provide an effective means for enhancing communication and consistency among departments and/or agencies (S. Speas-Frost and D. Howie, personal communication, 2013).

Respondents noted that public and industry perception can be mitigated through providing current and accurate information with respect to the health and safety of reclaimed water (T. Thomure, personal communication, 2013). Washington respondent K. Fowler (personal communication, 2013) mentioned public involvement and education prior to and throughout reclaimed water projects as being of primary importance.

5.5.2 Permitting

Recommendations made by US respondents in terms of permitting water reuse projects centered on maintaining balance between a clear and concrete system while having an ability to facilitate innovation and change. Recommendations for the use of templates for consistency between offices offered practical advice for the initiation of a reuse system (R. Barnard, personal communication, 2013). However, as J. Murray (personal communication, 2013) pointed out, too prescriptive a process can constrict the use of reclaimed water to such a degree that it is unattractive to a potential customer. Innovation in the industry and the pace at which technology changes were both seen as challenges for a reuse permitting system and as such would need to be addressed (D. Lahmann, personal communication, 2013). Generic terms, or broad definitions were suggested as one approach for incorporating flexibility within the permitting program (J. Murray, personal communication, 2013).

Another recommendation in the permitting approach would involve an extension in authority. The state of Colorado for instance is in the process of considering the placement of permitting authority in the hands of mature and well established WWTPs. Placement of the obligations of permitting into the hands of the utility would allow for increased turnaround times in reuse authorizations and project initiation (E. Lemonds, personal communication, 2013).

5.6 Examples of IR in Practice

Respondents from each of the jurisdictions surveyed were asked to provide potential examples of IR in practice. The intention of including this question into the survey was to solicit practical tools for assistance in the development of a reuse program.

5.6.1 Resource

Resources suggested by US respondents are summarized in Table 4.12 (California), Table 4.23 (Arizona), Table 4.35 (Florida), Section 4.4.6 (Texas), Table 4.56 (Washington), Section 4.6.6 (Colorado), and Table 4.78 (Oregon).

The most recommended type of resource was jurisdictional statutes and/or regulations. Statutes, often referred to as Administrative Codes, were suggested by respondents because they provide an impetus for regulatory agencies to develop regulations and/or guidelines. E. Hartling (California), G. Gregory (Washington) and J. Murray (Colorado) all addressed the positive impact the legislation had for their respective systems. In one instance, Colorado utilities approached the legislature to make a statement in the preamble of their statutes, expressing the importance of reuse and the need for regulatory guidance (J. Murray, personal communication, 2013). For a jurisdiction planning to initiate a reuse system, regulatory guidance documents suggested by respondents would be a valuable resource (A. Andrade, personal communication, 2013).

In addition to the statutes and regulations suggested by US respondents were reports that are designed specifically for the development or implementation of a reuse program. Florida's *Reclaimed Water Guide* (DEP 1999) is intended to be a resource for utilities in the development of a reuse system (A. Andrade, personal communication, 2013). Another supplemental guidance document is the *Final Report of the Governor's Blue Ribbon Panel on Water Sustainability* (ADWR 2010). This "Blue Ribbon Panel" report was suggested by all of the Arizona respondents as a helpful resource for guidance of communication and strategic planning.

The jurisdictions of California, Florida, Washington, Colorado and Oregon provided examples of internal directives, permits, and checklists that provide a practical sense of how reuse permitting is approached in practice. In addition, the precedent setting court case titled *Arizona Public Service Co. vs. Long* was suggested by C. Graf (personal communication, 2013) so as to provide insight into the legal ownership of water by a WWTP.

Particular resources of interest were recommended by California, Washington, Colorado, and Oregon respondents who noted the following water quality and water quantity permitting examples.

City of Corona Water Reclamation Facility, Corona, CA.
City of Corona: Order Cancelling Protest, Approving Change in Purpose of Use, Place of Use and Discharge Quantity (SWRCB 2012)

- This document provides an example of California's requirements related to a WWTP changing purpose of use, place of use and discharge quantity in relation to a reclaimed water project. Another component of this example is related to water right implications. California currently includes into water rights a "guaranteed uncertainty" in flow since an upstream utility may wish to divert discharge at any time. This uncertainty in flow written into a water right provides protection for a utility should a downstream user contest diversion of flow from a reuse initiative.

Cardinal Float Glass, Winlock, WA.

Reclaimed Water Permit ST 6210 (DOE 2011b)

- This particular project was mentioned by D. Lahmann (personal communication, 2013) who stated that this facility reclaims their own domestic waste water for use in their industrial operations. This permit is issued to Cardinal Float Glass Co. by Washington's water quality permitting agency. Cardinal Float Glass Co. is an industrial end user of reclaimed water that is treated on site for their stack gas scrubber system. This permit provides details of accepted water quality provisions and end user requirements to accept and use reclaimed water.

Fact Sheet for State Reclaimed Water Permit ST 6210 (DOE 2006)

- Associated with the Cardinal Float Glass Co. reclaimed water permit, this Fact sheet provides a detailed background on the reclaimed water project including the collection and treatment system, permit limitations, monitoring requirements, and other permit conditions. This document is an example information management strategy wherein public and regulators are able to reference details of a particular reclaimed water project.

Addendum to the Fact Sheet for Reclaimed Water (DOE 2011a)

- An addendum to the Cardinal Float Glass Co. reclaimed water permit, this document provides an example of procedures for reissuance of permits as related to use of reclaimed water by an industrial end user. The addendum outlines variations to original permit as well as information on public consultation procedures and responses to public comments.

Department of Health (DOH), WA.

Memo Re: Department of Health (DOH) comments concerning Washington Administrative Code (WAC) 2010 Draft Reclaimed Water Rule (DOH 2013)

- This document is an example of an accepted approach in Washington State to identify and address public health issues related to water reuse. Content of this memo offers perspective of public health concerns related to a reuse program initiative. As a background, Washington's DOH was solicited to provide feedback on a draft reclaimed water rule that Washington's quality agency (DOE) was developing. D. Lahmann (personal communication, 2013) had mentioned the usefulness of involving public health in early planning stages of a reuse program.

Denver Museum of Nature and Science, Denver, CO.

User Plan to Comply for the Use of Reclaimed Water (Denver Museum of Nature and Science 2012)

- This particular project was mentioned by J. Murray (personal communication, 2013) as an example permit for a closed-loop heating and cooling system. This document illustrates the first step in Washington's reclaimed water permitting process. This document, also known as a *Letter of Intent*, provides an example of a commercial end user seeking permission from Colorado's water quality agency to utilize reclaimed water for a closed-loop cooling system.

User's Notice of Authorization for the Use of Reclaimed Water (CDPHE 2013b)

- The second step of the permitting process after approving the Letter of Intent (above), Washington's water quality agency issues this final approval allowing an end user to obtain and use reclaimed water.

Colorado Oil and Gas Conservation Commission (COGCC), CO.

900 Series Exploration and Production (E&P) Waste Management (COGCC 2011)

- This document is an example of an accepted approach in Colorado to manage use of reclaimed water in their oil and gas sector (J. Milne, personal communication, 2013). Section 907(a) 3 provides encouragement for water reuse and recycling and also states that a management plan must be submitted when proposing plans for beneficial reuse.

Nehalem Bay Wastewater Agency, Nehalem, OR.

NPDES Waste Discharge Permit (DEQ 2012b)

- This document illustrates that reclaimed water permitting considerations are included as an attachment to a utilities existing discharge (NPDES) permit (R. Doughten, personal communication, 2013). Schedule D is included in a permit only when water reclamation is a component of a WWTPs operation.

Recycled Water Use Plan (Kennedy/Jenks Consultants 2012)

- Oregon's water quality agency requires a Recycled Water Use Plan as a companion document to NPDES Waste Discharge Permits. Oregon's Water Use Plan outlines various components of a water reuse project including the beneficial purpose, treatment system, monitoring and sampling, contingency, etc.

NPDES Permit Evaluation Report and Fact Sheet (DEQ 2012a)

- An example of an accepted component of a reclaimed water permitting system, this document accompanies all water quality permits issued by Oregon's water quality agency. This document is not a separate set of requirements but an explanation of how permit limits were derived and what is required of the utility. Secondarily, it is an educational tool for public who wish to review and comment during a public notice period that occurs before a permit is issued.

LNG Development Company, Warrenton, OR.

LNG Bidirectional Project – Registration of Reclaimed Municipal Water Use (CH2M HILL Engineers Inc. 2013)

- This is a proposal for the use of reclaimed water in construction and production operations for a Liquefied Natural Gas (LNG) bidirectional project (L. Jaramillo, personal communication, 2013). This LNG project document provides an example of a *Registration of Reclaimed Municipal Water Use* application that is filled out by the proposed end user of reclaimed water and submitted to Oregon's Water Resources Department. This document also contains a completed registration form and comprehensive summary of a proposed project including schematic diagrams and projected water use requirements.

5.6.2 Projects

Example projects are summarized in Table 4.13 (California), Table 4.24 (Arizona), Table 4.36 (Florida), Table 4.57 (Washington), Table 4.67 (Colorado), and Table 4.79 (Oregon). None of the respondents from Texas had suggestions regarding reuse projects in practice.

Projects suggested by US respondents were divided between example utilities and example projects. The intention of soliciting suggested utilities by US respondents was to provide a model for local utilities who may intend to practice water reuse. Of the multiple utilities that were suggested, Denver Water (Colorado) and the LOTT Clean Water Alliance (Washington) appear as the most notable.

Denver Water (Colorado) is professionally orientated with organized programs for public involvement and education. In addition, this entities reputation was validated based on comments from Colorado respondents. Denver Water has 80 reuse customers and provides water to 1.3 million people in metro Denver area. This company is also functionally similar to Alberta utilities in regards to their ownership and organization.

LOTT Clean Water Alliance (Washington State) is an aggregate of three cities and one county including Lott, Olympia, Tumwater and Thurston County. LOTT was highly recommended by Washington respondents due to their professional conduct, educational programs and business approach. LOTT is a growing entity with two reclaimed water plants and plans to build satellite plants and groundwater infiltration basins.

Both Denver Water and LOTT Clan Water Alliance take a professional approach to the reclaimed water industry. The appeal of these entities is that they have a valued reputation in the view of regulators surveyed as well as a progressively orientated business structure. Utilities such as West Basin Municipal Water District and the Sanitation District of Los Angeles County in California have advanced systems with "designer water" and a large customer base of 300 and 700 plus reuse sites, respectively. These utilities provide good examples of what can be accomplished with time and reuse program maturity (E. Goldman and E. Hartling, personal communication, 2013). However, these entities are at a level of maturity that may not provide the best model for utilities beginning a reuse system in practice.

Example projects of various industrial applications were mentioned by US jurisdictions surveyed. Cooling processes for conventional oil and gas (California), nuclear power (Arizona) and mining (Florida) were all among the applications cited. Of particular interest were recommendations of Washington, Colorado, and Oregon respondents who noted the water quality permitting project examples such as *Cardinal Float Glass*, *Denver Museum of Nature and Science, and the LNG Development Company* as described in Section 5.6.1.

CHAPTER 6 CONCLUSION AND RECOMMENDATIONS

Conclusions and recommendations are organized in terms of program management, accepted reuse permitting practices, and program development strategies.

6.1 Program Management

Single Agency Approach

Water reuse, as a practice and as an industry requiring regulation, has inherent complexities due to interrelationships between water quality, water quantity and health related factors. Water quality considerations such as separation of reclaimed and potable water systems, water quantity considerations such as managing a provinces water supply, and public health considerations as they relate to water quality, all unite and must interact in the field of water reuse.

A majority of US jurisdictions surveyed operated their programs via multiple agencies thus leading to complications with consistency and communication. A single agency or "super agency" approach to manage a reclaimed water program, such as in Texas or Washington State, is therefore recommended. While one agency will not eliminate the challenges, an agency such as the ESRD which functions as a single agency, could provide Alberta with a distinct advantage for managing a reclaimed water program.

Within a respective single agency, a water quality department and water quantity department would ideally administer these dual aspects of a reuse program. A water quality department is recommended to write and enforce reclaimed water permits since there is typically an established permitting mechanism already in place for domestic wastewater. A water quantity department is recommended to administer allocation of water rights and water resource considerations as they relate to reclaimed water projects.

Public Health Agency as Consultant

It is recommended that the public health agency assume the role of consultant on an as-needed basis in terms of reclaimed water permitting. Circumstances where public health involvement would be required could be clearly delineated in a MOA, as is done in California between the Department of Health Services and the State Water Resources Control Board (DHS and SWRCB 1996).

6.2 Accepted Reuse Permitting Practices in the US

Permitting reuse of municipally treated effluent for industrial purposes is approached in a relatively consistent and straightforward manner throughout US jurisdictions surveyed. There exist a number of examples of accepted permitting practices for water reuse in the US and these

examples are recommended as guides for stakeholders in the water reuse industry to consider for application in Alberta.

Reclaimed Water Quality Permitting

Water quality permitting processes did not vary based on the reuse application. Whether reuse was an industrial or urban application, a similar permitting mechanism was employed by the respective state agency. As such, distinction between accepted reuse permitting practices as related to particular end uses has not been made. In addition to the other examples outlined in Section 5.6.1, the *Nehalem Bay Wastewater Agency* in Oregon is recommended for review as an example to Alberta industry stakeholders, including ESRD, of Oregon's requirements related to reclaimed water quality permitting.

Reclaimed Water Quantity Permitting

Water quantity permitting processes were similar among most US jurisdictions due a WWTP's ownership of wastewater and/or reclaimed water prior to discharge. In addition to the other examples detailed in Section 5.6.1, the *LNG Development Company* in Oregon is recommended for review as an example to Alberta industry stakeholders, including ESRD, of an accepted approach to reclaimed water quantity permitting.

6.3 Program Development Strategies

Based on the results presented in this thesis, several recommendations can be made with respect to specific components of a water reuse program. When considering a water reuse application in Alberta, the following recommendations can be made to industry stakeholders regarding education, water quality, water quantity and networking.

Education

Programs to adequately educate public, industry and regulators, are recommended for incorporation prior and throughout development of a water reuse program. Public acceptance through education and accessible up-to-date/accurate information is one solution to promote the use of recycled water. In addition, public advisories, notifications and an ability to contest projects are recommended for consideration when working on a water reuse initiative.

Quality System

It is recommended that water reuse industry stakeholders consider Oregon's DEQ document: *Internal Management Directive – Implementing Oregon's Recycled Water Use Rules* (DEQ 2009a). Industry stakeholders can use this document as a suggested template to help ESRD streamline current internal (and external) permitting and management procedures. In addition, the *Reclaimed Water Guide* (DEP 1999), which was developed by water reuse stakeholders in Florida, is recommended as a reference tool for ESRD when developing a water reuse initiative in Alberta.

Industry stakeholders may also consider Arizona's water reuse permitting program as a goal or template for program development in Alberta. This system is suggested solely for long term planning purposes as Alberta's current regulatory and business framework may not support its development at this time.

Quantity System

Water reuse industry stakeholders may wish to work with regulators to determine if certain sources of water may be classified or deemed as completely reusable. Redefining a water source as reusable may serve to overcome certain water right impediments when diverting flow for reuse initiatives. Industry stakeholders, specifically utilities, may determine what proportion of influent, for a given WWTP, originates from "foreign" sources. In these cases, the utility may work with regulators to determine if there is potential to use and reuse these waters to extinction.

Determination of wastewater ownership is also recommended in the development of a water reuse program in Alberta. The *Growing Communities Doctrine,* mentioned by G. Gregory (personal communication, 2013), summarizes this by stating that a municipal use is whatever a municipality chooses to use their water for.

Networking

It is recommended that water reuse industry stakeholders approach both Denver Water (Colorado) and LOTT Clean Water Alliance (Washington State) for partnership purposes and/or as a business development strategy. These two utilities were chosen based on professionalism, growing reuse portfolio, and operational stage of development.

In addition, it is recommended that Alberta stakeholders seeking partnerships in the global water reuse industry consider the WateReuse Association. This association was mentioned by various US respondents as an invaluable resource and aid to their reuse programs. WateReuse Association consists of consultants, utilities, regulators, and solicitors etc. who are involved in various aspects of water reuse practice. It is recommended as a support network for information, education and research and as a driver for reuse projects.

6.4 Recommended Future Study

It is recommended that a pilot project be initiated between a reclaimed water provider (i.e. utility) and a specific industry and/or application. Using the findings of this thesis in conjunction with methods previously implemented in Alberta, a pilot project would present an opportunity to test the effectiveness and feasibility of the conclusions contained in this thesis.

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APPENDIX A – Preliminary Interviews

(Note: All telephone conversation records have been summarized and paraphrased)

A1 Alberta: Practitioner Telephone Conversation Summary

DATE	December 07, 2012	**TIME**	08:45
CONTACT	E. Phillips	**DEPARTMENT**	Water Resources
COMPANY	City of Calgary	**JOB TITLE**	Senior Leader; Regulatory Affairs and Compliance

(Note: Questions posed to respondents are in italics)

Local Background

1. *Re: status of IR in Alberta?*
   Response:
   - Current uses in Alberta include: grey-water or storm water for irrigation
   - Examples of Industrial water reuse in Alberta include:
     - Goldbar/Suncor
     - Calgary/Enmax (3 years to complete regulatory process)

2. *Re: trends in management of water reuse?*
   Response:
   - US jurisdictions have "purple pipe" to separate potable water from reclaimed water
   - What the US is focusing on currently is management of regions

3. *Re: Concerns regarding IR?*
   Response:
   - Water Quality requirements with IR
   - Manage water being retained/stored
   - Industrial water effluent has to coordinate with the municipality and the approval

4. *Re: Recommendations for IR in Alberta?*
   Response:
   - Identify the industries and the industry needs
     - If an industry does not require much water, then perhaps water reuse is not worth the investment
     - Is a pipeline required to get it there and what is the percentage reuse?
       - Getting the most out of one's capital investment

A2 Alberta: Quality Regulator Telephone Conversation Summary

DATE	November 21, 2012	**TIME**	16:10
CONTACT	B. Aidun	**DEPARTMENT**	Drinking Water and Wastewater
COMPANY	Alberta Environment and Sustainable Resource Development (ESRD)	**JOB TITLE**	Municipal Wastewater Specialist

(Note: Questions posed to respondents are in italics)

Local Background

1. *Re: current status of industrial water reuse is in Alberta?*
   Response:
   - Fundamentally there are two issues that are of importance from ESRD's point of view for approving municipal wastewater reuse
     - Quality of the water (risks associated)
       - Quality requirements are established
     - Quantity of the water
       - How much is withdrawn
       - Need to obtain license under the water act
       - How much needs to be returned
   - Regarding quality, the ESRD does not mandate or specify a quality per se
     - This is under the industrial approval for effluent
   - Regarding the Water Act:
     - There may be a requirement for re-allocation of water
     - Hypothetically, the license needs to be updated to only put back 50%
     - Accounts for water balance
     - Examples would include southern Alberta water basins that are fully allocated
     - City of Calgary has water use constraints as a result

A3 Alberta: Quantity Regulator Telephone Conversation Summary

DATE	January 17, 2013	**TIME**	14:43
CONTACT	K. Bullis	**DEPARTMENT**	Water Authorizations
COMPANY	Alberta Environment and Sustainable Resource Development (ESRD)	**JOB TITLE**	Water Administration Engineer

(Note: Questions posed to respondents are in italics)

Local Background

1. *Re: Current Alberta water reuse practices?*
   Response:
   - No concrete guidance that is available to applicants, industry, or internally to individuals that deal with water act licenses on a day to day basis
   - Lacking a consistent way that reuse projects are being dealt with in Alberta
     - Southern region for example as compared to what is going on around Edmonton and Ft. McMurray
   - Water Act allows for flexibility on how ESRD regulates various aspects:
     - Examples where a the water act license has been issued for water from a source through the works of the wastewater treatment plant
     - Examples where there's only an EPEA approval and conditions are modified on an EPEA approval and then the industrial water reuse is facilitated or regulated that way
     - With various stages in between the two above scenarios

2. *What would be a possible option to streamline the current reuse approval process (i.e. framework, Code of Practice?)*
   Response:
   - There is a policy that is being worked on currently
     - Contact Water Policy Director
   - Expectation is that this policy would provide clarity on how reuse programs will be carried out and what issues the stakeholders and regulators should consider
   - There is consideration around protection of the water sources from both aspects:
     - Scenario 1: if a polluted wastewater is going to a natural water body then it makes sense to intercept that wastewater and have it used for some beneficial purpose
     - Scenario 2: If there is a dry system that requires water, and there is discharge of suitable quality, then diverting that water could potentially cause more harm to the environment
     - The policy is trying to look at both the positives and negatives
   - The creation of this policy is the starting point in order to shift from the current "case by case" model to a more stream lined approach
     - A code of practice would not be required for our current system
   - An (official or unofficial) internal protocol could be useful
     - Outlines the stages of the process
     - Would allow for consistency
   - Consistency is important based on the current reuse process:
     - At ESRD there is a Water Act team, an EPEA team, and a Municipal approvals team
     - Each team could have a part in a reuse proposal
     - The question is: who actually needs to do the work and who would actually be drafting up the authorizations?

3. *What do you see as being important to glean from other jurisdictions that practice industrial water reuse?*
   Response:
   - How to protect the rights of the user (especially a third party user) of a reclaimed wastewater stream

    - Scenario:
        - An industry is seeking treated municipal effluent for a key component of their operation
        - Industry invests money by installing infrastructure and designing on-site treatment to polish imported effluent
        - Industry will want to have security around the supply
    - How is security provided? Is the risk on the end user?
    - Can the regulator use some existing mechanism to provide the end user with some security of supply?
- Third party security in relation to Water Rights:
    - In Alberta the law under the Water Act is "first in time, first in right" meaning that older licenses have priority over junior licenses
    - Regarding third party users, it would be difficult to determine who has priority if they do not possess a water license
    - Also, if an end user does not have a water license for the use of reclaimed water, then they do not really have protection for the use of that supply

4. *Re: Current trends related to reuse in Alberta?*
   Response:
   - Oilfield Injection Policy
       - Deals with reducing the amount of freshwater that is used for injection purposes on oil and gas projects
       - There is discussion about increasing the scope of that policy to include activities such as fracking or all upstream oil and gas water use
   - In-situ oil and gas facilities are required to study alternatives to freshwater use
       - Including an economic evaluation called a Tier 2 evaluation as well as other environmental impacts
   - Move to reduce the amount of freshwater taken out of the hydrogeological cycle
       - Attempt to put the focus on saline groundwater and also alternative sources of water
           - Including industrial and municipal wastewaters that may protect the environment
   - In the south of the province, water reuse is driven by a lack of water availability while in the north it is more policy driven
       - There is more water but the province is protective of it

5. *Re: Potential issues or impediments regarding industrial water reuse?*
   Response:
   - Pipelining and various technical issues (maintaining the quality that is required)
   - Many industries internally recycle to a 97% efficiency so the issue is obtaining the required makeup water

6. *Re: Current permitting process for reuse applications in Alberta?*
   Response:
   - If a project is new, than the ESRD would meet with the proponent to determine the best way to handle the project under the regulations
   - If the Water Act was determined to be the best means to handle the project then
       - The proponent would complete a Water Act Form, and
       - Report including plans
   - If there is a large scale project then there would be an EIA required
   - There are no specific forms related to water reuse

7. *Re: The Presentation you delivered with B. Aidun discussed several "Issues that are considered during Water Act regulatory review". Please explain the relevance for reuse projects?*
   Issues pointed out in the presentation included:
   a) "Conditions of the "primary" Water Act License (e.g. return flow conditions)"
   Response:
       - Refers to a case where a proponent has an existing water act license
       - Some licences (especially on the municipal level) have conditions which restrict the annual amount of water which is discharged and the rate at which it is discharged
       - Some licences have conditions, clauses, suggestions or estimates on how much is going to be released back to the environment

- There's no such thing as a "net water act license". Everything is based on how much water is coming out of the environment at the beginning
- There may be some conditions around the amount of water that is expected to be returned (return flow) based on stream quality
  - Example: City of Edmonton and refinery:
  - Project handled by modifying the return flow component on the City of Edmonton's license
  - That was a one off, so might not work elsewhere
- There could be a return flow component of the original water act license that could be altered

b) *"Is the reuse by the licensee or a third party?"*
Response:
- Example:
  - SAG-D project where the water is recycled over and over again to 97% efficiency and then deep-well injected for disposal
  - The proponent would only need the water license the first time
    - As it gets recycled ESRD is not involved
  - A third party approaches the industry and views some profitability with the last discharge (97% efficiency) that is to be deep well injected
    - Wants to reuse it for another purpose
  - In this scenario, the ESRD would become involved

c) *Re: "Appurtenance" issues (I.e. a legal issue where the Water Act license designates the land location for point of diversion and use)*
Response:
- Appurtenance is necessary on a water license as it designates where a diverter has their intake and where they use that water
  - Protects against diverters (with licenses) pumping out to their limit and using the water as they wish
- Deals with the land location of where the water is coming out of a source and the land location where that water is being used
- The license has a volume, a diversion, and a purpose
  - "The wise use of the crowns water"
- May be some legal issues with trucking treated wastewater far away in a reuse situation (especially if a third party is involved)
  - More of an issue in southern Alberta
- Also, the modification of a license that was intended for agriculture and then for another use can be an issue

d) *Re: "issues of double counting the volume of water withdrawn (i.e. administration of the water use across the basin or region"*
Response:
- Example:
  - A water act license will designate a river as a source.
  - ESRD would perform calculations/assessments across a basin to determine the impact
  - Using the ESRDs Environmental Management System (EMS) one would designate or query a river to see how much water is coming out
  - This scenario gains importance during inter-basin and trans-boundary agreements
- Between Alberta and Saskatchewan there is an agreement on the North Saskatchewan river that 50% of flow will proceed into Saskatchewan
  - To administrate that agreement, one could query the EMS to see how many licenses are coming out of the river or basin
- "Double counting" maybe an issue with reuse:
  - Multiple licenses for wastewater use which are intercepting that water before it is discharged into the river
  - Possible to double count that water in that it is not being pumped out twice but only pumped out once and used twice
- Accounting issue

e) *Re: "Water quality issues (saline water exempted from needing a license, but this is for the original source water); also where there is the potential for improving water quality (industrial heartland)"*
Response:

- Natural saline groundwater with a TDS >4000mg/L is exempt from requiring a license
- Recently it is easier to treat water so there is discussion about increasing that number
- Debate as to whether or not a wastewater that "becomes saline" would be then exempt from requiring a license
    - ESRD thought is that it would since the source was fresh water
    - Especially since it would have to be treated before it could be released so it would be "fresh" in that case
- The desire is to improve quality of water:
    - Example of North Saskatchewan River
        - Environmental concerns are not around quantity but around quality as there are a lot of point and nonpoint sources)
        - If one is able to intercept the wastewater before it enters the river (and one can encourage the use of that wastewater) then the quality of the river is being improved
    - Example of South Saskatchewan River:
        - Quantity is of a greater concern so interception of discharge is not ideal

A4 Alberta: Health Regulator Telephone Conversation Summary

DATE	February 14, 2013	**TIME**	13:30
CONTACT	D. Mooney	**DEPARTMENT**	Health Protection Branch
COMPANY	Alberta Health	**JOB TITLE**	Environmental Health Consultant

(Note: Questions posed to respondents are in italics)

Local Background

1. *Re: current involvement of public health with IR/reuse in Alberta?*
   Response:
   - Alberta Health does not regulate nor have any involvement with industrial water because the risks either tend to be occupational, or they tend to be environmental
   - In discussions about reuse, there is uncertainty about who has responsibility
     - Industrial reuse is less clear
   - Health provides feedback to other agencies that are trying to make decisions
   - Many decisions made concerning water reuse are at the municipal level
     - If the municipality is willing to monitor or oversee the use of treated water, then the industry could potentially report to them
     - Health could provide advice as to which end points are important to monitor, how frequent, etc.

2. *Re: Trends related to reuse in Alberta?*
   Response:
   - "Canadian Guidelines for Reclaimed Water and Urinal Flushing"
     - Currently represents the only Health document dealing with reuse
   - Currently, a small team is looking at developing standards for other kinds of uses of water, like car washes etc.
     - Cross-ministry group
     - Team consists of ESRD, Municipal Affairs, Transportation, etc.
   - The water council is organizing a workshop for 2014 on water reuse
     - Goal is to assist in the development of a broader policy piece (but not targeted towards industry)
   - One need regarding quality is what standards the water should meet
     - In the case of industrial water, it is not typically a health issue but a matter of what chemistry they need for their product
   - In the case of industrial uses where the reclaimed water would produce a mist (aerosols etc.), then it would have to be on a case by case basis
   - If it's on site only, and only the workers have access, even aerosols would just be occupation risk and that's not us
     - Occupational health is separate from Public Health

3. *Re: Oversight of reuse projects?*
   Response:
   - Health would not be an appropriate choice of taking the lead of reuse projects
   - If on-site, Municipal Affairs is responsible for plumbing and small waste disposal and Health provides support
     - Any time water is plumbed, and comes into contact with people then it is the Municipal Affairs jurisdiction
   - Municipal affairs would be an applicable agency for both urban municipalities and industry
     - The plumbing code is in effect if it enters any building whether a home or an industry

A5 Alberta: Health Regulator Telephone Conversation Summary

DATE	February 12, 2013	**TIME**	14:00
CONTACT	N. Fok	**DEPARTMENT**	Environmental Public Health
COMPANY	Alberta Health Services	**JOB TITLE**	Provincial Manager; Scientific Advisory Team

(Note: Questions posed to respondents are in italics)

Local Background

1. *Re: IR from Alberta Health Services (AHS) perspective?*
   Response:
   - If it is a closed loop system and there is no exposure to workers or the public then AHS would not get involved
     - Occupational Health is part of public health
   - Right now industrial reuse is not allowed under the plumbing code (Alberta Plumbing Code)
     - Not allowed to have any piping in a building that does not carry potable water
     - Even though Health Canada has a guideline for using wastewater for flushing toilets, it is not allowed via the plumbing code
     - Only way you can have water reuse within a building is to apply for a variance
       - Under Municipal Affairs, the Safety Code officer that looks after Plumbing
       - Applies to any plumbing system, if it enters a building (industrial or domestic)
     - If you use wastewater for irrigation, if it does not go into a building it is acceptable, but if it goes in the building you need a variance

2. *Re: Current reuse permitting process in Alberta from health perspective?*
   Response:
   - Health Department does not have any guidelines or regulations in place.
     - Health department works with Alberta Municipal Affairs
     - If a proponent is applying for a variance, AHS will look at the variance to see if there are any health concerns
     - This is how reuse projects are handled at the moment
   - AHS is alerted about IR projects either through the ESRD, the Municipality, or the industry
   - Note regarding difference between Alberta Health, and Alberta Health Services
     - Alberta Health – provincial ministry of health
       - Set all the standards, regulations as well as working relationships between different government departments
     - Alberta Health Services – Operational branch that carries out all the acts, regulations and enforcement
   - Currently, if an industrial proponent requests a standard for IR then the process has to come from Alberta Health
     - Alberta Health will consult with other Jurisdictions (ESRD, and Municipal Affairs), to make sure everything is harmonized
     - AB Health Services will carry out those acts and regulations to make sure they are complied with
   - Currently, there is no water reuse guideline in AB
   - Under our Nuisance and General Sanitation Regulations (Under the Public Health Act) there is a powerful clause that defines nuisance:
     - "Nuisance means a condition that is or might become injurious or dangerous to the public health. Or that might hinder in any manner the prevention or suppression of disease
     - Broad definition
   - With this definition, in one way reuse could be considered a "nuisance" so in this way Public Health would have jurisdiction to ensure that Public Health is protected

    - The Public Health Act has paramount-cy over all other acts and regulations in Alberta except for the Bill of Rights
- Water conservation and reuse is great, as long as there is no threat to public health

3. *Re: health issues related to IR?*
   Response:
   - Where there is the potential for exposure, we have to look at all the routes of exposure (inhalation, dermal contact) and come up with recommendations
   - When considering reuse, AHS considers microbial, chemical, as well as any other physical risk of exposure
     - If reclaimed water would be converted to steam then microbial risks would be less
     - With steam, the concerns would be volatile organics with low boiling points
   - Every scenario we look at the potential routes of exposure on a site by site basis.
     - Currently, AHS looks at the whole process and does a risk assessment as opposed to prescribing certain numbers
     - Case by case basis

4. *Re: recommendations for a reuse system in Alberta?*
   Response:
   - Need for every government agency to better understand their role and responsibility
   - At this point, the role of AHS is unclear as is the municipalities
   - Need to bring all regulators and stakeholders together to decide who will set the guidelines etc.
   - Reuse is a difficult issue because it is new and there is no defined process.
     - no guidance document so we have to look at every application one by one and come out with acceptable levels
   - ESRD likes specific numbers but Health does not look at projects that way (does not like to prescribe one set of numbers)
     - Health would conduct a SSRA
   - What is needed for Alberta is some guidance on who to approach and what to do

5. *Re: Reuse program development to date?*
   Response:
   - Municipal affairs, AB health, and ESRD are on a committee in an attempt to define a process for reuse
     - The policy is far from being written
   - This policy group is attempting to define the roles and responsibilities for all involved jurisdictions
   - ESRD they can only look at things that they regulate
     - Example: In Calgary there is a proposal to use storm water for irrigating a golf course
     - Because it is storm water the ESRD is not involved
     - Health might be the only jurisdiction to consider this project

A6 US: Practitioner Telephone Conversation Summary

DATE	January 10, 2013	**TIME**	14:00
CONTACT	J. Cotruvo	**DEPARTMENT**	N/A
COMPANY	Joseph Cotruvo and Associates LLC	**JOB TITLE**	President; National Regulatory Committee Chair (WateReuse Association)

(Note: Questions posed to respondents are in italics)

Local Background

1. *Re: General perspective on IR in the US?*
   Response:
   - American Society for Mechanical Engineers (ASME) is looking into IR as does a section in the WateReuse Association
   - Cotruvo and Associates has recently prepared a guideline for the reuse of water in the beverage and food applications (generally considered an industrial use)
     - International Life Sciences Institute (ILSI) Publication
   - A process has recently been initiated to develop guidelines across the state for potable reuse
     - Now collecting status information from all the states
     - Should be complete by the end of August, 2013
     - Once information has been collected, then guidelines will be produced
     - Technical consensus regulations since there are no guidelines in place
     - Being done through the WateReuse Association and the Association of State Drinking Water Administrators (ASDWA)
   - The States that are the most active in reuse are:
     - California
     - Florida
     - Texas
     - Arizona
   - Other states with reuse activity include:
     - Washington
     - Colorado
   - Eastern part of the US has water problems while on the west there are not the same issues.
     - Nevada:
       - Senator Reid of Nevada has an initiative to develop reuse in that state
       - Very little water there accept for what is available through the Colorado River
   - USEPA:
     - Not really involved in reuse except as an information provider
       - Published the 2012 Water Reuse Guidelines
       - Not as a guideline but as a source of information on reuse

2. *Re: Identification of agencies or individuals involved in Reuse for each state?*
   Response:
   - Contact water reuse association for a membership list
     - Inquire about what is happening regarding industrial reuse and the people they know who work in and support that industry

A7 US: Practitioner Telephone Conversation Summary

DATE	April 17, 2013	**TIME**	15:15
CONTACT	E. Rosenblum	**DEPARTMENT**	N/A
COMPANY	Eniroperspectives Inc.	**JOB TITLE**	President; Co-chair Industrial WateReuse Committee

(Note: Questions posed to respondents are in italics)

Local Background

1. *Re: General perspective on IR in the US?*
   Response:
   - Ease of use is important for industrial customers
     - If it is 3 years (or one year) to permit the use of a resource like effluent then most industries would not be interested
   - California, Arizona, Florida have industrial reuse programs
   - Regarding reuse of treated effluent, most regulations are focused on the separation of the potable and non-potable water systems as much as possible (especially in California)
   - The water rights issue is important for reuse systems:
     - California example:
       - As an inland user, if you are taking water out of a river and then using it, treating it, and supplying it to another entity within your service area then generally speaking (with respect to water rights) you have the rights to the water until and unless you return it to the river
         - If you treat it, you own it
       - The implication is that in some cases you deliver reclaimed water for process use is that it may be returned again after a second use, or
       - If reclaimed water is for cooling, then it is possible that it will simply be evaporated and return as rain somewhere else
       - Water rights implications when, due to reuse, there is a failure to return flow to a river causing a measureable diminishment of the value of the river for downstream users
         - Example, (the failure to return the water) raises the temperature or changes the availability of water for fishing etc.
         - If one can attribute these issues directly to the withdrawal and failure to return the water then there might be some constraints put on the reuse
     - Example:
       - City of Sacramento (upstream of Salt Sink)
         - Have demonstrated that their use of up to several tens of thousands of acre/ft is going to be a diminimus impact relative to the river (1-2%).
         - No argument regarding the right to reuse
         - Concern was if the diversion would cause measurable harm to downstream users

2. *Re: California specific?*
   Response:
   - Utilities in California to approach:
     - West Basin Municipal Water District (largest number of industrial customers) – they make designer water (5 grades of recycled water)

        - Sometimes multi-million dollar treatments done on site to ensure that the quality meets the industry needs
    - California has a general permit for water recycling
        - Every utility can permit their own end customers (does not go through the state organization any more)
        - Each utility is able to add customers to their roster and permit them based on their own general permit
        - Utilities do not have to do any extensive work to get permission
            - Simply qualify for a general permit that meets certain basic regulations in terms of water quality
            - Then, the utility takes on the responsibility for managing reuse programs
    - California is an example of a "mature" system
        - If a utility has a customer that wants to use recycled water then the facility could be permitted within 3 to 6 months
            - Send drawings up to a central area and say this is how we're separating the cross-connections etc.
            - Industry would obtain provisional permits so they could use water in the meantime (contingent on their eventual signoff)
    - Public Health involvement:
        - Two ways:
            - Public health department is focused on ensuring the two systems (potable and non-potable) remain separate
                - Easy on the industrial side because they're used to having non-potable water for their own internal use
            - Quality Requirements

3. *Re: WateReuse Association Research on IR?*
   Response:
    - WateReuse Association recently sponsored a research project that looks at:
        - Regulation and the process of communication between the utility and the industry
    - Project emerged from discussions between utilities and agencies
        - For example: Utility was proud of the fact that it only took 18months from the time that the industrial customer was aware of the availability of water until they were connecting and using it
    - Utility and Industry perspective
        - Process to facilitate industrial customers is onerous
        - Industry works on a quarter system and thus anything that extends over a year is an extended period of time
        - Learned that industrial customers "impatiently look at their watch while the utility is looking at a calendar"

4. *Re: recommendations on research approach?*
   Response:
    - When questions are asked in a yes/or no fashion then what you are asking is:
        - "Tell us how you manage water recycling?"
            - Too broad and the subject of a life's work
        - Want to know: "how can we develop a knowledge base for managing recycled water in our country"
        - The answer to that in the US has been the development of the water reuse association (now international)
            - Started with two different reuse groups (policy and technical)
            - Eventually had national significance and thus included other states
        - The foundation likely has studies, papers, etc. that might be appropriate
    - Could spend years obtaining detailed information but there would not be much to show for it
        - It's not just the sponsor that needs to know the information it's all the regulators, industries, people selling the water, wholesale water etc.
    - What is important is developing an institutional network that is appropriate for the use of recycled water: "it's not the rules it's the relationships"
    - This research has to do with "how does one entity work with another"
        - Questionnaire is overwhelming
    - Pass this on to the sponsors of the research

- Look at what's being done with water reuse and get to know some of the leaders in the WateReuse Association to obtain the information they need as quickly as possible for their work
- This topic is an important question with a lot of answers
    - Can obtain direct help from other agencies that are familiar in detail with anything that the sponsor is interested in doing
- There are whole trade associations devoted to providing the support that is implicit in this research
- Talk to the executive director of the WateReuse Association with an eye towards possibly developing a Canadian presence
- This is information you don't require at one time and one place:
    - these are the barriers that one will always have to move through to develop a dual reticulation system for water distribution

APPENDIX B – Investigation Template

Investigation Template (Final)

DATE	**TIME**
CONTACT	**DEPARTMENT**
COMPANY	**JOB TITLE**

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
      •
   b) *Re: other regulatory agencies involved in IR?*
      •
   c) *Re: inter-agency communication?*
      •
   d) *Re: water source?*
      •
   e) *Re: reuse applications in state?*
      •
   f) *Re: management of WWTP?*
      •

2) *Permitting Process Summary (from respondent perspective)?*
   •
   a) *Re: Water Quality? (i.e. Health, etc.)*
      •
   b) *Re: Water Quantity? (i.e. Usage)*
      •
   c) *Re: Water Rights?*
      •

3) *Commentary of IR Program in Practice?*
   a) *Re: efficiencies?*
      •
   b) *Re: Inefficiencies?*
      •

4) *Respondent Recommendations?*
   •

5) *Examples of IR in Practice?*
   a) *Re: Resources?*
      •
   b) *Re: Projects?*
      •

Rationale

The Rationale for inclusion of particular questions in the investigation template is based on findings as they relate to the current state of IR from Alberta and US preliminary respondents.

A summary of the current state of IR in Alberta as reported by local preliminary respondents (Appendix A1-A5) is as follows:

- Current regulatory system for managing IR projects, including identification of agencies involved and their responsibilities, requires improvement
- Water reuse projects are handled on a case by case basis without assistance of formal guidance documents or prescribed processes
- Permitting process is not consistent between projects and/or agencies and requires standardization
- There is an interest within government to resolve these issues and generate a policy and program for water reuse practices in Alberta

A summary of the current state of IR in the US as reported by US preliminary respondents (Appendix A6-A7) is as follows:

- Jurisdictions with involvement in IR projects in the US include California, Florida, Texas, Arizona, Washington, and Colorado
- USEPA not directly involved in IR at the state level
- Water rights issues may differ with local rules since, in some states, effluent is owned by the wastewater treatment plant once treated and prior to discharge

Based on information gathered from Alberta and US preliminary interviews, the rationale for inclusion of particular questions in the survey is as follows:

- Questions 1a to 1c: These questions reflect the issues noted by Alberta respondents summarized above and as found in Appendix A1-A5
- Question 1d: The source of raw water was included for comparison purposes with the Alberta framework. The Alberta regulatory framework has evolved based on the presence of the major trans-boundary river systems and the reliance on many surface water resources (B. Aidun, personal communication, 2013; Appendix A2).
- Question 1e: This question was asked of respondents for the dual purpose of assessing if industrial reuse was a major component of their program, and to solicit ideas for incorporation in Alberta
- Question 1f: Management of WWTPs was included to understand the relationships that may exist between the utility and the regulators. For example, county owned WWTPs may not hold the water right for the potable supply of the municipality providing their influent thus causing intrinsic complications in water reuse projects
- Question 2a to 2c: Quality/quantity permitting and water rights considerations reflect the needs of Alberta respondents summarized above and as found in Appendix A1-A5
- Question 3: Feedback from practitioners and regulators related to how well their respective IR systems works would provide the ability to learn from previous experience

- Question 4: This general question would provide the respondent the opportunity to make a recommendation on how to mitigate inefficiencies of a system or how to go about incorporating a water reuse program in a given location
- Question 5a: Documents used by practitioners and regulators may provide a useful resource for the incorporation of a water reuse program
- Question 5b: Example projects include the opportunity for further study and the opportunity to observe how the reuse system works in practice

APPENDIX C – California Survey Results

(Note: All telephone conversation records have been summarized and paraphrased)

C1 California: Practitioner Telephone Conversation Summary

DATE	April 25th, 2013	**TIME**	16:00
CONTACT	E. Goldman	**DEPARTMENT**	Public Information and Conservation Department
COMPANY	West Basin Municipal Water District	**JOB TITLE**	Water Efficiency Specialist

DATE	April 25th, 2013	**TIME**	16:00
CONTACT	E. Hartling	**DEPARTMENT**	N/A
COMPANY	Sanitation District of Los Angeles County (LACSD)	**JOB TITLE**	Water Recycling Coordinator

Note: Conference call organized and chaired by Elise Goldman. Unless otherwise noted, answers are provided by Earle Hartling.

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) IR Management?

a) Re: main permitting agencies for IR?
Response:
- Regional Water Quality Control Boards (RWQCB) of California.
  - Regulates water quality aspects of water reuse (i.e. Title 22).
  - Nine Regional Boards serving the State of California
  - The Department of Public Health consults in matters related to human health
- State Water Resources Control Board (SWRCB)
  - Regulates water quantity aspects of water reuse

b) Regulatory agencies involved in IR?
Response:
- SWRCB
- RWQCB (a.k.a. The Regional Board)
  - Grants "practical" approval for specific reuse projects
  - Enforces Title 22
- California Department of Public Health (CDPH)
  - Grants "theoretical" approval for reuse applications based on approved uses
  - Acts as the consultant of the Regional Board

c) Re: inter-agency communication?
Response:
- Communication between jurisdictions (SWRCB, Regional Board, and CDPH) is done on an *ad hoc* basis

d) Re: water source?
Response:
- In the LA region, the water source is either groundwater or imported water
  - Zero surface water use

e) Re: reuse applications in state?
Response:
- Cooling towers
- Injection into oil zones for re-pressurization
- Carpet and textile dying

- Metal plating
- Soil Compaction
- Dust Control
- Concrete manufacturing

f) Re: management of WWTP?

Response:

- Mainly privately and municipally owned
- Background on purveyance framework in California as follows:
    - Water Sources may come from:
        - Regional Agencies
            - For example, a regional agency may move large amounts of water from the Colorado River Project or from other state water projects from the north down into the LA basin
            - May use local agencies to move the water to sub-agencies in a complicated process
        - Producers of recycled water
            - May or may not also be the purveyors of recycled water
            - Their main function is to manufacture water to specification
            - The LACSD for example does not have a relationship with the end user but strictly the retail purveyor
            - The West Basin Municipal Water District is a hybrid in that it is both a producer and wholesaler (not a retailer).
                - West Basin Municipal Water District is a wholesaler, or pass through agency, taking imported water and passing it along to retail purveyors
    - Retail Purveyors (Retailer)
        - The retailer has the relationship with the end user (e.g. a particular industrial user)
        - The "middle man". Functions as a conduit to get the water from the producer to the end user
        - The purveyor is the water company
    - End Users
        - For example: particular industries or commercial applications
- The system is a basic Tariff structure:
    - The producer doesn't have a relationship with the end user
    - The producer has to rely on the "middle man" (i.e. purveyor) who is delivering the water to the end user
    - The producer does have a relationship with the retailer
    - The producer has contracts for the sale of their water through the retailer
    - The producer has contracts sometimes with a wholesaler, who then have contracts with the retailers who would then deliver the water to the end user
- The water is sold through a tariff just like any other water supply (based on rates for the quality of the water)

2) Permitting Process Summary (from respondent perspective)?

a) Re: Water Quality? (i.e. Health, etc.)

Response:

- All treatment plants have permits that are granted from the Regional Board based on the approved uses found in Title 22
- The CDPH sets the quality requirements and these requirements are then taken by the Regional Board and put into the permit
- For uses not included in Title 22, the Regional Board has mechanisms to approve what they deem to be "equivalent" (i.e. it is equated with another use)
    - Example: The application for use of recycled water for Carpet Dying should meet the criteria for Unrestricted Recreational Impoundments
- Important to note that the use of reclaimed water for cooling towers, plating industries etc., isn't tied to the end user but the treatment plant itself
    - Example: If the San Jose Creek Water Reclamation Plant (WRP) has an approval to provide reclaimed water to a certain cooling tower then that use would be permitted under the San Jose Creek WRP. If the Los Coyotes WRP wants to provide reclaimed water to that same cooling tower, a second permit would be required

- In the case of the LACSD, which produces tertiary treated water that is approved of for all applications, applications for each specific use would have to be added to the permit for waters originating from each WRP
- Subsequent users of water produced by WRPs have to follow the required uses of the original permit held by the WRP
    - The requirements of the original permit follow the water as it moves to each user. End users, having purchased the water, cannot use it for non-approved purposes

b) Re: Water Quantity? (i.e. Usage)

Response:

- There is no requirement for return flows back into the basin if waters originate from groundwater. It can be exported and used elsewhere
- In California we have "Basin Plan Objectives"
    - Designed to protect the underlying groundwater of the basin
    - Requirements set for total dissolved solids (TDS), Sodium (Na), Chlorides (Cl), and Boron (B) if irrigation is to occur above a particular groundwater basin
- Regarding recycled water, WRPs are the only entities that can legally appropriate the recycled water for use and once it is in their system, it belongs to them
- If the WRP wishes to divert water that has been hitherto discharged to a stream, permission must be granted from the SWRCB (which is one level up from the Regional Board)
- Imported water is assumed to be completely consumed.

c) Re: Water Rights?

Response:

- Basin to basin transfers
    - Political issues such as the sale of water to recycled water purveyors that are located on the edge of the county seeking to ship water over the county border
        - The issue is whether or not reclaimed water originating from the county should remain in the county. For instance, it is being treated in the county and is a resource of LA County paid for by LA county rate payers, but if it is sold outside the county, the money generated would go to benefit the rate payers
- Protection of third party users?
    - In order to physically guarantee the steady supply of water, the LACSD engineers redundant capabilities in terms of equipment, power supplies, monitoring equipment etc.
    - The metropolitan Los Angeles service area has seen an ongoing reduction in wastewater generation for many years
        - In the chance that WRPs experience water shortages, diversions can be made from the ocean disposal plants in order to compensate
        - There is an attempt to have the WRPs operating at as high a level as possible
    - The main "third party" that is being protected in California is the purveyor (or "middle man")
        - There is an "Anti-paralleling statute", or service duplication law, to protect purveyors who have installed, constructed and financed water distribution systems their entire certificated service area. There is no area that has two sets of pipes from two different companies
        - If a WRP (or producer) sold recycled water to a user, then the plant would have to pay them for economic losses suffered from their stranded assets

3) Commentary on IR in Practice?

a) Re: efficiencies?

Response:

- The timeline for approval of a new reuse application may take a matter of weeks based on the State's history of water reuse
    - This timeline is dependent on the workload at the Regional Board and the complexity of the project
- Although the process can be viewed as a "hassle" the benefits if properly understood should remove these perceived barriers
    - Recycled water in California will not be rationed even in times of drought.

- For example, industrial customers in the 1990s faced 25% rationing with the potential of 50% rationing of water (i.e. Billion dollar/year refinery being forced to become a 500 million dollar/year refinery)
- Recycled water as a reliable source can save the customer money and allow them to be more competitive

b) Re: Inefficiencies?
Response:

- Permits have not been updated since the mid-1980s while Title 22 was updated in the year 2000. Therefore the permit does not reflect the current approved reclaimed water uses
  - Due to the fact that these working documents (i.e. the permits) are not up to date, an engineering report must be submitted to the Regional Board outlining new applications

4) Respondent Recommendations?
Response:

- The 450 CT requirement could be removed if another jurisdiction was going to use Title 22 as a model. The number is extrapolated from a 1977 virus study
- Engineering reports are intended to keep everyone informed including the regulator, producer, purveyor and end user

5) Examples of IR in Practice?

a) Re: Resources?
Response:

- Guidance for creation of Engineering Reports
- Title 22 and the associated permits
- Basin Plan Objectives

b) Re: Projects?
Response:

- West Basin Municipal Water District
  - 250 to 300 reuse sites
- Sanitation District of Las Angeles County (LACSD)
  - 700+ reuse sites
- Las Virgenes Municipal Water District
  - Approximately 2,000 reuse sites
- Long Beach Water Department (LBWD)
  - There are "oil islands" that draw oil from under the city of Long Beach
  - Although the "oil islands" recycle approximately 90% of their water, they require "make-up" water which has been supplied by the LBWD for about the last 10 years
  - Recycled water is also used for oil-zone re-pressurization
  - The usage of reclaimed water by the oil islands was included in the original permit granted to the LBWD. That usage is one reason the plant was built there
  - At the same time the plant was built, a distribution line was installed between the LBWD and the oil islands. These were not used for many years since in the early years of the plant only secondary effluent was being produced. Years after moving to tertiary treated water, it was realized that the water was of sufficient quality for certain applications in the oil islands
  - For some of the deep-zone injection, micron-level filtration is usually required

C2 California: Quality Regulator Telephone Conversation Summary

DATE	July 02, 2013	**TIME**	16:00
CONTACT	G. Innes	**DEPARTMENT**	Water Quality
COMPANY	State Water Resources Control Board (SWRCB)	**JOB TITLE**	Senior Water Resources Control Engineer

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - The Regional Water Quality Control Boards (RWQCB) of California
   - The State Water Resources Control Board (SWRCB)

   b) *Re: other regulatory agencies involved in IR?*
   Response:
   - SWRCB
     - Interested in two aspects:
       - Encourage the use of reclaimed water at industrial facilities
       - Requirements put in place to protect the environment when water reuse occurs
   - RWQCB (a.k.a. The Regional Board)
     - Under the water code, there are nine Regional Boards
   - Boards issue water reclamation requirements that have implementation criteria that have been adopted by the California Department of Public Health (CDPH)
   - CDPH

   c) *Re: inter-agency communication?*
   Response:
   - No comments

   d) *Re: water source?*
   Response:
   - No comments

   e) *Re: reuse applications in state?*
   Response:
   - Recently constructed power plants
     - Cooling water towers and then the blow-down is evaporated resulting in the plant being categorized as a "zero-discharge" facility

   f) *Re: management of WWTP?*
   Response:
   - No comments

2) *Permitting Process Summary (from respondent perspective)?*
   a) *Re: Water Quality? (i.e. Health, etc.)*
   Response:
   - Water recycling criteria is in place explaining different requirements for different activities
     - Example: there is one set of requirements for agricultural irrigation and another one for cooling towers. In regards to the latter, the concern is that there would be some mist generated with bacteria in it possibly affecting the public
   - Regional Board issues the water reclamation requirements and before they issue those requirements they consult with the CDPH who sends recommendations to be incorporated into the water recycling requirements

   b) *Re: Water Quantity? (i.e. Usage)*

Response:

- In terms of the SWRCB, it may occur when there is a wastewater treatment plant that is discharging to a stream continually; the downstream water uses develop a "right" for that discharge
- When the WWTP proposes to cease discharging to the river and instead deliver that water for recycling purposes, they must come to the Water Rights division of the SWRCB to obtain permission
- The SWRCB would become involved when the facility was planning a new project and applying for a change in the point of discharge

c) Re: Water Rights?

Response:

- Re: protection of third party users?
    - Negotiations between the producer and the industrial facility ensure quality and quantity needs are met between both parties
    - May have a back-up freshwater supply if the utility was unable to deliver the recycled water for a certain time

3) Commentary of IR Program in Practice?

a) Re: efficiencies?

Response:

- Have adopted a good water recycling criteria so there is no ambiguity as to what levels need to be met

b) Re: Inefficiencies?

Response:

- Industrial reuse can be a difficult program to implement because an agency can spend a lot of dollars getting recycled water to an industrial facility (e.g. putting in the distribution systems) and then to have the industrial facility close down
- Or, the wastewater supply might not be of consistent quality and quantity
- The current system is not a model of efficiency as there are multiple agencies involved in environmental issues. Washington has a good program in that it is a single regulator which may simplify IR processes

4) Respondent Recommendations?

Response:

- The current system is not a model of efficiency as there are multiple agencies involved in environmental issues. Washington has a good program in that it is a single regulator which may simplify IR processes
- Recommended: CII Task Force Report (re case studies, vision etc.)

5) Examples of IR in Practice?

c) Re: Resources?

Response:

- No comments

a) Re: documents used in practice?

Response:

- SWRCB has an old policy that spells out a preference for industries to use recycled water if available
- California Water Code
    - SWRCB website (www.waterboards.ca.gov)
    - Click on laws and regulations (http://waterboards.ca.gov/laws_regulations/)
    - Click on "Porter-Cologne Water Quality Control Act (http://waterboards.ca.gov/laws_regulations/docs/portercologne.pdf)
    - Chapter 7.5 Water Recycling Act of 1991 (page 102 of document) for general information
    - Page 95 (Section 13552.6 Regarding Cooling) and required use for cooling (Section 13552.8)
        - This allows agencies to require industries to use recycled water for cooling water purposes
- California Health Laws Related to Recycled Water ("The Purple Book")
    - Page 51 – Use of recycled water

        - Page 53 – Use of recycled water for cooling
            - Puts out some requirements for cooling
        - Page 54 – Use of recycled water for other purposes
            - Lists some industrial purposes
    - Commercial, Institutional, and Industrial Task Force Water Use Best Management Practices Report to the Legislature - Volume I
        - Has a number of recommendations for water recycling in industrial facilities (although mostly relating to internal recycling)
        - Note: forwarded via email

d) Re: Projects?

Response:

- No comments

C3 California: Quality Regulator Telephone Conversation Summary

DATE	July 02, 2013	**TIME**	10:40
CONTACT	R. Medina	**DEPARTMENT**	Municipal Permitting Unit
COMPANY	Regional Water Quality Control Board (RWQCB)	**JOB TITLE**	Water Resources Control Engineer

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - The Regional Water Quality Control Boards (RWQCB) of California.
     - Each board oversees their respective region
   - The State Water Resources Control Board (SWRCB) oversees Water Rights

   b) *Regulatory agencies involved in IR?*
   Response:
   - SWRCB
   - RWQCB (i.e. The Regional Board)
   - California Department of Public Health (CDPH)

   c) *Re: inter-agency communication?*
   Response:
   - No comments

   d) *Re: water source?*
   Response:
   - No comments

   e) *Re: reuse applications in state?*
   Response:
   - No comments

   f) *Re: management of WWTP?*
   Response:
   - No comments

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - From the Regional Board perspective, the SWRCB is the head office but all the regions work autonomously
   - Each region oversees permitting within their respective geographical areas/jurisdictions. The criteria are relatively similar between regions
     - All of the regional boards will implement the applicable state and federal regulations related to water reuse
     - State-wide policies are implemented in the issued permits from the Regional Board so the SWRCB need not be included in typical permitting processes
   - Regional boards, including LA (Region 4) have their own board that approves all National Pollutant Discharge Elimination System (NPDES) permits
     - This is a federal permit originating from the USEPA
   - The Regional Board then permits the POTWs (privately owned treatment works – agency that collects and processes all household, domestic, or industrial wastewater)
     - It is the POTW that produces the recycled water and they that that facilitate the distribution or reuse of this recycled water
     - Example will be forwarded via email

        - The permit will specify what uses the recycled water can be used for
    - Once the water is treated (either secondary or tertiary treated water), the agency itself is the one who would create a list of user for the distribution of that recycled water
        - That list would be provided to the Regional Board
        - The list would include the users and how much water they will be using / consuming throughout the year
        - The permit would include which customers they provide water to
        - The third party users do not seek the permit from the Regional Board directly but enter into private contracts with the POTWs
        - The end-user's must still comply with the end use specifications
    - The board members meet every month to hear and approve (or not) any water related issues which also include issuing permits

a) Re: Water Quality? (i.e. Health, etc.)

Response:

- The CDPH dictates what the quality criteria would be
- The Regional Board is issuing agency for the discharge of water into groundwater or navigable waters. This board issues one permit as a whole to incorporate the CDPH requirements for recycled water
    - If the CDPH were to alter the numbers, those new numbers would need to be reflected in our permits
- It is a POTW that would approach one of the divisions of the Regional Board seeking an NPDES permit
        - The permit is issued to a discharger that allows them to discharge water of specified water quality criteria to a surface or groundwater supply
    - From the Regional Boards perspective, it is necessary to determine where the discharge will take place (storm drain, surface water, or groundwater)
- If an industry wanted to access reclaimed water, they would approach the POTW, the city, or jurisdiction
- The Regional Board is not approached directly by the industry but by the POTW

b) Re: Water Quantity? (i.e. Usage)

Response:

- No comments

c) Re: Water Rights?

Response:

- No comments

3) Commentary of IR Program in Practice?

a) Re: efficiencies?

Response:

- The current system of having prospective users of recycled water (i.e. industries) approach the individual POTWs rather than the Regional Board works well and should be retained
    - From the perspective of the end user, it is more fitting that they deal directly with the POTW or agency providing the water
    - If the Regional Board was regulating the "producer to user" component then it would be a huge task

b) Re: Inefficiencies?

Response:

- Having two agencies (CDPH and the Regional Board) regulate water reuse can sometimes increase the permitting turnaround time
    - Example: waiting for stipulations from the CDPH

4) Respondent Recommendations?

Response:

- No comments

5) Examples of IR in Practice?

a) Re: Resources?

Response:

- NPDES permit

b) Re: Projects?

- No comments

C4 California: Quantity Regulator Telephone Conversation Summary

DATE	July 2nd, 2013	**TIME**	15:00
CONTACT	R. Mills	**DEPARTMENT**	Water Recycling and Desalination Section; Water Use and Efficiency Branch: Division of State-wide Integrated Water Management
COMPANY	California Department of Water Resources	**JOB TITLE**	Chief

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - The Regional Water Quality Control Boards (RWQCB) of California
   - The State Water Resources Control Board (SWRCB)

   b) *Regulatory agencies involved in IR?*
   Response:
   - California Department of Water Resources
     - Operates as a supplier through the State Water Project
     - The State Water Project which takes water from the middle of California (called the Delta) and exports it mainly to the Las Angeles and San Diego and various irrigation districts
     - Another function is as the state-wide planning entity for water resources. The way in which it performs that function is to issue a "California Water Plan Update" approximately every five years. These updates deal with various topics or chapters including water quality, quantity, planning etc.
     - The third function is to channel state funds to local agencies to plan, design, and construct various types of facilities (including desalination funding for brackish groundwater or ocean water)
       - Voters can approve bond issues so that the state can sell bonds. The proceeds of these sales can be used for capital expenditures
       - Typically, the state has programs to channel the money to local agencies for various applications including water reclamation
       - Also, there is an "Integrated Regional Water Management Grant Program"
         - Allows a consortium of local agencies in a region to partner together and fund a variety of projects that may include water reclamation, water quality or water resources
     - This agency does not have a strong regulatory role, but is involved in incentives, state wide planning, information gathering etc.

   - SWRCB
     - The main program of funding regarding water reuse is with this board. This board has a water recycling funding program that uses state bond funds for grants or low interest loans
       - The states have a low interest loan program, state revolving fund, originating from the Federal Government. When the money is repaid buy a particular agency, it goes back into the same pool to be re-loaned again.

These funds can be used for water reuse or other water quality control purposes
    - Another function of the SWRCB is to allocate water rights
        - In particular, surface water rights, riparian rights and if a potential user does not have land next to the water body then an appropriate right can be applied for.
            - First in time first in right is the policy.
    - The other function is primarily water quality related. The permits that dischargers receive (both municipal and industrial) can be issued here but it also has nine Regional Water Quality Control Boards underneath it
    - The permitting is done by the Regional Boards, but the SWRCB establishes the rules
    - The SWRCB sets the framework that the Regional Boards will implement.
    - In some cases there are rules are established by the Federal Government. This would include the NPDES (National Pollutant Discharge Elimination System)
        - This system was set up under the Federal Clean Water Act. In most cases, the USEPA has delegated to the states the administration of that program. As such, the state will issue permits to the individual dischargers
    - The SWRCB can act as the appellant entity (i.e. hears appeals) if a permittee has an issue with the Regional Board
    - The SWRCB may also establish state policies if there are persistent issues.
        - Example: in 2009 the SWRCB adopted a Recycled Water Policy to address issues at the local level and create consistency between the nine regional board
- RWQCB (i.e. Regional Board)
    - Operates under the SWRCB
    - Issues permits that would include the applicable public health requirements outlined by the California Department of Public Health (CDPH)
        - May also include requirements to protect groundwater, runoff, or other issues etc.
    - There are nine boards, each with their own governing body, that have a semi-autonomous status
- CDPH
    - In California, the law established that the CDPH would set the rules for the levels and kinds of wastewater treatment that are required for various beneficial uses of the wastewater
        - Generally, the greater the opportunity for public exposure then the higher the level of treatment.
        - Example: maybe non-disinfected secondary treatment would be sufficient for orchard crops where the produce never comes into contact with the irrigation water. However, if it is a playground then it will require filtration in addition to secondary treatment with specified levels of disinfection
    - The CDPH sets the treatment criteria but does not issue the permit

c) Re: inter-agency communication?
Response:
- There is a Memorandum of Agreement between the CDPH and SWRCB to clarify roles and responsibilities
    - For example, how to resolve disagreements

d) Re: water source?
Response:
- No comments

e) Re: reuse applications in state?
Response:
- Golf courses
- Irrigation

f) Re: management of WWTP?
Response:
- The state does not build or implement any water reclamation facilities
- Water reclamation facilities are usually initiated by local water districts, wastewater districts or general purpose city plants that can do one or the other function

- The local districts are the entities that do the treatment and build the pipelines to get the water to the user
- As such, the relationship is between the industrial user and the local purveyor or treatment agency that is providing the water. The agency that treats or delivers the water is the one who has to have the state permit and would have to go the Regional Board

2) *Permitting Process Summary (from respondent perspective)?*
   a) *Re: Water Quality? (i.e. Health, etc.)*
   Response:
   - In regards to industrial water reuse, there are not only the public health issues, but each industry has its own water quality needs
     - Example: if you are going to use reclaimed water for a cooling tower then there would be concerns for bacteria growth inside the tower. As such, there would be limits on nitrogen (promoting algal growth), salinity (causing deposition in cooling towers)
     - Example: if the reclaimed water is going to be used for carpet dying, then water quality implications on the behaviour of the dye should be considered
   - These requirements are not dictated by the state, but by the perspective users

   b) *Re: Water Quantity? (i.e. Usage)*
   Response:
   - See water rights (below)

   c) *Re: Water Rights?*
   Response:
   - In California, state law has evolved such that whoever owns the water treatment plant, owns the wastewater coming out of it unless there are other contractual arrangements
   - If a wastewater generator has been discharging into a stream for many years then there may be downstream users who have become dependent on that flow. In cases such as these, then the downstream water diverter may have acquired a right to a certain quantity of water
     - In this case, if the wastewater agency decides to cut that water off so it can deliver reclaimed water to an industry or farm, then that might cause an issue downstream
     - In cases such as these, the SWRCB (water rights department) deal with those issues or its dealt with via contracts between agencies
   - Basin to basin transfers
     - Triggers a report to the division of water rights to assess if there is a water rights issue

   d) *Re: Resources?*
   Response:
   - California Water Plan Updates
   - Integrated Regional Water Management Grant Program
   - NPDES (National Pollutant Discharge Elimination System)

3) *Commentary of IR Program in Practice?*
   a) *Re: efficiencies?*
   Response:
   - No comments

   b) *Re: Inefficiencies?*
   Response:
   - The existing governmental framework with nine Regional Boards, each with their own governing body and semi-autonomous status, can be problematic
     - Inconsistencies in decisions of the Regional Boards. Some may be more restrictive than others

4) *Respondent Recommendations?*
   Response:
   - The best way to facilitate Water Reuse is to have a strong regulatory framework and structure (structured meaning a system with defined roles and guidance as to who will enforce it)
     - If a regulator is in doubt, then a decision won't likely be made either because there is the potential to make a mistake, or because there may be the possibility of stepping into the boundary of another agency
   - The two main models in the United States are:

    - A state environmental protection agency that handles both the public health and water quality or,
    - As in California, the two are separated with the CDPH and the SWRCB
- In terms of public trust, on the public health side, many people feel that public health criteria is best determined by an agency that is devoted to protecting public health. Not only for that reason, but for the fact that they have a history of protecting the people and the people are used to them
- Since with reclaimed water there are public health and water quality components and the origin is wastewater, then having the water quality side issue the regulatory permits in California is workable providing that the law delineates the roles between the Health Department and the SWRCB
    - In California these two agencies have a memorandum of agreement
- If a wastewater treatment plant is already used to being regulated by a certain agency then there is already a relationship of trust in place. If that relationship were extended to include water reclamation, then keeping the same institutional relationship would be important
- Water suppliers are better suited to operate a reclaimed water distribution system because they function in similar ways and have similar customers as on the potable side
- In general it is important to have a system that maintains institutional relationships since these are of primary concern to a successful project over technical issues. In practice, this would mean having:
    - A regulatory framework that allows permitting to the wastewater entities or water districts thus enabling them to take the lead on implementing projects (i.e. building and implementing). As mentioned, it is important at the implementation level to have customers work with the entities that they're used to working with. The other aspect is:
    - Preserving the public health and water quality regulatory jurisdictions

5) *Examples of IR in Practice?*
   a) *Re: Resources?*
   Response:
   - California Water Plan Updates
   - Integrated Regional Water Management Grant Program
   - NPDES (National Pollutant Discharge Elimination System)

   b) *Re: Projects?*
   Response:
   - The West Basin Municipal Water District
       - Noted for what it calls "Designer Water"
       - This plant takes secondary treated water from the city of Las Angeles and then treats the water to five different levels of treatment
           - The basic tertiary treatment with filtration is used for common applications such as irrigation, and some commercial and industrial
           - For some oil refineries and other customers there are some specialized treatments that are sometimes located on the property of the customer

C5 California: Quantity Regulator Telephone Conversation Summary

DATE	July 09, 2013	**TIME**	16:15
CONTACT	K. Mrowka	**DEPARTMENT**	Water Rights
COMPANY	State Water Resources Control Board (SWRCB)	**JOB TITLE**	Senior Water Resources Control Engineer

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
      Response:
      - The Regional Water Quality Control Boards of California (RWQCB)
      - The State Water Resources Control Board (SWRCB)
   b) *Regulatory agencies involved in IR?*
      Response:
      - SWRCB
      - RWQCB (a.k.a. The Regional Board)
      - California Department of Public Health (CDPH)
   c) *Re: inter-agency communication?*
      Response:
      - Issuance of notices to other parties with a 30 day period to voice objections.
   d) *Re: water source?*
      Response:
      - Only surface waters discussed
   e) *Re: reuse applications in state?*
      Response:
      - Irrigated medians
      - Parklands
      - Some industrial including cooling towers
   f) *Re: management of WWTP?*
      Response:
      - No comments

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - Historically, the Legislature produced a method for wastewater treatment facilities to do their own reuse projects
     - Historically, under the typical water rights scheme you have applications then permits then you perfect your water rights and then you would obtain a license
     - The change occurred where wastewater treatment plant owners would be able to file a “wastewater change petition” and get that approved
     - This process doesn’t have an underlying water right, but is an process in and of itself
   - Reuse becoming more popular in some ways because the Regional Board is raising the treatment requirements for discharge
   - The process, from our agencies perspective, is as follows:
     - Have a loans and grants program
     - Before an agency can receive the loan or grant, they have to obtain signoff from the SWRCB water rights division stating that they do not need a water right
       - Done by email and does not take much time
       - Entity seeking funding or initiating the project must submit information on the proposal

        - Examples where water rights are not an issue would include:
            - Sewer pipe improvements
            - Flow to percolation ponds (since this agency only regulates surface and subterranean streams)
        - Email approval is then attached to the application for the loan or grant
        - If there is a water rights issue, then the entity must get its clearance before they can obtain their loan or grant
            - To do this, the entity would have to do the Wastewater Change Petition process
            - From this division's perspective, there is the requirement to have environmental work done (i.e. the requirements of the Environmental Quality act involving a checklist and guidance on what level of report to complete)
        - There is also a public disclosure provision so individuals have the opportunity to object which can happen
            - This agency cannot issue an approval in the face of an objection without satisfying the complaint
            - The agency does have the ability to sometimes override the conclusions of another agency if unwarranted
    - In general, the process is the same for industrial and non-industrial applications. The petition is triggered with the removal of water from a stream, not the end user

a) Re: Water Quality? (i.e. Health, etc.)

Response:

- No comments

b) Re: Water Quantity? (i.e. Usage)

Response:

- Only the owner of a wastewater treatment plant can file the "wastewater change petition" so they in a sense "own the water" over the person delivering water to them
    - There is a Water Code provision on that
- This scenario can get complicated with "joint use" facilities having to agree on projects because they may not "own it" at the wastewater facility, but the wastewater facility is able to file petitions on its own to go and do projects
- Any time that discharge to a stream system is reduced, an entity is required to complete the Wastewater Change Petition and get it approved
- There is typically not a provision for a WWTP to return flow
    - Tensions may arise if the SWRCB stipulates that the return flow quality is unacceptable and the WWTP has to decide whether to upgrade to tertiary treatment (and discharge high cost water) or switch to water reuse

c) Re: Water Rights?

Response:

- The water rights issue is somewhat negated in California due to:
    - The water being the property of the treatment plant against the supplier, and
    - No requirement to continue non-native flow (i.e. Guaranteed uncertainty with respect to water rights)

d) Re: Resources?

Response:

- Wastewater change petitions
- Environmental Impact Report (EIR) – water reuse master planning document

3) Commentary of IR Program in Practice?

a) Re: efficiencies?

Response:

- The system as it currently sits works very well. Systems improved when press releases peaked interests of the public

b) Re: Inefficiencies?

Response:

- No comments

4) Respondent Recommendations?

Response:

- The way that the reuse system is portrayed to the public is of great importance (i.e. good salesmanship)
- The loan/grant system and the requirement for approval from the water rights division of the SWRCB allows for good coordination between agencies
- Guaranteed "uncertainty" clause in water rights:
    - Historically, in a scenario where there was a WWTP upstream of parties a statement would be added stating:
        - Inasmuch as this flow may contain treated wastewater and other sources (i.e. agriculture return flow) there is no guarantee that this flow will continue
    - This provision, which guarantee's uncertainty in the water right, is now a standard entry into permits
    - This provision, or clause in the water right, is helpful when
        - WWTPs wish to divert flow from the stream to another beneficial use
        - It is also helpful, when for other circumstances, a plant or operation has decreases in return flow

5) *Examples of IR in Practice?*
   a) *Re: Resources?*
   Response:
   - Wastewater change petitions
   - Environmental Impact Report (EIR) – water reuse master planning document
   - Can view all wastewater change orders with this link
       - http://www.waterboards.ca.gov/waterrights/water_issues/programs/applications/wastewater_petition_orders/

   b) *Re: Projects?*
   Response:
   - San Luis Obispo:
       - Two entities in the San Luis Obispo area were providing water to a wastewater treatment plant and one entity decided they wanted to pull out and do their own treatment facility and do reuse
       - There is a lot of change happening in California with respect to wastewater treatment facilities due to upgrades by the Regional Water Quality Board on what can be discharged. Thus, many facilities are having to decide on whether or not they upgrade to tertiary treatment or cease discharging to a stream system altogether
           - Reminder, that any time that discharge to a stream system is reduced, an entity is required to complete the Wastewater Change Petition and get it approved
       - In this scenario, you have a WWTP with an order stipulating when they have to stop their discharge to a stream system which puts the facility in a difficult position as they now require a hasty approval from the SWRCB

C6 California: Health Regulator Telephone Conversation Summary

DATE	June 28, 2013	**TIME**	15:40
CONTACT	R. Barnard	**DEPARTMENT**	Drinking Water and Environment
COMPANY	California Department of Public Health (CDPH)	**JOB TITLE**	Senior Sanitary Engineer; CDPH Recycled Water Treatment Specialist

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - The Regional Water Quality Control Boards of California
     - With the CDPH
   - The State Water Resources Control Board (SWRCB)
     - Water rights issues is the only specific involvement

   b) *Regulatory agencies involved in IR?*
   Response:
   - State Water Resources Control Board (SWRCB)
     - Parent entity over the Regional Boards
     - Each runs independently in their own region
     - Consist of their own assigned board members and their own offices in each region
     - Each region is made up of a number of engineers
   - Regional Water Quality Control Board (i.e. The Regional Board)
     - Nine Regional Boards
   - California Department of Public Health (CDPH)
     - One agency, but broken up into local districts throughout California.

   c) *Re: inter-agency communication?*
   Response:
   - Memorandum of Understanding (MOU) helps to clarify communication between agencies

   d) *Re: water source?*
   Response:
   - More water reuse in the southern part of the state since the north has increased run off and surface water supplies

   e) *Re: reuse applications in state?*
   Response:
   - Boiler feed make-up water
   - Makeup water for cooling towers

   f) *Re: management of WWTP?*
   Response:
   - No comments

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - The Regional Boards are the permitting agency (regulatory authority) for recycled water
   - The Regional Board gets their directions from the SWRCB (the parent agency), however, the SWRCB does not typically get involved
     - The State board (SWRCB) are concerned with water rights, who can withdraw from what etc.
   - Recycled water is typically controlled by each local Regional Board

        - They write the permits, do inspections, enforcements and fines
        - Check monthly reports etc.
    - The CDPH are concerned about public health whereas the Regional boards are concerned with environmental health of their own region
        - Each district office of the CDPH deals with their own area
        - There is overlap between districts of the Regional Board and the CDPH because the CDPH has 20 districts the Regional Board has nine
    - In California, between the SWRCB, the Regional Boards, and CDPH, there is a MOU that has been signed by all three agencies
        - Defines rolls and responsibilities for recycled water so there is no repetition of work etc.
        - This document can be found on the website
    - The MOU states:
        - The Regional Boards have the authority/enforcements
        - The CDPH writes regulations regarding public health issues for recycled water in California. This document is called Title 22
            - Title 22 is a large legal document but only certain sections deal with reclaimed water and are written by CDPH
    - If a project is initiated where there is an entity that wants to use recycled water (or they want to build a treatment plant to provide recycled water), they apply through the local Regional Board
    - If the application submitted to the Regional Board has a public health concern or impact, then the board will notify the CDPH
        - They will submit the engineering report for CDPH review
        - The CDPH will review the project to determine if there is any component that will be impacted by Title 22 regulations that were written by our department
    - In general, the Regional Board specializes in environmental issues so that if a quality issues arises, they will defer to the CDPH
        - Deferral to the CDPH would also include matters of technology etc.

a) Re: Water Quality? (i.e. Health, etc.)

Response:

- The CDPH has public health concerns regarding Industrial Water Reuse depending on the industry:
    - If a refinery where recycled water will be used for boiler feed makeup, then there are regulations that pertain to "dual-plumbed"
        - If it is a dual-plumbed system (i.e. recycled water piping and potable water piping in the same building) then there are special regulations involved due to the higher chance of cross connections
    - If it is makeup water for cooling towers, then Title 22 also has stipulations in place
        - With cooling towers that have an evaporative processes the issue is typically misting (i.e. a working breathing in the mist from recycled water and getting legionella)
- The CDPH is involved with industrial operations such as dual plumbed systems not so much for the health of the workers, but cross connection issues
    - I.e. what kind of backflow do they have?
    - If there is a backflow or a cross connection issue on the "public side" of the meter, then it could affect an entire area
- The California government has jurisdiction up to the meter
    - If there is a cross-connection on the property, then the County or County Health department gets involved
    - If CDPH is reviewing a project where there appears to be impact to workers, then the most the department can do is put in a comment. This issue would not be CDPH jurisdiction per se. It might be recommended to contact OSHA or the county
    - CDPH cannot make an industry follow OSHA rules but can direct them to the particular agency

b) Re: Water Quantity? (i.e. Usage)

Response:

- No comments

c) Re: Water Rights?

Response:

- No comments

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*

Response:

- One way that consistency has been fostered is having a Recycle Water Specialist for the entire state who can stay abreast of what is happening state-wide and be the point of contact and reference person for all of the Regional Boards

b) *Re: Inefficiencies?*

Response:

- Although there is a functioning MOU, there exist communication challenges in that there are nine separate Regional Boards and 20 different CDPH district offices
- Also, consistency between the various Regional Boards and CDPH district offices is also a challenge since every agency has their own character in dealing with water reuse
    - There are no set guidelines on Engineering Reports or Response document
    - In essence two issues (talking to each other…and inconsistencies between the same agency offices)

4) *Respondent Recommendations?*

Response:

- Template documents for all Regional Boards and the CDPH may improve consistency between agencies. However, allowances for variability for new projects and technologies should be maintained
- Info: Los Angeles (Region 4) or San Diego (Region 9)
    - Go on website
    - Docket or agenda for their board
    - Somewhere you can click where it will take you to permits that are being presented to their board for approval

5) *Examples of IR in Practice?*

a) *Re: Resources?*

Response:

- Memorandum of Understanding
- Title 17
    - Pertains to backflow preventions and cross connections
    - Sections 7083 through 7605
- Title 22
    - Pertains to all regulations around recycled water use, use areas, treatment, filtration, disinfection etc.
    - Sections 60,001 through 60,355
- Statutes
    - The statues are what the lawmakers write. The lawyers in Sacramento. These are overarching laws of the land
    - Statues go in the Health and Safety code or the Water Code
    - Law writers will require, in the statute, something for CDPH to do
    - After that, the CDPH writes the regulations based off of the requirements in the statue (e.g. Title 17 or Title 22)
    - The statues have many details but may not get into specific details
        - Example: The statue may say that entities should recycle water from municipal water sources. The CDPH will then write a Title 22 regulation stating what the statue means by "recycled water" or "municipal water source" etc.
- Our website has a link to most pertinent documents:
    - http://www.cdph.ca.gov/HealthInfo/environhealth/water/Pages/Waterrecycling.aspx

b) *Re: Projects?*

Response:

- No comments

APPENDIX D – Arizona Survey Results

(Note: All telephone conversation records have been summarized and paraphrased)

D1 Arizona: Practitioner Telephone Conversation Summary

DATE	May 28, 2013	**TIME**	10:30
CONTACT	T. Thomure	**DEPARTMENT**	NA
COMPANY	HDR Engineering, Inc.	**JOB TITLE**	Associate; Arizona Water Business Group Manager; President – Arizona Section: WateReuse Association

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - Arizona Department of Environmental Quality (ADEQ)
     - Quality considerations and compliance
     - Health department not involved individually rather health is considered through the ADEQ

   b) *Re: other regulatory agencies involved in IR?*
   Response:
   - Arizona Department of Water Resources (ADWR)
     - Requirements with respect to water quantity and conservation
     - Involvement is from the information/data perspective rather than regulatory

   c) *Re: inter-agency communication?*
   Response:
   - ADEQ and ADWR
     - Coordinate on a case by case basis
     - Good communication via regular meetings on particular issues
   - Stakeholders
     - Tend to have a global involvement (i.e. policy and practice) as opposed to specific projects
     - Universities such as the University of Arizona, Arizona State University, and Northern Arizona University are all active stakeholders
     - Arizona Corporation Commission (ACC)
       - Involved with private utilities
       - Governs financial dealings with regards to rates and charging restrictions
       - Financial involvement only and is not involved directly in water reuse
     - US Bureau of Reclamation
       - Manages Colorado River and major dams and river diversions
       - Lake Powell and Lake Mead are two major reservoirs managed by the Bureau

   d) *Re: water source?*
   Response:
   - Groundwater and surface water

   e) *Re: reuse applications in state?*
   Response:
   - Power generation
     - Nuclear power (i.e. cooling towers)
   - Mining (e.g. copper mining)

   f) *Re: management of WWTP?*
   Response:

- Cities, counties, and private entities own water treatment plants/water reclamation pants
    - None that are state owned
- Publically owned treatment facilities are most common
- Some private companies may serve portions of a city under private agreements

2) *Permitting Process Summary (from respondent perspective)?*
Response:
- The process in place could be classified as a framework with some required practices
    - Water Reuse program can be viewed in the following link:
        - http://www.azdeq.gov/environ/water/permits/reclaimed.html
        - Links to permits are located on this webpage
- If an industry wishes to obtain reclaimed water then it would become a customer of the water provider (e.g. the city of Phoenix or Tucson)
- Regulatory requirements fall mainly on the agency providing the reclaimed water
    - A utility with a reuse system would then provide reclaimed water to the customer be it an industry, golf course, etc.
- State law establishes all of the various types of reuse applications that can be done
- Regulatory agencies define five different classes of recycled water based on quality criteria
    - For each class of water, various acceptable uses are permitted
- Utilities set up their system to become classified and permitted so as to provide one of the five different qualities of water
    - Based on treatment type and management practices
    - Utility would obtain a "Water Reuse Agent Permit"
        - Example can be viewed/downloaded on the webpage provided.
    - End users are not necessarily included on the permit
        - Utility can add customers under their Agent Permit without requiring approval by the regulator
- If an industry wishes to provide further treatment to the water then an individual permit would be required
    - As opposed to a "license to use" with all requirements falling under the provider
- End user would be required to meet some best management practices
    - Signage, cross connections etc.
    - Outlined and prescribed in the rule
- Once requirements are met, then the user is able to connect to the reclaimed water supply
- Summary/History:
    - Groundwater is considerably less expensive than recycled water; however, that fact is offset by the negative impacts of overdrawing an aquifer and creating issues through water level decline
    - In Arizona, a regulatory push was required to encourage communities to use less groundwater and replace it with something more sustainable like recycled water.
    - Practice of water reuse has evolved over the last 30 years but began with requiring stipulations on new builds
        - E.g. if a company is going to build a golf course, they have to use recycled water or they will not be able to build
        - Based on the consequent increase in cost, the city or state might subsidise the process from funds originating from the potable system
            - Reclaimed water use would save the potable side money and use less groundwater

a) *Re: Water Quality? (i.e. Health, etc.)*
Response:
- Classification of water into the five classes hinge on the two following points:
    - Is the reuse water filtered (measured by turbidity), and
    - Nitrification/de-nitrification
- Example:
    - Highest quality is A+ water
        - Both filtered and denitrified
        - State agency provides a list of uses for this type of water
    - Other qualities include A, B+, B, and C
        - Fewer uses permitted as quality of water diminishes

b) *Re: Water Quantity? (i.e. Usage)*
Response:

- Background:
    - Two large river systems in Arizona
        - Salt River System – an instate river that supplies a large portion of water to the Phoenix area
        - Colorado River System – enters the central part of the state
    - Colorado river forms part of northern and western state boundary and enters Arizona first (like the north and south Saskatchewan rivers)
        - Seven states and Mexico have a share of the Colorado River
            - Treaties, agreements and court cases govern the use of the river
            - Managed federally by the Bureau of Reclamation
            - Law of the River
    - Pumping stations deliver water to Phoenix and Tuscan (like Calgary and Edmonton)
- Shortage Criteria:
    - River is over-allocated based on its long-term yield
    - Criteria for when a shortage is declared
        - Triggered by water levels in the reservoir of Lake Mead
    - Certain requirements about which user will take the shortage or how it will be divided
    - Some states have higher priority than others but no state is allowed to be neglected of their supply completely

c) *Re: Water Rights?*
Response:

- Arizona falls under the Doctrine of Prior Appropriation
    - i.e. the older the water right, the higher the seniority
    - A company may have to let water flow past them to allow a more senior downstream user to access the water
- Many instate rivers are consumed within the state

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*
Response:

- The current system is straight forward if the perspective use has been established and permitted by state law

b) *Re: Inefficiencies?*
Response:

- Public acceptance and cost are key issues

4) *Respondent Recommendations?*
Response:

- Re: public acceptance:
    - Current and accurate information about the safety of recycled water would help frame the discussion between the public and the utilities
- Offset water conservation:
    - For an industry it may not be feasible to install 20Kms of pipeline. Instead it may be feasible to require a company to use a portion of the money they would have spent in order to develop a cities recycled water program
    - For example
        - If a mining company (or fracking operation) wished to use recycled water the state might require an offset in cost or use:
        - Might stipulate that the industry has to use recycled water or,
        - If it is not logistically feasible to use recycled water then the industry could use a local supply but would have to fund the development of recycled water somewhere else in the basin
    - Flexibility is key
        - May not have to offset water use in the same area especially if it is a rural area
        - A company may develop a reclaimed water supply in a city to offset their use of freshwater in a rural location

5) Examples of IR in Practice?

a) Re: Resources?
Response:

- Arizona Revised Statues (laws)
    - Give the intent of the program
- Arizona Administrative Code (regulations)
    - Rules on how to comply are located in this document.
- Water Reuse Agent Permit
- Shortage Criteria

b) Re: Projects?

Response:

- Nuclear Power Plant:
    - Large user of reclaimed water
    - Reuse water delivered by the City of Phoenix
    - Company provides additional treatment to achieve quality needed for cooling process
    - As it is used for multiple cycles, the manage salinity increases internally.
- Salt River Project:
    - Manages the Salt River
    - Uses include power and water supply
    - Manages the river and sells supplies of water to different cities that are within the service area

D2 Arizona: Quality Regulator Telephone Conversation Summary

DATE	June 20, 2013	**TIME**	10:00
CONTACT	C. Graf	**DEPARTMENT**	Water Quality Division
COMPANY	ADEQ	**JOB TITLE**	Associate Director; Director of the Arizona Water Institute

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
      Response:
      - ADEQ
   b) *Re: other regulatory agencies involved in IR?*
      Response:
      - ADWR
        - Water quantity and water rights considerations
      - USEPA
        - The USEPA has limited jurisdiction in regards to groundwater
        - Their jurisdiction is in the area of surface waters and the federal Clean Water Act
        - If a WWTP discharges to surface waters (waters of the US), they must obtain a surface water permit, or NPDES (National Pollutant Discharge Elimination System) permit
        - WWTPs that have the APP (state permit) for groundwater must also obtain the NPDES permit (federal permit) for discharge into a surface water (i.e. dual permits are required)
        - In terms of reclaimed water, the USEPA has no jurisdiction and does not get involved in Arizona's water reuse program
        - However, because many states are either thinking of reuse or do it differently they take on a guidance role
          - USEPA Water Reuse Guidelines
        - Not a significant involvement in water rights unless there is federal lands and decreed water rights issues (First nations lands, military bases etc.)
   c) *Re: inter-agency communication?*
      Response:
      - In general there is not much need for communication between the ADEQ and the ADWR
      - Recharging groundwater is an example of where the two agencies interact
        - Example:
          - A groundwater aquifer is to be recharged via reclaimed water
          - The ADEQ issues and APP for the recharge facility since it is a discharger like any other discharger
            - Have to meet a certain quality standard by a certain distance from injection wells
            - Once completed the ADEQ would send the permit over to the ADWR
          - The ADWR also issues a Recharge Permit because it is interested in the amounts of recharge to determine the mounding etc.
            - They would assess the amount recharged so they can get the credits for that activity and offset it with another groundwater pumping activity elsewhere
        - In some instances there are individuals who have worked in both agencies

        - This will increase the efficiency of communication between the two agencies
    - The two agencies are very separate and have different processes in obtaining similar information

d) *Re: water source?*
Response:
- Surface and Groundwater

e) *Re: reuse applications in state?*
Response:
- Golf courses
- Nuclear power (cooling)
- Pulp and paper

f) *Re: management of WWTP?*
Response:
- 65% of the WWTPs in Arizona distribute reclaimed water (out of approximately 300 plants)

2) *Permitting Process Summary (from respondent perspective)?*

a) *Re: Water Quality? (i.e. Health, etc.)*
Response:
- Mr. Graf essentially wrote the rules for reuse in 1991 and continues to be very involved in reuse
- The Reuse Program and the Aquifer Protection Permit (APP) program are separate but work together
- Aquifer Protection Permit (APP) Program (1991)
    - All of the WWTPs fall under the APP program
    - Classification of water is based on degree of treatment
    - Requires that every discharger (WWTP, mines, industrial facilities etc.) in Arizona have a permit if they have the potential to impact groundwater quality
    - Using the Best Available Demonstrated Control Technology (BADCT) premise, the APP program states that:
        - All new or expanding WWTPs that discharge over 0.25 MGD must meet certain quality standards.
            - Pathogen free effluent (measured via E-coli)
            - Removal of nitrogen (denitrify) below the drinking water standard, and
            - have a non-turbid discharge
    - Many of the WWTPs were developed after 1991 and hence fell under this provision. As a result a large portion of the WWTPs were discharging good quality wastewater (A+ water)
    - If, for instance there is a recharge facility, then the APP permit would stipulate that drinking water standards be met by a certain distance away from injection wells (called “point of compliance wells”)
    - Hydrogeological studies have to be done in these instances
    - If the reclaimed water is coming from an industry and is to be reused at another location then site specific standards must be developed
- Reuse program (End User Permits)
    - If a WWTP wants to distribute wastewater for reuse within their APP the ADEQ will designate the class of reclaimed water that they produce (e.g. A+ with the “A” meaning it’s pathogen free and the plus meaning it is denitrified)
        - Some of the older plants might be B or B+
    - The designation (e.g. A+) from the APP program is matched to a list of uses in the Reuse program
        - Each class of water has a list of acceptable uses of the reclaimed water
            - A+ can be used for virtually any reuse
                - Power plant cooling
                - Food crop irrigation
                - Landscape impoundments etc.
            - B or B+ water for example cannot be used for irrigation on food or food crops
    - Once a WWTP is given a discharge designation of A+, then it is permitted to discharge to any end user of reclaimed water that possesses an end user A+ permit

    - Permittees must approach the ADEQ separately to obtain an "End User Permit"
- Agent End User Permits:
    - Instead of getting multiple end users obtain their A or A+ permit an "agent" can act on behalf of many end users
    - Example:
        - County level WWTP provides water to the City of Tucson
        - City of Tucson has a large reclaimed water distribution system that serves approximately 60 parks, 100 schools, University of Arizona campus, 700 residences etc.
        - Because this is a lot of separate permits for the ADEQ, the City of Tucson has one "Agent End User Permit"
        - The City of Tucson is then the responsible entity that ensures all the ADEQ end use standards are met by their various end users
        - The city would have contracts with all of their end users
- The two programs are kept separate for ease of use
    - Example:
        - if a home owners association (HOA) wanted to take reclaimed water and distribute it to the association, then they can approach the ADEQ to obtain an A+ permit
        - With that permit, a WWTP who also holds an A+ designation for treatment can distribute water to the HOA
    - Regarding industrial users:
        - If an industry wished to use reclaimed water then they would have to approach the ADEQ to get an "end user permit" for a particular class of water (e.g. B+)
        - They would then approach a WWTP that holds the classification of water that is required
        - If further treatment was required, it would happen on the industries own site unless decided otherwise
        - See examples below
- Regarding instances when a "new" reuse application is applying for reuse (e.g. oil and gas)
- A separate permit would be issued in cases where there is not an "approved use" for a particular class of water
- In the rules, the ADEQ is able to craft individual (site specific) quality standards under a separate end user permit
    - One of the 700 numbers in the rule

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- When a well is installed for drinking water use, this activity is not considered very much in our APP
    - Quantity amounts are looked at in the Source Water Reviews that the drinking water program performs
- The ADWR is encouraging recharge of reclaimed water
    - This is an area of ambiguity
    - As recharge increases the question of Indirect Potable Reuse (IPR) surfaces
        - There is a stakeholder review process underway to look at developing better guidance on IPR as aquifer recharge increases to become popular
        - The stakeholder process was funded in part (~$40,000) by the WateReuse Association
        - Quantity considerations are not considered here as much in comparison to questions of emerging contaminants of concern (low level constituents that may be un-regulated)

c) *Re: Water Rights?*
Response:
- Doctrine of prior appropriation is in effect in Arizona
    - First in time, first in right
    - Rights have been established and individuals would have to purchase rights from one another
    - Effectively every drop of water (both surface and groundwater) is accounted for in some right
- ADWR administers water rights

- A court case in Arizona (Arizona Public Service Co. vs. Long) found that under the water rights system that whoever treats the water, owns the water
    - i.e. the WWTP owns the effluent that they discharge
    - Part of the lawsuit attempted to prove that the treatment plant only "processes" the water and it didn't originate with them but the court case established that the plant owns it
    - It is then up to the WWTP to decide where the effluent goes

3) *Commentary of IR Program in Practice?*
    a) *Re: efficiencies?*
    Response:
    - The separation of the APP program and the Reuse program
        - The state attempted to make it a simple process to promote reuse
        - The End User Permits for A+ water are meant to be simple and easy to obtain
        - The standards on the side of the treatment plant were increased to ensure quality
        - This way, if the water exiting the WWTP is of good quality then there is little required of the end user
            - If the reclaimed water is A+ and denitrified then the end user (i.e. the industry) would have very little reporting requirements (e.g. volume etc.)
                - In Rules (R189 starts at 701)
                - End user permits are 706 and 708
        - End user permits for the "not pluses" meaning the water is not denitrified are much more complicated
            - This is an attempt to prevent overuse of waters with high nitrogen (in an effort to minimize nitrogen contamination of groundwater).
            - Example:
                - A or B waters (that have not been denitrified and may have a nitrogen of 45 mg/L)
                - The permit would apply an agronomic rate so that the end user is irrigating at a rate that the nitrogen can be used efficiently
                - End users would have to report the amount of reclaimed water they are taking, the types of crops and the amounts that are in cultivation on a yearly basis

    b) *Re: Inefficiencies?*
    Response:
    - The ADWR and ADEQ have different processes and it can be challenging to connect data between the agencies
        - Yet, these authorities are well established and they know what the other is doing which helps efficiencies

4) *Respondent Recommendations?*
Response:
- Each state will handle reuse differently because each will have a differing regulatory framework
    - In Arizona the APP program was already in place so the ability was there to regulate the quality of the discharge through that mechanism
    - The End User, or Reclaimed Water Program, developed to complement the existing APP program
        - Listed the classes of water and acceptable end uses
- May not want to adopt the California model *per se*
    - California has tight treatment standards and technology standards on the "front end" which might be inappropriate for the end use. For example it might prescribe RO systems that are excessive for furrow irrigation (technology driven system)
    - The program is also somewhat fragmented in California does not regulate all of their groundwater quality at the state level with one single agency
        - I.e. divisions of the different districts etc.
    - 90% of the reuse that occurs in the US is conducted through four main states
        - California
        - Arizona
        - Texas, and
        - Florida

- There may be a benefit looking at what Florida does regarding reuse as they may have similarities with Alberta (surface water resources etc.)

5) *Examples of IR in Practice?*

a) Re: Resources?

Response:

- USEPA Water Reuse Guidelines
- APP program
- End User Permit
  - Agent End User Permit
- Point of compliance wells in groundwater recharge situations.
- Court Case (Arizona Public Service Co. vs. Long)

b) Re: Projects?

Response:

- City of Phoenix 91st Ave Wastewater Treatment Plant
  - Largest WWTP in Arizona with 140 MGD (million gallon per day)
    - B+ plant
  - Half the flow from this plant goes to the Palo Verde Nuclear Generating Station
    - Palo Verde is the largest nuclear power plant in the US and the only one that is cooled exclusively with reclaimed water
  - Palo Verde performs additional treatment on site (e.g. flocculation)
- Wildcat Hill Wastewater Treatment Plant, Flagstaff, AZ.
  - Smaller community A+ plant
  - Supplies reclaimed water to a Paper mill for the paper making process
  - Paper mill has gone to 100% reclaimed water
  - Paper mill has an end user permit (A+)
    - take the treated wastewater from the WWTP and polish the water on site for their paper making process
- Local issues regarding golf courses:
  - Naturally high TDS in source water (~700mg/L TDS in drinking water)
  - Water will pick up ~250-400mg/L of additional salts
  - Influent into WWTP from distribution system may be at 1,100 mg/L
  - Reclaimed water discharged may be highly saline
  - Golf courses have complained that the quality of water is burning their turf
  - Up to WWTP to resolve issue:
    - De-Sal
    - RO
  - Solving the issue is contractual and between the user and the producer
    - E.g. who will pay what amount, who will treat the water etc?
    - Stakeholder meetings concluded that the state should not get involved in these issues

D3 Arizona: Quality Regulator Telephone Conversation Summary

DATE	June 14th, 2013	**TIME**	13:18
CONTACT	M. Mullins	**DEPARTMENT**	Aquifer Protection and Wastewater Reuse Permits
COMPANY	Arizona Department of Environmental Quality (ADEQ)	**JOB TITLE**	Environmental Program Specialist

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - ADEQ
     - Lead agency for water reuse

   b) *Re: other regulatory agencies involved in IR?*
   Response:
   - ADWR

   c) *Re: inter-agency communication?*
   Response:
   - No comment

   d) *Re: water source?*
   Response:
   - No comment

   e) *Re: reuse applications in state?*
   Response:
   - No comment

   f) *Re: management of WWTP?*
   Response:
   - No comment

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - The ADEQs permit that is granted to the water utility company would state the various users of the reclaimed water
     - Aquifer protection permits must account for the fate of all waters leaving the WWTP
   - Utility companies may not charge for the delivery of the water if it is a benefit to the WWTP as a disposal option
   - Once reclaimed water has entered the property of the customer/industry, then water reuse is outside (or exempt from) the ADEQ rules
     - The reason is that facilities will have a federal program for workplace exposure such as Occupational Safety and Health Administration (OSHA) or the equivalent based on their particular industry
     - A facility will not be "double regulated" so if a federal program is in place, then they are exempt from ADEQ reuse rules
       - In this case the particular site is permitted through an agency of OSHA
     - Citation:
       - Arizona Administrative Code (AAC), Title 18, Chapter 9 (701 definitions)
         - Number 1: gives definition of what is considered beneficial reuse regulated under the rules
         - Number 1(c): states that the use

   a) *Re: Water Quality? (i.e. Health, etc.)*
   Response:

- Not discussed

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- No comments

c) *Re: Water Rights?*
Response:
- Dealt with by the ADWR
    - If there are provisions dealing with water rights or water resources then the ADWR would issue their own permit separate from the ADEQ

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*
Response:
- No comments

b) *Re: Inefficiencies?*
Response:
- Reclaimed water rules and gray water rules need to be redone
    - Have been in place for 11 years

4) *Respondent Recommendations?*
Response:
- When developing an reuse program, it is difficult to foresee all the issues so it is useful to speak with various stakeholders
- In Arizona, a Blue Ribbon Panel was formed:
    - Consisted of various industries, cities, towns, counties etc.
    - Asked what the issues that have surfaced with respect to water and greywater reuse
    - Documented the issues and recommended solutions

5) Examples of IR in Practice?

a) Re: Resources?
Response:
- AAC
- Aquifer Protection Permits
- Blue Ribbon Panel

b) Re: Projects?
Response:
- *No comments*

D4 Arizona: Quantity Regulator Telephone Conversation Summary

DATE	June 10, 2013	**TIME**	15:30
CONTACT	M. Lacey	**DEPARTMENT**	Office of the Director
COMPANY	Arizona Department of Water Resources (ADWR)	**JOB TITLE**	Deputy Director

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
      Response:
      - ADEQ
   b) *Re: other regulatory agencies involved in IR?*
      Response:
      - ADWR
        - Advisory role rather than regulatory
        - Work on the supply side of the industry to encourage the use of reclaimed water as much as possible
      - USEPA
        - Federal government has "primacy" on water quality through the "Clean Water Act" (reclaimed water mainly relates to this legislation) and the "Safe Drinking Water Act"
        - Delegate "primacy" to the ADEQ
   c) *Re: inter-agency communication?*
      Response:
      - Entities involved include:
        - Water providers
        - End users
        - Industry groups
        - County environmental services department
        - ADEQ
        - USEPA (on occasion)
        - ADWR
      - No formal document providing guidance on communication:
        - ADWR was involved in the development of the laws that created the ADEQ
        - Both entities work for the same Governor so communication flows from there
        - Blue Ribbon Panel:
          - The group of stakeholders assembled a list of recommendations on how to better use reclaimed water and how to facilitate communication between agencies
   d) *Re: water source?*
      Response:
      - Surface and Groundwater
   e) *Re: reuse applications in state?*
      Response:
      - Golf courses
      - Wood processing
      - Power generation
   f) *Re: management of WWTP?*
      Response:
      - No comments

2) *Permitting Process Summary (from respondent perspective)?*
Response:

- Information on the reclaimed water program can be found on the ADEQ website:
  - http://www.azdeq.gov/environ/water/permits/reclaimed.html
- The ADEQ can enforce their own permits
- The ADWR hasn't the ability to enforce their own permits so in effect, it is the courts that do it
  - Judge enforces who then hands the case over to the Sheriff
- In Arizona, a large portion of the reuse system is "recharge and recovery" (indirect use of reclaimed water)
  - Recharge Facilities will be constructed to import reclaimed water into an aquifer
  - The ADWR manages the "debiting and crediting" (accounting) system for the recharge and subsequent withdrawal
  - Direct reuse is important, but more has been accomplished through the indirect reuse program

a) *Re: Water Quality? (i.e. Health, etc.)*
Response:

- ADEQ has a permitting system that governs and classifies the quality of reclaimed water produced by a sewer
  - Based on BADCT (Best Available Demonstrated Control Technology)
- Classifications of the water include:
  - A+, A, B+, B etc.
  - A+ water , for example would be secondary and tertiary treatment plus de-nitrification
- For each treatment classification, there is a list of acceptable uses
- National Pollutant Discharge Elimination System (NPDES)
  - Federal level regulation
  - Takes effect when discharging pollutants to the surface waters of the US

b) *Re: Water Quantity? (i.e. Usage)*
Response:

- The ADWR administers water resources and water rights
- Debiting and Crediting system/recharge and recovery
- Regarding water leaving a basin:
  - In regards to reclaimed water, there are no requirements for water to stay within a source basin
  - If a producer wished to sell reclaimed water across a boundary it would be allowed (provided they did not violate any other jurisdictional boundaries or laws)

c) *Re: Water Rights?*
Response:

- Water rights driven by the court system:
  - By the ruling of the courts in Arizona, the producer of the water is the owner and hence can sell the water to whom they wish
  - Creates a free market as opposed to the state allocating waters
- Groundwater is owned by the state and surface waters are also public resources
  - Waters treated by a WWTP are owned by the plant
  - Case law has determined that as soon as the water is discharged the water is back in the public realm
- In General:
  - Arizona has a bi-forkated legal system:
    - Surface water rights are administered under one set of laws while groundwater is administered under a separate set of laws
  - Surface water code and doctrine of prior appropriation governed since the beginning of the state:
    - These principles were in place before the large scale development of wells and the use of the groundwater system
  - ADWR was formed in 1980 through the passage of a law called the "Groundwater Management Act"
    - Incentives for users to switch to reclaimed water rather than surface or groundwater
    - Governs the use of groundwater in what are called "Active Management Areas"
    - There are five management areas

        - These laws do not deal directly with water reuse
    - Summary:
        - Surface water system is largely governed by the court system and the groundwater is generally done administratively
        - The ADWR does most of the regulation on the quantity side
        - Reclaimed water is governed by a court decision
        - The ADWR doesn't necessarily govern reclaimed water from a quantity standpoint
- Producer of reclaimed water has no obligation to discharge it
- Once the wastewater is discharged it is considered to be surface water
    - Downstream diversions are then governed by Arizona Surface Water Statutes (ADWR)
    - ADWR has no enforcement authority like the ADEQ has
        - Statutes are managed by the ADWR
        - Statutes are enforced judicially
        - Example:
            - If Farmer A diverted waters that Farmer B didn't think they had a right to, then Farmer B would have to go to court to stop Farmer A from diverting that water
- Diverting water from surface waters:
    - If a user wanted to divert water then they would have to file a "Notice of Appropriation"
    - Once the Notice of Appropriation is filed and handled through the ADWR administration, then the user is granted a "Certificate of Water Right"
    - The Certificate of Water Right includes:
        - Point of diversion
        - Place of use
        - Maximum quantity
        - Annual volume
- Regarding Allocation:
    - There is no "maximum" allocation set for each river. Most rivers in Arizona are over allocated
    - Doctrine of Prior Appropriation:
        - Strict interpretation is that junior water users only get water when there is water available at a quantity sufficient to satisfy all the senior users in front of him
- Return flows are typically not stipulated except in cases such as the Colorado River
- Besides the surface water allocations, and the doctrine of prior appropriation, the most common method for transporting reclaimed water is through closed conduits from the producer directly to the user
    - Some communities develop their own reclaimed water distribution infrastructure
    - Other entities will build dedicated piping directly to an industry
    - Done through contractual arrangements as with the Intel facility and the City of Chandler

3) *Commentary of IR Program in Practice?*
   a) *Re: efficiencies?*
      Response:
      - No comments
   b) *Re: Inefficiencies?*
      Response:
      - No comments

4) *Respondent Recommendations?*
   Response:
   - Have an advocate promoting reuse
       - The ADWR encourages reuse as much as possible
       - Different jurisdictions will have natural variations in the way they conduct their reuse system
   - Indirect Reuse/Recharge and Recovery program:

- Aquifer replenishment and a debiting and crediting system for recharge and recovery is a large portion of the Arizona reuse system
- More successful than the direct reuse portion of the program

- ADEQ's APP program and Reclaimed Water Program:
  - The system of classification of water and lists of acceptable uses is clear for end users and producers of reclaimed water
  - The rules governing this process would be helpful because there is a lot of details provided
- Ownership of wastewater:
  - Case law determining that treated water is the property of the WWTP has worked well for Arizona on the supply side of the industry
  - Free market as opposed to the state allocating all the waters

5) *Examples of IR in Practice?*

a) Re: Resources?

Response:

- Blue Ribbon Panel:
  http://www.azwater.gov/AzDWR/waterManagement/BlueRibbonPanel.htm
  - Final Report provided
- Water Rights:
  - Notice of Appropriation
  - Certificate of Water Right
- Recharge and Recovery program
- The Law of the River

b) Re: Projects?

Response:

- Palo Verde Nuclear Generation Station:
  - Built in the 70s and cooled with reclaimed water delivered from:
    - A treatment plant that is owned by the city of Phoenix and s
    - other municipalities in the Phoenix metropolitan area
  - A local developer sued over the contracts that were developed by
    - Arizona Public Service and other entities
  - The developer was asserting a more public right to the reclaimed water then could be signed away in a two party contract
  - The courts found that the entity that treats the water owns it
  - In this case, the City of Phoenix and the other entities which are a sub-regional operating group (SROG) are the owner of the reclaimed water
  - The entities entered into an agreement with Arizona Public Service for delivery of the reclaimed water to cool Palo Verde
- Colorado River
  - Rights to the Colorado River are administered by the US Bureau of Reclamation
    - Secretary of Interior is the person with ultimate responsibility
    - Done federally since it is an inter-state stream
  - Return flow obligations and diversion rights are prevalent in this scenario
  - Discharge back into the river via WWTP gets accounted for
  - Governed by what is called "The Law of the River"
    - Not one law but a body of laws
    - Includes
      - Acts of congress
      - Supreme court rulings
      - Minutes (which are changes to the Colorado river compact) etc.
  - Summary forwarded via email:
    - http://www.azwater.gov/AzDWR/StatewidePlanning/CRM/default.htm
- Intel Chip-making Plant (Chandler, AZ)
  - Contract between the City of Chandler and Intel for the delivery of reclaimed water
  - The ADEQ governs the quality aspects of that arrangement as well as the local county environmental health department
  - The water provider would have reporting requirements to ADWR of which reclaimed water is a part
  - ADWR does not play the "oversight" role or "enforcement" role in any way

    - The arrangement is a contract between the two parties under the permit from the ADEQ
- City of Scottsdale
    - Multi-contract agreement
    - Scottsdale's reclaimed water distribution system serves approximately 21 golf courses
    - Contracts are between the city and the golf courses
    - Contracts will cover delivery, quality, reliability of supply, etc.

APPENDIX E – Florida Survey Results

(Note: All telephone conversation records have been summarized and paraphrased)

E1 Florida: Practitioner Telephone Conversation Summary

DATE	May 03, 2013	**TIME**	08:36
CONTACT	A. Elorfi	**DEPARTMENT**	Public Utilities
COMPANY	Hillsborough County – Water Resource Division	**JOB TITLE**	Engineering Specialist II; Reclaimed Water Planning Team

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - Department of Environmental Protection (DEP)

   b) *Re: other regulatory agencies involved in IR?*
   Response:
   - DEP is the sole agency

   c) *Re: inter-agency communication?*
   Response:
   - Not applicable

   d) *Re: water source?*
   Response:
   - No comments

   e) *Re: reuse applications in state?*
   Response:
   - Hospitals
   - Cooling towers
   - Mining
   - Agriculture
   - Gypsum manufacturing
   - Golf courses

   f) *Re: management of WWTP?*
   Response:
   - The county owns and operates WWTPs in the state of Florida
     - Includes the transmission lines up to the meter
   - Hillsborough County maintains several WWTPs
   - There are 67 counties under the DEP

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - Firstly, an entity applies for a certain operation (i.e. IR) to the DEP who will then want to know your capacity, equipment, etc.
   - The DEP will stipulate the maximum limit of your operations and issue a permit stating all the requirements you have to meet
   - Permits act as a certificate to operate from the DEP as well as a guideline of how you must operate
     - If a provider violates those requirements, then they are subject to penalties under the DEP
   - For example:
     - SW Hillsborough County Reclaimed Water Station would have to list who they are supplying reclaimed water to
       - Golf courses etc.
     - If another industry such as a power plant requires water they would approach the WWTP directly and not the DEP
     - The two entities reach an agreement together. This is not a permit, but an agreement

    - The power company would sign the agreement in accordance with the standard set by the DEP
- The DEP holds the right to inspect facilities that supply reclaimed water to ensure compliance
    - Signage for example

a) *Re: Water Quality? (i.e. Health, etc.)*
Response:
- No comments

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- No comments

c) *Re: Water Rights?*
Response:
- No comments

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*
Response:
- No comments

b) *Re: Inefficiencies?*
Response:
- No comments

4) *Respondent Recommendations?*
Response:
- None

5) Examples of IR in Practice?

a) Re: Resources?
Response:
- None recommended

b) Re: Projects?
Response:
- TECO Energy
    - Approach Hillsborough County for reclaimed water to run their towers since drinking water is very expensive
    - TECO would state that they would like the water for industrial purposes as well as the quantity and quality
    - An agreement between the WWTP and TECO is signed
        - Note that the agreement is not with the DEP but between the two entities
    - The WWTP reviews their capacity and if possible supplies TECO with the requested amount of reclaimed water
    - The WWTP would report to the DEP all of the end users and quantities of reclaimed water being supplied
    - TECO would supply lines and infrastructure up to the County's meter

E2 Florida: Quality Regulator Telephone Conversation Summary

DATE	June 5th, 2013	**TIME**	9:00
CONTACT	S. Speas-Frost	**DEPARTMENT**	Wastewater
COMPANY	Florida Department of Environmental Protection	**JOB TITLE**	Reuse Coordinator

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
      Response:
      - Department of Environmental Protection (DEP)
   b) *Re: other regulatory agencies involved in IR?*
      Response:
      - Florida Water Management District (FWMD)
        - In charge of regional water supply
        - Boundaries coincide with natural watershed boundaries
   c) *Re: inter-agency communication?*
      Response:
      - No comments
   d) *Re: water source?*
      Response:
      - Groundwater
      - Surface waters for large industries
   e) *Re: reuse applications in state?*
      Response:
      - No comments
   f) *Re: management of WWTP?*
      Response:
      - No comments

2) IR Process Summary from Industry/Department Perspective?
   Response:
   - In Florida there are no rules in place for internal industrial waste recycling, it is done on a case by case basis
   - There are set rules in place for domestic wastewater that is treated to high level standards and sent out to other users for reuse, like power plants
   - Wastewater treatment plants that supply reclaimed water operate under one permit from the DEP
     - Including NPDES discharge
   - If a particular project is large in scope, then all stakeholders would be involved from the beginning
     - Public workshops, meetings
     - Example stakeholders include:
       - Tampa Bay Estuary Group
       - St. Johns River Keepers
       - National Fisheries
       - Fish and Wildlife
       - Everglades etc.

   a) *Re: Water Quality? (i.e. Health, etc.)*
      Response:
      - Rules or statutes stipulate that no harm will be caused to the environment
        - A project cannot cause or contribute to water quality violations
      - Environmental Impact Assessments (EIAs) may be required for larger scale projects

- Total Maximum Daily Loading (TMDLs) rates are set for all water bodies
- Once TMDLs are set then a Basin Management Action Plan (BMAP) is established:
    - Looks at inputs/outputs and stakeholders involved
    - Establish allocations

b) *Re: Water Quantity? (i.e. Usage)*
Response:

- Florida Water Management Districts (FWMDs) manage consumptive use permits and provide funding for "alternative supply"
    - May also manage stakeholder and communication details for new projects
- Consumptive use permits may be altered if the entity is putting the water back in another location
- FWMDs must write 20 year water supply plans in an attempt to prepare for projected water use with future water supply constraints
    - Attempt to predict and plan for challenges over the long term
    - Look at wastewater plants as a potential source in various areas
- Reuse Feasibility Studies
    - If a wastewater treatment plant is in a "water resource caution area" then they must seek to do more reuse then currently practiced
    - Also, surface water dischargers, regardless of being in a water resource caution area or not, must look at the feasibility of practicing ruse in lieu of discharging to surface water

c) *Re: Water Rights?*
Response:

- State has been broken up into regions and within each region water rights are managed
    - All water sources such as natural waters (surface or ground), de-sal water etc.
- Any user of water requires a consumptive use permit
- Permit renewals where groundwater extraction may cause is negatively impacting surface waters may have to mitigate issues via:
    - Conservation
    - Alternatives
        - Users must provide mechanisms for putting treated water or treated storm water back into an aquifer
- Water Conservation Areas
    - Local districts attempt to identify critical water supply areas such as depressed water tables, rivers or altered headwaters causing downstream problems
- Minimum Flows and Levels
    - Set by FWMDs
    - Any user of water must adhere to these minimum flows and levels of surface and groundwater
- Basin to basin transfers:
    - City of Atlanta has large well fields/reservoirs outside Atlanta providing potable water from another watershed
    - Waste treatment plants use and dispose of the water in their own (separate) watershed
    - FWMDs ability to manage the water resources from a regional level provide the mechanism to deal with these issues
- Third party security of supply issues:
    - The consumptive use permit handles the "interuptablility" of the supply issue
    - Example:
        - Power plant needs to have 20MGD to operate its cooling towers
        - WWTP promises to deliver that quantity
        - If the water treatment plant fails in their contract, the consumptive use permit might state:
            - "Reclaimed water is the main source of water, but in the event of reduced flows, the plant would be authorized to use 20 MGD from their wells"

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*
Response:

- Reclaimed water has become integral as an alternative water source partly due to the Minimum Flows and Levels criteria set by the FWMDs
    - Industries or commercial users must seek alternate supplies if their consumption of natural sources reduces waters below the minimum standards
- FWMDs co-operative funding assists reuse programs

b) *Re: Inefficiencies?*
Response:

- Scenarios:
    - Inherent in the system is the scenario where there is a city that operates a potable supply of water and needs to increase their consumptive use permit to service their customers. Often the city might not own the wastewater treatment plant as it is owned by the county. In this case, the city has no way of replenishing the groundwater
    - On the other hand, there are large privately owned regional wastewater treatment facilities that spend millions of dollars to treat water and then pump the treated effluent into the groundwater. The wastewater treatment plant does not require a consumptive use permit because they do not operate on the potable side. So in that area, other entities can claim it in their consumptive use permits
    - Based on the above, an incentive is needed
- Differences in outlook between departments:
    - FWMD only focuses on quantity of water so in certain projects they fund there may be larger issues such as quality at stake
- Industry buy-in:
    - Sometimes difficult to get the industry comfortable with using reclaimed water in fear of compromising their systems

4) *Respondent Recommendations?*
Response:

- None

5) Examples of IR in Practice?

a) Re: Resources?
Response:

- TMDLs
- BMAP
- Water Conservation Areas
- Minimum Flows and Levels
- Co-operative funding
- 20 Year Water Supply Plans
- Reuse Feasibility Studies

b) Re: Projects?
Response:

- Crist Power Plant:
    - Owned by Gulf Power: private company
    - Accepts reclaimed water from a public entity for their processes
        - Public utility had to move from downtown location to a new location
        - New location's river had an "impairment" status so they had to look for alternate discharge location
        - Almost all reclaimed water is sent to the Crist Power Plant
    - Gulf Power had to take on increased treatment of nutrients from the reclaimed water but saw the overall benefit from the relationship
        - Gulf Power took on responsibility to hire modellers to accommodate their change in effluent to an already impaired river
    - Award winning partnership
- Dual distribution systems:
    - City of Clearwater
    - St. Petersburg
    - Juniper Beach
- Central Florida Water Initiative:
    - Includes the cooperation of the following:
        - Big three FWMDs

                - St. Johns River
                - South Florida
                - Southwest Florida
            - DEP districts
                - Orlando office
                - Tampa office
            - Cities and utilities, department of transportation, etc.
        - These have joined in a 50 year study of water supply needs for the next 50 years and ways to improve
- West Coast Energy Center (owned by Florida Power and Light):
    - Palm Beach county (south Florida)
    - Built new power plant to accept reclaimed water from the Palm Beach county Regional Facility
    - Treatment plant had to build a side treatment plant in order to supply water to their cooling towers and a gated community who uses the water for irrigation

E3 Florida: Quality Regulator Telephone Conversation Summary

DATE	May 24, 2013	**TIME**	11:10
CONTACT	J. Squitieri	**DEPARTMENT**	Southwest District
COMPANY	Florida Department of Environmental Protection (DEP)	**JOB TITLE**	Environmental Manager

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
      Response:
      - Department of Environmental Protection (DEP)
   b) *Re: other regulatory agencies involved in IR?*
      Response:
      - Water Management Districts
        - Not a permitting agency
        - Concerned with water quantity issues and water rights
        - Sister agency to the DEP
        - Fund reuse projects
   c) *Re: inter-agency communication?*
      Response:
      - No comments
   d) *Re: water source?*
      Response:
      - Mainly groundwater
   e) *Re: reuse applications in state?*
      Response:
      - Residential
      - Golf courses
      - Parks
      - Cemeteries
      - Green ways
      - Percolation pond
      - Spray field
      - Industrial including:
        - Power plant cooling
        - Wall board manufacturing
        - Resource recovery facilities
        - No oil and gas reuse.
   f) *Re: management of WWTP?*
      Response:
      - Predominantly owned by the County owned with some private utilities that provide sewer and water service including reclaimed water
      - Tampa and Orlando districts deal with the majority of water reuse projects

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - Florida is divided into six regional areas (districts) and all permitting is done from the district level
   - If a brand new facility there must be an application to build
   - If an existing facility, the utility, not the industry, would submit an application for “public access reuse” to add a particular application to their reuse system

- The WWTP or facility would designate their service area and inform the DEP of who the users will be
    - For example, they would state that they will provide water for a particular golf course, three parks, and residential sub-divisions within their service area
- The DEP would review the application and consider hydraulic loading rates, the total quantity that would be used and where water storage would be
- The DEP would designate model sites for groundwater monitoring
    - Typically at a golf course using reclaimed water for irrigation, the golf course would have to install background, intermediate and compliance wells to ensure they are not exceeding groundwater standards

a) *Re: Water Quality? (i.e. Health, etc.)*
Response:
- SOPs may state turbidity or chlorine values and if they are not met, the water is rejected from the reuse system and sent to an alternate location (tank, pond etc.)
- Code 62-610
    - This is the main guidance regarding quality considerations for water reuse
- The National Water Research Institute (NWRI) sets criteria for the DEP to approve UV disinfection systems
- The DEP also enforces the Total Mass Discharge Limits (TMDLs) consisting of numeric nutrient criteria

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- Water Management Districts were formed in the 1970s and 1980s in response to water quantity considerations
- Districts may stipulate that a particular user must use a certain percentage of reclaimed water in order to conserve potable supplies

c) *Re: Water Rights?*
Response:
- No comments

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*
Response:
- Industrial applications for water reuse allow a "year round" customer
- The DEP promotes using the appropriate quality water suited to the task

b) *Re: Inefficiencies?*
Response:
- No comments

4) *Respondent Recommendations?*
Response:
- Regarding water reuse, recommend a discussion with the state wide water reuse coordinator with DEP
- Regarding water resource protection and quantity considerations, recommend speaking with the one of the Water Management Districts
    - South West Florida Water Management District

6) Examples of IR in Practice?

a) Re: Resources?
Response:
- Florida Administrative Code 62-610
    - Main rule that governs water reuse
- Permitting forms
    - Form 1
    - Form 2A
- Standard Operation Protocol (SOP)
    - Every facility must have an SOP
    - Outlines how the facility will run their plant and how they are going to protect the reuse system and the reuse customer from substandard water
    - Available on website
- Minimum Flows and Levels

- Water Management Districts set these parameters for particular streams

b) Re: Resources?

Response:

- CF Industries
  - City of Tampa supplies water to CF industries with reclaimed water to be used in Phosphate mining

E4 Florida: Quantity Regulator Telephone Conversation Summary

DATE	June 5th, 2013	**TIME**	11:40
CONTACT	A. Andrade	**DEPARTMENT**	Water Supply
COMPANY	Southwest Florida Water Management District (SWFWMD) – Water Resources Bureau	**JOB TITLE**	Reuse Coordinator

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - Department of Environmental Protection (DEP)
     - Wastewater
     - Quality considerations
     - Water distribution systems
   - Florida Water Management District (FWMDs)
     - Water use permits
     - Example scenarios requiring the FWMDs permit:
       - Drilling a well
       - Pulling water from a lake
     - Only get involved with reclaimed water as it protects source waters from being consumed or discharged into

   b) *Re: other regulatory agencies involved in IR?*
   Response:
   - Stakeholders may include:
     - DEP
     - FWMDs
     - Department of Health
     - Department of Agriculture
     - Department of Transportation
     - Etc.

   c) *Re: inter-agency communication?*
   Response:
   - Reuse Coordinating Committee
     - Organized by the DEP
     - Meet with stakeholders twice/year plus calls and emails as needed
     - Anyone involved with water reuse would be on the committee

   d) *Re: water source?*
   Response:
   - 80% groundwater

   e) *Re: reuse applications in state?*
   Response:
   - Power plants
   - Golf courses

   f) *Re: management of WWTP?*
   Response:
   - Public and private

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - Co-operative Funding through FWMDs

- In reclaimed water, co-operatively fund projects to the order of approximately 300+ per year
- Co-operative operates as a 50/50 grant
  - Example: $10 million reclaimed water project to supply ten golf courses with reclaimed water
  - Utility submits an application to the FWMD with a project proposal that would compete against other projects
  - If awarded, the utility would build the proposed operation and would be reimbursed 50% of their costs (i.e. $5 million)
- Funding procedure provided

- FWMDs began after World War 2.
  - South Florida (SFWMD) and Southwest (SWFWMD) were first
  - Originally a flood control measure
  - Duties were extended by the legislature
  - Not a state agency, but an agency of the state
  - Receive funding through Ad Valorem taxes
  - Responsibilities of the FWMDs include:
    - Flood control
    - Water supply
    - Natural systems
    - Water quality
  - FWMDs do not sell water and are not in charge of wastewater treatment
  - Permitting agency for all water use in each respective district
  - Although wastewater is a "source", FWMD do not restrict that. The utility would follow DEP rules

a) *Re: Water Quality? (i.e. Health, etc.)*
Response:
- No comments

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- Reduction of groundwater withdrawals is the primary purpose of the FWMDs.
  - Every gallon reused is one gallon not discharged into Tampa Bay.

c) *Re: Water Rights?*
Response:
- Treated or reclaimed water belongs to the utility that treats it
- Not a lot of water rights issues except that an entity is not permitted to impede on anyone else or the environment
- Minimum Flows and Levels:
  - It is not permitted to withdraw water that will cause a negative harm to neighbours or the environment
  - Levels are set for aquifers in such a way that if the level goes down, then the permit is reduced until the level recharges
  - Example:
    - Tampa Bay Water provides all the water in Tampa Bay
    - This utility had their groundwater permit reduced from 190 million gallons/day to 90 million gallons/day
    - Had to find other sources of water and the SWFWMD helped fund the effort
- Regarding "third-party" users:
  - Ensure the third party (user) has a guaranteed source and steady flow through 20 year agreements
  - Co-operative guidelines provide information on this topic
- Regarding basin to basin transfers:
  - In Florida there are governing boards from each of the populated areas with officials from a cross section on stakeholders
  - These boards decide what can and what cannot happen
  - In Florida there exists the ability to have inter-connection and transfers of water across a basin but the attempt must be made to find local waters first
  - Florida has rules regarding inter-basin transfers
    - No. 373 and 40-2 in the Florida Statutes

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*
Response:
- Funding and numeric nutrient criteria allow incentives for reuse
- Reuse coordinating committee
- Reclaimed Water Guide
- GIS system of all reclaimed water lines, treatment plants and groundwater wells in the district

b) *Re: Inefficiencies?*
Response:
- No comments

4) *Respondent Recommendations?*
Response:
- Reclaimed Water Guide (Document): see examples (Question 5)
- Industries as end users
    - Less expensive than residential or irrigation type projects
    - Customers and flows are not seasonal rather day in and day out.
    - Customers are generally very efficient.
    - Utility can deal with one customer as opposed to many customers
        - In the SWFWMD there are over 100K water reuse customers, and most of them are residential (that would be over a hundred thousand customers). Having nine power plants would be easier to deal with ("one and done")

5) Examples of IR in Practice?

a) Re: Resources?
Response:
- Co-operative Funding Procedures/Guidelines.
    - Provided
- Website mapping/GIS program
    - Reclaimed Water Map Viewer
    - http://www8.swfwmd.state.fl.us/ReclaimedWaterMapViewer/#/Home
- See: http://www.swfwmd.state.fl.us/conservation/reclaimed/
    - Water Reuse for Florida (document)
    - Reclaimed Water Guide (document)
        - Originated from the DEP water reuse coordinating committee approximately 10 years ago
        - Award winning document
        - How to start and operate a reclaimed water system
        - Will show who takes part in water reuse and give an overview of the reuse program:
            - Anti-degradation
            - Reuse feasibility
            - Statues from Florida
            - Ordinances
            - Real world policies
            - Regulations and rules
        - Recommendations are relevant to today
        - Statutory provisions haven't changed over the years
        - See page iii to see Florida's reuse program
        - Not current, but relevant
- No. 373 and 40-2 in the Florida Statutes (regarding inter-basin transfers)

b) Re: Resources?
Response:
- Tampa Electric Company (TECO)
    - SWFWMD co-funding an $80 million project
    - Water from the City of Lakeland, Mulberry and Polk southwest water treatment facility
    - Accepts seven to ten million gallons/day so TECO does not have to withdraw seven to ten million gallons/day of groundwater
        - One to one offset
    - Numeric nutrient criteria:

        - Surface water dischargers must achieve low numbers (e.g. <0.3 mg/L nitrogen)
        - Reuse of water to TECO allows cost savings in that the WWTPs do not have to treat to levels suitable for discharge
    - Lakeland, Polk and Mulberry will be giving the water to TECO
    - TECO and the SWFWMD will be paying for the pipeline
    - Lakeland, for example, within two years will no longer have to achieve numeric nutrient criteria since 100% of their flow will go to TECO and none will go the Alafia river
- Duke Power Plant (used to be called Progress):
    - Brings water from the City of Crystal River
    - Helps quality and quantity:
        - The power plant will no longer be extracting groundwater
    - Nutrients will not be discharged into the spring-shed

APPENDIX F – Texas Survey Results

(Note: All telephone conversation records have been summarized and paraphrased)

F1 Texas: Practitioner Telephone Conversation Summary

DATE	May 28, 2013	**TIME**	13:30
CONTACT	M. Rochelle	**DEPARTMENT**	NA
COMPANY	Lloyd Gosselink Rochelle & Townsend, P.C.	**JOB TITLE**	Principal; Chair of the Legislative committee with the Texas Section of the WateReuse Association

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) IR Management?

a) Re: main permitting agencies for IR?
Response:
- Texas Commission on Environmental Quality (TCEQ)
  - All surface water diversions
  - Non-oil and gas waste discharge issues
  - Waste disposal issues
  - Enforces the 210 Rules

b) *Re: other regulatory agencies involved in IR?*
Response:
- Railroad Commission of Texas deals with reuse projects pertaining to the oil and gas sector
  - Governs oil and gas development in Texas
  - Clean Water Act compliance for the oil and gas industry is regulated by the Railroad Commission
  - Enforces within their jurisdiction only
  - Small reuse program

c) *Re: inter-agency communication?*
Response:
- Memorandum of Agreement (MOA)
  - Between the Railroad Commission and the TCEQ
  - Defines what the oil and gas sector includes and what other activities are
  - How communication will be handled in order to keep all parties informed

d) *Re: water source?*
Response:
- Surface and ground waters

e) *Re: reuse applications in state?*
Response:
- Gold courses
- Parks/park lands
- Fracking

f) *Re: management of WWTP?*
Response:
- Private and Public

2) *Permitting Process Summary (from respondent perspective)?*
Response:
- Reuse Protocol outlines process
  - 30 Texas Administrative Code (TAC) – Chapter 210
  - TAC is the state-wide code for regulations produced by the state for all agencies
  - 30-TAC are the TCEQ's regs while chapter 210 states the direct reuse requirements

- Divided down between the use of effluent resulting from municipal waste treatment, and use of effluent resulting from industrial waste treatment
- 210 Regs are not a permit by rule or a general permit but tell the user what to do

- Permitting with respect to various participants in reuse:
  - 210 rule rates producers of effluent, providers of effluent (usually also the producers of effluent, but not always), and the users of effluent
    - Example:
      - May have a regional treatment plant that is a producer and sells their effluent to the City of Dallas
      - Dallas in this this case would be the provider (or "wheeler") of the reclaimed water to applications such as ten golf courses
      - Golf courses would be the user, Dallas the provider, and the Trinity River Authority (a large wastewater treatment plant in the Metro-Plex) would be the producer
      - All three would be regulated under the 210 Rules
      - Based on their contractual rights, and their ownership in the base water right, any of the three participants would be able to get the 210 authorization
  - Commonly, the wastewater treatment plant owner (as the producer) will obtain the 210 authorization
    - Only need one authorization and other participants are included as opposed to having "ten authorizations"

a) *Re: Water Quality? (i.e. Health, etc.)*
Response:
- No comments

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- No limits to the direct use of reuse water
  - If there is a project that intends to use recycled water then the applicant can get a water right, or water right amendment

c) *Re: Water Rights?*
Response:
- TCEQ handles water rights
- Reliability of water for third parties
  - Industries have begun to recognize the reliability of flow from reclaimed water plants
- Water Right Amendments:
  - Example: City of Marshall Texas has the right to use a base water amount within its environment. If an industry from outside the area approaches Marshall and wants to purchase municipal effluent then Marshall might have to amend its base water right to add a place of use
- Once a WWTP has and treats the water it belongs to them, however, they must put it to a beneficial use
  - Texas Water Code (Section 11.046) states two things:
    - You can use and reuse water to a beneficial use before (or if) you discharge it (i.e. it may be completely consumed)
      - This clause is the reason why very few direct water reuse projects have water rights implications
    - Once you discharge the water into a stream you must get another appropriation before you can divert that water again
      - One reason, for example, might be that others may have become reliant on your discharge
  - Purpose of Use
    - For example: City of Dallas may have a municipal use surface water right and then an industry would request use of the water for non-municipal purposes. City of Dallas would have to amend its water right to add a "purpose of use"
  - Consumptive limits are rare in Texas while diversion limits will have limitations
    - In Texas, an entity would have the right to consume all of the full quantity of the diversion right (i.e. there would be no obligation to discharge at all).

Thus, this rule makes direct reuse of effluent free from water right constraints

- In-direct reuse:
  - The City of Dallas could, for example, discharge it's waste stream into the river and obtain a separate water right downstream to re-divert that water
- Prior Appropriation Doctrine:
  - This doctrine is present in Texas without the provision for return flows
    - If a downstream senior water right is in place then an upstream junior is unable to divert flow
  - Could be altered to regulate consumption thereby forcing return flows

3) *Commentary of IR Program in Practice?*
   a) *Re: efficiencies?*
   Response:
   - IR gets a "second" use out of the raw water
     - Treated to near drinking water standards / Clean Water Act standards.
     - Use the water for a beneficial purpose before abandoning downstream
   - Drought proof
     - Reclaimed water plants have a number of industries that rely on them due to the fact that they are basically drought proof
     - The dominant flow source are uses inside the home which occur at a relatively consistent rate making the plants more reliable to users

   b) *Re: Inefficiencies?*
   Response:
   - 210 Rules do not involve notice to any third parties and do not include possibility for a "contest a case" hearing process in the case of reclaimed water projects
     - If it's a regular point source discharge or water right issue then there are many provisions for an adjudicative process if you think you will be affected
     - With reclaimed water projects the process involves filling out a form and submitting it to the agency
     - Applicant and agency negotiate the reclaimed water authorization based on the 210 rules. Once details are established, the agency sends a letter of authorization without public consult

4) *Respondent Recommendations?*
Response:
- Include a mechanism for public comment or "contest a case" provisions to allow for public comment
- Colorado:
  - Similarities between Colorado and Alberta regarding surface and groundwater supply issues
  - Colorado has limits on consumption and provisions for return flow that are not present in Texas

5) Examples of IR in Practice?
a) Re: Resources?
Response:
- 30 TAC – Section 210
- Purpose of Use
- Memorandum of Agreement
  - Between the Railroad Commission and the TCEQ

e) Re: Projects?
Response:
- Fracking
  - Increase in fracking using reclaimed water where there is a shortage of conventional supplies
  - Effluent typically cost less, however, solicitors are convincing their clients to sell reclaimed water at the same value of their raw water since it is augmenting or off setting raw water use
  - With the increase in "shale plays" in Texas, industries are becoming more conservative in their use of water

F2 Texas: Practitioner Telephone Conversation Summary

DATE	June 18th, 2013	**TIME**	08:00
CONTACT	E. McDonald	**DEPARTMENT**	N/A
COMPANY	Alan Plummer Associates Ltd	**JOB TITLE**	Principal

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) IR Management?

a) *Re: main permitting agencies for IR*
Response:
- Texas Commission on Environmental Quality (TCEQ)
  - Departments separated between quality and quantity

b) *Re: other regulatory agencies involved in IR?*
Response:
- Railroad Commission regarding oil and gas operations

c) *Re: inter-agency communication?*
Response:
- No formal documentation that outlines protocols for communication
  - There isn't a great need for the quantity and quality departments to communicate since there are no rules specifically related to indirect reuse

d) *Re: water source?*
Response:
- Surface and groundwater

e) *Re: reuse applications in state?*
Response:
- Power plants
- Shale gas
- Process uses not including public contact

f) *Re: management of WWTP?*
Response:
- No comments

2) *Permitting Process Summary (from respondent perspective)?*
Response:
- As an industry wanting to use reclaimed water, the first step would be approaching the wastewater entity (producer)
- The producer is the entity that obtains the authorization not the Industry
- The Industry (or User) would enter into a contract with the Producer
- The TAC, chapter 210, has a set process which includes "accepted uses" for reclaimed water
  - If a proposal for reuse is already accepted, then the approval should happen quickly
- Discharge permit is completely separate from the water rights allocation
- Water rights department focused on quantity but quality is addressed through an environmental review that is done as part of the water right
  - Quality considerations are considered by the quantity group as a function of the scope of the proposed project
- Regarding oil and gas applications:
  - A municipality would obtain a 210-Authorization to deliver reclaimed water to a pond that would then be accessed by the oil and gas companies in order to perform their fracking
  - Once the reclaimed water reaches the pond, then the water is under the jurisdiction of the railroad commission

a) *Re: Water Quality? (i.e. Health, etc.)*

Response:

- TCEQ sets the standards for quality considerations
- Discharger obtains a discharge permit based on quality issues
    - This permit is completely separate from the water rights allocation

b) *Re: Water Quantity? (i.e. Usage)*

Response:

- Dischargers are allocated only certain quantities of water to ensure that sufficient quantities remain in the stream for downstream users
    - I.e. users reliant on certain water flows and also for environmental needs
    - Quantities are determined on a case by case basis with variation between permits
        - Depends on what is negotiated between the various interests

c) *Re: Water Rights?*

Response:

- Reclaimed water belongs to the treatment facility or the entity that operates the treatment facility until it is discharged into state waters
    - Until water is discharged from a wastewater treatment plant the state does not have rights to the water
    - Once discharged it becomes "water of the state"
    - To obtain a water right, an entity would have to go through the Water Rights Adjudication Process
    - A wastewater treatment plant would not need a water right until they have discharged the waters back into waters of the state. At that time, it becomes state water
        - As said, it belongs to the owner of the wastewater treatment plant until they discharge it into state water (any natural water body)
- Regarding inter-basin transfers
    - These transfers predominantly occur with raw water but not so much with reclaimed water
        - The value of reclaimed water is that it is a local source
    - There are specific water right rules that apply to permits
        - Example: A number of Dallas/Fort Worth entities import water from outside their basin. As a result, any volume of discharge that is attributed to the import water is allowed to be consumed 100%
            - Imported water is considered "developed" water of which downstream entities has no historical reliance on
- Third-party security of supply
    - Provisions to ensure security with the supply of reclaimed water are done through contractual arrangements and not through the regulator
    - To provide the reliability requires a more expensive system so security of supply can either be done through:
        - Systems (redundancies and/or storage), or
        - Alternate (raw water) supply
            - Well or a connection to the potable system
            - This option is most common

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*

Response:

- Legislative push to conduct in stream flow studies for all the major river basins.
    - Based on this study, it is unclear how the results will affect future water right arrangements
- Interest in reuse has increased due to the droughts that have taken place
    - Specifically the coastal region where there are an abundant number of oil refineries and oil and gas development
- The regulations in Texas are set up to be very user friendly and supportive of reclaimed water reuse
    - The TCEQ is helpful and supportive of water reuse by looking for ways enable the process and not stand in its way
- Fairly efficient system with authorizations being granted by the TCEQ in 3 or 4 months
    - It is more a case of implementation issues as opposed to permitting issues

b) *Re: Inefficiencies?*

Response:

- Even though the TCEQ operates as one agency, there can sometimes be a disconnect between departments (i.e. water rights and quality departments)
- Industrial applications require more difficult water quality requirements than have been experienced or dealt with to date
    - Cooling towers and irrigation applications with regards to scaling and corrosion. Make up of water can have repercussions that have not been important in conventional water treatment
    - Not a regulatory issue, but an implementation and cost issue
    - Industries may have on-site treatment systems that are accustomed to receiving potable water. If reclaimed water is accepted with higher nutrients then their systems may suffer

4) *Respondent Recommendations?*

Response:

- Issues regarding:
    - Water quality needs by the industry (as noted above)
        - Likely handled contractually between the WWTP and the industry as to what quality would be required on delivery
    - Reliability issue.

5) Examples of IR in Practice?

a) Re: Resources?

Response:

- Texas Administrative Code – Chapter 210
    - Addresses industrial reuse but focuses on internal recycle or industry to industry waters
    - The main rules, dealing with municipal wastewater, include industrial applications
- Chapter 210 Authorization
    - Not called a permit officially
    - Granted to the wastewater treatment plant
    - Mechanism to track where the water goes if not discharged
    - Includes rules for using reclaimed water, quality requirements, design requirements etc.

b) Re: Projects?

Response:

- Dallas/Fort Worth and Houston Water Rights Agreement:
    - Dallas Fort Worth area treatment plants discharge into the Trinity River
    - From that location, the Trinity River flows into the Houston area
    - Dallas/Fort Worth entities began trying to obtain rights to their return flows
    - Houston protested because they had become reliant on the flows
    - All entities came to an agreement that the Dallas/Fort Worth plant would continue to discharge 30% of their return flows that originate in the Trinity Basin
        - Imported raw water volumes did not have to be discharged into the Trinity Basin
        - Separation of indigenous water vs. imported water has led to the need for sophisticated water tracking and accounting systems
    - The TCEQ, who administers water rights, was approached by some environmental groups who protested the permits
    - Protests were negotiated and the TCEQ ensured that in stream flows were sufficient via stream gauges placed at various critical locations

F3 Texas: Quality Regulator Telephone Conversation Summary

DATE	June 28, 2013	**TIME**	10:00
CONTACT	J. Centeno	**DEPARTMENT**	Water Quality Division
COMPANY	Texas Commission on Environmental Quality (TCEQ)	**JOB TITLE**	Engineer

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) IR Management?

a) *Re: main permitting agencies for IR?*
Response:
- TCEQ
  - Water Quality Division
    - Implement the 210 rules for reclaimed water
    - Concerned with wastewater treatment and disposal

b) *Re: other regulatory agencies involved in IR?*
Response:
- TCEQ
  - Water Supply Division
    - Permit water rights

c) *Re: inter-agency communication?*
Response:
- Interaction is in-frequent between the water supply division and water quality
  - Communication would occur mainly if reclaimed water was used for potable water since it now directly becomes a supply and quality concern

d) *Re: water source?*
Response:
- No comments

e) *Re: reuse applications in state?*
Response:
- No comments

f) *Re: management of WWTP?*
Response:
- No comments

2) *Permitting Process Summary (from respondent perspective)?*
Response:
- Website will explain: http://www.tceq.state.tx.us/
  - Rules: Current TCEQ Rules:
    - http://www.tceq.texas.gov/rules/current.html
  - Download TCEQ Rules:
    - http://www.tceq.texas.gov/rules/index.html
  - 30 Texas Administrative Code (HTML format)
    - http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC
  - Title 30:
    - http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=2&ti=30
  - Part 1:
    - http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=3&ti=30&pt=1
  - Chapter 210:
    - http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=4&ti=30&pt=1&ch=210

- The processes regarding reclaimed water originating from a municipality or an industry are separate.
- The permitting structure:
    - Firstly, the producer must have a water quality discharge permit before it is possible to get a reclaimed water authorization
        - Not a permit but an authorization
        - Reclaimed water reuse authorization `piggy backs` on the regular discharge permit or land application permit
            - Without either of the two permits, it is not possible to obtain a reclaimed water authorization or 210 authorization
        - Water supply is not involved in the above process as it is all handled by Water Quality Division
    - The agency holding the permit will request the 210 Authorization for the use of reclaimed water towards the end user (i.e. the industry)
    - The user and the one who holds the permit (i.e. the producer who supplies the reclaimed water) will have a contract together
        - The user does not deal directly with the TCEQ but the one who generates, produces and supplies the reclaimed water
            - As mentioned, the entity who holds the regular permit is the one who obtains the 210 Authorization
    - The producer must comply with the stipulations within the 210 authorization

a) *Re: Water Quality? (i.e. Health, etc.)*
Response:
- See above

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- Any considerations towards water supply fall outside the scope of the 210 authorization
    - This would be the jurisdiction of the Water Supply Division

c) *Re: Water Rights?*
Response:
- No comments

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*
Response:
- No comments

b) *Re: Inefficiencies?*
Response:
- No comments

4) *Respondent Recommendations?*
Response:
- No comments

5) *Examples of IR in Practice?*

f) Re: Resources?
Response:
- Water Quality Discharge Permit
- Land application permit
- 210 Authorization (or, Reclaimed water authorization)

g) Re: Projects?
Response:
- None recommended

F4 Texas: Quantity Regulator Telephone Conversation Summary

DATE	August 27, 2013	**TIME**	09:00
CONTACT	K. Alexander	**DEPARTMENT**	Water Availability Division
COMPANY	Texas Commission on Environmental Quality (TCEQ)	**JOB TITLE**	Technical Specialist

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
- a) *Re: main permitting agencies for IR?*
  Response:
  - TCEQ
    - Water Quality Division
    - Water Supply Division
- b) *Re: other regulatory agencies involved in IR?*
  Response:
  - No comments
- c) *Re: inter-agency communication?*
  Response:
  - No comments
- d) *Re: water source?*
  Response:
  - No comments
- e) *Re: reuse applications in state?*
  Response:
  - Several million acre/ft permitted for indirect reuse
  - More popular than direct reuse
- f) *Re: management of WWTP?*
  Response:
  - No comments

2) *Permitting Process Summary (from respondent perspective)?*
Response:
- a) *Re: Water Quality? (i.e. Health, etc.)*
  Response:
  - The quality standpoint of reuse permitting is carried out by the TCEQ, Water Quality Division, Chapter 210
    - Deals with Direct Reuse
    - Certain parameters that have to be met
- b) *Re: Water Quantity? (i.e. Usage)*
  Response:
  - Texas differentiates between two different types of reuse into two different permitting programs:
    - Direct reuse
    - Indirect reuse
  - This department/program mainly looks at indirect reuse.
    - A WWTP discharging into the river and then another end user picks up that effluent stream downstream
  - Direct reuse is permitted under Chapter 210, TCEQ, Water Quality Division
  - When a WWTP wishes to divert some of its discharge from a river for reuse purposes, it does not need approval from the Water Supply Division or notify them of the direct reuse

        - When this department looks at availability from the water rights permitting side, the TCEQ has an underlying assumption that when water is diverted for municipal purposes (i.e. a city diverts it, treats it, distributes it, and then it enters into a WWTP), then the assumption is that that water is fully consumed
        - Discharged effluent is not considered part of river flows when the TCEQ grants new permits for new water rights
        - Direct reuse is growing (example: Big Spring and Brownwood, Texas)
            - Potable reuse is beginning
    - Dependency on raw water source:
        - Complication when the primary water supply is groundwater
        - The reuse of groundwater is treated differently than the reuse of surface water

c) *Re: Water Rights?*
Response:

- Only in limited circumstances is a WWTP obliged to consider downstream dependency when diverting their treated effluent
    - When new water rights are granted, the assumption is that the wastewater discharge is fully consumed by the diverter so it is not considered as flow available for another user
    - Downstream dependency is considered only when a WWTP wants to indirectly use their effluent after it has been discharged to a river
- Example:
    - City of Dallas discharges water into the river from their WWTP and then want to collect it again downstream
        - The TCEQs water supply division will consider to what extent existing water rights have relied on that effluent
- Certain permits will state that the permit is based on the continual discharge from a certain treatment plant and that if the WWTPs flow diminishes or stops, so too does their water right
- Texas Water Code, Section 11.042: when considering if an entity can obtain a reuse permit, the TCEQ is obliged to determine if there is impact on existing water rights
- The water rights that the TCEQ writes are typically in perpetuity
    - Get to use the water for as long as they use it
- Some tenure or term permits
    - Term permits allows a user to take advantage of water that is not being used on another water right for a certain period of time
    - If a city has 100 acre/ft for future needs, but are only using 50 acre/ft now
    - The model is called “the current condition”
    - To grant these term permits, the TCEQ does look at the wastewater effluent that is in the river
    - The TCEQ will observe the river and update their models based on reported discharges every couple of years (depending on the growth rate of a basin)

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*
Response:

- State Water Plan: www.twdb.texas.gov
    - The board plans plan water resources
    - Evaluate various strategies for water conservation and development in certain areas
    - Some funding through the Texas Water Development Board for indirect and direct water reuse
    - Funding available when it compliments overall goals for water conservation
        - Some funding exists as loans
- Collaboration between utilities to ensure that water is delivered to where it is needed

b) *Re: Inefficiencies?*
Response:

- No comments

4) *Respondent Recommendations?*
Response:

- No comments

5) *Examples of IR in Practice?*

h) Re: Resources?

Response:

- None provided

i) Re: Projects?

Response:

- Collaboration: Dallas Fort Worth Area of Texas
    - Early 2000
    - Large water suppliers and water districts had received their own individual indirect reuse permits
    - Theses separate entities are looking at collaborative processes, systems and interconnects
    - The theme is to get the water to where it is needed in the most efficient way possible
    - Because the systems are intertwined, they are beginning to work together to make processes more efficient
        - Example: trading water (runoff, for indirect water)
- City of Abilene, Texas
    - Has both indirect and direct water reuse occurring within their city
    - Trend has been to look at creative methods from a water rights perspective
    - Attempt to redirect the water to where it is needed
- Bigspring, Texas
    - Potable reuse systems

APPENDIX G – Washington Survey Results

(Note: All telephone conversation records have been summarized and paraphrased)

G1 Washington: Practitioner Telephone Conversation Summary

DATE	June 13, 2013	**TIME**	15:00
CONTACT	K. Fowler	**DEPARTMENT**	NA
COMPANY	LOTT Clean Water Alliance	**JOB TITLE**	Community Relations and Environmental Policy Director

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
      Response:
      - Washington Department of Ecology (DOE)
        - Involved in quality and quantity aspects of water reuse
      - Washington Department of Health (DOH)
        - Involved from the standpoint of protecting drinking water
          - Cross connections etc.
        - DOH role in water reuse has been diminished over time and so there is some ambiguity as to whether or not there will be joint permitting

   b) *Re: other regulatory agencies involved in IR?*
      Response:
      - As above

   c) *Re: inter-agency communication?*
      Response:
      - No comments

   d) *Re: water source?*
      Response:
      - Varies depending on the location: both surface and groundwater

   e) *Re: reuse applications in state?*
      Response:
      - Irrigation
      - Not a lot of industrial reuse
      - Unfamiliar with oil and gas activities

   f) *Re: management of WWTP?*
      Response:
      - The majority of facilities in Washington are owned by municipalities, cities or counties

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - In the State of Washington, reclaimed water permits are issued jointly by:
     - State Department of Ecology (DOE) and
       - Mainly involved with a municipal wastewater system serving industrial customers
     - State Department of Health (DOH)
       - Exclusively involved if internal recycling and reuse of an industry is occurring
   - Reclaimed water is authorized by state statute in Washington
     - In the statute it says that the generator of the water has the exclusive right to the water
   - There are existing state guidelines for reclaimed water programs
     - Have been in place since 1997 (i.e. old)
     - Process is underway (over the last 3-4 years) to write new reclaimed water rules for the state
       - This would change the guidelines into official regulations

- Process was stopped when the Governor put a moratorium on rule making due to economic situations
- The DOE is attempting to have this process restarted this year
- If successful, in the next year Washington could have "official regulations"

- At this point there are only guidelines
  - Only have enforcement power when a permit is administered
- In total, there are approximately 30 reclaimed water systems operating in the state of Washington
  - Also a number of facilities that are underway (actual number is unknown due to staff shortages at the DOE

a) *Re: Water Quality? (i.e. Health, etc.)*
Response:
- No comments

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- No comments

c) *Re: Water Rights?*
Response:
- Very important in the State of Washington
- The generator of the water has the exclusive right to the water according to state statutes
  - Written in law as opposed to originating from case law
  - There is no obligation to return water; can be sold by the WWTP
  - Inter basin transfer may be an issue in Eastern Washington, but on the coast the discharge would be to marine waters and hence not an issue
    - Example:
      - Lacey is technically considered an inter-basin transfer but because it is being discharged into Budd Inlet (Puget Sound)
      - With reclaimed water, however, the water is being "sent back" to Lacey and solves inter-basin transfer issues
- Once the water is discharged, it becomes a "water of the state"
- New Reclaimed Water Rule
  - Particular issue regarding water rights is a section on water rights impairment
    - i.e. a new proposed permittee would have to conduct significant analysis to prove that they are not impairing quality or quantity of someone else's water right
      - The quantity aspect is important if for instance a utility is producing reclaimed water for irrigation or other uses instead of discharging to a stream (which had been the former practice)
    - A downstream water rights holder could be impaired if they were dependent on the water
    - These issues are more prevalent in Eastern Washington
- Supply guarantee strategies
  - Reclaimed water supplies will be interrupted from time to time
    - LOTT puts the system down for maintenance from time to time or shut downs due to construction etc.
  - In cases where there is a dependence on water all of the time, then there would have to be a potable backup
    - This would mean dual infrastructure/piping and systems to reduce cross connections
    - Local building codes and permits would specify these needs
  - One of the issues with attempting to make effective use of reclaimed water is the costs related to dual piping etc.

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*
Response:
- LOTT conducts a public involvement work when planning new facilities etc.

b) *Re: Inefficiencies?*
Response:
- Currently the guidelines are in a state of "limbo" due to economic sanctions
  - The industry is awaiting the approval to transform the guidelines into regulations
- Employment shortages are causing a slow-down in approval processes

4) *Respondent Recommendations?*
Response:
- Public involvement and education with new facilities or existing projects:
    - See LOTT website
    - There still exists misunderstanding in the public eye regarding the quality and uses of reclaimed water
    - Public support is important not only when beginning new facilities but for supporting the ultimate end users who will have neighbours who may raise questions about reclaimed water use
        - i.e. irrigating a school yard, golf course etc.
    - One of LOTTs satellite facilities is located adjacent to offices, retail stores, apartment complexes and housing units while another proposed facility is across from a middle-school and housing developments
    - In the above cases, public awareness and education is extremely important

5) Examples of IR in Practice?

a) Re: Resources?
Response:
- New Reclaimed Water Rule
- The Guidelines themselves
- Permit writers manual (from the DOE)
    - http://www.ecy.wa.gov/programs/wq/reclaim/Permitting.html

b) Re: Projects?
Response:
- Multi-jurisdictional entities. For example:
    - LOTT Clean Water Alliance
        - Wastewater utility company with four government partners (three cities and one county):
            - Lacey
            - Olympia
            - Tumwater
            - Thurston County
        - Operating since 2005 with two reclaimed water plants
        - Plans to build additional satellite plants and groundwater infiltration basins
    - King County
        - approximately 30 different affiliated cities, sewer districts and other entities that they serve as part of their function
        - good source of information regarding industrial reuse applications
    - Kitsap County
        - sewer districts producing reclaimed water with the water district being be the user
        - These entities would have to work out inter-local agreements to make a project of this nature happen.

G2 Washington: Quality Regulator Telephone Conversation Summary

DATE	June 27, 2013	**TIME**	13:50
CONTACT	D. Howie	**DEPARTMENT**	Water Quality Section
COMPANY	Department of Ecology (DOE)	**JOB TITLE**	Stormwater Engineer

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - Department of Ecology (DOE) – Water Quality Section
     - Wastewater plants and storm water

   b) *Re: other regulatory agencies involved in IR?*
   Response:
   - Department of Health (DOH)
     - Potable water and potable water aquifers
     - Local county health departments may have some involvement on individual projects
   - DOE – Water Resources Section
     - Concerned with water resources and water rights

   c) *Re: inter-agency communication?*
   Response:
   - Between the DOE and DOH
     - Assigned people:
       - The DOH has individuals (two people) that are assigned to communicate and handle reclaimed water/reuse projects
       - These individuals will make decisions as to whether or not the DOH will review an application or not
       - Communication will be between the selected DOH individuals and applicable people within the DOE
     - Regular meetings:
       - The DOE has a "Reclaimed Water Working Group" and the assigned DOH individuals are invited to those meetings
       - There are four regional offices and Headquarters within the DOE and the Working Group would have individuals from each of the offices
       - The goal is to have consistency between the departments in regards to the requirements of their permits and their management of projects
       - The need for these meetings emphasise why the WAC is important since it would outline what should be done and how it should be done

   d) *Re: water source?*
   Response:
   - Dependent on location:
     - Seattle, Tacoma – surface water (Tacoma also has groundwater fields)
     - Olympia is solely groundwater
     - Eastern Washington is almost exclusively groundwater with the exception of those along the Columbia River

   e) *Re: reuse applications in state?*
   Response:
   - Irrigation
   - Not familiar if applications are being used at industries
   - Internal recycle for washing
   - Infiltration basin

   f) *Re: management of WWTP?*

Response:

- No comments

2) *Permitting Process Summary (from respondent perspective)?*

Response:

- State DOE creates individual permits to various WWTPs to produce reclaimed water
    - The main application is irrigation
- Example:
    - LOTT Clean Water Alliance:
        - Treatment plant that transports reclaimed water to a series of lakes and lagoons and potentially an infiltration basin
        - Evaporates or infiltrates to groundwater
        - Goal is to reduce effluent discharge to surface water bodies especially in Puget Sound and recharge aquifers
            - In Olympia reclaimed water is being discharged into Budd Inlet at the south end of Puget Sound so there is very little water movement and turnover (i.e. accumulation)
- In Washington, reclaimed water is separate from Reuse:
    - Reclaimed water
        - Domestic wastewater that is treated and is used again
    - Reuse
        - Water no longer used in an industrial or commercial process that is treated and recycled
- Applicable Legislation:
    - Revised Code of Washington
        - These are the laws passed by the legislature
    - Washington Administrative Code (WAC) rules
        - Various agencies create their own applicable administrative code
        - WAC rule interprets the law and assists the public/industry
        - WAC is essentially a "Guidance Manual"
        - Three years ago the DOE had begun creating a WAC rule side by side with the DOH
        - Governor of Washington halted the process in 2012
        - Fiscal year begins on July 1st and it is the desire of the DOE to begin the rule making process again
            - Likely one year to obtain completion
        - Once completed, the WAC rule would:
            - Allow the DOE to renew permits
            - Grant new permits (reclaimed water and reuse)
            - Address Reuse at the same time it is addressing reclaimed water
        - In addition to the WAC there would be associated documents:
            - Templates for permits etc.
                - Would include multiple alternative language paragraphs for the applicant to choose from
            - Fact Sheet
                - Would outline the reasons for granting permits and the limitations to granting permits
    - Currently, without a WAC in place, there is little legal rules for the DOE to work with regarding "reuse" (i.e. not reclaimed water)
        - East side of Washington (with little rain fall) there are many industries looking to practice "reuse"
    - In the absence of the WAC, the DOE is putting emphasis on other legislation to place limits on water quality and treatment technology etc.
        - i.e. Clean Water Act
    - Once the WAC is in place, the lead agency (or permitter) would be the DOE with the DOH review certain applications
        - Certain criteria will be specified as to when the DOH will review an application for reclaimed water or reuse
            - E.g. is there a drinking water well near to a reclaimed water infiltration basin

        - Thus, the DOE would be concerned with both quality and quantity considerations with the DOH overseeing potable aquifer considerations

a) *Re: Water Quality? (i.e. Health, etc.)*
   Response:
   - The DOH oversees projects that have a potable water or potable water aquifer component
   - The DOE administers permits, with the input of the DOH where required, regarding water quality parameters for discharge

b) *Re: Water Quantity? (i.e. Usage)*
   Response:
   - Depending on the water right description, diversion permits are typically 100% consumptive use
     - Based on peak flow and annual volume considerations
     - Wastewater effluent may be considered to not be part of the "natural" flow conditions of a stream
     - As such, return flows may not be a requirement
     - Some jurisdictions may have stream flow requirements, and may have the ability to use reclaimed water to meet those requirements
   - In Washington there is a lot of activity with Aquifer Storage and Recovery
     - Placing reclaimed water in an aquifer throughout the winter and removing the water in the summer when water requirements have increased
   - Water Resource accounting considers net amounts regarding inputs and outputs of water from an aquifer or surface water body
     - Offset system

c) *Re: Water Rights?*
   Response:
   - With many treatment plants on the shores of Puget Sound or into the Columbia River. As such, downstream water rights or return flow stipulations are not considered applicable
   - For this reason, any reductions in flow entering Puget Sound are viewed by the DOE as being a benefit since Puget Sound has minimal flows
   - Water rights will be dealt with in the WAC once completed and as such the DOE will administer water rights issues
     - Once discharged, effluent becomes a "water of the state"
   - The Doctrine of Prior Appropriation is in effect in the State of Washington
     - The DOE hasn't a long experience with reuse of reclaimed water who has the right to utilize it
   - Security with flows between the WWTP and the end user would be dealt with through individual contracts between the parties

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*
   Response:
   - Incentives for reclaimed water reuse would exist with local jurisdictions such as the City of Olympia
     - The city will contact potential end users to solicit their use of the reclaimed water
   - In an effort to deal with backlogged water rights and water resource approvals, the DOE (Water Resources Section) has a rule that if you want to pay a private consulting company to conduct the review then your application will move up in the line. If not, the application will be processed when the DOE has time

b) *Re: Inefficiencies?*
   Response:
   - There are no state wide incentives for practicing reclaimed water reuse
   - While jurisdictions may offer reclaimed water to potential end users, the cost of installing infrastructure remains an impediment

4) *Respondent Recommendations?*
   Response:
   - Prior to incorporating a water reclamation and reuse program in place, develop the standards first so as to work consistently
     - Identify what is and what is not acceptable
     - Develop templates for permits etc.

5) *Examples of IR in Practice?*
   a) *Re: Resources?*
      Response:
      - Revised Code of Washington (incomplete)
      - Reclaimed Water Work Group (DOE and DOH)
      - Aquifer storage and recovery
   b) *Re: Projects?*
      Response:
      - No knowledge of IR applications in practice

G3 Washington: Quantity Regulator Telephone Conversation Summary

DATE	July 2, 2013	**TIME**	12:50
CONTACT	G. Gregory	**DEPARTMENT**	Water Resources Section
COMPANY	Department of Ecology (DOE)	**JOB TITLE**	Technical Unit Supervisor

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
      Response:
      - Department of Ecology (DOE)
        - "super agency"
        - Administer a host of US federal and state environmental statutes dealing with solid and hazardous waste management, contaminated site clean-up and assessment and the Clean Water Act
        - Delegated by the federal government to implement the Clean Water Act
        - Administer the state water resource rule known as "The Water Supply Code" which is part of the Western Water Law in the US
        - Resource Management Law (or Environmental Law) and Water Law are separate
          - Water reuse is one of the locations where these two laws meet

   b) *Re: other regulatory agencies involved in IR?*
      Response:
      - No comments

   c) *Re: inter-agency communication?*
      Response:
      - No comments

   d) *Re: water source?*
      Response:
      - No comments

   e) *Re: reuse applications in state?*
      Response:
      - Mainly municipal irrigation (Golf courses etc.)
      - Non-contact cooling
      - Gravel washing at quarries

   f) *Re: management of WWTP?*
      Response:
      - No comments

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - DOE is what is known as a "super agency"
     - Divided between the "quality" program and the "quantity" program
     - The two sections of the DOE meet in water reuse
   - Quality Section leads the permitting process
     - On water reclamation permits, the Water Resources Section is called upon to make a determination in regards to "impairment" (i.e. will anyone be impaired by a water diversion)
   - If a proponent, such as an industry, wishes to access reclaimed water their first point of contact would be the WWTP
     - If the infrastructure is in place and permits are in place on the WWTP side, then the project is straight forward

- Water Resources Section would get involved in a project when the WWTP intends to reclaim a portion of their discharge
- The WWTP, if they did not have a history of reclaiming water, would have to alter their permit by working through the reclaimed water permitting process (i.e. is anyone impaired downstream)

a) *Re: Water Quality? (i.e. Health, etc.)*
Response:
- If reclaimed water, or any water, is applied to the ground there are the following requirements:
  - Clean Water Act
  - Groundwater quality standards
  - Receiving water standards

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- Regarding municipalities:
  - The DOE has adopted and interpreted the "Growing Communities Doctrine" of Western Water Law (which is a Prior Appropriation Doctrine) to mean:
    - A municipal use is whatever the municipality chooses to use the water for
  - Many municipalities are free (with permits in place) to discharge their effluent through "purple pipe" to various end users in order to sell it again
- Industrial applications using reclaimed water are attractive to municipalities in Washington
- From the DOE (Water Resources Section) perspective, reuse is between the vendor and the consumer
- In the water reclamation permitting process, the Water Resources Section of the DOE is called upon to make a judgement on "impairment"
  - Typically in quantity rules, "impairment" is strictly prohibited
  - In Washington, the rule states that the impairment analysis is done to determine "who could be impaired"
  - The project proponent is then able to "mitigate" that impairment with the parties that would be potentially affected by the project
  - Once the affected party signs off to say they accept the impairment, then the project can proceed

c) *Re: Water Rights?*
Response:
- Regarding "return flow" stipulations
  - There is concern in the water resource community regarding the diversion of treated effluent that does not return (at least in part) to its origin
  - The motto adopted for the State of Washington is "Clean Flowing Waters for the State of Washington"
  - Reclaimed water diverted from "effluent" is water that does not make it to "effluent" so it is a net increase in consumptive use of the water that is initially extracted (or pumped)
  - In eastern Washington (especially in late summer) many streams are effluent dominated so in many cases the "net benefit" of diverting reclaimed water to another use is seen to be worth the potential impacts downstream
- Inter-basin transfers have not been an issue yet in the realm of reclaimed water
  - Price for installing "purple pipe" usually makes inter-basin transfers a non-issue

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*
Response:
- DOE promotes water reuse through various statutes and regulations including the Water Supply Regulation
  - Example: If an entity has a water right and has the ability to acquire reclaimed water so as to put it to beneficial use then that practice is supported by the DOE
- One agency approach
  - Has advantages but can be logistically challenging
- Proponents of a reuse project may approach peoples "impaired" by a project and come to an agreement. Once mitigated, the project can proceed

b) *Re: Inefficiencies?*
Response:
- More attention needs to be paid to the water balance on the system as a whole

- Example: Community WWTP
    - Scenario:
        - Calculations for the total maximum daily load (TMDL) into a stream resulted in extremely low effluent limits for phosphorus
        - DOE (Water Quality Section) stipulated that for the late summer, the WWTP should not discharge to the river but use their effluent for reclaimed water reuse
        - Small community so there is an absence of a large population to share the cost of capital investment (i.e. on purple pipe)
    - Stream Conditions:
        - Fully appropriated (adjudicated in 1913)
        - In stream flow conditions passed in 2010 stipulating flows to protect in stream values (including fish habitat)
        - Protected by the "Endangered Species Act"
            - It is a salmon spawning stream
        - 70% of the stream flow comes from effluent
    - Issues:
        - Unable to discharge effluent to groundwater due to groundwater standards
        - Water reclamation is the city's most economical alternative; however, there is risk of upsetting stakeholders such as first nations, Species at Risk regulators, and downstream users who use flow for irrigation
    - Questions:
        - Which aspect of the "whole system" can accommodate some impact:
            - River, riparian areas, fish species, downstream users etc.
        - Is it possible to violate a numerical standard of discharge if it means enhancing the riparian area in terms of other factors
        - Is the regulator looking with a "system wide" vision
- Proponents of a water reclamation project need to communicate issues to individuals or entities who would be "impaired" by a project with clarity and a desire to work "with" the individual
    - Uncontrolled cost item when planning a project
- A real impediment to water reuse is "seasonality" and should not be underestimated

4) *Respondent Recommendations?*
Response:
- System wide approach
    - Consideration of the entire system from a "distance" in order to make proper decisions in terms of water rights and water resources
    - Avoid "narrow scope" of vision

5) Examples of IR in Practice?
a) Re: Resources?
Response:
- Water Supply Code
- Water quantity statute, groundwater code 90-44 and 90-03 and implementing Regulations
- Reclaimed Water Statute
    - Municipalities in Washington passed this legislation
    - Does not function well in practice
- Growing Communities Doctrine
- To obtain a permit:
    - Check out the reclaimed water page on the website

b) Re: Projects?
Response:
- Reclaimed water is relatively new in Washington
    - No examples of IR from this office

G4 Washington: Health Regulator Telephone Conversation Summary

DATE	June 27, 2013	**TIME**	15:32
CONTACT	D. Lahmann	**DEPARTMENT**	Wastewater Management Section
COMPANY	Washington Department of Health (DOH)	**JOB TITLE**	Supervisor

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - No comments

   b) *Re: other regulatory agencies involved in IR?*
   Response:
   - comments

   c) *Re: inter-agency communication?*
   Response:
   - Defined roles enables consistent communication
     - DOH will not review applications unless the DOE requests a public health review

   d) *Re: water source?*
   Response:
   - No comments

   e) *Re: reuse applications in state?*
   Response:
   - Groundwater recharge
   - Irrigation projects (golf courses etc.)
   - Cardinal glass facility (Industrial application)

   f) *Re: management of WWTP?*
   Response:
   - A list will be provided of water reclamation facilities throughout Washington
     - Out dated but will provide some information

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - The DOE has a reclaimed water page:
     - http://www.ecy.wa.gov/programs/wq/reclaim/index.html
     - A good starting point to find out information
   - The DOH also has a website dedicated to water reuse:
     - http://www.doh.wa.gov/CommunityandEnvironment/WastewaterManagement/WaterReclamation.aspx
     - See related links at the bottom of the webpage
   - With respect to reclaimed water, there is a draft rule that the DOE has been working on:
     - Washington Administrative Code (WAC) 173-219
     - It has been on hold since December , 2010 due to legislative direction to stop all but critical rule making
       - Reclaimed water, being an alternative source of supply, is an optional program so was put on hold
     - Here is the link: http://www.ecy.wa.gov/programs/wq/reclaim/OTS3438version4.pdf
   - DOH and DOE work together on reclaimed water projects:
     - Legislature gave both agencies for oversight on water reclamation projects
     - The legislature directed that the DOE would be writing the rule

        - Reason is that most of the approvals that will get issued will be in conjunction with a facility that has a discharge permit
            - NPDES and state permits etc.
        - Also, wastewater is the source from where reclaimed water is taken
    - Responsibly with reclaimed water projects are written in the WAC
    - DOH is involved due to the health aspects of reclaimed water including:
        - Reliability assurances were written into the rule so as to assure that if something goes wrong, insufficiently treated water will not make its way to end users
            - Examples include: alarms, duplicate disinfection, virus removal treatment steps etc.
            - These steps are similar to the drinking water realm
        - Cross connection control and protecting drinking water supplies
            - Regulated through the DOH and not DOE
- In the absence of the WAC, reclaimed water projects have been using a set of standards that both agencies developed
    - Last published date is 1997 (i.e. out of date)
    - Located online:
        - http://www.ecy.wa.gov/programs/wq/reclaim/advisorycommittee/standards.pdf
    - Up to now the DOE and DOH have been regulating by guidance ("should do this, should do that") which is not legally sound
        - Engineers can then use alternatives which may not be appropriate for other reasons
        - Should be regulating by rule ("shall do this")
- As part of the new WAC rule that will be implemented, DOE has begun work on the "Purple Book" for reclaimed water alongside the DOE "orange book" that is currently used for typical discharges
    - Purple Book will attempt to clarify items in the rule

a) *Re: Water Quality? (i.e. Health, etc.)*
Response:
- The DOH will review water reclamation permits only when engineering staff requests the review. For example:
    - Uncomfortable with a portion of a project
    - Projects that are atypical etc.
- Permits state that "if an event occurs, the permit holder must contact DOE and DOH"
- The DOH put together internal checklist for permit reviews, inspections of facilities or as a list of what to consider in water reclamation projects
- With new innovative projects being proposed, it is difficult to ensure that a consistent level of public health protection is being adhered to. For example:
    - Uniform Plumbing Code:
        - The DOH has adopted that Code in whole or in part and the DOH amend parts of that document
        - Gives plumbers jurisdiction within a building
        - Some venders would like to put treatment systems inside a building and recirculate it for toilet flushing
        - In this case, plumbers have the ability to review, approve and authorize of the entire project since there is no discharge
        - The DOH is not comfortable with this scenario as this would constitute a lesser standard
- Quality considerations include:
    - Protecting potable water from reclaimed water, and
    - Protecting reclaimed water from lower quality reclaimed water or storm water
    - There are currently four classes of water but that may be reduced to two (class A and class B)
- Will send DOH internal email to DOE stating what this agencies comments were for the amendment to the WAC
    - Goal is to have health concerns written in the law so that DOH review of proposed permits is not so critical

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- No comments

c) *Re: Water Rights?*

Response:

- Water rights can be an important impediment to water reuses projects in Washington

3) *Commentary of IR Program in Practice?*
   a) *Re: efficiencies?*
   Response:
   - Communication:
     - In the past communication was an issue:
       - With most of the permitting passing through DOR first the DOH did not always receive timely documents
       - Because involvement with DOH is not "routine" this agency can sometimes be forgotten
       - Logistics, staffing turnover, etc. all contribute to communication difficulties
     - DOH redefined their roles to state that they would not review a reclamation permit unless the DOE requested a public health review
   - Writing health considerations in the law makes review by the DOH less critical

   b) *Re: Inefficiencies?*
   Response:
   - Rules are not very responsive to innovative reuse applications

4) *Respondent Recommendations?*
Response:
- Contact the LOTT Clean Water Alliance
  - Consortium of three cities and one county
  - Each has their own sewer collection system that is channelled to and treated by LOTT
  - Have two reclamation facilities
  - Advanced utility in terms of water reclamation
  - May want to contact LOTT regarding implementation
- Define roles
  - If an agencies involvement is "non-routine" then there is a tendency to forget to involve them.
  - The move by DOH to only review applications as requested solved communication problems between the two agencies
- Pilot studies to allow for flexibility:
  - In order to deal with innovative and non-conventional water reuse proposals
    - Example: living buildings etc.
- Have health consideration written in the reclaimed water rules so that review of proposals or permits by a health department will be less critical
- In Washington, the legislature had to first be convinced that water reclamation was important. With that, it had to be authorized by the legislature
  - In the front of the RCW, that authorizes water reclamation, the state explains why they are interested and why they wish to encourage it
- The statute firmly declares in the definition of reclaimed water that there has to be a beneficial use for the water
  - i.e. reclaimed water, is not wastewater

5) *Examples of IR in Practice?*
   a) Re: Resources?
   Response:
   - Memo and Draft rule on reclaimed water (WAC 173-219)
     - http://www.ecy.wa.gov/programs/wq/reclaim/OTS3438version4.pdf
   - WAC rules stem from the Revised Code of Washington (RCW) 90.46 which is the legislation regarding water reuse
     - http://apps.leg.wa.gov/RCW/default.aspx?cite=90.46
   - 1997 Guideline
     - Used in the absence of the WAC

   b) Re: Projects?
   Response:
   - Cardinal Glass (Winlock, WA)
     - Respondent sent copy of permit

APPENDIX H – Colorado Survey Results

(Note: All telephone conversation records have been summarized and paraphrased)

H1 Colorado: Practitioner Telephone Conversation Summary

DATE	June 11, 2013	**TIME**	14:30
CONTACT	K. Patrick	**DEPARTMENT**	N/A
COMPANY	Patrick Miller Kropf & Noto, PC (Water Law)	**JOB TITLE**	Principal

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - Colorado Department of Public Health and Environment (CDPHE): Water Quality Control Division
     - Water quality agency
   - Water Court through the Colorado State Engineers Office: Division of Water Resources (DWR)
     - Water quantity agency

   b) *Re: other regulatory agencies involved in IR?*
   Response:
   - Colorado Oil and Gas Conservation Commission
     - Responsible for:
       - Permitting oil and gas wells
       - Hydro-fracking
       - Water injection wells
       - Disposal of frac water

   c) *Re: inter-agency communication?*
   Response:
   - Through authorizing legislation CDPHE looks at quality and the DWR office looks at quantity
   - As such, the agencies differ naturally to one another
   - Agencies will often correspond on particular cases
     - For example: if there is a water quality issue or a quantity issue. The DWR may write a letter to the other agency stating that there are water quality issues on which they must act

   d) *Re: water source?*
   Response:
   - No comments

   e) *Re: reuse applications in state?*
   Response:
   - Municipal, golf courses, green space irrigation
   - Industrial:
     - oil and gas industry and hydro-fracking industry
     - Energy: co-generation, bio-mass, coal gasification

   f) *Re: management of WWTP?*
   Response:
   - No comments

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - In Colorado, water reuse is divided distinctly into:
     - Water Quality, and
     - Water Quantity
     - Therefore, there are two distinctly different permits

- If a proponent wanted to acquire reclaimed water, the following would occur:
    - The proponent would engage a water attorney who offer guidance through the process
        - The permit may at times be processed through the engineer via the water quality side of the program
        - Attorney oversees the process and is involved if the Water Court is required
    - Examples of guidance that an attorney might be required to give:
        - under the existing water right the proponent does not need a permit but can do such and such under this existing right, or
        - In order to do such and such, the proponent must file a new water court case. Other water users will get notice of the proposal, and can comment on whether or not there is injury (from a water quantity standpoint) to their right
    - The water court process is much longer than the water quality agency process
        - Water quality agency process is a three to nine month process
        - Can be longer if a project is heavily contested (which seldom happens)
    - The water court process can vary in length from 18months to 6 years depending upon the level of opposition, the nature of the stream course, how litigated it is etc.
    - The water quantity agency process is the most time consuming because it is a court process that by law requires an attorney
- Oil and Gas:
    - Colorado Oil and Gas Conservation Commission would work with the Water Courts and the CDPHE
        - Regarding quality and drilling and disposal practices (not quantity)
    - Colorado has transitioned from approximately 7% to 60% reuse of hydro-frac water in the past few years
        - Reasons include:
            - Costly to treat and dispose of water
            - Obtaining water is difficult
            - Economic incentive to reusing frac returns for multiple hydro-fracs

a) *Re: Water Quality? (i.e. Health, etc.)*
Response:
- The agency responsible for water quality is the CDPHE: Water Quality Control Division
    - Oversees discharge permits under the federal "Clean Water Act"
    - This division does not consider "environmental quality" such as reduction of fish habitat etc.
- In Colorado there is no state agency, like in California, that oversees "state wide" environmental impact analysis
- The federal government oversees the "Clean Water Act" except where a state requests authority for certain sections of the Clean Water Act
    - The CDPHE is the agency that administers certain sections of the Clean Water Act
    - The purview of the CDPHE with respect to the Clean Water Act are discharges of pollution in navigable water ways

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- Water Quantity system based upon the Doctrine of Prior Appropriation
- Colorado has an established water quantity "permitting" and "decree" program
    - Programs are implemented by the courts
- Water Courts
    - Seven Water Courts corresponding to the seven water divisions and seven major rivers in Colorado
    - Judges and referees with expertise on water issues that only hear water cases
    - Only state in the US that has this system
    - The Act they operate under is:
        - "Water Rights Determination and Administration Act" (1969)
            - Article 37-92-101 through 600
            - Articles deal with what is looked at, what is considered injury and what is considered actionable
- Quantity considerations are tied closely with water rights considerations

c) *Re: Water Rights?*
Response:
- Proponents seeking to obtain a water right (or with injury to a water right) do so through the analysis and decision of the "Water Court"

    - The administrative agency charged with implementing the decrees of the Water Court is the Colorado State Engineers Office: Division of Water Resources (Policeman)
- Water rights, through the water court, become "property rights" and a proponent is granted a certain usage
    - Agricultural Example: an irrigation ditch
        - A user would obtain 1 ft^3/sec of time to irrigate 40 acres of land
        - The user applies the water and the part that isn't used by crops or evaporated returns to the stream through percolation into the ground or surface runoff to the stream
        - The evaporated/percolated/runoff component you had a right to use but never owned
        - Have to guarantee that that component returns to the stream
    - Industrial Example: Coal Fired Power Plant
        - Import water from a stream for cooling purposes
        - Proponent must make sure that return flows are not altered since downstream users are reliant on that flow
- Water right may also state "full consumption" in such a return flow component would not be considered

3) *Commentary of IR Program in Practice?*
   a) *Re: efficiencies?*
   Response:
   - Water is so tight that water reuse is becoming increasingly popular just as an economic tool that differs the cost of acquiring additional water resources
   - An established water quantity permitting program and a water quantity decree program

   b) *Re: Inefficiencies?*
   Response:
   - Regarding industrial water reuse, there is concern that reuse will negatively impact the stream and/or downstream water right owners.
   - Water court process can be burdensome
       - Every proponent must have their day in court
       - People may oppose projects in order to find out what the proponent is doing and to assess the potential for injury
       - Many people involved:
           - May have 10 to 15 stakeholders, each with their own engineer to review drawings and plans etc.
       - The court system allows time for the parties involved to settle their differences without going to trial
           - On occasion, the process may carry on for three or four years before the parties realize they are not going to settle
           - Then it goes to trial, which begins the process again

4) *Respondent Recommendations?*
   Response:
   - Streamline the Water Court System
       - Incorporate a timeline for the referee process encouraging parties to decide quickly whether or not they will settle or go to trial

5) Examples of IR in Practice?
   a) Re: Resources?
   Response:
   - Water Courts

   b) Re: Projects?
   Response:
   - No comments

H2 Colorado: Practitioner Telephone Conversation Summary

DATE	July 3, 2013	**TIME**	13:30
CONTACT	J. Murray	**DEPARTMENT**	Planning
COMPANY	Denver Water	**JOB TITLE**	Recycled Water Program Manager

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - Colorado Department of Public Health and Environment (CDPHE)
     - Water Quality Control Division (is the department that permits reclaimed water)
     - Water quality
     - Oversee treatment plant upgrades, sizing, changes in process etc.
   - Colorado Division of water Resources (DWR)
     - Administer water rights for the state and districts of the state
     - Would ensure that the water that an entity is reusing or taking into their treatment plant is what the DWR would consider reusable

   b) *Re: other regulatory agencies involved in IR?*
   Response:
   - Water Quality Control Commission
     - Regulation 84: Reclaimed Water Control Regulation

   c) *Re: inter-agency communication?*
   Response:
   - There is limited information sharing between the two agencies
   - There are limits are where one can send recycled water:
     - If recycled water is being sent to a water of the state, then a discharge permit is required
     - The two agencies may interact when there is a question as to whether or not a "water" is a water of the state
   - There is no formal process in place

   d) *Re: water source?*
   Response:
   - No comments

   e) *Re: reuse applications in state?*
   Response:
   - Agriculture
   - Industrial
     - Energy sector
     - Industrial/commercial laundries
   - Municipal
     - Dust suppression
     - Street sweeping
     - Car washes
     - Zoo (animal washes)

   f) *Re: management of WWTP?*
   Response:
   - Denver Water
     - Separate from the city and county of Denver but is quasi-public not for profit enterprise
     - Water provider (utility) for the metro Denver area

        - Link: http://www.denverwater.org/
        - Independent of the city but overseen by the board of water commissioners via the City of Denver
        - Provide water to 1.3 million people and reclaimed water to approximately 80 customers (mostly irrigation)
        - Pursuing industrial customers such as:
            - Suncor Refinery
            - Car washes
            - Industrial laundries
    - The majority of treaters do both wastewater treatment and reclaimed water
        - There are some that strictly do wastewater and some that receive treated wastewater and reclaim it/polish it further
    - Some communities have systems that have water and wastewater/reclaimed water systems

2) *Permitting Process Summary (from respondent perspective)?*
Response:
    - Permitting done separately
        - Quality
        - Quantity
            - Although, technically not a permit
            - A proponent would file for a water right

    a) *Re: Water Quality? (i.e. Health, etc.)*
    Response:
        - Administered by the CDPHE
        - CDPHE issues "Notices of Authorization" (NOAs)
            - The NOA is the permit
        - There are two different types of NOAs
            - One is issued to the treater to be able to treat and supply recycled water
            - One is issued to the End User to be able to use the water for a specific use
        - The End User NOA process is as follows:
            - The end user approaches the treater asking for reclaimed water
            - The treater provides the potential end user with a copy of Regulation 84 (the states regulation) and a three page form that has the customer write down:
                - How they will use the water on their site
                - What will be the best management practices to be able to comply with the regulations (e.g. minimize spray and runoff in irrigation)
                - The End User would complete the form incorporating their best management practices (types of sprinkler heads, how often they will check every week etc.)
            - The Regulation spells out the general information that needs to be provided in a "Letter of Intent"
                - As a matter of policy, the CDPHE has developed a questionnaire that the user fills out which acts as the letter of intent
                - The Letter of Intent is the *application*/questionnaire used to request a NOA.
                - NOA = permit, Letter of Intent = application
            - The Letter of Intent, after completion by the end user, is given to the treater
            - The treater reviews the letter to approve the content to ensure that it fits with the treaters program
            - The treater then forwards the Letter of Intent to the CDPHE for review
            - The CDPHE has 30 days to review the letter and to reply with any questions or issues
            - If there are issues, there is given another 30 days to resolve the problems
            - Once approved, the state will send a copy of the permit (NOA) to both the treater and the end user
            - The NOA is specific to the use that the customer is using the reclaimed water for (e.g. a NOA to use reclaimed water for industrial cooling)
        - The treater NOA is similar to the above with certain exceptions, including:
            - More information about the treatment processes
            - Information on their program to assist end users in complying with the stipulations of the NOA and the regulations
            - Information about how the treatment and the program will be managed

- One aspect that is considered by the CDPHE is whether or not the treater applying for the NOA is following a WWTP that is already doing reporting or already meeting certain quality standards
    - If water coming into a recycled water plant has already been "regulated" then the assumption is that it is of a certain quality
    - This would result in fairly lenient water quality monitoring requirements on the reclaimed side
- Once the treater has the NOA, then they do not have to apply for a new permit for every additional customer
    - Additional users/customers are added/amended with each letter of intent filled out by the perspective end user
    -

b) *Re: Water Quantity? (i.e. Usage)*
Response:

- In Colorado, water is considered reusable that:
    - Has been diverted from the other side of the mountains (trans-basin diversion)
        - This type of water is permitted to be reused "to extinction" because it was not native to the basin and is not expected by downstream users
    - Groundwater well water (considered not native to a basin)
    - An agricultural water right to a municipal water right there is a different pattern of use or volume of use
        - This change may result in a portion of water that can be reused

c) *Re: Water Rights?*
Response:

- Doctrine of prior appropriation is in effect in Colorado
- File for water rights:
    - Diversions, consumptive use, storage, municipal uses etc.
- If there is to be a change to a water right then this would have to go through "Water Court"
    - Many water rights do not need to be altered because there are rules in place as to what is "reusable"

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*
Response:

- Industrial customers provide a more consistent demand making them attractive customers
- In May there was a rule making hearing that changed the regulations to enable utilities to use recycled water for:
    - Additional industrial processes
    - Commercial laundries and
    - Car washes
- Denver Water has similarities with Alberta regarding:
    - Denver's main water source is surface water and has return flow obligations
    - Historical perspective in Colorado
        - 10 years ago a number of different water-treaters that were either treating and providing recycled water, or contemplating that practice
        - WWTPs desired to have a framework in order to:
            - Make the permitting process more streamlined (easy and clear), and
            - Provide a set of rules to ensure that other entities would not act irresponsibly (in order to maintain a positive view of the industry in the public eye
        - A regulation was drafted that outlined reclaimed water uses and water quality standards
            - Guidance regarding Water rights stipulating what is reusable and what is not
                - Water rights compliance requires a systematic way of reporting (accounting)
                - This is directed by the State Engineers office
            - Goal of health regulations was to have one location for all requirements regarding recycled water
    - The name of the document is:

        - Regulation 84: Reclaimed Water Control Regulation
            - http://www.colorado.gov/cs/Satellite?blobcol=urldata&blobheadername1=Content-Disposition&blobheadername2=Content-Type&blobheadervalue1=inline%3B+filename%3D%22Regulation+84.pdf%22&blobheadervalue2=application%2Fpdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1251857079587&ssbinary=true
            - Through the Water Quality Control Commission
                - Oversees the CDPHE
    - Regulations stipulate waters that are deemed "reusable"
        - Clarifies water rights agreements

b) *Re: Inefficiencies?*
Response:

- Regarding uses for the water, the rules have been too prescriptive
    - Example:
        - A proponent might obtain a permit for reclaimed water in a pond used for irrigation. If the proponent wanted to use the water for something else it becomes an issue
        - If reclaimed water is used for a cooling tower in a power plant, what if they wanted to use the water to also feed their boilers etc.
        - Utility operators find additional uses that were case by case
- Approvals for new uses:
    - In Colorado, new uses and a change to the regulation have to be vetted through the Water Quality Control Commission board which is a year or year and a half process
        - Wait list, then a hearing which is an onerous process
- Grey water:
    - Used a lot in western US excluding Colorado
    - Recently a bill went through Legislature directing the CDPHE to draft regulations that would govern the use of grey water
    - This bill could impact the water reclamation plants water rights and the yield of their system

4) *Respondent Recommendations?*
Response:

- Contact and become affiliated with the WateReuse Association
    - They have been an invaluable help in our program
    - Will send individuals to help further a programs efforts to expand
    - Will send lecturers on certain topics
    - If seven members or organizations (seven agencies) join it is possible to start a chapter
        - As a chapter, a significant amount of the dues return to the chapter for use in lobbying, education, news, or other benefits
    - If other entities (consultants, colleges, universities) wish to join then a chapter could be formed in Alberta
    - With a chapter, it is not just a utility pushing a project but many stakeholders
    - The Association also looks at alternative sources of supply:
        - Desalination, grey water, aquifer storage/recharge etc.
        - Other entities would benefit from the organization in a different way and may wish to join the association
    - WateReuse Association members have access to the database which lists:
        - Sizes of facilities
        - Catalogue reuse providers, how they use it, and what volumes they produce
- As in Colorado, a Regulation was drafted to help streamline the reclaimed water reuse process
    - Regulation 84 referenced other regulations for consistency in the industry
    - To create the regulation, the primary stakeholders met together to assess the best approach to setting up a rule
        - Stakeholders included the CDPHE, Utilities (Colorado Springs, City of Westminster, City of Aurora, Range view Metro District), Metro-wastewater (WWTP), engineering consultants, lawyers etc.
            - Note: the regulation will give a basis and purpose that will tell who the proponents were
        - Stakeholders reviewed what was done in California, Arizona, Texas along with what Colorado's own structure was, and decided what was the best approach

        - WWTPs supply Daily Monitoring Reports (DMRs) that specify the quality of their water, their flows and whether or not they meet certain parameters
        - Because WWTPs had documented flow conditions, it was easy for the authors to develop the recycled water regulation
            - The authors assumed that recycled water had already flowed through a WWTP and had thus already been governed by the rules applied to WWTPs
        - Specific parameters were added as a concern including:
            - Ecoli as an indicator organism for disinfection, and
            - TSS or Turbidity depending on the category of water
        - A larger portion of the regulation outlined what the water could be used for and what the related best management practices would be:
            - For example: purple pipe, signage for workers or public, training programs etc.
        - Also dealt with reportable violations:
            - Water spills to water of the state, cross connection reports to CDPHE
    - Once regulations are in place, each agency would develop policies and rules within their own organizations
        - E.g. cross-connection testing program
- When developing uses for the water it would be helpful to use broad categories and descriptions
- Addition of new uses:
    - Grant the ability to authorize new uses to the CDPHE
    - Every set amount of years, the Commission could review and ratify new authorized uses that the CDPHE had done
    - Need a more efficient process
- In Colorado, utilities approached the Legislature and had them make a statement that they felt that reuse was important and that they wanted the state to draft regulations to encourage the use of recycled water
    - The direction to draft the regulation came from the Legislature
    - Direction "from above" gives governmental departments an added incentive to move on a particular piece of legislation
    - This step was very useful in Colorado and is repeatedly used as a reference when dealing with regulators to remind them that it is "their job to promote the use of recycled water"
    - The legislature then told the CDPHE to promulgate a rule or regulation-84 that would promote the use of recycled water in the state

5) *Examples of IR in Practice?*
    a) *Re: Resources?*
    Response:
    - Regulation 84: Reclaimed Water Control Regulation
    - "Letter of intent"
        - The customer fills out this letter to give to the utility when they want to request the use of reclaimed water
    - "Notice of Authorization"
        - This is the permit issued by the state telling the customer that they can use the water

    b) *Re: Projects?*
    Response:
    - Xcel Energy (Denver, CO)
        - Denver water provides 2,600 Acre/feet to Xcel Energy per year for cooling tower use
    - Fort Lupton and Anadarko (Colorado), (J. Murray, personal communication, 2013)
        - Town engineers for a town in Colorado that is situated in the Niobrara Formation with oil and gas and fracking in the area
        - Historically, the town has sold potable water to oil and gas companies for fracking
        - Due to water right considerations, the oil and gas company was unable to purchase the potable water
            - In northern Colorado a large portion of the water is part of the Colorado-Big Thompson (C-BT) project and as such can only be used "once" in district and has to be returned
            - Fracking violated that provision and so the town was unable to sell potable water to Anadarko

- Anadarko analyzed the effluent from the town of Fort Lupton and determined that they would be able to use the treated effluent
- The town approached the CDPHE in order to have fracking included as one of the acceptable uses of the reclaimed water but were unsuccessful
- As such, the town discharges to the river and Anadarko diverts the water further downstream
    - The city may have some quantity of water that can be used "to exhaustion"
    - In such cases the cities are trying to make good use of that portion of effluent through a reuse program for irrigation or industrial uses
        - Fort Lupton also sends water to a co-generation plant
- The town will look towards reuse in the future

H3 Colorado: Quality Regulator Telephone Conversation Summary

DATE	August 27, 2013	**TIME**	09:30
CONTACT	E. Lemonds	**DEPARTMENT**	Water Quality Control Division
COMPANY	Colorado Department of Public Health and Environment (CDPHE)	**JOB TITLE**	Permit Writer

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - CDPHE regulates quality and is responsible for health

   b) *Re: other regulatory agencies involved in IR?*
   Response:
   - DWR

   c) *Re: inter-agency communication?*
   Response:
   - There is no requirement for interagency communication between the CDPHE and the DWR
   - When treaters approach the CDPHE for a permit, they must demonstrate that they will not materially injure any other water rights
     - The treater demonstrates this by having a letter from the state engineer stating that they have a right to use the water
     - Unless they have permission, they are not able to approach the CDPHE, it is part of the regulations

   d) *Re: water source?*
   Response:
   - Likely half and half perhaps with more surface water
   - Groundwater is scarce in Colorado and is more difficult to treat to potable standards due to natural metals concentrations (arsenic, selenium)

   e) *Re: reuse applications in state?*
   Response:
   - Industrial uses are becoming more frequent

   f) *Re: management of WWTP?*
   Response:
   - No comments

2) *Permitting Process Summary (from respondent perspective)?*
   a) *Re: Water Quality? (i.e. Health, etc.)*
   Response:
   - The use of reclaimed water is covered under Regulation 84 under the CDPHE under the Water Quality Control Division
   - The CDPHE permits both treaters and users
   - Regarding Treaters:
     - Treaters have certain responsibilities to treat and distribute the water and to oversee the users
       - The treater is not able to obtain a permit from the CDPHE until they have a letter from DWR stating that they have a right to use the water
   - Regarding Users:
     - Users have the responsibility to operate their systems correctly
     - Users approach the treater and submit their “user plan to comply”

        - The treater then submits that application also with a request to amend their own permit
        - Example:
            - If for instance a golf course wanted to use reclaimed water, they would approach the utility.
            - The golf course would submit a "user plan to comply" to the utility
            - The utility would then submit the "user plan to comply" to the CDPHE along with a request to amend their NOA
            - The CDPHE would then issue two NOA including an amended NOA to the utility now including the golf course name and one to the golf course
    - Stipulations for permitting are spelled out in the permit and in the regulation
        - This poses a problem

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- The treater is not able to obtain a permit from the CDPHE until they have a letter from DWR stating that they have a right to use the water

c) *Re: Water Rights?*
Response:
- No comment

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*
Response:
- No comments

b) *Re: Inefficiencies?*
Response:
- NOAs never expire but regulation 84 changes
- The fact that permitting stipulations are present in the regulation and in the permit poses an problem
    - NOAs never expire but regulation 84 does change
    - As regulation 84 is updated there is no process to update the NOA
    - For example, when the CDPHE reissues a general certification or makes changes to a general certification that is renewed, then the permittee is not subject to the new regulations until such time as they renew their permit
    - Since there is no renewal process there is an issue
    - Regulation 84 is self-implementing, but it is difficult to keep all permittees up to date
- Some users and treaters comment that the system in Colorado is cumbersome
    - The system has gone from 200 to 600 users in the last five years
    - This entails a lot of work for writing and issuing the NOAs
- Not enough resources to operate the system properly

4) *Respondent Recommendations?*
- There is discussion of removing the state from the process of issuing NOAs to the users
    - The treater would then be granted authority similar to an MS4 program
    - The MS4 program is the regulator gives authority to cities to implement their own stormwater management rules even though the regulator has a stormwater regulation
    - The regulator would instruct them to make sure that everyone follows the rules
    - The CDPHE has been giving thought to granting this authority to some of the more efficient treaters who have a robust system
    - The state of New Mexico issued authority the City of Santa Fe to have control over all of their users
        - In the case of Santa Fe, their water quality is impeccable so the risk is somewhat mitigated
    - Check: www.coloradowaterpermits.com for more information
- Colorado's system would not be recommended (as it is now) for incorporation
- The implementation of a framework depends on what the overriding goals are:
    - The guidelines in Colorado is very protective of the environment, but not user friendly to businesses
- Idaho has a strict system

    - Alberta being a headwaters province is extremely protective of its surface water and so is Idaho
    - Idaho is quite ahead of Colorado and they have a lot of resources
- Recommend having the resources to implement any new system that is adopted

5) *Examples of IR in Practice?*
   a) *Re: Resources?*
   Response:
   - Regulation 84
   - Letter of Intent
   - Notice of Authorization
   - Website: www.coloradowaterpermits.com

   b) *Re: Projects?*
   Response:
   - No comments

H4 Colorado: Quantity Regulator Telephone Conversation Summary

DATE	June 27, 2013	**TIME**	09:08
CONTACT	K. Rein	**DEPARTMENT**	Division of Water Resources
COMPANY	Colorado Department of Natural Resources	**JOB TITLE**	Deputy State Engineer

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - DWR
     - Administer diversions of naturally occurring water (streams or ground) within the prior appropriation system and within the decrees for water rights in the state system
     - Protect injury of other water rights

   b) *Re: other regulatory agencies involved in IR?*
   Response:
   - No comments

   c) *Re: inter-agency communication?*
   Response:
   - No comments

   d) *Re: water source?*
   Response:
   - Majority is surface water
   - Groundwater

   e) *Re: reuse applications in state?*
   Response:
   - No comments

   f) *Re: management of WWTP?*
   Response:
   - No comments

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - Water appropriated in the state is appropriated from the basin for use in the basin
   - If a proponent was seeking to reuse waters, the DWR would wish to confirm what the "source" of their water was
     - Once confirmed that would determine if it was "reusable"
   - From the perspective of the DWR, there is no defined "process" or "protocol" since reuse directives are rooted in statutory and case law
   - There is no "active event" or process that results in a WWTPs approval to reuse water
     - If a WWTP has water in their portfolio that is deemed "reusable" they are allowed based on statutory and case law (they can "just go and do it")
     - The nature of water and water law allows for reuse
       - Example: A homeowner does not need permission to wash their car with water from the city since it is assumed in water law. There is no need to go to a court to reaffirm that right
   - When water that is deemed "fully consumable" is diverted, because an entity is taking water out of a stream they would be required to keep records of that and report it to administrators

   a) *Re: Water Quality? (i.e. Health, etc.)*
   Response:

- No comments

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- Water appropriated in the state is appropriated from the basin for use in that basin
- Unless it is otherwise allowed in a water right through a decree, that water can be used only once
- Once discharged from a WWTP then it is the state's waters again and available for appropriation by all other waters in the prior appropriation system
    - Takes on the nature of naturally occurring flow once again
- In other cases, there is water that the state calls "foreign water" that has been:
    - imported from another basin or
    - "non-tributary" groundwater that has been pumped out of deep bedrock aquifers
- Foreign water naturally takes on the character of water that can be used, reused, and successively used to extinction
    - Once discharged from a treatment plant, the water user with the original water right (e.g. the municipality) can capture that water, divert it again to put back in their system, lease it, sell the water right to another water user etc. until it is fully consumed
- In Colorado, if a WWTP treats the water it is not "theirs"
    - The ability to divert or discharge has to do with the source and not the fact that a WWTP has treated it
        - Most appropriations in the basin are going to have a right to use the water for a certain use and once used and treated, it becomes the states waters and is available for appropriation by senior water users
        - If foreign water, then they can capture and reuse it

c) *Re: Water Rights?*
Response:
- First come, first serve premise of the prior appropriation system underlies the State's water rights
    - The amount that a senior water user (higher priority) is able to take is based on the beneficial use identified in their water right
    - Example:
        - If the beneficial use is domestic use in a single house then the right would be limited by use to a small amount of water (1/2 acre-foot/year)
            - Return flows must be returned to the stream and cannot be used to extinction through other uses
        - In contrast, a farmer who's water right stipulates that he is permitted to irrigate 640 acres would have the right to divert 1,500 acre-ft/year to the crop
            - If sprinkler irrigation, the crop would consume 80% of that water (approximately 1,200 acre-ft/year)
            - The remaining 300 acre-feet/year would result in return flow to the stream
            - The farmer would not have a right to the 300 acre-ft/year
        - Downstream users (with junior water rights) would only be able to access what is the result of upstream activities
        - The original water right defines what can be diverted (i.e. whatever is needed for that beneficial use) and what the return flow characteristics will be (based on the type of use it was)
- The water rights system does not require that certain flow levels would remain in a river
    - Perhaps, if a water user was proposing to export water out of a basin and as part of the negotiations (with the basin of origin certain) certain flows may be left in the river for environmental reasons
- Example:
    - A stream in an average year is expected to have a peak flow of 500 cfs
    - Water rights that have been applied for and granted from the stream amount to 450 cfs
    - If another water user applies for an appropriation of 100 cfs (which is in excess of the peak flows) then they are allowed that water right

        - During peak years that user may access that water but during low years they might not obtain any water. In average years the user might get some of it and dry up the stream
    - Water rights guidance is based on statutory law and case law

3) *Commentary of IR Program in Practice?*
    a) *Re: efficiencies?*
    Response:
        - Specific legal terminology:
            - Use
            - Reuse
            - Successive use
        - The source of the water determines if it can be reused or not
    b) *Re: Inefficiencies?*
    Response:
        - Water rights framework is similar to Alberta

4) *Respondent Recommendations?*
Response:
    - No recommendations

5) *Examples of IR in Practice?*
    a) *Re: Resources?*
    Response:
        - Colorado water law publications
    b) *Re: Projects?*
    Response:
        - City of Greeley, CO
            - North of Denver
            - Various water sources in their water portfolio
                - Some of their sources are described as foreign water or fully consumable
            - Greeley may discharge water from their WWTP and based on their portfolio, some of that water may be diverted to industrial purposes
            - There was no process or procedure that Greeley would need to follow
                - The ability to divert water is in the nature of their water right and the administrative process in Colorado allows that

H5 Colorado: Oil and Gas Regulator Telephone Conversation Summary

DATE	July 10, 2013	**TIME**	16:18
CONTACT	J. Milne	**DEPARTMENT**	NA
COMPANY	Colorado Oil and Gas Conservation Commission (COGCC)	**JOB TITLE**	Environmental Manager

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
      Response:
      - No comments
   b) *Re: other regulatory agencies involved in IR?*
      Response:
      - No comments
   c) *Re: inter-agency communication?*
      Response:
      - No comments
   d) *Re: water source?*
      Response:
      - No comments
   e) *Re: reuse applications in state?*
      Response:
      - No comments
   f) *Re: management of WWTP?*
      Response:
      - No comments

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - COGCC has a rule encouraging water reuse
     - 907 rules Management of E&P (Exploration and Production) waste
     - Anything that has exited (naturally or previously injected) through the well bore is considered E&P waste
     - Rule will give a foundation of managing waste
     - 907 (a) (3): encourages reuse and recycling
   - 907 (a) (3) rule states that a "written management plan" would be submitted
     - Case by case basis the COGCC can look at what the project is proposing in terms of recycling
   - Further in the rule are what are called acceptable methods of disposal
     - Injection wells
     - Evaporation/percolation pits
     - Commercial facilities
     - Road spreading
   - There are not set rules regarding recycling
   - Municipal water has been purchased for fracking purposes, but there are no cases of reclaimed water being used for oil and gas purposes

   a) *Re: Water Quality? (i.e. Health, etc.)*
      Response:
      - No comments
   b) *Re: Water Quantity? (i.e. Usage)*

Response:

- No comments

c) *Re: Water Rights?*
Response:

- No comment

3) *Commentary of IR Program in Practice?*
a) *Re: efficiencies?*
Response:

- In the State of Colorado, the water is adjudicated
    - A proponent would have to obtain a water right for beneficial use
    - There is a benefit to purchasing water from a municipality because the water has already been adjudicated and has a designation
    - There is a water right designation that is capable of being used for fracking (Stuart would know)

b) *Re: Inefficiencies?*
Response:

- Large volume storage tanks:
    - Operators are using tanks that can hold 35-40,000 barrels that can hold fresh water to use for fracking
    - Have had failures in the tanks so as a result the COGCC will be developing a policy not encouraging tanks for storage of recycled water

4) *Respondent Recommendations?*

- No comments

5) Examples of IR in Practice?
a) Re: Resources?
Response:

- 900 series: Management of E&P Waste

b) Re: Projects?
Response:

- No comments

APPENDIX I – Oregon Survey Results

(Note: All telephone conversation records have been summarized and paraphrased)

I1 Oregon: Practitioner Telephone Conversation Summary

DATE	July 2, 2013	**TIME**	10:30
CONTACT	R. Glick	**DEPARTMENT**	N/A
COMPANY	Davis Wright Tremaine LLP	**JOB TITLE**	Partner

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
      Response:
      - Oregon Water Resources Department (WRD)
      - Oregon Department of Environmental Quality (DEQ)
      - Oregon Health Authority (OHA)
   b) *Re: other regulatory agencies involved in IR?*
      Response:
      - As above
   c) *Re: inter-agency communication?*
      Response:
      - No formal process
   d) *Re: water source?*
      Response:
      - No comments
   e) *Re: reuse applications in state?*
      Response:
      - Golf courses (preferred approach)
      - Power companies for cooling
   f) *Re: management of WWTP?*
      Response:
      - Majority of water providers are municipal (publicly owned)
      - Some private utilities but tend to be small

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - The water reuse program is not a "settled regulatory program"
     - There is no specific guidance
   - In Oregon, a city may treat its wastewater and recapture that water for other beneficial uses
     - This process is still in controversy
     - Junior water users (downstream) are asserting their dependency on that flow and the right to make use of that water
     - This issue has not been resolved nor has there been an definitive case
   - Three jurisdictions that have authority over municipal water
     - Water Rights
     - Discharge of Effluent
     - Water Safety
   - Oregon example (three facets to regulatory program)
     - Quantity:
       - Water Rights are administered by Oregon WRD
       - A municipality would file a permit application and begin putting the water to a beneficial use
       - Once the water has been put to a beneficial use they fully develop the water infrastructure

        - After that, the city would obtain a certificate that is the "vested water right" (which they can rely on)
    - Quality re: discharge:
        - Federal Clean Water Act requires that effluent from sewage or industrial sources has to be treated and discharged under a permit
        - The authority to issue permits and manage the Clean Water Act program is delegated by the federal government to the states
        - In Oregon, it is the DEQ that has regulatory authority over the discharge
            - DEQ would have no comments regarding water rights
    - Quality re: health/safety of supply:
        - The Federal Safe Drinking Water Act which requires the water that is being served by municipal water providers be treated to a certain standard and shown to be safe for the public
        - The Agency that regulates this aspect is the OHA

a) *Re: Water Quality? (i.e. Health, etc.)*
Response:
- Summary of the Clean Water Act:
    - Intended to restore the physical, biological and chemical integrity of the nation's waterways
    - Two strategies for attempting to achieve that outcome:
        - Establishment of water quality standards
            - If delegated to the state, then the state develops those standards for a number of parameters (toxics, temperature, sediment and nutrient loading etc.)
            - Standards are numerical and also a designated beneficial use
                - Salmon or humans or domestic contact could be the beneficial use
        - Those who need to discharge water from a point source will be required to obtain a permit
            - The permit will include technology based effluent limitations for the discharge
    - Every few years the law requires that the state regulatory agency evaluate the current conditions of streams to determine if water quality standards are being attained
    - If they are not, another process is initiated:
        - A list of impaired streams is developed
        - TMDL assessments are conducted to assess the carrying capacity of the impaired streams
        - Once completed, discharge permits are changed to accommodate the new TMDLs
    - One "whole" in the regulatory framework is that point source discharges are regulated (municipalities and/or industries that discharge wastewater) but non-point source discharges are not (farm fields etc.)
        - In Oregon there is an impaired waterways list comprised mainly from "non-point sources"

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- See water rights

c) *Re: Water Rights?*
Response:
- Regarding a Municipality water rights:
    - The city technically owns a water right
        - The inhabitants of the city use the water pursuant to the city's water right
        - A city can obtain a water right for municipal/industrial purposes
        - The city would collect the raw water from a water body or stream and treat the potable water for human consumption and recycle the water after it passes through
        - Different authorities administer the various aspects of water program
- If the municipality owns the treatment plant and owns the water right, then the view in law is that their treated effluent can be reused by the city under their current water right
    - As long as they do not enlarge the water right it would be reusable
    - This scenario may get more complicated if it is a regional water treatment plant

        - Example:
            - Portland metro area: City of Portland is the largest water provider and sewage treatment operator
            - Western part of the city, in Washington County (fastest growing section of the region) there is a regional sewage agency (operated by the county) that serves various communities in the area. Called Clean Water Services
            - The City of Hillsborough (which is a city in the Portland Metro Area and to the west) has its own water rights and uses the regional sewage agency (Clean Water Services) for their treatment
            - In this scenario, the regional sewage agency would need a special arrangement for the City of Hillsborough to reclaim the water that is being discharged out of the Clean Water Services outfall
            - Clean Water Services took the view that they could sell their outfall but it is not being done at this time
    - From the legal perspective of those who represent municipalities, there is a view that they can reuse the water
        - Junior water rights users will typically take exception to upstream uses
    - If a senior water right holder took exception to the diversion of reclaimed water upstream then that would present a different problem
        - The senior would have the ability to insist that waters reached them first which could inhibit a city's ability to reclaim the water
    - Oregon also has a Water Conservation Statute which presents another complexity for water reclamation
        - The statute effectively says that if an entity becomes "more efficient" and makes better use of the water rights they have then they can use 75% of that water for whatever is consistent with their water right, but the other 25% of that has to be dedicated in stream in the name of the City of Oregon
            - Partial incentive if an entity becomes more efficient
        - Not many instances of a city using this statute rather it is used more often in the Agriculture sector

3) *Commentary of IR Program in Practice?*
    a) *Re: efficiencies?*
    Response:
    - No comments
    b) *Re: Inefficiencies?*
    Response:
    - There are many agencies with a part in the reuse program
        - Communication challenges bring confusion to the program

4) *Respondent Recommendations?*
Response:
- Department of Ecology in Washington may be a system to consider
    - One agency has pro's and con's
- Recommend having a single agency that manages the water rights and the water quality programs
    - These programs are inter-related so would require a common regulatory view on how they are managed
- Revisit he way the Doctrine of Prior Appropriation operates
    - Inefficiencies promote non-sustainable activities
    - The water rights program tends to reward use of water as opposed to conservation, and punishes "lack of use" of water except under certain circumstances
- The water quality program should be integrated with the water use so the result is the best level of protection
    - A program should have a provision for more robust water efficiency
    - This type of program would result in less kinds of pollutants and non-point sources contributing to the system
    - The only way this could happen is if there was funding to support the program
- Recommended cities for further study:
    - Portland
    - Hillsborough
    - Bend

- City of Eugene (Municipal water and electric utility)

5) *Examples of IR in Practice?*
   a) *Re: Resources?*
      - Water Conservation Statue
   b) *Re: Projects?*
      - None

I2 Oregon: Quality Regulator Telephone Conversation Summary

DATE	July 3, 2013	**TIME**	10:30
CONTACT	R. Doughten	**DEPARTMENT**	Biosolids and Water Reuse
COMPANY	Oregon Department of Environmental Quality (DEQ)	**JOB TITLE**	Program Coordinator

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
   Response:
   - The DEQ issues the reuse permit
     - Interested in treatment
     - Reuse activity
     - Health and Safety

   b) *Re: other regulatory agencies involved in IR?*
   Response:
   - WRD concerned with water rights and how they are distributed
     - Impacts on stream flows etc.
   - OHA
     - Public health

   c) *Re: inter-agency communication?*
   Response:
   - Legally, there is a separation between the WRD and the DEQ
   - Documents:
     - The DEQ produced a document that attempted to outline what the communication process would look like
     - The registration form used by WRD might also state what the process would be
   - Even with documents communication can still be a challenge
   - Internal Management Directives discuss interagency review

   d) *Re: water source?*
   Response:
   - Surface and groundwater

   e) *Re: reuse applications in state?*
   Response:
   - Irrigation (common)
   - Aggregate operations (rock crushing, concrete mixing)
   - Municipal toilet flushing

   f) *Re: management of WWTP?*
   Response:
   - No comments

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - In General:
     - From a regulatory perspective, reuse and water rights are handled by two different departments so coordination does occur
     - There is a program for "recycled water" which is municipal wastewater that has been treated to certain standards
     - Approximately 1/3 of the treatment facilities in the state have some reuse applications in practice

    - Not much treated municipal wastewater going to industrial end users
        - Some reuse waters to aggregate operations (rock crushing, concrete mixing)
    - Website: http://www.deq.state.or.us/wq/reuse/recycled.htm
- There is a permitting scheme in place
    - If an application (like industrial) is new and hasn't been encountered before then the proponent would have to submit:
        - Background info (where else has this been done)
        - What controls will be in place relating to public health
        - Environmental considerations
    - Application success would depend on the level of treatment:
        - If highly polished water then there would be a less rigorous process
    - The permit would instruct the treatment plant as to what they must do to provide recycled water to a customer for reuse
    - The permit holder must then write a "Recycled Water Use Plan"
        - Describes the details of the operations, what levels of treatment the recycled water will get, what sites it will be used on and what the beneficial uses are
        - Outlines how the end user will meet the requirements of the permit
- Process is outlined through:
    - Administrative rules that deal specifically with recycled water from municipal WWTPs
    - Internal Management Directives (IMDs)
        - Internally talks about how the DEQ would implement a program
        - Published in June 2009
        - Instead of "rule making" the DEQ creates these IMDs on how to implement the program
        - Discusses interagency review
        - The IMD for recycled water pertains to domestic wastewater only
            - Industrial wastewater reuse (e.g. from an industry to commercial end use) is dealt with similarly but there are no specific rules in place
- Administrative rules (Division 55)
    - Pertain to domestic wastewater only
    - When rules were written, there were specific uses of recycled water were included
        - If a proponent was seeking a permit for a specified use, then the process is straightforward
        - If not, then more information will be required to ensure that there will be no public health or environmental impacts
        - List of recycled uses (beneficial purposes) is listed with the associated level/type of treatment that would be required

a) *Re: Water Quality? (i.e. Health, etc.)*
Response:
- Any entity that will generate water for recycled uses has to have a permit (NPDES)
    - The addition of a recycled water diversion is added to the NPDES permit as a "special condition" in Schedule D
    - If a new program, the proponent is given time to submit a plan (dependent on the class of water)
        - Example: weekly monitoring and reporting
        - Some locations are allowed to discharge in the winter and in the summer are required to use the treated effluent for irrigation
    - If a new program, it is a condition in the permit that before the entity begins delivery of water, they must get the plan submitted and approved first
        - The DEQ will look at the level of treatment and the beneficial uses
- Recycled Water Use Plan will state the levels of treatment
- Four classes of water that are permitted to be reuse:
    - A, B, C and D based on the level of treatment (A highest quality)
- OHA is contacted in certain circumstances:
    - Only concerning lower class waters (Class C and D)
    - Small municipalities in remote parts of the state are permitted to irrigate with non-disinfected water in pasture lands with fences etc.
    - Recycled water use plan must be submitted to the OHA for review

b) *Re: Water Quantity? (i.e. Usage)*
Response:
- The DEQ's permitting process mainly considers quality, but one component of their review considers:

        - Diversions and the potential for adverse impact on a stream
        - In some instances, diversion may positively impact a stream in that potential withdrawals are reduced in other locations or reducing high temperature discharges
    - When a proponent is seeking to initiate a reuse project, in addition to the DEQ process, they must file with the WRD:
        - A registration of recycled or reclaimed water use
    - This process allows the WRD the ability to manage the water rights component of the project
    - The DEQ will sign off on the registration form
        - Once registered, the DEQ will get the registration number with the knowledge that the project is approved by the WRD

c) *Re: Water Rights?*
Response:

- If effluent discharge to a stream makes up >50% of the total stream flow then a more detailed review is triggered through the WRD
    - The WRD in this scenario could decline an application for diversion since the impact would be too great on the stream and downstream users
- In circumstances involving urban activities (i.e. non-agricultural) the DWR typically does not have issues with reuse activities since
    - The municipality may have had the original water right and water is still being used in that jurisdiction
    - Also depends on the amount or quantities removed
- Once a WWTP treats the water it is theirs to control and sell
    - Economic benefit but also the liability
    - In Oregon, if treatment standards are not met or a customer misuses the water then the liability would come back to the permit holder
        - Even if there is a contractual arrangement with the end user, the liability will be with the permit holder
- Security with supply would be handled between the utility and the customer

3) *Commentary of IR Program in Practice?*

a) *Re: efficiencies?*
Response:

- The program has been implemented and it works but is still in its infancy
- Oregon has administrative rules and a legal framework

b) *Re: Inefficiencies?*
Response:

- Communication can be a challenge:
    - Two agencies (DEQ and WRD)
    - Field personnel around the state who, due to local variations in practice, may operate differently
- Oregon's framework could be more robust in comparison with Washington
- Challenges with generating interest in the reuse program
    - WWTP initiate the process but there is not enough end users seeking this alternative water source
    - As such, because there are no end users, then there is no financial incentive for WWTPs to develop reuse
- Summary, at this point, the economic benefits are not yet here in Oregon to drive the reuse system

4) *Respondent Recommendations?*
Response:

- Documentation of what the program will look like at the outset
    - How entities and programs will work together
    - Key participants and stakeholders are part of the development process
- Re: challenges with interest in a reuse program
    - Environmental drivers regarding discharge limits may increase incentive for alternative water supplies and/or reuse programs

5) Examples of IR in Practice?

a) Re: Resources?

- Nehalem Bay Wastewater Agency NPDES permit and associated documents

- Webpage devoted to water reuse
    - http://www.deq.state.or.us/wq/reuse/recycled.htm
- (Oregon Administrative Rules) OAR 340, Division 55 – Recycled Water Use Rules
- DEQ Internal Management Directive (Implementing Oregon's Recycled Water Rules)
    - Outlines internal policies how DEQ permits reuse projects and how interactions are handled between agencies
- Table of Beneficial Uses
- Recycled Water Use Plan (filled out by applicant/industry)

b) Re: Projects?

- Utility: Nehalem Bay Wastewater Agency
- Energy/Co-generation facility
    - Located close to a WWTP
    - Discussion about whether or not the WWTP will treat to the level that the industrial customer requires, or if the industrial user accept the reclaimed water and polish it to their required standards
    - Decision was that the user will accept reclaimed water and treat the water "on site"
    - In this case, the DEQ would grant the permit not to the WWTP but to the industrial user who is treating the water
        - The DEQ will permit
    - This is a proposed project still in the litigation stage so no further information can be provided

I3 Oregon: Quantity Regulator Telephone Conversation Summary

DATE	August 30, 2013	**TIME**	10:30
CONTACT	D. French	**DEPARTMENT**	Water Right Services
COMPANY	Oregon Water Resources Department (WRD)	**JOB TITLE**	Water Right Services Division Administrator

DATE	August 30, 2013	**TIME**	10:30
CONTACT	L. Jaramillo	**DEPARTMENT**	Water Right Services
COMPANY	Oregon Water Resources Department (WRD)	**JOB TITLE**	Water Management and Conservation Analyst

Note: Conference call with Lisa Jaramillo and Dwight French. Conference call organized and chaired by Dwight French.

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
      - DEQ
      - Oregon Water Resources Department (WRD)
        - Regulate water use from within the state of Oregon
        - 20 Field offices and 150 staff with 90 staff in headquarters in Salem
        - Agency has five divisions, but the Water Rights Services Division
        - This office deals with:
          - Applications for a new use of water
          - Amend a water right, called a transfer or permit amendment
          - Review conservation and management plans
        - Water reuse
          - as an agency we understand where the water is coming from originally, but want to understand how a community might be using water reuse to meet their current needs or offset their current needs
          - slow growing interest in development in water reuse
          - Biggest impediment is that the infrastructure isn't in place
          - Cities are having to consider reuse in their management plans
          - Reuse has been in place since 1991 but there is only 40 to 50 registrations in the database
   b) *Re: other regulatory agencies involved in IR?*
      - No comments
   c) *Re: inter-agency communication?*
      - Situational basis between WRD and DEQ
      - Statute Oregon Revised Statute (ORS) 537.132 subsection 1(b) states that DEQ would consult with the Oregon Department of Fish and Wildlife when they are issuing water quality permits
      - WRD can access the DEQ databases
        - End user has to identify the permit that the DEQ has issued in their application
      - Written into registration form that the DEQ is informed
   d) *Re: water source?*
      - 2/3 of state is more of a high desert and the Willamette Valley is lush
      - Mix of groundwater and surface water

e) Re: reuse applications in state?
- 95% irrigation in Oregon (out of 50 registrations)
  - Pastures
  - Golf course
  - Nursery stock
- Some industrial (cooling)

f) Re: management of WWTP?
- No comments

2) Permitting Process Summary (from respondent perspective)?

a) Re: Water Quality? (i.e. Health, etc.)
- No comments

b) Re: Water Quantity? (i.e. Usage)
- Registrations for reclaimed municipal water use is triggered by water quality permits that are issued by the DEQ
- It is the end user that initiates the process with WRD
  - They will state the facility that is going to supply the reclaimed water
  - The WWTP are a party to the application along with the registrant, the supplier and the DEQ. All are involved in the preliminary stage
  - The user has to check into the DEQ to obtain their signoff
  - Once all is complete, then it is submitted to the WRD
- When a registration application comes in, the WRD looks at whether or not that municipality has discharged that effluent into a river for 5 years or more
  - If they have then, the WRD looks at the % of the total average flows
  - If that discharge was 50% or more of that natural flow
  - If it is, then if the reuse would cease the discharge, then the WRD would notify downstream users that would be affected by that
  - The downstream users are given a preference to the use of the reclaimed water
    - This means if the downstream use wanted the reuse water, they would have to install a conveyance system or channel other than the natural water course
    - This is like a first right of refusal
- The end user is seeking from the WRD a permission to use reclaimed water (not necessarily a "water right" per se.
  - Statutes allow a person to use reclaimed water in lieu of a water right
  - If the user does that, then there is protection for that water right so it is not subject to forfeiture
  - The WRD wants to make it easy for people to use reclaimed water
- From the WWTP perspective they approach the DEQ, and the end user approaches the WRD
- In terms of indirect reuse, the end user would obtain a regular diversion permit as per any other water diversion

c) Re: Water Rights?
- The WWTP owns the water prior to discharge
- Re: security of supply of third party
  - Contractual agreement between utility and third party user
- Re: inter-basin transfer
  - Has not been an issue yet

3) Commentary of IR Program in Practice?

a) Re: efficiencies?
- Some communities need to find another way to dispose of their effluent
  - Situated on small streams and their discharge can cause issue
  - Reuse may be less expensive than developing tertiary treatment capabilities
  - Example: Prineville and Union

b) Re: Inefficiencies?
- No comments

4) Respondent Recommendations?
- When building new subdivisions, the infrastructure for reclaimed water could be installed at the time
- Education for the public to increase acceptance for reclaimed water

- Education for those who do the application
- Government oversight system developed and kinks worked out before talking to big users near water treatment plants to see if you can work something out
    - Once established with a good couple of projects that work then a system can build from there
    - Example:
        - Cities of Prineville and Union built golf courses to deal with the challenges associated with their effluent
        - Built golf courses instead of soccer fields is because the median age of the golfer is older than a park that may have children
    - If there is a golf course next to the water treatment plant, or land to do it, it would make a good demonstration project
- Some grants to do feasibility studies on water reuse opportunities

5) *Examples of IR in Practice?*

a) Re: Resources?

- DEQ website: http://www.deq.state.or.us/wq/wqpermit/permits.htm
- WRD "Registration of Reclaimed Municipal Water Use" form: http://www.oregon.gov/owrd/pubs/docs/forms/reclaimform96.pdf
- Instructions and guidance for completing the registration: http://www.oregon.gov/owrd/pubs/docs/forms/reclaimforminstr.pdf

b) Re: Projects?

- LNG Development Company, Warrenton, OR.
    - LNG project
    - Industrial cooling
- Entity called "Clean Water Services"
    - Southwest of Portland in Washington County
    - The sewer agency for Washington county
    - Wastewater/storm water management utility
    - Suppliers of reuse
    - Could discuss reuse
- Meadow Lakes Golf Course
    - Prineville
    - Pond discharge does not have to meet drinking water standards as would direct pumping of reclaimed water into an aquifer
    - A lot of small ponds are always full to allow discharge to seep into the groundwater system plus irrigation with reclaimed water
    - City built the golf course to meet their effluent discharge needs

I4 Oregon: Health Regulator Telephone Conversation Summary

DATE	July 3, 2013	**TIME**	10:00
CONTACT	D. Leland	**DEPARTMENT**	Drinking Water Program
COMPANY	Oregon Health Authority (OHA)	**JOB TITLE**	Program Manager

(Note: Questions posed to respondents are in italics)

Investigative Topics

1) *IR Management?*
   a) *Re: main permitting agencies for IR?*
      Response:
      - No comments
   b) *Re: other regulatory agencies involved in IR?*
      Response:
      - No comments
   c) *Re: inter-agency communication?*
      Response:
      - No comments
   d) *Re: water source?*
      Response:
      - No comments
   e) *Re: reuse applications in state?*
      Response:
      - Golf course irrigation
      - Agricultural irrigation
   f) *Re: management of WWTP?*
      Response:
      - No comments

2) *Permitting Process Summary (from respondent perspective)?*
   Response:
   - The OHA has little to do with the reuse program in Oregon
     - The DEQ is charge of the reuse program
   - The OHA key area includes public health aspects related to reuse
   - OHA's involvement in water reuse would only include specific applications:
     - E.g. spray irrigation on lands via drift
   - OHA provides consultation services to the DEQ for specific reuse proposals
     - "Health Consult"
   - Regarding Industrial Reuse:
     - OHA would only have interest on peripheral issues (e.g. cross-connection control)
   - There is plenty of water in Oregon so there is not a lot of demand for reuse
     - Emphasis on reuse is not in relation to using the water, as it is in controlling the nutrient loads in receiving waters

   a) *Re: Water Quality? (i.e. Health, etc.)*
      Response:
      - No comments
   b) *Re: Water Quantity? (i.e. Usage)*
      Response:
      - No comments
   c) *Re: Water Rights?*
      Response:
      - No comments
   d) Documents or procedures used in practice

- No comments

3) *Commentary of IR Program in Practice?*
   a) *Re: efficiencies?*
      Response:
      - No comments
   b) *Re: Inefficiencies?*
      Response:
      - No comments

4) *Respondent Recommendations?*
   Response:
   - No comments

5) Examples of IR in Practice?
   a) Re: Resources?
      - None
   b) Re: Projects?
      - None