Water Demand and Forecasting

What to Expect and How to Cope with Decreasing Trend in Demand

PNWS AWWA Water Resources Committees Pre-Conference Workshop
Yakima, WA May 2, 2012
Best Practices for Strategic Water Operations and Planning

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Presentation Organization

- Demand for water
- Forecasting
  - Needs
  - Methodology
  - Consequences of errors
- Trend in demand
- Demand Side Management (DSM)
  - Nature of water utilities
  - Costs and benefits
- Coping with trend

Demand for Water

- Needs and wants vs. demand
- Value of water
- Costs, economic value and efficient use

Needs and Wants vs. Demand for Water

- **Needs:** drinking, cooking, hygiene, producing goods and services, and transportation.

- **Wants:** cleaning, aesthetics, landscaping, recreation, disposing waste, etc.

- **Demand:** amount of water individuals and organizations are willing and able to purchase at different prices for different purposes.

Needs

- Impacted by local culture, traditions, religion, etc.
  - Type of food
  - Ways and frequency of hygiene
  - How water and wasting water is culturally looked upon
- Usually cannot be avoided or curtailed
- Failing to meet needs is costly
  - Malnutrition, epidemics and other possible diseases
  - Impact on production of goods and services

Wants

- Impacted culturally and by water availability
  - Cleaning, waste disposal, recreation, food supply, etc
- Impacted by economic conditions
  - Aesthetics, landscaping, recreation, environmental protection
- Impacted by weather and climate
- Can be avoided or curtailed
- Failing to meet wants might lead to dissatisfaction and economic consequences

Demand

- Willingness and ability to pay, an entirely economic concept
- Needs and wants do not necessarily lead to demand
- Impacted highly by economic, demographic, cultural, and climate conditions
- Combined with supply, theoretically leads to efficient use of water
  - Whoever is willing and able to pay the price gets to use the water for the desired purpose

Value of Water

- Impacted by type of use
  - Municipal
  - Irrigation
  - Power generation
  - Recreation
  - Environmental
- Impacted by type of user
  - Households
  - Private industries and organizations
  - Public organizations
  - Wild life
- Impacted by supply, delivery, quality, and reliability
  - Ground vs. surface
  - Raw, treated , filtered, desalinated, etc.
  - Pumped vs. gravity
  - Reclaimed water

Determinants of Costs, Economic Value, and Efficient Use of Water

- Costs
  - Supply and delivery
  - Scale of operation and infrastructure
  - Quality and reliability
  - Cost of capital
- Economic Value
  - Scarcity or abundance
  - Type of use and benefit to the user
  - User's perception of benefit
  - Opportunity costs
- Efficient use (theoretically)
  - Marginal costs = Marginal benefit

Demand Forecasting

- Forecasting needs
  - Long-term (10 to 30 years or more)
  - Short-term (1 to 5 years)
  - Immediate-term (1 year or less)
- Forecasting methodology

Forecasting Needs

- Long-term planning (10 - 30 years or longer)
  - Acquiring new sources and expanding capacity
  - Extension of permits, rights, and contracts
  - Sizing transmission and distribution system
  - Assessing system reliability and vulnerability
  - Asset management
  - Environmental compliance
  - Assessing impact of climate change

Forecasting Needs (Cont.)

- Short-term planning (1 - 5 years)
  - Budgeting
  - Rate setting
  - Assessing cash flow and revenue volatility
  - Weather effect
  - Impact of economy

Forecasting Needs (Cont.)

- Immediate-term planning (1 year or less)
  - Peaking
  - Reservoir operation
  - Pump operation
  - Supply augmentation
  - Weather effect
    - Peak and drought management
    - Turbidity events

Forecasting Methodology

- Per capita/account based extrapolation
- Time-series extrapolation
  - ARMA, ARIMA, exponential smoothing
- Econometric (regression) model
- Artificial Neural Network (ANN)
- Filters, Spline, Wavelets, Curve Fitting, etc.

Per capita/account based extrapolation

Requirements

- Per capita or per account demand
- Population or accounts extrapolation
- Adjustment for different customer classes
- Adjustment for peaking
- Adjustment for land use
- Adjustment for rate impact, conservation, economy, weather, and changes in customer class composition

Strengths and weaknesses

- Less data intensive
- Not much statistical expertise needed
- Fairly reliable for short-run
- As reliable as population or account forecast for long-run
- Does not provide measurement for impact of demand drivers
- No statistical confidence
- Relies on other studies for different adjustments

Time-series extrapolation

Requirements

- At least 10 years of data
  - Daily or monthly production
  - Monthly billing
- Statistical expertise
- Statistical software
- After the fact adjustments for demand drivers and other variables

Strengths and weaknesses

- Reliable for immediate and fairly reliable for short run
- Not reliable for long-run
- Provides statistical confidence
- Does not provide measurement for impact of demand drivers
- Needs expertise and special software
- Relies on other studies for proper adjustment

Econometric (regression) model

Requirements

- At least 10 years of data
  - Daily or monthly production
  - Monthly billing
  - Demographic , economic, weather
- Forecasts of demand drivers
- Statistical expertise
- Statistical software
- After the fact adjustments for trends due to other factors

Strengths and weaknesses

- Reliable for immediate and short run
- As reliable as the forecasts of demand drivers for long-run
- Provides measurement for the impact of demand drivers
- Provides statistical confidence
- Highly data intensive
- Needs expertise and special software
- Could benefit from other studies for adjustment

Artificial Neural Network (ANN)

Requirements

- At least few years of data for training the model
  - Daily or monthly production
  - Monthly billing
- Modeling expertise
- Special software
- After the fact adjustments for demand drivers and other variables

Strengths and weaknesses

- Reliable for immediate-run and one or two years forecasts
- Does not provide measurement for impact of demand drivers
- No statistical confidence
- Needs modeling expertise and special software
- Relies on other studies for different adjustments

Filters, Spline, Wavelets, Curve Fitting, etc.

Requirements

- At least 10 years of data
  - Daily or monthly production
  - Monthly billing
- Modeling expertise
- Statistical software
- After the fact adjustments for trends due to other factors

Strengths and weaknesses

- Reliable for immediate and short-run
- Fairly reliable for long-run if trend continues
- Provides statistical confidence depending on the model
- Does not provide measurements for impact of demand drivers
- Needs modeling expertise and special software
- Relies on other studies for adjustment

Forecasting Error and Consequences

- Sources of Error
  - Model related
  - Errors in the forecasts of the drivers
  - Errors in estimation of other studies used for adjusting demand
- Consequences
  - Long-term
  - Short-term
  - Immediate-term

Sources of Error

- Model related
  - Inappropriate methodology
  - Misspecification of the model
  - Not enough data
  - Model performance
  - Forecasting time span
- Forecasts of demand drivers
  - Inaccurate per capita estimates
  - Error in forecasts of demographic, economic, weather variables
- Other studies estimation errors
  - Land-use impact
  - Conservation impact
  - Climate impact
  - Price elasticity
  - Economic impact
  - Trend in demand

Consequences, Risks, and Remedies

Long-term

- Consequences
  - Excess or shortage of supply
  - Over or under capacity
  - Failure to renew permits on time
  - Failure to meet environmental commitments
- Risks (not very high)
  - Enough lead time to see trend in demand
  - Flexibility to change course of action
- Remedies
  - Improve forecasting
  - Update forecasts every 5 years (at least every 10 years)

Consequences, Risks, and Remedies

Short-term

- Consequences
  - Budgeting related issues
  - Revenue volatility
  - Rates instability
- Risks (relatively high)
  - Not likely to change rates in the middle of the year
  - Might have to cut budget and expenses
  - Impacting ability to fulfill commitments
  - Impact on bond rating
- Remedies
  - Improve forecasting
  - Simulate demand under different weather scenarios
  - Reduce degree of reliance on revenue from volumetric sales
  - Rainy day funds

Consequences, Risks, and Remedies

Immediate-term

- Consequences
  - Impacting peaks management
  - Impacting operation of reservoirs
  - Timing of supply augmentation
- Risks (relatively moderate depending on the system)
  - Might have enough lead time to change operations
  - Might be able to resort to curtailment for a limited time
  - Might have access to emergency sources
- Remedies
  - Improve forecasting to better estimate impact of weather and economy
  - Simulate demand under different weather scenarios
  - Obtain better weather forecasts
  - Increase frequency of updating the forecasts

Trend in Demand (PWB)

Annual average and per capita annual average demand for the PWB's retail and wholesale service area, 1960-2011

Trend in Demand (Coomes et al., 2009)

Figure ES.1 — Partners' average annual water usage per residential customer, in gallons

Trend in Demand (overall causes)

- Increasing trend (1960 to early 1980s)
  - Population growth
  - Bigger households
  - Lack of metering
  - Low water and sewer rates
  - Inefficient fixtures
  - Bigger lots and water demanding landscapes
  - Economic growth

- Decreasing trend (mid 1980s to present)
  - Lower population growth and increase in average age
  - Smaller households
  - Metering
  - Increase in water and sewer rates (conservation rate structure)
  - Efficient fixtures and conservation attitude
  - Smaller lots and water-efficient landscaping
  - Increase in multifamily dwellings
  - Economic slowdown
  - Wetter, milder weather
  - Coomes, et. al. (2009)

Coomes et al., Study Focus

- North America residential water usage trends since 1992
  - National trends represented by 43 utilities
    - utility size, water source, ownership type, precipitation zone, temperature zone, and drought index
  - Detailed study of 11 participating utilities
    - conservation initiatives, billing practices, and government oversight
  - Detailed study of 65 households using data loggers
    - Impacts of water-conservation fixtures
    - household demographics, socioeconomic characteristics
    - indoor and outdoor water-using fixtures

Coomes et al., Key Findings

- Decline in household water consumption at the national and regional levels
  - Decrease of more than 380 gallons annually over the last three decades in household water usage.
  - Decline of 13.2 percent compounded over 30 years.
  - A household used 11,673 gallons less water in the 2008 billing year than an identical household did in 1978.
- Daily usage of household sample is highly influenced by:
  - weather, household demographics , housing stock age, size, and value
  - characteristics of water using appliances inside and outside the home
- Daily household water usage fell 10 percent between 1990 and 2007 after adjusting for weather.
- A 16 percent reduction in average household water use due to low-flow appliances and changing household demographics from 1990 to 2007.
- Net decline in water usage per household appears to be due to the steady penetration of low-flow appliances over the past 20 years.

Global Comparison

Year 2000	Liter	Gallon	PWB Ret	PWB Ret-WS
US	575	152	148	142
Australia	493	130		
Italy	386	102		
Japan	374	99		
Mexico	366	97		
Spain	320	85		
Norway	301	80		
France	287	76		
Austria	250	66		
Denmark	210	55		
Germany	193	51		
Brazil	187	49		
Peru	173	46		
Philippines	164	43		
UK	149	39		
India	135	36		
China	86	23		
Bangladesh	46	12		
Kenya	46	12		
Ghana	36	10		
Nigeria	36	10		
Burkina Faso	27	7		
Niger	27	7		
Angola	15	4		
Cambodia	15	4		
Ethiopia	15	4		
Haiti	15	4		
Rwanda	15	4		
Uganda	15	4		
Mozambique	4	1		
Water Poverty Threshold	50	13		

Demand Side Management (DSM)

- Brain child of Rocky Mountain Institute for electric utility industry in the 1970s
- Cheaper to reduce demand than increase supply incrementally
- Least-cost planning
  - Equal consideration to both supply and demand options
  - Use lower cost energy saving options than more expensive supply alternatives

DSM: Costs, Benefits and Incentives

- Costs
  - DSM related expenses (utility and customers)
  - Decrease in demand and loss of revenue
  - Opportunity costs of DSM resources
- Benefits
  - Avoided costs of additional supply
  - Time value of deferred capital investment
  - Avoided costs of environmental impacts
- Incentives
  - Providing assistance to customers to lower demand
  - Allowing utilities to recover DSM expenses and lost revenues

Matters of Fact

- Decreasing trend in demand and revenue shortfalls
- Compliance with conservation requirements
- Rigid nature of water utility organization
  - Not possible to downsize infrastructure to be in line with demand
  - Limited ability to downsize workforce
  - Unacceptable to forego upkeeps in order to reduce costs
  - High fixed costs
  - Limited ability to adjust costs to be in line with revenue
  - Mandated to provide service

Coping with Trend by Incorporating DSM into Planning

- Estimating the impact of DSM on long-term demand forecast
- Estimating the avoided costs and time value of deferred capital investment
  - (haven't seen any study doing this for impact of 1992 code changes)
  - Estimate potential impact on rates
- Estimating future DSM expenses and revenue losses
- Decoupling revenue from sales
  - Increasing revenue from fixed charges
  - Rainy day funds
- Conservation promoting rate structure
  - Recover 50-60% of costs through fixed charges
  - Aggressive increasing block rate structure
  - Provide incentive for water savings
  - Provide low income assistance
- Reduce costs by minimizing inefficiencies

Questions

GALLARDO LP 550-2 TRICOLORE

"Best" Practices for Selecting a Long Term Water Supply Option

Hillsboro Utilities Commission
and
Hillsboro Water Department

Peter Martins, PE
May 2, 2012

Oregonian as a 2nd Language

Oregonian as a 2nd Language

Butchers of the English Language

Oregonian as a 2nd Language "Verbally Challenged"

ER = A	(RIVER = RIVA) (WATER = WATA)
A = ER	(SODA = SODER)
AR = A	(CAR = CA)
ALL = AL	(FALL = FAL)

Fall River = **Boston**

Carla Martins = **Honey**

DISCLAIMER #1

- “The City of Hillsboro in is not responsible in anyway for the material, opinions, guidance, or representations made by the speaker.”

DISCLAIMER #2

- What is a “Best Practice”?
- We’re all “snow flakes”
- All may not work for you…but some might.

"Best Practice" Overview

- Prepare. Communicate
- Know the problem. Communicate
- Know your message. Communicate
- Build a stakeholder team. Communicate
- Work the problem. Communicate
- Choose. Communicate
- Communicate.
- Move forward. Communicate

Prepare….yourself….& others

- Project is going to…
  - Take longer.
  - Cost more.
- How do you feel about that????
- Consensus or Driving the Schedule?

Know the problem…

City of Hillsboro and JWC Water Source
AUGUST 2007
N
HILLSBORO WATER
0 0.375 0.75 1.5 Miles
SOURCE:
City of Hillsboro GIS
- Current as of Nov, 2007
City of Hillsboro Water
- Current as of Nov, 2007
Washington County GIS
- Current as of Nov, 2007
Metro Regional Land Information System (RLIS)
- Current as of Nov, 2007
DISCLAIMER:
This map is derived from various digital database sources. While care has been taken to insure the accuracy of the information shown on this page, the City of Hillsboro assumes no responsibility or liability for any errors or ommissions in this information. All data presented on this map is continually updated and is current as of the dates listed abouve. This map is provided "as is".
Banks
North Plains
Forest Grove
Cornelius
City of Hillsboro
Gaston
Hagg Lake
16 inch
EVERGREEN RESERVOIR 15 MG
66 inch
72 inch
72 inch
42 inch
42 inch
42 inch
24th St RESERVOIR 6 MG
30 inch
INTAKE PUMP STATION
45 inch
FERN HILL RESERVOIRS 20 MG EACH
JOINT WATER COMMISION PLANT
DILLEY RESERVOIR 9 MG
18 inch
18 inch
CHERRY GROVE SODA ASH STATION
HAINES FALLS INTAKE
E.S. MILLS DAM
SLOW SAND FILTER
BARNEY RESERVOIR
Legend
Transmission Pipes
City Limits
Banks
Beaverton
Cornelius
Forest Grove
Gaston
North Plains
Tigard
Hillsboro
Hillsboro Water Dist.
Reservoirs
Slow Sand Filter
Haines Fall Intake
Hagg Lake
Barney Reservoir
TVWD
UGB
County Boundry
Hydrology
Freeways
Major Streets

Water Demand Projection Process

JWC Partner Peak Day Demand Projections (mgd)
Peak Day Demands (mgd)
160
140
120
100
80
60
40
20
0
2010
2015
2020
2025
2030
2035
2040
2045
2050
Year
Total JWC PDD
Hillsboro PDD

Basin Storage Needs

Know the problem…

- 80 MGD PD FW Capacity
- Need 35,000+ Ac-ft
- Regional solution
- Diverse stakeholders / politics
- Environmental Concerns
- Public Perception

Know your message…

- Original supply exp. may be unaffordable.
- All options on table.
- Regional solution.
- Balancing least cost / least risk
- Project provides an “off ramp” for further study.
- No cheap water.

Build your stakeholder team

- TAC
  - Internal – 4 Members
  - External – 4 Agencies
- Keys
  - Diverse
  - Representative of the need
  - Not “yes” men…(or women)
- *Others…(Communication)*

Work the Problem

- Establish the basic "need to know"
  - Demand analysis
  - Water Availability / Water Rights / Reliability
  - Water Quality (FW target)
  - Permitting
  - Infrastructure Development / Phasing
  - Cost (Capital, Invest. Schd., O&M, Risk = PW)
  - Selection Criteria
  - Political Allies & Adversaries **Not a TM**

- Separate TM's that build and bind

Choose

- Justifiable & Objective Criteria (Examples)
  - Cost
  - Water Right Reliability
  - Source Water Exposure
  - Permit mitigation risk
  - Operational control / investment control
  - SDC fund utilization
  - Impacts to water supply during construction
  - Resilience/Redundancy
- Define
- Similar Scoring Range (1-10; P/F; etc)
- Pair-wise Comparison
- Time

Communicate

- Tell the story…early and often.

Tualatin Basin Water Supply Project

Project: Hagg Lake Expansion

Goal: To Develop a Cost-Effective 50-Year Water Supply Source to Support the Municipal Water Supply and Watershed Needs of Hillsboro and Other Washington County Communities

Project Partners: Hillsboro is Partnered With Tualatin Valley Water District, Beaverton and Clean Water Services

Our Story

Tualatin Basin Water Supply Project

- Project delayed due to Federal Seismic Studies
- Timing of federal funding is uncertain
- Costs have significantly risen on project

Our Story

Tualatin Basin Water Supply Project: Increasing Costs

- Previous (2007) Dam Raise Cost Estimate: $263 Million
- Updated Cost Estimates (Depending on Final Design): $389 million – $868 million

$300 Million (+/– 20%)

- Total Project Cost: $1.2 – $2.0 Billion
- Federal Cost Share Estimated: $330 Million

Our Story

Tualatin Basin Water Supply Project

- Questions?
  - Will the delays impact our ability to meet demand?
  - Is it still the most cost effective option for Hillsboro?
  - What are the additional risks of this option?

Our Story

Hillsboro Water Supply Alternatives Study

- Need Water Supply Options & Bridging Strategies
- Determine “Best” option for Hillsboro and Partners
- Balancing least cost / least risk
- Further study “Best” option to next level
- No cheap water.

Our Story

Communication

- Who do you take your story too????

- Customer Survey
- Website generation
- "Story" (Chamber, Rotary, Council workshop, etc)

www.hillsborowatersupply.org

- UC Prelim approval of recommendation.
- Intensive Community outreach activities (WA County Fair, Celebrate Hillsboro, Tuesday/Saturday Markets, Latino Festival, Northwest Children's Festival, etc.)

•City Council work session presentation

•Report to UC on public outreach feedback

•UC adopts Package of Short and Long Term Water Supply Source Strategies as part of Water Master Plan

•Begin implementation of Adopted Interim Strategies

•Continue investigation of preferred Long Term water supply source option

□Additional Concerns

□Partnership collaboration

Questions?????

www.hillsborowatersupply.org

"Best" Practices for Selecting a Long Term Water Supply Option

Hillsboro Utilities Commission
and
Hillsboro Water Department

Peter Martins, PE
May 2, 2012

Best Practices for Selecting Non-Traditional Supply Alternatives

AWWA PNWS Pre-Conference Seminar

May 2, 2012

Andrew Graham

HDR Engineering, Inc.

Context of Presentation

- Long-Range Planning of New Supplies
- Need Water for Growth or Replacement of Existing Supplies
- It’s Tough to Find New Water in the West
- Mix of Traditional and Non-Traditional Supplies May be Needed

Best Practices Overview

1. Start by Defining Objectives, not Solutions
2. Cast a Wide Net for Alternatives
3. Define Metrics that Apply to a Range of Solutions
4. Look for Partners and Multiple Benefits
5. Think Long Term (and Address Uncertainties)

Two Project Examples

Example 1:
Cascade Water Alliance Transmission and Supply Plan

Lake Tapps

Best Practices for Water Reuse/Reclaimed Water from the Implementers/Engineers Perspective

2012 PNWS-AWWA Conference
Yakima, WA May 2-4, 2012

Mark Cullington

Kennedy/Jenks Consultants

Reclaimed Water

"Reclaimed water is a water supply produced by treatment of municipal or domestic wastewater. The treatment processes are designed to assure that the water is safe and suitable for the intended use." – *WDOE, October 2010*

Water Resources to Reclaimed Water

Potential for Water Reuse in the U.S.

11.2%
Reclaimed &
Beneficially
Reused

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National Perspective

90% of Water Reuse Occurs in Four States

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National Perspective

...but it is growing in other states

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Projected Growth in the U.S.

Example: **California Policy - Increase recycled water use: 1 MAF/year by 2020 and 2 MAF/year by 2030**

(~1 bgd by 2020 and ~2 bgd by 2030)

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Reclaimed Water Market Sector

Beneficial Uses:

- **Agricultural Irrigation**
- **Urban Irrigation**
- **Impoundments**
- **Internal Use – Buildings**
- **Commercial & Industrial Uses**
- **Environmental Enhancement**
- **Indirect Potable Reuse**

Reclaimed Water Drivers

- **Wastewater Discharge Compliance**
  - **Can you say TMDL?**
- **Alternative Water Supply**
  - **Exclusively**
  - **Partial off-set**
- **Sustainable Water Resources Management**
  - **Water Supply Reliability**
  - **Energy Conservation**
  - **Resource Recovery**

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Reclaimed Water Constraints

- **Water pricing and subsidized water rates**
- **Needs for funding, economy of scale**
- **Lack of consistent legislation, policies and regulations**
- **Possible negative public or media perception**

Developing a Water Reuse Program

- **Planning**
- **Design**
- **Construction**
- **Operations**
- **Financing Plan**
- **Public Outreach**
- **Regulatory Compliance and Health Protection**
- **Institutional and Organizational Issues**

Reclaimed Water Best Practices

"Implementing Recycled Water Projects is not about Engineering and Science, it's about Community Building"

-Ed Everett, Redwood City, Retired City Manager

Understand the Big Picture

- **Behavioral Change**
- **Collaboration & Partnerships**
- **Clearly Stated Needs & Benefits**
- **Adequate Time for Informed Decisions**
- **Get into your customer's shoes**

Establish Political Leadership

- **Educate**
- **Prepare**
- **Maintain Communication**
- **Expect change in make-up of decision makers**

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Build Community Trust

- **Identify Stakeholder Groups Early**
- **Understand Perceptions of Risks & Benefits**
- **Varying Attitudes & Emotions**
- **Provide an Inclusive Process**

Maintain Strong Customer Focus

- **Ask them <u>first</u>**
- **Incentives vs. Ordinances**
- **Site Retrofit Process**
- **Create Rate Schedules**
- **Education and Training**

Communicate Appropriately

- **Develop a Strategy and Use Multiple Platforms**
- **Select appropriate Speakers & Venues**
- **Broadcast your Success**
- **Avoid Jargon**

Do the Work

- **Review Broad Range of Alternatives**
  - **Provide Economic Framework for Comparison**
  - **Consider Triple Bottom Line type Analyses**
- **Bring Stakeholders through the process**
- **Build Credibility and Trust**

Be Creative

- **Beyond the low-hanging fruit**
  - **Water Transfers**
  - **Augmentation of Irrigation Canals**
  - **Public Private Partnerships**
  - **Incremental development of a program**
- **The right water for the right use**

Thank You!

Questions?

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Getting Started in Protecting the Source McKenzie Watershed, Oregon

Karl Morgenstern, Eugene Water & Electric Board

Discussion Summary

- Why is protecting the source important?
- Quick overview of McKenzie & EWEB's Source Protection Program
- Foundation of source protection – WQ Monitoring
- How to get started building an effective source protection program

Fully Appropriated Summer Flow

Example: EWEB data shows direct correlation between increased turbidity and increased treatment costs

WASHINGTON
Columbia River
Vancouver
Portland Metro Area
Salem
Snake River
McKenzie River Watershed
OREGON
Eugene
Willamette River
Boise
Crater Lake NP
IDAHO
Medford
Klamath River
Redwood NP
CALIFORNIA
NEVADA

Watershed size: 1,338 sq miles
Elevation range: approx 430'-10,358'
Average annual river flow at confluence: 5,809 cfs
Average annual precipitation: 40"-110" (mostly snow at higher elevations)

High Cascades

Young basalts, basaltic andesites, andesites, pumice, and ash < 7 million years old

Youngest Mckenzie Pass lava flows (≤ 3000 years old)

Cascade Springs - blue pools

Cascade Springs - GUSHERS!

US Geological survey

Likely future summer water supply:

Cascades:

Sustained, due to groundwater storage

Sierra:

Greatly diminished, due to loss of snowpack

Land Ownership in the McKenzie River Watershed

Drinking Water Protection Plan

- The drinking water protection plan technical report was completed in August 2000.
  - Source Protection Monitoring
  - Effective Partnerships
  - Regulatory Analysis
  - Environmental Setting & Risk Assessment
- Protection Plan completed in October 2000.
- The Board adopted plan in October 2000.

DWSP Plan Goals and Objectives

- Goal: Protect the McKenzie River as a reliable source of excellent drinking water for present and future generations.
- Objectives:
  - To prevent, minimize, and mitigate activities that have known or potentially harmful impacts on source water quality.
  - To promote public awareness and stewardship of a healthy watershed ecology in partnership with others.

RISK CATEGORIES RANKED BY AVERAGE SCORE

Source Protection Program Objective

- To measure the balance between watershed health and human use over time and to implement actions that maintain a healthy balance for production of exceptional water quality.

Elements of Source Protection Program

- **Comprehensive Monitoring**
- **Disaster Preparedness and Response**
- Point Source Pollution Evaluation and Mitigation
- **Nonpoint Source Evaluation and Mitigation**
- Education and Research Assistance
- Land Acquisition and Conservation Easements
- Watershed Land Use Tracking and Management
- Public Outreach and Information Sharing

Nonpoint Sources

- Agriculture
- Forestry
- Septic Systems/Development
- Urban Stormwater Runoff
- Roadside Spraying

Water Quality Monitoring & Data Analysis:
The Foundation of Source Protection

Assessment of Water Quality

- Focused monitoring:
  - Urban and Stormwater Runoff
  - Forestry
  - Agriculture
  - Septic Systems
- Watershed monitoring:
  - Baseline long-term (WQ Trends)
  - Treatment impacts (DBP formation)
  - Amount of dissolved organic chemicals in river

McKenzie Watershed Monitoring Sites

Monitoring Partnerships

- Army COE
- City of Springfield
- University of Oregon
- Oregon DEQ
- U.S. Geological Survey
- Lane Regional Air Pollution Authority
- Springfield Utility Board
- U.S. EPA
- Springfield School District
- Oregon State University
- McKenzie Watershed Council
- Lane Council of Governments
- U.S. Forest Service

Sampling Plan Development

- Purpose & Objectives
- Focus sample collection on areas of highest relative risk or general WQ trends
- Sampling method and justification (storm event, season (wet/dry), grab/composite/passive sampling, etc.)
- What to analyze for and at what detection limit
- Location & number of samples
- Quality assurance & quality control
- How much money do you have to spend?

McKenzie Baseline Monitoring

Map 1-3: McKenzie Watershed EWEB Baseline Monitoring Sites

Monitoring Sites

E01M - Mohawk River @ Hill Rd Bridge
E02M - Mohawk River @ Wendling Rd Bridge
E010 - McKenzie River @ EWEB Intake
E020 - McKenzie River @ Hendricks Bridge
E060 - McKenzie River @ Holden Creek Rd Bridge nr Leaburg
E170 - McKenzie River @ Brutgers Bridge
E182 - McKenzie River @ Frissell Bridge
E210 - Cedar Creek @ Saunders Bridge
E310 - Camp Creek @ Camp Cr Rd Bridge
E480 - SF McKenzie @ Bridge below Cougar Dam
E482 - SF McKenzie @ Rte 1980 Bridge Upstream of Cougar Reservoir
E540 - Blue River @ McKenzie Hwy Bridge
E810 - Keizer Slough @ SUB Bridge

Map 6-6: McKenzie Baseline Monitoring

E. coli Values, 75th Percentile and Maximum

This map shows both the 75th percentile values and maximum values for e. coli for baseline water quality monitoring sites in the McKenzie Watershed.

McKenzie River at Hendricks Bridge

Storm Event Monitoring

Assess pollution/pesticide runoff from:

- Urban stormwater
- Forestry
- Agriculture

Storm Event Equipment

70 to 90% of pollution loadings to surface waters occur during storm runoff events.

Concentrations observed in McKenzie River Basin during 2002-2010, by major land-use category

Total concentrations for detected pesticide compounds at specific sample sites, according to season and land use

Getting Started

- Focus on high priorities that have agreement (e.g., hazardous material spill response)
- Do not start with funding…start with what exists and what is possible long-term solutions
- It is all about building relationships…take the time to get to know partners (go slow to go fast)

Program Approach

- EWEB accepts a leadership role for protection of the McKenzie River.
  - Seeking & developing partnerships
  - Share project approaches, data, info (be open)
  - Provide funding and other resources

- EWEB provides fixed amount of funding – use grants/outside funding to supplement.

Hazardous Materials Response

HazMat Threat Assessment

- Purpose is to identify most probable chemical threat from transport, storage, and use in watershed.
- Threat evaluation includes:
  - ODOT/County Accident & Hwy Information
  - Spill History in watershed
  - Inventory of industrial & commercial facilities
  - Forest Mngt chemical use/storage/transport
  - Agricultural chemical use/storage/transport
  - Lane County commodity transport study

In McKenzie: 500 Trucks/day with 3-5% carry hazardous materials

(*source: ODOT Freight Survey)*

Vehicle Accident “Hot Spots”

HazMat Spill Incidents (1982 – 2002), Lower McKenzie Watershed

View

ools Window Help MWERS

reate New Feature | Target:

Insert Vertex Snapping... Set Selectable Layers...

Identify Results

Layers: <Top-most layer>

- FireMarshal
  - MONACO COACH COF
  - MONACO COACH COF
  - MONACO COACH COF
  - MONACO COACH COF
  - MONACO COACH COF
  - MONACO COACH COF
  - MONACO COACH COF
  - MONACO COACH COF
  - MONACO COACH COF
  - MONACO COACH COF

Location: (4280712.256865 880619.563714)

Field	Value
Emp File Number	080599
Company Name	MONACO COACH CORPORATION
Reportable Qntys	Y
EHS Chemicals	N
Location Address	5280 HIGH BANKS RD
Loc City	SPRINGFIELD
Loc County	LANE
Loc State	OR
Loc Zip Code	97478
Manager Name	DALE WEINS
Business Phone	541-988-3070
Mail Address	91320 COBURG INDSTRIAL WY
Mail City	COBURG
Mail State	OR
Mail Zip Code	97408
Sic Code 1	3083
Sic Code 1 Desc	LAMINATED PLASTICS PLATE/SHE
Chemical Trade Name	ACETONE
Most Hazardous Ingredient	ACETONE
Hazard Class Code 1	3.1
CLASSIFICA	Flammable Liq.(FP<0F)
CODES	3.1
Max Qnty Code	11
Max Qnty Desc	500-999
Unit Desc	GALLONS

Hazardous Material Category	Average Quantity Stored[1]	Number of Facilities
Gasoline	140,000 Gallons	15 Locations/23 Tanks
Diesel	117,000 Gallons	19 Locations/26 Tanks
Transformer Oil (Hydroelectric)	75,000 Gallons	4 Locations
Fertilizer	39,000 Pounds	4 Locations
Pesticides	11,200 Gallons[2]	84 Locations
Solvents	5,200 Gallons	3 Locations
Propane	5,100 Gallons	6 Locations
Motor Oil	3,600 Gallons	10 Locations
Waste Oil	1,200 Gallons	3 Locations
Formaldehyde	900 Gallons	2 Locations
Hydraulic Oil	750 Gallons	4 Locations
Oil-Based Paint	200 Gallons	2 Locations

Facility hazmat storage that would need deliveries thru McKenzie

Chemical Type	Quantity[1]
Urea Fertilizer	10.5 Million Pounds
Sodium Hydroxide	16.5 Millions Gallons
Formaldehyde	500,000 Gallons
Calcium Hydroxide	500,000 Gallons
Pentane	250,000 Gallons
Sodium Magnesium Aluminosilicate	75,000 Gallons
Methanol	50,000 Gallons
Sulfuric Acid	50,000 Gallons
Naphtha	50,000 Gallons
Other Acids (Muriatic, adipic, acetic)	35,000 Gallons
Sodium Hypochlorite	10,000 Gallons
Potassium Hydroxide	10,000 Gallons
Aluminum Sulfate	10,000 Gallons
Herbicides/Pesticides	5,000 Pounds
Chlorine	5,000 Gallons
Cyclohexylamine	5,000 Gallons
Dipropylene Glycol Methyl Ether	5,000 Gallons
Bromochlorodifluoromethane	5,000 Gallons
Ethyl Vinyl Acetate	5,000 Gallons
Sodium Dioxide	5,000 Millicures
Acetone	2,500 Gallons
Herbicides/Pesticides	1,500 Gallons

Source: State Fire Marshal Data for ~300 Facilities above EWEB Intake

Type of Threat	Most Probable Chemicals
Truck Transport	Petroleum Products
	Fertilizers
	Pesticides
Helicopter Transport	Fertilizers
	Pesticides
Accidents/HazMat Spills	Petroleum Products
Fixed Facilities Near River	Petroleum Products
	Fertilizers
	Sodium Hydroxide

Participating Agencies

- McKenzie Fire & Rescue
- McKenzie Watershed Council
- Mohawk Rural Fire
- Upper McKenzie Rural Fire
- Springfield Fire & Life Safety
- Springfield Public Works
- Springfield Environ Srvcs
- Eugene Fire & EMS
- Lane County Public Works
- Lane County Public Health
- Lane County Sheriff
- Springfield Utility Board
- Rainbow Water District
- Region 2 HazMat Team
- Lane Council of Governments
- Lane Air Pollution Authority
- Oregon DEQ
- Oregon Health Division
- Oregon DOT
- Oregon Fish & Wildlife
- Oregon State Police
- Oregon Water Master
- Weyerhaeuser
- US EPA
- Army Corps of Engineers
- US Forest Service
- US BLM

interagency response team
McKenzie Watershed Emergency Response

OBJECTIVES

- To recognize and be prepared for events that have a low likelihood of occurring, but would cause extensive problems to Eugene's water supply.

MWERS Provides Responders With:

- Response Information (GIS): compiled and updated from partner agencies and easily accessible for first responders ($65,000 in grants).

- Response Equipment and Resources: inventoried from 27 federal, state, and local agencies ($441,000 in grants for 3 response trailers, laptops, handhelds, mobile color printers, GIS software, GPS units)

- Interagency Training/Drills: conducted 16 trainings and drills involving 386 people from 33 agencies and organizations ($157,000 in grants)

Response Strategies

- Most likely threat to the watershed is petroleum (86% of chemicals stored, used, transported, spilled are petroleum products).
- Mapped “slow water” areas on river (helicopter & boat).
- Developed 49 response strategies in the watershed at accessible areas w/slow water.

Location of Response Strategies, McKenzie Watershed

East River Boom Deployment

Bank to Bank Rope Anchor System

Fast River Boom Deployment

Bank to Bank Rope Anchor System

McKenzie Watershed Response Team
McKenzie Watershed Emergency Response

INTERAGENCY RESPONSE STRATEGY IMPLEMENTATION DRILLS

INTERAGENCY RESPONSE STRATEGY IMPLEMENTATION DRILLS

INTERAGENCY RESPONSE STRATEGY IMPLEMENTATION DRILLS

19

Our Goal

- Provide first responders with the tools they need to avoid confusion and implement response actions to stabilize an incident within the initial hours of a spill or chemical release.

AGRICULTURE

Sediment/erosion
Pesticides
Fertilizer
Fecal bacteria

Agricultural Land in the McKenzie River Watershed, Upstream of EWEB's Drinking Water Intake

Distribution of Crops in the McKenzie

Back of Envelope Assessment

- Used U.S. Geological Survey 1997-98 study of Willamette Valley typical pesticide use by crop type.
- Applied typical pesticide use to crop types in McKenzie.
- Initial evaluation of potential threat from runoff from agricultural fields.
- Approx. 6,700 lbs pesticides applied annually.

Annual Pesticide Use By Crop

Crop Type	Total lbs Active Ingredient
Hazelnuts	2,857
Hay	2,100
Grass Seed	813
Pasture	340
Christmas Trees	203
Blueberries	125
Nursery	72

Annual Pesticide Use By Crop/Acre

Crop Type	Total lbs Pesticide/acre
Hazelnuts	3.8
Nursery	3.8
Blueberries	3.7
Grass Seed	2.5
Hay	1.2
Pasture	.8
Christmas Trees	.5

McKenzie Watershed Agricultural Census

Total Pounds Per Acre of Pesticide Application

0.00 - 0.13 | 0.14 - 0.70 | 0.71 - 1.20 | 1.21 - 2.85 | 2.86 - 4.13

Sheet 1

N

Feet

0 2,000 4,000

EWEB

LCOG Lane Council of Governments

April 5, 2005

Agriculture Relative High Risk Areas In Lower McKenzie Watershed

THE LONG-TERM SOLUTION:

Watershed Protection Through Community Support of Agriculture – increase economic viability of farming while reducing chemical use

AGRICULTURAL CHEMICAL REMOVAL PROJECT 2006

Farm Chemicals

Assistance

Collection

Ag chemical roundup removed 44 tons of old pesticides and other chemicals from 126 area farms

Organic Certification Assistance

58D
72G
1B
MEAD-05
MEAD-01
MEAD-02
MEAD-04
61
MEAD-03
48
W
61
122
61
104G
104G
N
W
E
S
610
305
0
610 Feet
Composite Soil Sample Location

Building Partnerships

- OSU Ag Science
- OSU Inst. For Natural Res
- OSU Extension Service
- U of O Landscape Arch.
- USDA NRCS
- **Upper Willamette SWCD**
- McKenzie WC
- Lane Council of Govern.
- 68 Farmers/Producers
- Hazelnut Association
- Ecotrust
- **Cascade Pacific RC&D**
- Oregon Dept of Ag
- Willamette Farm & Food
- Food For Lane County
- NCAP
- Farm to School Program
- McKenzie River Trust
- Lane Community College

NFWF Grant Project

MENU:

- Reduce Chemical Use/Organic
- Nutrient Management
- Access Local Markets
- Remove Old Ag Chemicals
- On-Farm Renewable Energy
- Energy/Irrigation Efficiency
- Habitat Restoration
- Ag/Conservation Easements

Demonstration Farm

- 13 Partners
- Demonstrate HFCW concepts

Summary

- Understand threats, trends, stakeholder needs, partner strengths to see bigger picture w/long-term perspective
- Have solid monitoring foundation
- Focus on smaller win-win projects to build relationships and grow toward longer-term goal
- Flexibility, patience and being opportunistic – good solutions attract funding

http://www.eweb.org/waterquality/protection

Contact Karl Morgenstern at:

(541) 685-7365 or via e-mail Karl.morgenstern@eweb.org

Best Practices for Groundwater Protection

Recognizing and Prioritizing Potential Risks

Dennis Nelson*

GSI Water Solutions, Inc.

*Formerly with Oregon OHA Drinking Water Program

Protecting a Community's Source of Drinking Water Requires:

- Recognition of the resource
- Recognition of the connection between land use activities and water quality
- Recognition of the potential risks
- Recognition of the susceptibility of drinking water to those risks/threats

Source of Information

- Source Water Assessments: 1996 Amendments to Safe Drinking Water Act
- Purpose of SWAs: To provide information water systems need to protect their resource
  - Identification of drinking water source area
  - Inventory of potential contaminant sources
  - Determination of the susceptibility of the drinking water to those PCSs
- Most PWSs have received reports

What Protection Steps Should We Take?

- Where is the Drinking Water Source Area located and who has jurisdiction.
  - Within city limits
  - Extends into the county
  - Rural, private ownership
- Partnerships need to be developed

Community Dilemma

- How do we use the information provided in the Source Water Assessment?
- What actions can we take that will actually work?
- Who should be involved in these decisions?
- What should we do first and where?

Developing Protection Strategies

- Use Source Water Assessment to identify high- and moderate- risks.
  - PCS Risk factors
  - Aquifer sensitivity
- Evaluate based on
  - Susceptibility at given location
  - Benefit achieved (reducing the risk to water supply)
  - Challenges (time to complete, staff effort, total cost)
  - Community buy in (does the community see the benefit?)

Implementation Matrix: Prioritizing the Approach*

Each site is evaluated w/respect to benefit and challenge

Benefit / Challenge	Higher	Moderate	**Lower**
Lower	High Risk Site Easy to do		
Moderate			
Higher			Low Risk Site Hard to do

* OHA/DWP

Value: Green > White > Red

Benefit Evaluation: Potential Contaminant Source andAquifer Sensitivity

High

Moderate

Low

1. Soil and subsoil permeability
2. Depth to aquifer

Benefit Evaluation: Susceptibility

Water Town Well 1	High Aquifer Sensitivity	Mod Aquifer Sensitivity	Low Aquifer Sensitivity
High Risk PCS	**1 Sewer Lines** **3 Auto Repair Shop** 10 Machine Shop	**18 Machine Shop** *6 High density Housing* 12 Stormwater drywells *19 City shop* *20 Auto body shop*	*15 Abandoned Wells*
Moderate Risk PCS	**2 Furniture/Lumber** **4 Construction Area** *8 Food Processing*	*5 Junk/Scrap/Salvage Yd* **7 City Park** 9 Land Application Site 14 Irrigated Crops	**16 Transportation Freeways** 17 Transportation Railroads
Low Risk PCS		11 Fireworks Distributor **13 Homesteads**	

Susceptibility: Red = higher; Yellow = moderate; Green = lower

TOT (**<2**, *2-5*, >5 yr)

Ranking Risks: Susceptibility and Location (TOT)

- Susceptibility Score (S) from previous table
  - High = 3
  - Moderate = 2
  - Low = 1
- Time of Travel Score (T) based on location of PCS
  - < 2yr TOT = 3
  - <2 - <5 yr TOT zone = 2
  - >5yr TOT zone = 1
- Benefit Score = S x T

Implementation Matrix

PWS Name: **Water Town** PWS ID# **419999 ½**			
Implementation Impact/Benefit based on Susceptibility and Time-of-Travel Zone: Combined List			
Time Frame	Higher Benefit Score (= 9)	Moderate Benefit Score (= 6)	Lower Benefit Score (= <6)
To Be Determined*	**1 Sewer Lines** **3Auto Repair Shop** **2 Furniture/Lumber** **4 Construction Area** **18 Machine Shop**	**8 Food Processing** **7 City Parks** **19 City Shop** **20 Auto Body Shop**	**10 Machine Shop** **9 Land Application** **14 Irrigated Crops** **11 Fireworks Dist** **13 Homesteads** **15 Abandoned Wells** **16 Roads** **17 Railroads**
Up to 6 months			
6 months to 2 yrs			
Greater than 2 years			

***Time elements in the table should be completed with input from the community**

GSI Water Solutions, Inc.

Implementation Matrix: Road Map to Protection*

Each site is evaluated w/respect to benefit and challenge

Time \ Benefit	Higher	Moderate	Lower
6 months	**2 Furniture/Lumber** **4 Construction Area**	**7 City Parks** **19 City Shop**	**11 Fireworks Dist** **13 Homesteads**
6 mos. to 2 years	**3Auto Repair Shop** **18 Machine Shop**	**8 Food Processing** **20 Auto Body Shop**	**10 Machine Shop** **15 Abandoned Wells** **16 Roads**
> 2 years	**1 Sewer Lines**		**9 Land Application** **14 Irrigated Crops** **17 Railroads**

* OHA Drinking Water Program

Oregon Examples of Source Water Protection Activities

Groundwater Systems

City of Cave Junction Septic Tanks or Sewer?

City of Florence

PCS Inventory: Present and Past Sites

Protection Based on Future Landuse

Potential Strategies

- Adopt “Drinking Water Protection Overlay Zone”: Add additional requirements to existing zoning
- Re-designate specific properties to maintain low density in residential areas (large lot zoning)
- Prohibit certain land uses in different time of travel zones
- Transfer of Development Rights (outside of DWPA)
- Amend drainage requirements for stormwater
- Regulate hazardous materials transport

City of Springfield

GSI Water Solutions, Inc.

Springfield Overlay Zone Restrictions

GSI Water Solutions, Inc.

Tool to Determine Chemicals that are "Harmful to Groundwater"

- Springfield's Development Code establishes procedures and standards for businesses that store or use >20 gallons of "harmful" chemicals
- How to objectively determine whether or not a chemical is "harmful"
- **Chemical Characteristics**
  - Solubility
  - Tendency to attach to soil particles
  - Vapor pressure
  - Persistence of the chemical (half-life)
- **Site Characteristics**
  - Organic matter content
  - Soil permeability
  - Depth to the water table
- **Time of Travel Zone**
- Spreadsheet Analysis
- Relative Risk Score (0-10)*

Influence of Site Location

Site A: Kw = 8 ft/d; foc = 0.001; depth = 5 ft

Site B: Kw = 0.5 ft/d; foc = 0.01; depth = 50 ft

Stormwater Solutions: Recharge vs. Impact to Groundwater using Grassy Swales

Permeability of Vadose Zone

Recharge via Vegetated Swales

- Provides for stormwater recharge
- Potential for reducing risk of stormwater contaminants, e.g., petroleum products, industrial/commercial chemicals, pesticides, pathogens, etc.

Grassy Swale

C_{wt} = function of

1. C_{sw}
2. permeability
3. organic matter
4. depth to WT
5. persistence

Recommendation for Swale Construction

- Where water table is 10 feet or less, swale base must comprise a 50:50 mixture of loam and compost a minimum of 24 inches in thickness
- Where water table is >10 feet, 12 inches of loam-compost mixture is sufficient
- Within 2-year time-of-travel of source water protection areas, 24 inches of loam-compost mixture is required

Water Quality: Value of Planning and Protection

- Protecting the current resource
- Preserving water quality
- Preserving public trust
- Protecting water infrastructure investment
- Protecting economic value, e.g., property, business
- Avoiding costly treatment, M&O
- New regulations, emerging contaminants of concern

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Best Practices for Risk Assessments:
Using Asset Management as a Business Practice Improvement

PNWS-AWWA Water Resources Committee
Pre-Conference Workshop, May 2nd 2012 - Yakima

Terry Martin, P.E., Seattle Public Utilities

Seattle Public Utilities

Seattle Public Utilities Background:

Seattle Public Utilities (SPU) is a Municipal Utility Owned Directly by the City of Seattle and Funded Entirely by the Rates Paid for our Services

- SPU provides retail water service to the citizens of Seattle and wholesale water service to 21 water purveyors in the Seattle Metropolitan Area.
- Wastewater within the City of Seattle is collected by SPU and treated by King County

Seattle Public Utilities

SPU Background (Cont'd)

Four Utilities (Water, Wastewater, Drainage, & Solid Waste) with Over $4.5 Billion in Assets

- 1,830 mile water system serving approximately 1.3 million retail and wholesale customers
- 2,020 mile drainage and wastewater system serving approximately 700,000 retail customers
- 800,000 tons of solid waste is collected and disposed of annually
- 1,500 - 2,000 customer calls per day
- Annual operating budget of $630+ million
- Ten year capital program of ~$1.3 billion
- 1,350 employees

Seattle Public Utilities

The General Lay of the Land in the early 2000's...

- Tightening regulations
- Mounting rate pressure and public scrutiny
- Aging infrastructure
- Increasing emphasis on the environment

Seattle Public Utilities

Starting in 2002...A New Direction at SPU

- A new focus on Asset Management
- Learn from the best - Technical exchange with Hunter Water in Australia
- Fit best practices into our needs
- Change the culture

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Define Service Levels

To Create This We Are Working to

- *Find out from customers what services are most important to them.*
- *Set Service Levels and make investments needed to meet them – now and into the future.*
- *Establish and measure Performance Indicators.*

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Residential & Business Customer Surveys

How Are We Doing?

Customer Satisfaction Service Levels for Residential Customers

SERVICE LEVEL TARGET	TARGET MET IN 2007?
Receive a satisfaction score of at least 5.0 (on a scale of 1 to 7) for each of SPU's services and SPU's customer service attributes	Yes
Reduce litter and graffiti so that 80% of residents are satisfied	Yes

Actual 2007 Scorings:

- SPU services received scores ranging from 5.52 to 6.48.
- SPU customer service attributes received an average score of 5.67.

Business Services	2007 Scores	2005 Scores
Drinking water quality	6.04	5.63
Water supply	6.48	6.31
Garbage pickup	6.29	6.09
Sewer services	6.38	6.23
Recycling services	6.18	6.05
Storm water drainage	5.52	5.50
Yard and food waste pickup (in 2005, this was just yard waste pickup)	6.07	5.78
Transfer stations	5.63	5.52
Customer service attributes	5.67	5.72

- SPU is generally meeting its residential and business customer service level targets for satisfaction

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Service Levels & Performance Indicators

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To Create This We Are Working to

Define

Learn About Risk

- *Understand our highest risk activities.*
- *Understand the likelihood and consequence of failure of our assets.*
- *Manage based on risk cost and the cost to mitigate risk.*
- *Reduce asset risk through capital investments, or changed maintenance practices and response protocols.*

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Risk Assessment

1. Define failure.
2. Collect and analyze data.
3. Determine Risk...

Risk Cost = Likelihood of Failure x Consequence of Failure

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Corporate Risk Management

RISK SIGNATURE LEVEL DETERMINANT

	Consequence				
Likelihood	Minimal	Minor	Moderate	Major	Extreme
Almost certain	M	M	H	C	C
Likely	M	M	H	C	C
Possible	L	M	M	H	H
Unlikely	L	L	M	H	H
Rare	L	L	M	M	M

L	Low
M	Medium
H	High
C	Critical

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Corporate Risk Categories:

- Public Trust
- Regulatory
- Asset and Service Reliability
- Legal
- Environmental
- Workforce
- Financial
- Public Health

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Corporate Risk Management
An Example: Water Conservation Policy

Alternative Conservation Baseline Strategies	Description and Performance Measure	Public Trust Risk	Regulatory Risk	Asset and Service Reliability Risk	Legal Risk	Environmental Risk	Workforce Risk	Financial Risk	Public Health
Do Nothing	No messaging or incentives. No performance measure.								
Awareness Campaign	Messaging; no incentives. Less intense than 1% program. Customer survey to assess effectiveness. Results estimated <.3 MGD annual savings.								
Program to Shave Peak Investment Variable	Less intense than 1% program. Set performance goal for peak season. Results could range from <.3-.5 MGD peak season savings.								
Low Intensity Program / Investment	Less intense than 1% program. Set performance goal on per capita demand. Results could be in range of .7 MGD annual savings.								
Medium Intensity Program / Investment	Similar intensity to 1% program. Set performance goal to keep demand flat. Results could range from 1-1.5 MGD annual savings.								
High Intensity Program / Investment	Intensity estimated to be greater than 1% program. Set performance goal to reduce total demand. Results could be above 1.5 MGD annual savings.								

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Asset
Risk Assessment

An Example: Sewer Pipes

Risk is Minimized by Concentrating Limited Resources on Sewer Pipes with the Highest Risk Cost of Failure

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Asset Risk Assessment

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Asset Risk Assessment

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Asset Risk Assessment

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Asset Risk Assessment

Risk Helps to Define Strategy for Management of Assets

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Risk Reduction: Valve Criticality Model

Dayton Ave N & N 115th St

Before Valve Criticality Model:
Single Valve Shutdown Block Covering 321 Customer Taps

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Risk Reduction: Valve Criticality Model

Dayton Ave N & N 115th St

Valve Criticality Model Recommendation:
Add Two Mainline Valves at a Total Cost of Less Than $10,000

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Risk Reduction: Valve Criticality Model

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Define

Learn

Focus On Life Cycle Costs

To Create This We Are Working to

Make investment decisions – large and small – based on understanding of life cycle costs and benefits.

- Initial Capital Investment
- Expected Life
- Maintenance and Operation Costs
- Other Asset Costs such as Electricity
- Salvage Value
- Disposal Costs

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To Create This We Are Working to

Define

Learn

Focus

Use Triple Bottom Line

Assess projects and initiatives based on the Triple Bottom Line

- *Social*
- *Environmental*
- *Financial*

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Triple Bottom Line Costing: An Example

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Triple Bottom Line Costing: An Example

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Triple Bottom Line Costing: An Example

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An Example: Tying Together Service Levels, Lifecycle Costing, and the Triple Bottom Line

A Sample "Bathtub Curve" for the Sewer Maintenance Program

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An Example: Tying Together Service Levels, Lifecycle Costing, and the Triple Bottom Line

A Sample "Bathtub Curve" for the Sewer Maintenance Program

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An Example: Tying Together Service Levels, Lifecycle Costing, and the Triple Bottom Line

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An Example: Tying Together Service Levels, Lifecycle Costing, and the Triple Bottom Line

A Sample "Bathtub Curve" for the Sewer Maintenance Program

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To Create This We Are Working to

- *Gather more asset attribute information, such as….*
  - *Size, material, age*
  - *Condition*

- *Needed for tools such as risk models*
- *We have also created a corporate specifier for asset data systems in order to ensure that they are well coordinated and that investments make good business sense*

Seattle Public Utilities

Data and Data Systems

Asset Data

- Age, material, location, etc
- History (problem history, maintenance history, etc)
- Condition
- Consequence of failure

Data Systems

- Provide for analysis
- Mobile systems
- Asset costing

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To Create This We Are Working to

- *Develop planning documents for each asset category*
- *These allow us to better understand the assets and risks associated with them in order to develop renewal plans and maintenance strategies*

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Strategic Asset Management Plans

- Planning documents for asset categories
- Allow us to better understand the assets in order to develop Action Plans as well as renewal & maintenance strategies

Action Plan Examples:

Analyze and update mainline maintenance strategy

Develop Annual O&M Workplan

Develop Performance Targets for CIP Replacement and Renewal Projects

Action Plan Number	O&M	CIP	Involved Parties (Responsible Party in Red)	Estimated Date of Completion
1	X	X	WW, CPP, SAM	Ongoing
2		X	WW, SAM	Ongoing
3		X	WW, SAM	Q3 2011
4		X	SAM, WW	Q2 2011
5	X		WW, SAM, O&M, SC	Q2 2011
6	X		O&M, WW, SAM	Q1 2011
7	X	X	WW, O&M	Q3 2011
8	X	X	WW, SAM, Tech	Q4 2011
9	X		O&M, WW	Q3 2011
10	X	X	WW	Ongoing
11		X	WW, SAM	Q3 2011
12		X	WW	Q4 2011
13		X	WW, SAM	Q3 2011
14		X	WW, Tech	Q4 2011
15	X		O&M, WW	Q4 2011
16		X	WW	To Be Determined

Seattle Public Utilities

To Create This We Are Working to

We are working to clarify roles, responsibilities, accountabilities, and decision making authority throughout the organization

Seattle Public Utilities

Roles & Responsibilities

Clarify Roles, Responsibilities, & Accountability

- Decision-making
- Distinguish between specifiers and service providers within the utility

Seattle Public Utilities

To Create This We Are Working to

- *We have created a more explicit decision making body at SPU*
- *Major decisions are made based on asset management concepts*
- *In a transparent manner*

Seattle Public Utilities

Asset Management Committee

Create a more explicit capital resource decision making body where decisions are made based asset management concepts and in a transparent manner.

Seattle Public Utilities

To Create This We Are Benchmarking

- *We have participated in various industry benchmarking efforts*
- *Our goal is to understand how we're doing relative to other similar organizations*

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Benchmarking

Water Services Association of Australia
SPU Benchmarking Results

Service Level vs. Cost

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How Far Have we Come?

Service Levels	2002	Future
Risk	2002	Future
Life Cycle Costs	2002	Future
Triple Bottom Line	2002	Future
Data	2002	Future
SAMPs	2002	Future
R & R	2002	Future
AMC	2002	Future
Measure Results	2002	Future
Benchmark	2002	Future

Questions & Discussion

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Seattle Public Utilities

www.geosyntec.com

Best Practices for Strategic Water Operations and Planning

Best Practices for Technology and Modeling

Robert Annear, Senior Engineer, Ph.D., P.E.
Geosyntec Consultants

Geosyntec consultants

engineers | scientists | innovators

Presentation Outline

- Source water protection
- Supply
  - Rivers
  - Reservoirs
  - Snowpack
  - Groundwater
  - Integrated surface water / groundwater
- Distribution systems
- Decision support systems
  - Instruments
  - Tools
- Integration with decision making

Identifying the Problem/Issue

- What is the water quantity or quality issue conceptually?
  - Need a conceptual model of the system or problem
- Model needs to:
  - Describe appropriately the hydrodynamic and water quality changes
  - Be theoretically valid, based on physics, biology and chemistry
  - Easily adapted to the site specifics of the water body of interest.

Source Water Protection

Objective: Assess risks to source water quality and develop strategies to address

- Basin analysis
  - Collect and review watershed data
    - Develop a GIS database
    - Assess data gaps
  - Assess risks
    - Conduct GIS spatial analysis (septic systems, land use etc.)
    - Developing ranking and prioritization scheme
    - Prioritization of risks
  - Watershed and pollutant load modeling
  - Water quality monitoring
- Take action
  - education, emergency preparedness etc.

Watershed and pollutant load modeling

- Infiltration and ET
- Runoff (natural, urban, agriculture)
- CSOs/SSOs/WWTPs (point sources)
- Septic systems and Forestry (non-point sources)
- Spill response

- Example Tools: WARMF, HEC-HMS, HSPF, SWMM (PC, XP, EPA), BASINS, SWAT, and WMS

Source: Marsh and Dozier, Landscape: An Introduction to Physical Geography

Supply, Rivers

Objective: Manage water supply quantity and quality

- Quantity
  - Water availability, flow duration
  - Seasonality
  - In-stream flow requirements (fish)
  - Source supply, multi-objective management
  - Irrigation demands/on-time delivery
- Quality
  - Temperature
  - Turbidity
  - Algal blooms
  - Spills, chemicals, pollution etc.

Hydraulics/Hydrodynamics

Flow-duration and pollutant transport

- Longitudinal division of river reach (1-D or 2-D)
- Ecologically significant flows
- 1-D: CE-QUAL-R1, DYNHYD, EPA SWMM, HEC RAS, HEC-5, MIKE11, UNET
- 2-D: MIKE 21, FLO-2D, EFDC, ADCIRC, RMA2, GEMSS).

2-D, xy model (vertically averaged)

1-D, laterally and vertically averaged

Supply, Reservoirs

Storage Operations

Objective: Manage water supply quantity and quality

- Management
  - Hydropower
  - Flood control
  - Irrigation
  - Recreation
  - Fish passage
  - Downstream impacts (TMDLs, ESA)
  - Optimization
- Quality
  - Sedimentation
  - Taste and Oder
  - Temperature Stratification
  - Algal Blooms

Hydrodynamics

Reservoir Performance, Supply Quality

- Laterally averaged (2-D) or 3-D
- Water supply management, quality
- Competing demands: irrigation, recreation, fish passage, supply
- 2-D: CE-QUAL-W2
- 3-D: MIKE 3, EFDC, GEMSS, Computational Fluid Dynamics (CFD)

xz model (laterally averaged)

no averaging

Supply, Rivers & Reservoirs

- Temperature
- Total Dissolved Solids
- Generic Constituents
- Total suspended solids
- Phosphate-P
- Ammonia-N
- Nitrate & Nitrite-N
- Dissolved silica
- Particulate biogenic silica
- Iron
- Organic matter
- CBOD
- Algae
- Epiphyton
- Zooplankton
- Macrophytes
- Dissolved Oxygen
- Total Inorganic Carbon
- Alkalinity

Water Quality

- Source water quality and management
- Eutrophication
- Bacteria
- Chemicals
- Examples: EFDC, GEMSS, Qual2k, PHREEQC, QUAL2E, SPARROW, CE-QUAL-W2

Snow Pack

Accumulation and Ablation

Objective: understanding your "frozen reservoir"

- Snow water equivalent and snow covered area
- Spatial distribution of snowfall and/or snowpack
- Interpolation of in-situ measurements (e.g., snow pillows)
- Remote sensing (radiometry, spectrometry, LiDAR)
- Temperature-index and energy balance modeling methods
- Integration with GIS data
- Examples:
  - SNOW-17
  - Snowmelt Runoff Model (SRM)
  - SNTHERM
  - SAST
  - BATS
- Effects of climate change

Wellhead Protection and Management

Objective: Manage water supply quantity and quality

- Multi use impacts
- Contamination Impact
- ASR
- Conjunctive use
- Water quality

Source: Gupta, 2008

Groundwater hydrology and pollutant transport

- 2-D or 3-D
- Groundwater recharge
- Fate and transport
- Examples:
  - AQUIFEM
  - FEMWATER
  - HELP
  - MODFE
  - MODFLOW
  - HYDRUS
  - PLASM
  - SHARP
  - SLAM

Subsurface Flow

Integrated Surface/Groundwater Systems

Objective: Manage water supply, where are the conflicts

- Distributed hydrology
- Surface water runoff
- River modeling (1-D)
- Groundwater, conceptual to 3-D model
- Examples:
  - GSFLOW (PRMS and MODFLOW-2005), USGS (02/2012)
  - MIKE-SHE (DHI)
  - Integrated Surface Water and Groundwater Model (WRIME)
  - FLOW-3DL and DIVAST, National Technical University of Athens

Surface and Subsurface Flow

Source: DHI

Objective: Manage water distribution, quality, cost, and efficiency

Hydraulic Routing

Pressurized pipe networks

- Supply and demand
- Pump curves
- Water hammer
- Optimization
- Water quality mixing/residual
- Examples:
  - EPANET
  - H2OSurge
  - MIKE URBAN/NET
  - H2ONET
  - InfoWorks
  - Hammer
  - WaterGEMS

http://www.epa.gov/nrmrl/wswrd/dw/epanet.html

Definition of "Internet-of-Things"

- "things having identities and virtual personalities operating in smart spaces using intelligent interfaces to connect and communicate within social, environmental, and user contexts" (EPoSS 2008).

European Technology Platform on Smart Systems Integration

- Geosyntec is seeing rapid and ubiquitous adoption occurring in civil environments

Smart Monitoring

Example: ioBridge controllers during installation, St. Louis, MO

ioBridge Pro controller

What are Decision Support Systems & Tools?

Tools (often software) that makes sense of disparate data and information in a decision space by presenting it in a compelling format

Decision Support Systems

Needs and Functions

- Integration of internet based data into infrastructure logic
- Predictive control
- Integration of modeling into control in real-time
- Adaptive management solutions
- Verify and report environmental compliance
- Alert notification
- Integration of disparate infrastructure
- Efficient use of resources
- Hazard monitoring
- Real time data acquisition and management
- Data and model management
- Watershed system management
- Flood forecasting
- Irrigation system management
- Added benefits with reduced costs
- Real time control of infrastructure

Decision Support Systems

Possible Water Supply Decision Support Tool

Geosyntec consultants

Decision Support Tools, Software Development

- Data Management Systems
- GIS Tools and Interfaces
- Data Integration and Visualization
- Data Processing and Analysis (large data sets, spatial data sets)
- Web Portal Design
- Multi-User Interfaces (decision makers, operators, interested stakeholders) for models, databases, and online web portals.
- Custom Software Tool Development
- iPad®/Tablet Applications
- Large Database Management

Thank you

Questions

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Modeling Process and Best Practices

- Defining goals and objectives for model
- Assessing data availability and needs
- Appropriate level of detail
- Budgeting
- Scopes of work
- Modeling deliverables
- Technical considerations

Identifying the Problem/Issue

- What is the water quality problem or issue conceptually?
  - Need a conceptual model of the system or problem
- Model needs to:
  - Describe appropriately the hydrodynamic and water quality changes
  - Be theoretically valid, based on physics, biology and chemistry
  - Easily adapted to the site specifics of the water body of interest.

Defining Model Goals and Objectives

- Questions to ask (not a complete list)
  - What is the problem or issue?
  - What questions do you want the model to answer?
  - What is the spatial scale?
  - What is the level of spatial detail needed (1-D, 2-D, 3-D)?
  - What is the temporal scale?
  - How dynamic is the system?
  - What needs to be managed?
  - What operations are involved?
  - Are there regulatory drivers? Design drivers?
  - What is the timeframe for completing the study?
  - What is the budget available?

Model Performance

- Performance of a numerical model is dependent on the following:
  - Problem identification
  - Model type selection and how well it represents the problem
  - Computational configuration (grid and assumptions)
  - Model calibration, including sensitivity analyses
  - Model application to management scenarios

Model Selection

- Identifying the appropriate model should focus on questions:
  - What are the physical processes in the model and are they sufficient for the solving the problem?
  - What physical processes are missing from the model?
  - How are the various processes represented in the model and are they appropriate for the site?
  - What processes have model coefficients and can they be adjusted?

Model Selection

- You should also consider site specific information:
  - What are the physical characteristics of the site?
    - River/reservoir/estuary
    - Hydrodynamic characteristics
    - Water quality characteristics
    - Hydraulic facilities and features
    - Operations
  - What are the operational or management objectives?

Model Selection

- Finally you should also consider:
  - What resources are available for the project?
    - Data availability
    - Time constraints
    - Available staffing and expertise
    - Budget

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How to Get the most out of your Consultant Or, How to Use Water System Planning as a Tool for Developing a More Efficient Utility

PNWS
IDAHO • OREGON • WASHINGTON

GO WITH THE FLOW
2012 PNWS • YAKIMA, WA

Dale Jutila

May 2, 2012

Overview

1. Utilities Experiencing Revenue Gaps
2. Mounting Pressure to Demonstrate Efficiency
3. Water system planning process can demonstrate and improve performance.

Get the most out of your Consultant – use *Master Utility Planning* to develop a more efficient utility

1. Think about broader planning, beyond infrastructure
2. Challenge consultants
3. Be open to suggestions

Ten Attributes of Effectively Managed Water Sector Utilities

October 2011 Journal AWWA, State of the Industry Survey lists top issues of utility respondents

October 2011 Journal AWWA, State of the Industry Survey lists top issues of utility respondents

Water Utilities are evaluating strategies to deal with economic pressure of revenue gaps

- Understand Revenue Risks
- Delay Expenditures
- Develop New Revenue Streams
- Reduce Financing Costs
- Reduce Expenses
- Educate Public
- Evaluate Value of Water

Typical Water System Plan Objectives focus on Developing New CIP

1. Description of Water System
2. Basic Planning Data and Water Demand Forecast
3. System Analysis
4. Conservation, Water Rights, Reliability and Interties
5. Source Water Protection
6. Operation and Maintenance Program
7. Design and Construction Standards
8. Capital Improvement Program
9. Financial Program
10. Supporting Documents

Opportunities to improve utility efficiency and financial outlook

- Repair and Replacement
- Supply Reliability Issues
- System Analysis
- **Operations**
- **Utility Management**

Opportunities to improve utility efficiency and financial outlook

Repair and Replacement

- Risk-reduction Driven
- Proper Level of Investment
- Strategies for Infrastructure Replacement

Opportunities to improve utility efficiency and financial outlook

Supply Reliability Issues

- Climate Change
- Water Rights
- Storage
- Alternative Supplies

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Opportunities to improve utility efficiency and financial outlook

System Analysis

- Energy Efficiency, Optimization
- System wide fire flow evaluations
- Extended period simulations
- Energy efficiency/SCADA Information
- Impacts of reduced demand

Opportunities to improve utility efficiency and financial outlook

Operations

- Prioritized O&M Activities
- Emergency Planning
- Prioritized Operations
- SCADA Strategy, Security
- Communications Reliability
- Energy Efficiency
- CMMS

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Opportunities to improve utility efficiency and financial outlook

Utility Management

- Level of service goals
- Revenue streams
- Revenue risk profile
- Succession planning
- Financing strategies
- Training
- Sustainability overlay (Must-Should-Can-Will)

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Realistic, prioritized risk evaluation sets the stage for a financially sound asset investment strategy

Asset Management Approach: Consequence x Likelihood = Risk

- Identify assets presenting highest risk
- Evaluate their need for risk-reduction improvements
- Build on Previous Work
  - Vulnerability assessments
  - Emergency management plans
  - Leak testing
- Field condition assessment
  - Defined, repeatable evaluation
  - Visual, structural, electrical tests
  - SCADA Review

Realistic, prioritized risk evaluation sets the stage for a financially sound asset investment strategy

Asset Management Approach: Consequence x Likelihood = Risk

- Use tools to help prioritize risk-reduction measures
  - Workshops
  - KANEW, SCREAM, ProjectSelect, Excel
- Plan replacements and improvements according to utility policies
  - Financial policy
  - Resource policy

Manage supply reliability risks to strengthen public confidence and protect revenue

- Evaluate Your Supply Reliability
  - Identify the Financial Impact of Water Restrictions: $150 per household, (Grafton & Ward, 2008)
  - Evaluate potential impacts of Climate Change
  - Understand Municipal Water Law and what you need to do protect your Water Rights
- Evaluate options for New Water Supply
  - New water rights & mitigation
  - Reuse
  - Peaking storage
  - Aquifer Storage and Recovery,
  - Off line storage
  - Purchase

Manage supply reliability risks to strengthen public confidence and protect revenue

- Reuse (Trends)
- Cost reimbursement for Water Rights
- Desalination
- ASR & Groundwater Quality
- Water Rights Adjudication
- Climate Change

System analysis improves efficiency and mitigates risks

System Operations

- Energy Optimization
- SCADA /Control System Optimization
- Facility Evaluations

Hydraulic Modeling

- Understand Model Capabilities, Costs and Uses
- System Wide Fire Flow
- Extended Period Simulations
- Water Quality and Water Age

Operations reviews improve efficiency and level of service

Operations Task Prioritization

Process Facility and Equipment Reviews Evaluate

- Equipment and Process Efficiency
- Process Capacity
- Costs for Residual Disposal
- Processes to minimize chemical and energy consumption
- O&M tasks
- SOPs
- Automation/Control

Emergency Planning

Communications Reliability

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Management policies guide utility performance

Over-Arching Policies

- Levels of Service
- Resource Stewardship, Sustainability
- Regulatory Compliance
- Triple Bottom Line

Financial Policies

- Sources and Uses of Money
- Rate Study
- Asset Management
- Risk Management

Business/Accounting Policies

- Billing
- Meter Reading/Testing
- Cost of Water
- Discontinuation of Service
- Business Continuity
- GASB Compliance

People Policies

- Creating High Performing Teams
- Project Management Policies
- Training
- Human Resources
- Compensation

Marketing Policies

- Pricing Strategy
- Demand Management
- Revenue Risk
- Public Education

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Over-Arching: Utilities need to understand the cost of level of service policies

Policies will reflect the Vision and Mission of the Utility

- Vision and Mission
- Customer service
- Technical services
- Field services
- Water supply
- Water quality
- Response time
- Environmental stewardship, sustainable practices
- Greenhouse gas
- Residential sprinkler systems
- Hydrant maintenance costs

Regulatory compliance strategies control risks to quality and public perception

Develop Regulatory Pathway

- Evaluate current compliance
- Understand potential regulatory changes coming
- USEPA regulating contaminant classes
- Total Coliform Rule revisions
  - Distribution Water Quality BMPs
  - Distribution system backflow/ mini-surges
- Hexavalent Chromium
- Manganese
- DBPs
- PPCPs
- Microbial contaminants

Financial Policies Define the Best Use of Money

Financial Policies

- Sources of Money
  - Cost of money
  - Debt Servicing
  - Incentives for A/R
  - External Funding Sources
  - New Revenue Sources
- Investment Strategy

  Existing Assets
  - Repair & Rehabilitation
  - Risk Management

  Capital Improvement for Growth
  Regulatory Compliance
  - Risk Management
- Rate Studies/Cost of Service

Considerations

- How are project prioritized and approved?
  - BCA
  - TBL
- Are specific Benchmarks established for ROI?
- Can existing debt be reduced or refinanced?
- Are there alternative revenue sources?
  - Non-Potable water Supply
  - Energy
  - Rental
  - Resource management

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Capital planning and cost estimating policies control cost risks

Today's Needs

- Cost estimating
  - Procedures
  - Mitigating risk for large projects
- Prioritization
- Platform to allow utilities to update for budgeting

Cost Risk Mitigation

- Cost estimates based on materials takeoffs at planning stage
- Tied to indices that are updatable
- Schedule and Cost Risk Analysis

Business accounting policies affect revenues and costs

Accounting Policies

- Billing Practices
- Meters
  - Reading
  - Testing
  - Replacement
- Cost of Water
  - Purchases
  - Chemicals
  - Electricity
- Collections
- Business Continuity
- GASB Compliance

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People: Creating high performing teams reduces cost and improves customer service

High performing teams lead to:

- Low turn-over
- Reduced training costs
- Happy customers
- Improved performance

Actively marketing your product puts the utility in the "Revenue Driver's Seat"

- Pricing : Different from a rate study
  - Cost of Service
  - Base Rate
  - Price Elasticity
  - Develop a Revenue Risk Profile
- Public Education and Outreach
- Educate your Customers on the Value of Water
- Consider Demand Management as a Marketing Strategy
  - Conservation matched to supply

Get the most out of your Consultant – use *Master Utility Planning* to develop a more efficient utility

1. Think about broader planning, beyond infrastructure
2. Challenge consultants
3. Be open to suggestions

Ten Attributes of Effectively Managed Water Sector Utilities

Questions

Case Study for Stakeholder Involvement: Yakima River Basin Integrated Water Resource Management Plan

AWWA Presentation by Ben Floyd

Yakima, WA
May 2, 2012

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DEPARTMENT OF ECOLOGY State of Washington

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION

Best Practices – Top 10 for Stakeholder Engagement

1. Sponsor(s) committed
2. Adequate resources dedicated
3. Key parties involved and committed
4. Well-defined process: goal/product, schedule and decisions
5. Provide support
   - Technical
   - Communications

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Best Practices - Top Ten

6. Maintain momentum - make progress
7. Interests resolve issues - not sponsor(s)
8. Ad hoc committees focus on specific topics
9. Be flexible and adapt
10. Celebrate successes

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Case Study

YAKIMA INTEGRATED PLAN

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- **Basin Size = 6,155 sq. miles**
- **Irrigated cropland = 500,000 acres**
- **Avg. runoff = 3.3 MAF**
  Reservoirs store 1.0 MAF
  Deliveries = 1.7 MAF

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Water Problems in the Yakima River Basin

- **Adjudication ►** 30+ year effort to determine rights
- **Droughts/Water Shortages ►** 1 year out of 4 since 1990
- **Anadromous fish runs ►** Not sustainable
  - **Chinook, sockeye, coho, steelhead, bull trout ►** Extirpated, reduced, and/or threatened (300,000 to 960,000 historical, now averaging 10,000).
- **Climate change ►** Runoff timing changed and changing creating less snow and less summer water
- **Use by junior water users ►** Cabin owners and permit-exempt wells

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Water Problems Related to Water Utilities

- Creates uncertainty for growth projections
  - Future municipal and water system supplies potentially at risk
  - Land use and growth projections may not be realized
- Affects water management strategies
  - Supply management
  - Conservation
  - Rates
- Economic impacts on state and regional economy, and government revenues

Water Problems in the Yakima River Basin

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Yakima River Basin Integrated Water Resource Management Plan

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Initiate Process

- State commitment: staff and resources
- Federal commitment: staff and resources
- Outline planning process and schedule
- Establish Workgroup: local and regional commitments

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YRBWEP Workgroup Members

- Washington Department of Agriculture
- NOAA, National Marine Fisheries Service
- Benton County
- Yakima Basin Fish & Wildlife Recovery Board
- Yakima – Tieton Irrigation District
- Yakama Nation – Yakima/Klickitat Fisheries Project
- American Rivers
- Kittitas Reclamation District
- Yakima County
- City of Yakima
- Kittitas County
- Yakima Basin Storage Alliance
- Kennewick Irrigation District
- Yakama Nation – Natural Resources
- Washington Department of Ecology
- Washington Department of Fish and Wildlife
- US Fish and Wildlife Service
- Sunnyside Valley Irrigation District
- Roza Irrigation District
- Bureau of Reclamation

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Objectives

- Achieve consensus around a set of strategies for addressing water supply and streamflow imbalances as well as other aquatic resource issues

- A plan to move forward with a solution to the basin water shortages – Final IWRMP

- Affordable and adaptable program that can adjust to future needs of the basin to accommodate climate change and population growth

June 2009 to May 2012

June – December 2009

- Operating rules
- Consensus/decision-making process
- Confirm 7 Plan Elements and Actions
- Preliminary Integrated Plan

2010

- Develop technical memoranda
- Proposed Integrated Plan
- Hydrologic analysis
- Costs and benefits
- Decision document

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June 2009 to May 2012

2011

- Finalize plan
- Develop programmatic EIS
- Provide Workgroup updates
- Implementation Committee
- Early actions

2012

- Final PEIS
- Framework for Implementation
- Education and outreach
- Early actions

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Integrated Water Resource Management Plan (IWRMP)

- Categories:
  - Habitat
  - Water Supply
  - Structural and Operational Changes

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Integrated Water Resource Management Plan (IWRMP)

- Seven elements:
  - Fish Passage at existing reservoirs
  - Habitat protection and enhancements
  - New or expanded storage reservoirs
  - Groundwater storage
  - Enhanced conservation
  - Market-based reallocation of water resources
  - Structural and operational changes to existing facilities

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DEPARTMENT OF ECOLOGY State of Washington

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION

Yakima River Basin Integrated Water Resource Management Plan

Structural & Operational Changes

1. Raise the Cle Elum Pool by three feet to add 14,600 ac-ft in storage capacity.
2. Modify Kittitas Reclamation District canals to provide efficiency savings.
3. Construct a pipeline from Lake Keechelus to Lake Kachess to reduce flows and improve habitat conditions during high flow releases below Keechelus and to provide more water storage in Lake Kachess for downstream needs.
4. Decrease power generation at Roza Dam and Chandler power plant to support outmigration of juvenile fish.
5. Make efficiency improvements to the Wapatox Canal.

Enhanced Water Conservation

1. Implement an agricultural water conservation program designed to conserve up to 170,000 acre-feet of water in good water years.
2. Create a fund to promote water use efficiency basin-wide using voluntary, incentive-based programs. Focus on outdoor uses as top priority.

Habitat/Watershed Protection & Enhancement

1. Protect ~70,000 acres of land by acquiring high elevation portions of the watershed and forest and shrub steppe habitat.
2. Evaluate potential Wilderness, Wild and Scenic River, and National Recreation Area designations to protect streams and habitat.
3. Create a habitat enhancement program to address reach-level floodplain restoration priorities and restore access to key tributaries.

Market Reallocation

Employ a water market and/or a water bank to improve water supply in the Yakima River basin. Market reallocation would be conducted in two phases:

The near-term phase would continue existing water marketing and banking programs in the basin, but take additional steps to reduce barriers to water transfers.

The long-term program would focus on facilitating water transfers between irrigation districts. This would allow an irrigation district to fallow land within the district and lease water rights for that land outside the district.

Reservoir Fish Passage

Provide fish passage at:

1. Clear Lake
2. Cle Elum
3. Bumping
4. Tieton (Rimrock)
5. Keechelus
6. Kachess

Surface Water Storage

1. Build a 162,500 ac-ft off-channel surface storage facility at Wymer on Lmuma Creek.
2. Access an additional 200,000 ac-ft of water by tapping into inactive storage at Lake Kachess.
3. Construct a new dam at Bumping Reservoir to increase capacity to 190,000 ac-ft.
4. Begin appraisal of potential projects to transfer water from the Columbia River to the Yakima Basin.

Groundwater Storage

1. Construct pilot projects to evaluate recharging shallow aquifers via groundwater infiltration. Full scale implementation may follow.
2. Build an aquifer storage and recovery facility allowing Yakima City to withdraw water from the Naches River during high flow periods and store it underground for use during low flow periods.

Rev 4 11-30-11

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Power of the Top Ten in the Yakima Basin

- Unprecedented cooperation
- Interests aligned: irrigation/business, municipal, tribal, fisheries, environmental
- Making significant progress at State and Federal levels
- Opportunity for solving Yakima water problems has never been better!!

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For Information:

- Ecology's Website: http://www.ecy.wa.gov/programs/wr/cwp/cr_yak_storage.html

- Reclamation's Website: http://www.usbr.gov/pn/programs/yrbwep/

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EWEB

Eugene Water & Electric Board

BEST PRACTICES FOR OPERATIONS: OPTIMIZING DISTRIBUTION SYSTEMS

Eugene Water & Electric Board

Best Practices for Operations:

Optimizing Water Distribution Systems

Strategic Water Planning Preconference Seminar

May 2, 2012

Jill Hoyenga, Eugene Water & Electric Board

It’s all about safe drinking water

- Optimization is a continuous improvement process
- Water Research Foundation & Partnership for Safe Water Report
- Focus on some EWEB optimization projects

Source: Friedman et al 2010. *Criteria for Optimized Distribution Systems* ©2010 Water Research Foundation and Partnership for Safe Water. Reprinted with permission.

EWEB: Rely on Us

- Public utility serving Eugene, OR for 100 years
- McKenzie River sole drinking water source
- 51,628 Accounts
- Serve 3 Water Districts

Three Areas of Optimization

- Chlorine Residual
- Pressure Management
- Main Breaks/Leakage

Optimize: Chlorine Residual

- Maintains coliform sampling plan
- Sample collection throughout the month
- Chlorine residual tested on each sample
- HPC tested on each sample
- Continuous residual monitoring

Optimize: Chlorine Residual

- Water Quality Complaints are captured in database
- Uploaded into GIS to examine trends
- Aggressive flushing program based on past reporting
- Proactive flushing on dead end mains

Optimize: Chlorine Residual

- Interdisciplinary Water Quality Working Group
- Winter & Summer operation strategy SOP
- Energy management includes electric peak hour management pilot

Optimize: Pressure Management

- Hydraulic model evaluation of delivery pressure
- Deficient areas are identified
- Operational changes, infrastructure upgrades, or other mitigation

Optimize: Pressure Management

- Invite customers to partner in flow/pressure management efforts

Optimize: Pressure Management

- Peak hour water management has avoided nearly $1 million in emergency upgrades

Optimize: Main Breaks & Leaks

- “Never go negative” main repair protocol
- Main break and leak locations are uploaded into GIS
- Trends discovered in GIS inform main replacement priorities

Optimize: Main Breaks & Leaks

- Proactive leak detection program
- Goal: Listen at every curb stop and valve every three years
- Prompt repairs resulting from findings

Optimize: Main Breaks & Leaks

- Tracks main breaks and outages using electric utility metric SAIFI & CAIDI
- AWWA Benchmarks also calculated
- 2009 Benchmark: 5.2 (2007 AWWA Top Quartile 21.7)

Three Areas of Optimization

- Chlorine Residual
- Pressure Management
- Main Breaks/Leakage

Source: Friedman et al 2010. *Criteria for Optimized Distribution Systems* ©2010 Water Research Foundation and Partnership for Safe Water. Reprinted with permission.

EWEB

Rely on us.

Strategic Financial Planning

The Future of Planning & Management Tools

2012 PNWS-AWWA Annual Conference
Yakima, WA

May 2, 2012

Presented by Joe Healy

Typical Capital Project Cycle

Financial Management Relates to All Phases

Overview of Financial Planning

Focus is Long-Term	• 5- to 10-years or longer
Cash-Flow Perspective	• How much cash do we need? • When do we need it? • Where will it come from?
Key Performance Ratios	• Debt service coverage • Rate revenue adjustments • Typical bills

Key Elements of a Financial Plan

Planning

- Big-picture Forecast
- Funding Strategies

Communication

- Highlight Upcoming Issues and Opportunities
- Focus on Key Performance Issues

Financial Plan

Information

- External
- Internal

Policy Assessment

- Scenario and Sensitivity Analyses
- Reserve Policy

Finance Plan is for Broad Goals

Broadly Defined Goals

- Level of reserves (fund balances)
- Planned CIP expenditures
- Use of reserves
- Debt service coverage
- Capital structure

Does Not Include

- Daily cash balance
- Reconciliation with financial reports
- Project tracking and reporting
- Rate structuring
- Cost-of-service rates

Finance Plan is a Communication Tool

Highlight Upcoming Issues and Opportunities

- Infrastructure investments
- Set-aside cash for future use
- Quantify reasons for action

Focus on Key Performance Indicators

- Debt service coverage
- Rate revenue adjustments
- Typical bills

Communicating Results to Stakeholders

Water Financial Plan
Hypothetical Example

Model OK | Calibration Manager | Charts & Display | Scenario Manager | Navigation | Fit to Screen | Coverage OK | Gen Fund OK | Optimization Complete | Solve Time 0:00:26

Example Debt Service Coverage Ratio

Line	Description	Value	Notes
1	Gross Revenue	$9,500,000	
2	Less: O&M (excluding Depreciation)	5,600,000	
3	Net Revenue	$3,900,000	1 minus 2
4	Annual Debt Service	2,800,000	
5	Debt Service Coverage Ratio	1.39	3 divided by 4

Finance Plan is an Information Tool

External

- Regulations and legal factors
- Local and regional economy
- Debt and financial markets

Internal

- Policies, goals, targets
- Operating costs
- Facilities needs

Assessing Policies and Goals

Assessing Assumptions

Sensitivity Analysis

- Inflation
- Interest rates
- Customer growth assumptions

Scenario Analysis

- What if we accelerate or delay a portion of the CIP?
- What if we use more debt or other outside financing?

Moving Forward

Describe Financial Options

- Ensure adequate resources to maintain the utility's financial health
- Communicate results in a clear and transparent manner

Provide Road Map for Future Policies

- Prudent reserve fund levels
- Financial ratios that exceed minimum requirements

Strategic Financial Planning Model

The Future of Planning & Management Tools

HDR

Capital Improvement Plan

Capital Improvement Plan

Description	Line	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	Total FY2012-21
Project 1	1	$8,500,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$8,500,000
Project 2	2	0	5,000,000	0	0	0	0	0	0	0	0	5,000,000
Project 3	3	0	0	8,000,000	0	0	0	0	0	0	0	8,000,000
Project 4	4	0	0	0	5,750,000	0	0	0	0	0	0	5,750,000
Project 5	5	0	0	0	0	5,000,000	0	0	0	0	0	5,000,000
Project 6	6	0	0	0	0	0	5,000,000	0	0	0	0	5,000,000
Project 7	7	0	0	0	0	0	0	5,000,000	0	0	0	5,000,000
Project 8	8	0	0	0	0	0	0	0	5,750,000	0	0	5,750,000
Project 9	9	0	0	0	0	0		0	2,000,000	6,000,000	0	8,000,000
Project 10	10	0	0	0	0	0	0		0	0	3,000,000	3,000,000
Annual Replacements	11	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	7,000,000
Total (w/o Inflation)		$9,200,000	$5,700,000	$8,700,000	$6,450,000	$5,700,000	$5,700,000	$5,700,000	$8,450,000	$6,700,000	$3,700,000	$66,000,000
Expected Expenditure Rates		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Inflation Factor 1												
Expected Inflation Rate		2.0%	2.5%	3.0%	3.5%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	
Inflation Factor		1.020	1.046	1.077	1.115	1.159	1.206	1.254	1.304	1.356	1.410	
Capital Outlays		$400,000	$414,000	$428,490	$443,487	$459,009	$475,075	$491,702	$508,912	$526,724	$545,159	$4,692,557
Equipment Replacements		0	0	0	0	0	0	0	0	0	0	0
Capital Expenditures w/Inflation		$9,784,000	$6,373,350	$9,797,216	$7,632,369	$7,066,093	$7,346,442	$7,637,924	$11,526,630	$9,612,104	$5,763,150	$82,539,277
Total Growth-Related CIP		$867,000	$522,750	$861,492	$640,869	$579,569	$602,751	$626,862	$6,356,376	$8,136,161	$0	$19,193,831

Dashboard with Non-Optimized Results

Customer Impacts (Non-Optimized Scenario)

Dashboard with Optimized Results

Customer Impacts (Optimized Scenario)

Comparison (Non-Optimized v. Optimized)

Original CIP

Capital Improvement Plan

Description	Line	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	Total FY2012-21
Project 1	1	$8,500,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$8,500,000
Project 2	2	0	5,000,000	0	0	0	0	0	0	0	0	5,000,000
Project 3	3	0	0	8,000,000	0	0	0	0	0	0	0	8,000,000
Project 4	4	0	0	0	5,750,000	0	0	0	0	0	0	5,750,000
Project 5	5	0	0	0	0	5,000,000	0	0	0	0	0	5,000,000
Project 6	6	0	0	0	0	0	5,000,000	0	0	0	0	5,000,000
Project 7	7	0	0	0	0	0	0	5,000,000	0	0	0	5,000,000
Project 8	8	0	0	0	0	0	0	0	5,750,000	0	0	5,750,000
Project 9	9	0	0	0	0	0		0	2,000,000	6,000,000	0	8,000,000
Project 10	10	0	0	0	0	0	0		0	0	3,000,000	3,000,000
Annual Replacements	11	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	7,000,000
Total (w/o Inflation)		$9,200,000	$5,700,000	$8,700,000	$6,450,000	$5,700,000	$5,700,000	$5,700,000	$8,450,000	$6,700,000	$3,700,000	$66,000,000
Expected Expenditure Rates		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Inflation Factor 1												
Expected Inflation Rate		2.0%	2.5%	3.0%	3.5%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	
Inflation Factor		1.020	1.046	1.077	1.115	1.159	1.206	1.254	1.304	1.356	1.410	
Capital Outlays		$400,000	$414,000	$428,490	$443,487	$459,009	$475,075	$491,702	$508,912	$526,724	$545,159	$4,692,557
Equipment Replacements		0	0	0	0	0	0	0	0	0	0	0
Capital Expenditures w/Inflation		$9,784,000	$6,373,350	$9,797,216	$7,632,369	$7,066,093	$7,346,442	$7,637,924	$11,526,630	$9,612,104	$5,763,150	$82,539,277
Total Growth-Related CIP		$867,000	$522,750	$861,492	$640,869	$579,569	$602,751	$626,862	$6,356,376	$8,136,161	$0	$19,193,831

Expanded CIP

Capital Improvement Plan

Description	Line	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	Total FY2012-21
Project 1	1	$8,500,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$8,500,000
Project 2	2	0	5,000,000	0	0	0	0	0	0	0	0	5,000,000
Project 3	3	0	0	8,000,000	0	0	0	0	0	0	0	8,000,000
Project 4	4	0	0	0	5,750,000	0	0	0	0	0	0	5,750,000
Project 5	5	0	0	0	0	5,000,000	0	0	0	0	0	5,000,000
Project 6	6	0	0	0	0	0	5,000,000	0	0	0	0	5,000,000
Project 7	7	0	0	0	0	0	0	5,000,000	0	0	0	5,000,000
Project 8	8	0	0	0	0	0	2,000,000	20,000,000	0	0	0	22,000,000
Project 9	9	0	0	0	0	0	0	3,000,000	30,000,000	0	0	33,000,000
Project 10	10	0	0	0	0	0	0		0	2,000,000	4,500,000	6,500,000
Annual Replacements	11	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	7,000,000
Total (w/o Inflation)		$9,200,000	$5,700,000	$8,700,000	$6,450,000	$5,700,000	$7,700,000	$28,700,000	$30,700,000	$2,700,000	$5,200,000	$110,750,000
Expected Expenditure Rates		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Inflation Factor 1												
Expected Inflation Rate		2.0%	2.5%	3.0%	3.5%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	
Inflation Factor		1.020	1.046	1.077	1.115	1.159	1.206	1.254	1.304	1.356	1.410	
Capital Outlays		$400,000	$414,000	$428,490	$443,487	$459,009	$475,075	$491,702	$508,912	$526,724	$545,159	$4,692,557
Equipment Replacements		0	0	0	0	0	0	0	0	0	0	0
Capital Expenditures w/Inflation		$9,784,000	$6,373,350	$9,797,216	$7,632,369	$7,066,093	$9,757,448	$36,473,555	$40,537,783	$4,187,996	$7,878,552	$139,488,362
Total Growth-Related CIP		$867,000	$522,750	$861,492	$640,869	$579,569	$1,808,254	$16,925,262	$39,116,161	$0	$0	$61,321,357

Expanded CIP Results

Comparison with Expanded CIP Scenario

Strategic Financial Planning Model

The Future of Planning & Management Tools

HDR

Dynamic Results

Strategic Financial Planning

The Future of Planning & Management Tools

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