

# Assessing the Real Condition of those Assets

**Dale Jutila, CH2M HILL**

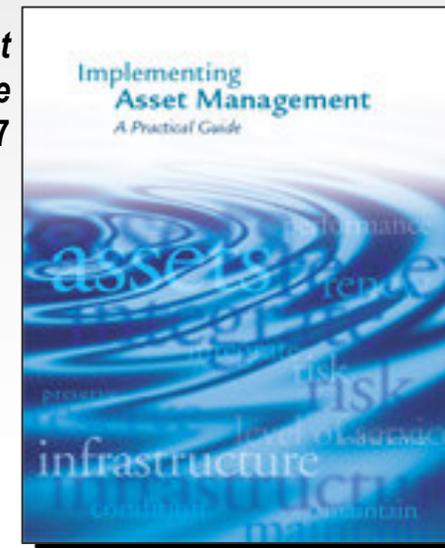
Pacific Northwest Section AWWA  
May 7, 2009

# Universal Definition is Useful

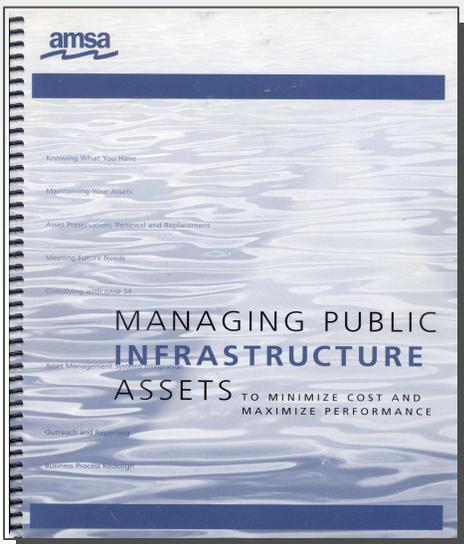
## Effective Asset Management is:

*An integrated set of processes to minimize the life-cycle costs of owning, operating and maintaining assets, at an acceptable level of risk, while continuously delivering established levels of service.*

**Implementing Asset Management  
– A Practical Guide  
AMWA, NACWA, WEF 2007**

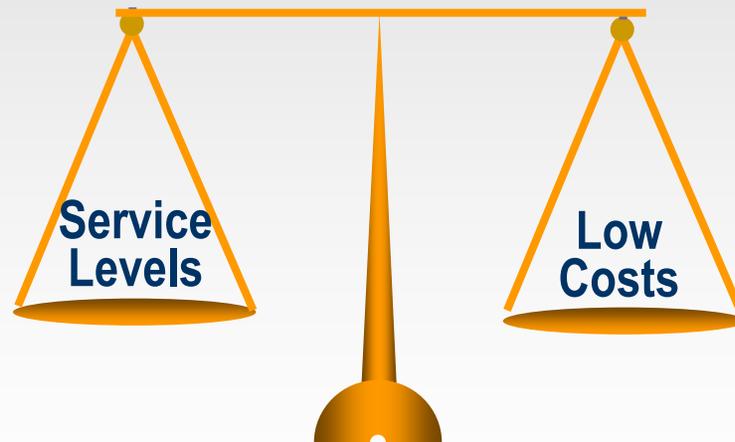


**Managing Public Infrastructure Assets to  
Minimize Costs and Maximize Performance  
AMSA, AMWA, AWWA, WEF 2002**



# Balance conflicting goals by managing risk

- ◆ Minimize the life-cycle costs of assets
- ◆ Continuously deliver established levels of service
- ◆ At an acceptable level of risk



***RISK***

# Risk is quantified using the classic Risk Equation

$$\text{Risk} = f(\text{consequence} \times \text{likelihood})$$



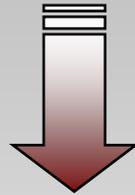
*How severe are the consequences of asset failure?*



*How likely is it for the asset to fail?*

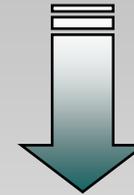
# Classic risk equation

$$\text{Risk} = f(\text{consequence} \times \text{likelihood})$$



*How severe are the consequences of asset failure?*

- Loss of service
- Environmental
- Health and safety implications
- Community disruption
- Damage to property
- Loss of revenue
- Regulatory compliance
- Service agreements
- Public image

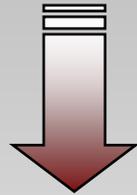


*How likely is it for the asset to fail?*

- Condition of asset
- Performance of asset
- Effectiveness of O&M protocols
- Available inventory
- Capacity and utilization
- Functionality

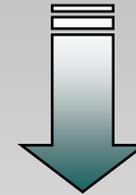
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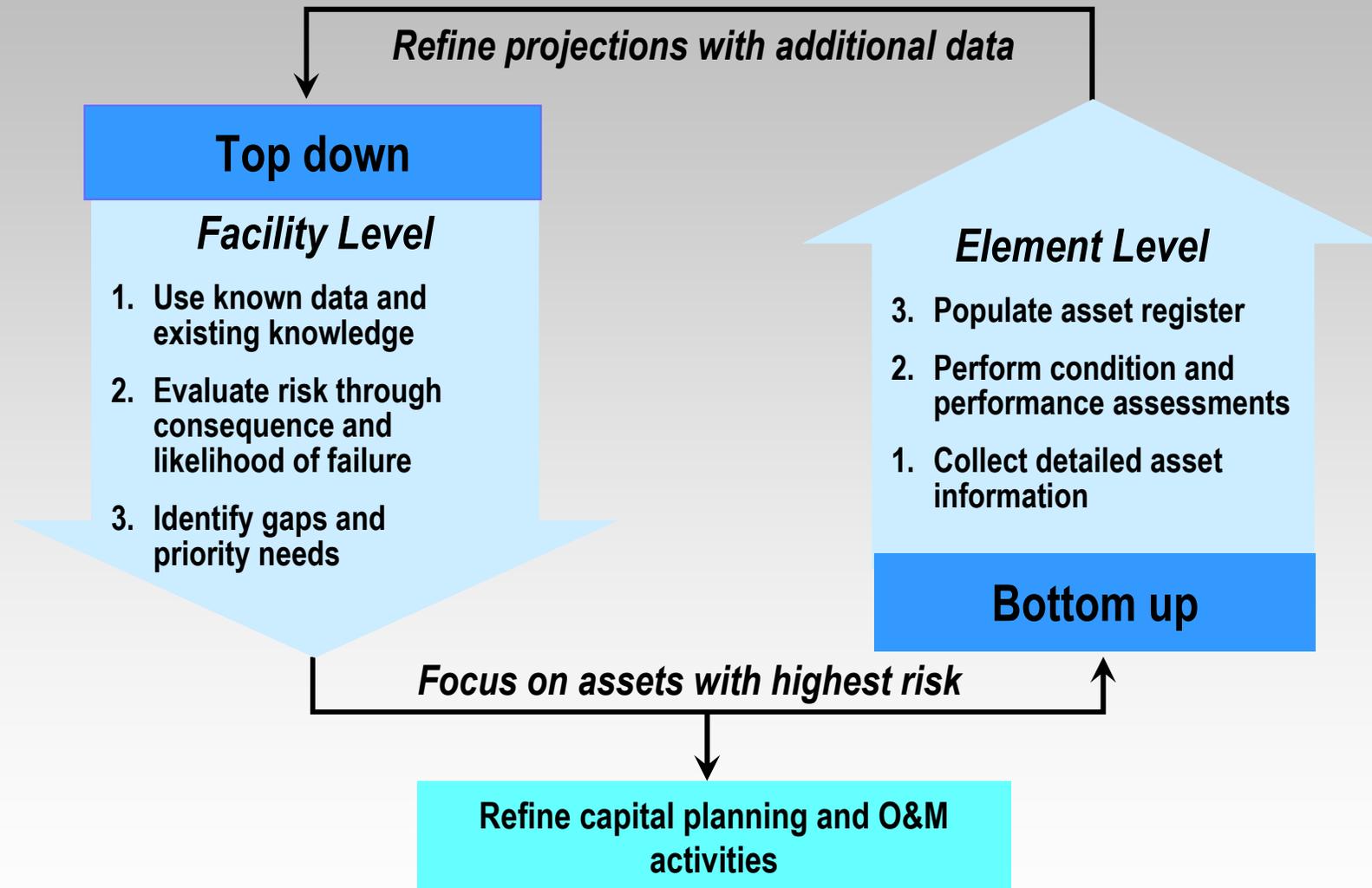
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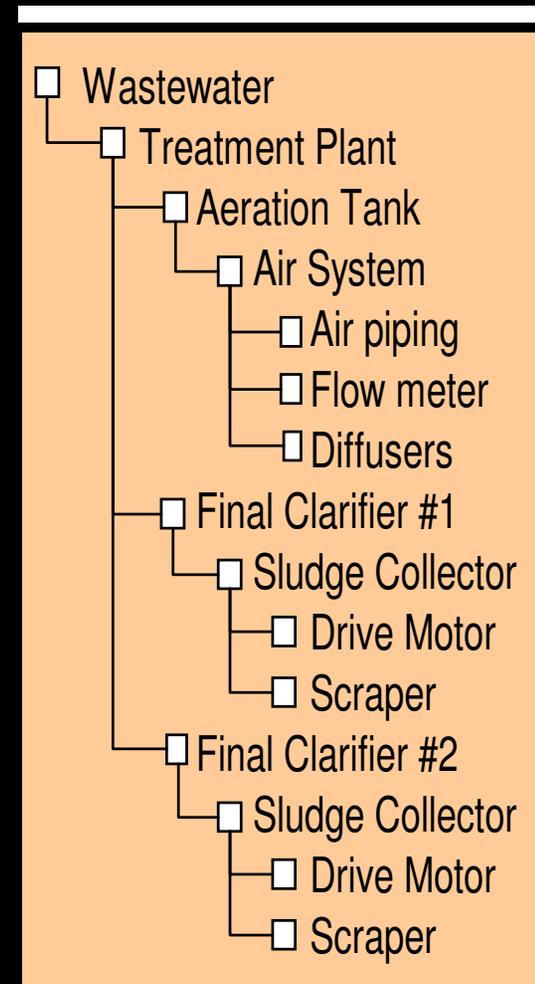
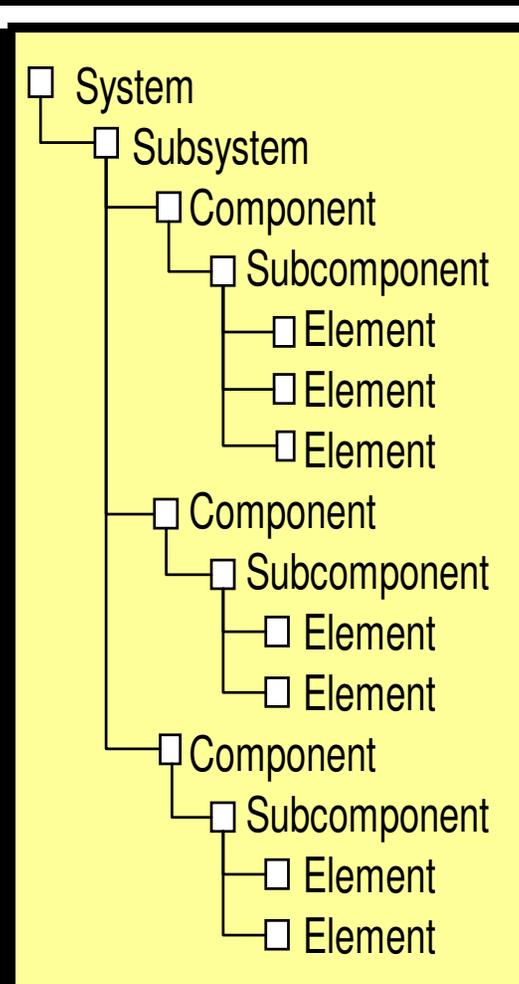
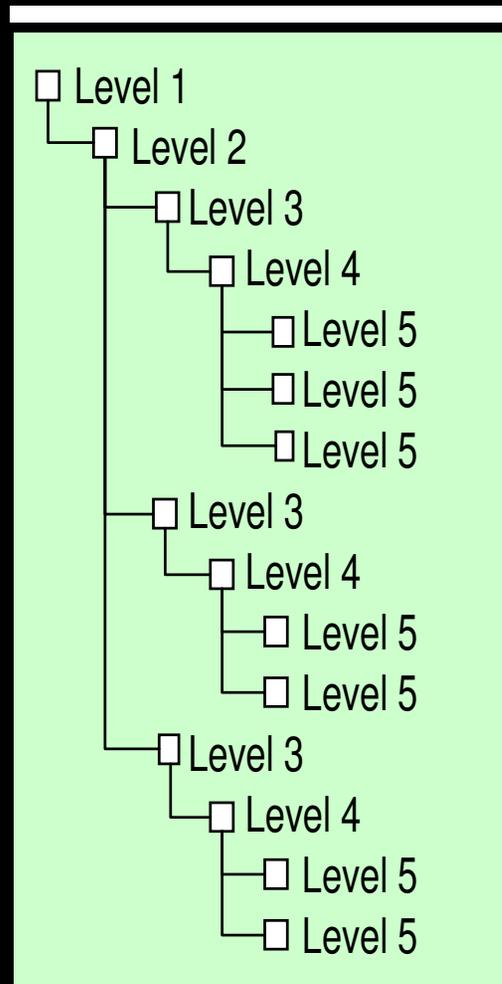
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- **Condition of asset**
- Performance of asset
- Effectiveness of O&M protocols
- Available inventory
- Capacity and utilization
- Functionality

# Top down/bottom up



# Apply Matrix to Appropriate Level of Hierarchy



# Consequence of Failure Matrix

Consequence of Failure Determination			Water		
Consequence Category	Weight	Negligible = 1	Low = 4	Moderate = 7	Critical = 10
Service reliability	0.17	Pressure >45 psi. No unplanned service interruptions. No impact on reserve.	Pressure <45psi >30psi. <250 services effected. Possible impact on reserve.	Pressure <30 psi. Service interruption affecting 250-500 services. Definite impact on reserve.	Zero pressure. Service interruption >500 services. Fire volume reserve not met.
Financial impact on utility	0.15				
Ability to return to service	0.13				
Compliance with regs and permits	0.20				
Health & Safety of employees and public	0.20				
Disruption to the community / Public Image	0.15				

Example

# Likelihood of Failure Matrix

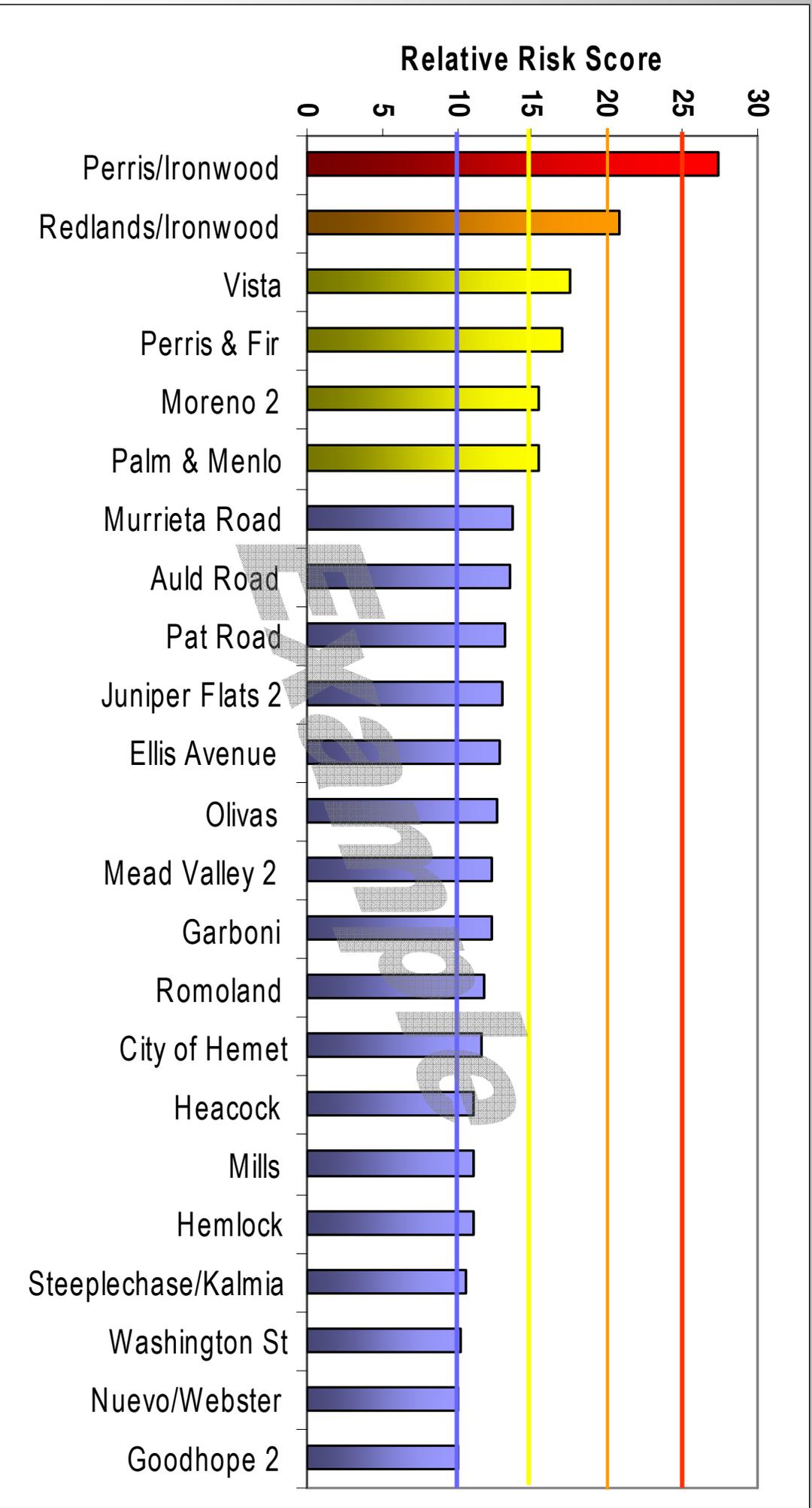
Likelihood of Failure Determination						Water
Likelihood Category	Weight	Negligible = 1	Minor = 2	Moderate = 4	Major = 7	Critical = 10
Condition Assessment Overall	0.40	Very good. Only normal maintenance required. (Condition Grade 1)	Good. Minor defects only. ~5% needs maintenance. (Condition Grade 2)	Fair. Significant maintenance required. ~10 to 20% needs maintenance. (Condition Grade 3)	Poor. Significant renewal required. ~20 to 40% needs renewal. (Condition Grade 4)	Very poor. >50% requires replacement. Asset unserviceable. Condition Grade 5)
Capacity and Utilization	0.28					
Effective Operating Protocols	0.12					
Reliability	0.16					
Inventory Redundancy	0.04					

Example

# Assign consequence and likelihood scores to assets - using Score Definitions

ASSET	Weight->	CONSEQUENCE							LIKELIHOOD						Risk Score	Risk Rank
		Safety of public and employees	Financial impact on Utility	Public confidence	Regulatory compliance	Service Delivery	Consequence Score	Consequence Rank	Physical Condition	Performance (i.e., capacity, utilization and functionality of asset)	O&M Protocols (i.e., SOPs)	Planned maintenance as a % of total maintenance	Likelihood Score	Likelihood Rank		
MILLS		1	7	10	4	10	6.7	1	1	1	7	2	1.6	94	11.0	23
ELSWORTH		1	1	4	1	1	1.6	65	1	4	7	4	3.5	8	5.6	68
HEACOCK		1	7	7	1	10	5.4	4	1	1	7	2	2.1	88	11.1	22
CACTUS & NASON		4	1	4	1	7	3.6	28	1	1	7	4	2.6	37	9.3	37
NASON & DRACAEA		4	1	4	1	4	2.8	41	1	1	7	4	2.7	34	7.4	53
FREDERICK/ SUNNYMEAD		7	7	1	1	1	2.8	39	2	1	7	4	3.1	28	8.6	45
MORENO 2		4	7	7	1	7	5.1	7	2	1	7	4	3.1	27	15.5	5
PERRIS & FIR		4	7	7	4	4	5.1	7	1	4	7	4	3.4	18	17.0	4
HEMLOCK		7	4	4	1	7	4.5	14	1	1	7	4	2.5	59	11.0	24
ELDER		4	7	4	1	4	3.7	19	1	1	7	4	2.6	39	9.6	32
MEDLEY		1	1	1	1	1	1.0	68	1	1	7	4	2.4	73	2.4	94
PIGEON PASS ROAD		4	1	1	1	1	1.5	66	1	1	7	4	2.5	65	3.6	84
VILLAGE ROAD		1	1	1	1	1	1.0	68	1	4	7	4	3.3	20	3.3	87
PERRIS / IRONWOOD		10	7	7	1	4	5.2	5	1	10	7	4	5.3	1	27.5	1
HIDDEN SPRINGS		1	1	1	1	1	1.0	68	1	4	7	4	3.4	16	3.4	86
STEEPLECHASE / IRONWOOD		4	7	4	1	4	3.7	19	1	1	7	4	2.5	54	9.2	39
STEEPLECHASE / KALMIA		4	7	1	1	4	3.1	34	1	4	7	4	3.4	13	10.6	28
SUNNYMEAD PKWY		1	1	1	1	1	1.0	68	1	1	7	4	2.4	71	2.4	93
PERRIS & KALMIA BOOSTER		1	1	4	1	4	2.4	48	1	1	7	4	2.4	70	5.7	64
COVEY		1	1	1	1	4	1.8	58	1	1	7	4	2.4	76	4.3	81
REDLANDS / COTTONWOOD		1	1	7	1	4	3.0	36	1	1	7	4	2.6	38	7.7	49

# Calculate relative risks of assets and prioritize



# Use Risk Levels to Prioritize Detailed Condition Assessments

**Pump Condition Assessment Form**

Date \_\_\_\_\_ Assessor \_\_\_\_\_  
 Entity ID \_\_\_\_\_ Entity Class \_\_\_\_\_  
 Entity Description \_\_\_\_\_  
 Site \_\_\_\_\_ Facility \_\_\_\_\_  
 Picture Number \_\_\_\_\_

	Yes	No	N/A	Acceptable Noise	Yes	No	N/A
Running at Inspection	<input type="checkbox"/>						
Oil OK at inspection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Acceptable Vibration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
All Safety Guards Present	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	All Components	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Acceptable Smell or Heat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Absence of Leaks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Oil Level within Range	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Running on Curve	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Absence of Pump Cavitations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

Note: Check the box of the parameters that apply.

	Rating Parameters
<input type="checkbox"/> (1) Corrosion	0 1 2 3 4 5 6
<input type="checkbox"/> (2) Packing Gland/Seal	0 1 2 3 4 5 6
<input type="checkbox"/> (3) Bearings	0 1 2 3 4 5 6
<input type="checkbox"/> (4)	
<input type="checkbox"/> (5)	



**FIRST STREET PUMPING STATION**

Equipment  
 Pumps Condition Assessment Group Rating - 2.0



Overall Condition  
 Generally the pumps in this facility are in good condition with the exception to the comments noted in this section.



Exceptions  
 Isolation valves on the following pumps could not be closed as part of the assessment to see if they hold because the pumps connected to these valves were in operation:

- 12086 HORIZONTAL SPLIT CASE PUMP P4E
- 12085 HORIZONTAL SPLIT CASE PUMP P3E
- 12084 HORIZONTAL SPLIT CASE PUMP P2E
- 12083 HORIZONTAL SPLIT CASE PUMP P1E
- 12084 HORIZONTAL SPLIT CASE PUMP P2E

Safety  
 The following pumps had exposed shafts between the seal and bearing:

- 12086 HORIZONTAL SPLIT CASE PUMP P4E
- 12085 HORIZONTAL SPLIT CASE PUMP P3E
- 12084 HORIZONTAL SPLIT CASE PUMP P2E
- 12083 HORIZONTAL SPLIT CASE PUMP P1E

And the following pumps had no upper shaft guards installed:

- 12076 VERTICAL TURBINE PUMP (P1A)
- 12080 VERTICAL TURBINE PUMP (P3A)
- 12088 VERTICAL TURBINE PUMP (P2B)
- 12089 VERTICAL TURBINE PUMP (P3B)

COMMENTS

- Re-score likelihood of failure based on updated field information
- Recalculate risk

# Condition Assessment is step-by-step process

1. Gather asset data
2. Develop questions and possible answers
3. Upload required data into tool
4. Conduct field condition assessment
5. Re-evaluate risk



# Gather asset data

- ◆ Assets need to be captured
- ◆ Easiest to obtain from CMMS
- ◆ Massage General Asset List to get standard equipment types. i.e. compressor, pump, centrifugal pump, submersible pump, electrical equipment, etc.
  - ◆ May have two dozen assets in a pump station
- ◆ Final asset list

# Develop questions and possible answers

- ◆ Once the general equipment types are determined, questions can be developed
- ◆ The more measurable a question is, the more likely subsequent assessments can be repeated year to year with the same degree of accuracy
- ◆ Example:
  - ◆ Vibration: Smooth less than 0.05 inches/sec
  - ◆ Good = 0.05 and 0.1 inches/sec
  - ~~◆ or~~
  - ◆ Vibration Smooth
  - ◆ Good

# Develop questions and possible answers

- ◆ Questions that relate to the equipment condition are predefined
- ◆ Questions are grouped by asset type. Therefore all *pumps* will have the same question and answer group.
- ◆ Each answer is rated from 1 to 5 with 1 being excellent and 5 being un-serviceable.

INSTRUMENT			
Question	ConditionWeight	AnswerDescription	Explanation
Absence of Leaks	1	Yes	
		No	Tubing Leaks, etc
All Components	1	Yes	
		No	Covers, lenses, etc
Calibration records available	1	Yes	
		No	No written records
Display Ok	1	Yes	
		No	Fogged, cracked, etc
Instrumentation - Labeled Correctly	1	Yes	
		No	range and units
Operating at Inspection	1	Yes	
		No	Equip not functioning
Calibration	1	1 -Excellent	
		3 -Minor signal Fluctuations	Confirm with SCADA
		5 -Unable to Calibrate or not Calibrated	
Installation	3	1 -Excellent	
		3 -Minor Problems	Flow meter distances, access
		5 -Severe obstruction or installation issues	
Installation/ Accessibility	3	1 -Excellent access	
		3 -Limited access	
		5 -Unacceptable access	

# Upload required data into tool

- ◆ Many sources of data to help with condition assessment
  - ◆ SCADA data for telemetry reliability, on/off cycles, runtime, etc.
  - ◆ CMMS for work order histories
  - ◆ Personnel interviews
  - ◆ Previous condition assessments

# Upload required data into tool

- ◆ Consolidate gathered data into a database to evaluate asset condition – and risk
  - ◆ Use it for comparison with subsequent assessment of each asset
  - ◆ Use database tool used to store and evaluate asset condition and risk data
- ◆ Synchronize, test field tablets, ship to job site



# Conduct Field Condition Assessment

- ◆ Typically use three to six non-destructive tests for condition assessments:
  - ◆ Vibration inches/sec horizontal, vertical, and axial
  - ◆ Ultrasonic listening for valves, bearings, and some electrical
  - ◆ Thermography
  - ◆ Insulation resistance testing
  - ◆ Oil analysis from records
  - ◆ Performance testing

# Conduct Field Condition Assessment

## Inspection page for centrifugal pump

Asset Name: PUMP025, Inspection Date: 10/17/2006

CENT PUMP, CENTRIFUGAL PUMP, System: Albany LS, Location: LS No 14 CHARLOTTE STREET

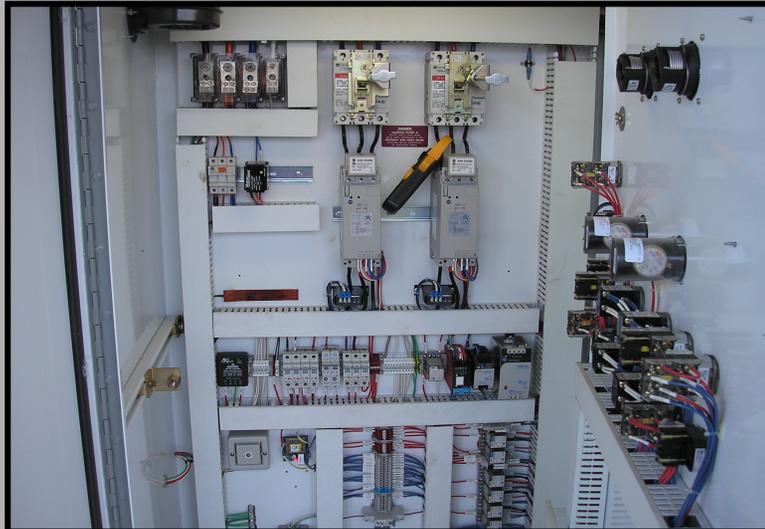
General Condition Questions Risk Questions Photos and Documents

Save Changes Cancel

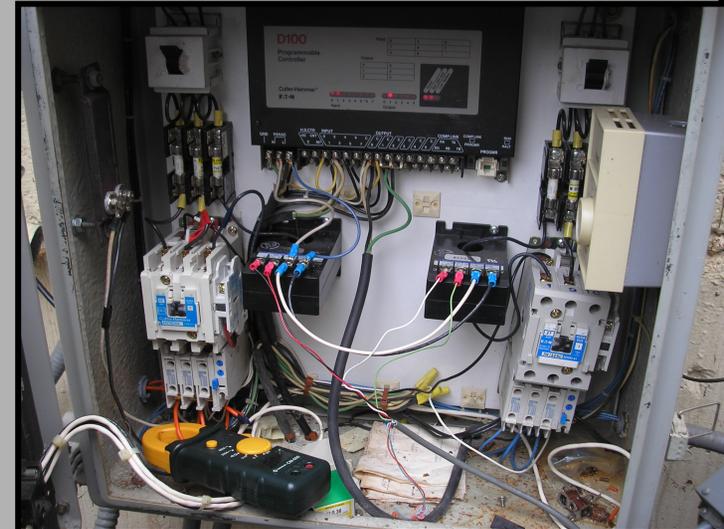
Question	Answer	N/A Flag	Comment
Absence of Leaks	<input checked="" type="radio"/> yes <input type="radio"/> no	<input type="checkbox"/>	
Absence of Pump Cavitations	<input checked="" type="radio"/> yes <input type="radio"/> no	<input type="checkbox"/>	
Acceptable Noise	<input type="radio"/> yes <input checked="" type="radio"/> no	<input type="checkbox"/>	Appears to be debris on impeller
All Safety Guards Present	<input checked="" type="radio"/> yes <input type="radio"/> no	<input type="checkbox"/>	
Operation at Inspection	<input checked="" type="radio"/> yes <input type="radio"/> no	<input type="checkbox"/>	
Accessibility	3 - Restricted Access	<input type="checkbox"/>	Typical for can station
Corrosion	2 - Minor	<input type="checkbox"/>	
Mounting	3 - Operational	<input type="checkbox"/>	Suction line penetration not reinforce
Vibration Analysis	2 - Good 1-4mm/sec.	<input type="checkbox"/>	

# Field Condition Assessment Examples - control panel

Question	Answer	Description	Comment
Absence of Burn Marks	0	yes	
Acceptable Noise	0	yes	
Acceptable Smell or Heat	0	yes	
All Components	0	yes	
All Safety Features Present	0	yes	
Good House Keeping	0	yes	
Good Wire Labeling	0	yes	
Operating at Inspection	0	yes	
Proper Drawings Accessible	0	yes	
Appearance (Carbon Dust)	1	Excellent	
Control Gauges (Hour Meters Volts & Amps)	1	Excellent	Hour meters only - amps SCADA monitored
Control Lamps	1	Excellent	
Control Switches	1	Excellent	
Corrosion	1	Negligible	
Infrared	1	Negligible Ambient	
Installation	2	Normal	
Main Breaker	1	Normal	
Protective Devices	1	Normal	
Starter Block	0	Not Found	Soft start
Structural (Panel)	1	Excellent	



Question	Answer	Description	Comment
Absence of Burn Marks	0	yes	
Acceptable Noise	0	yes	
Acceptable Smell or Heat	0	yes	
All Components	5	no	Not mounted in proper enclosures
All Safety Features Present	5	no	See photos
Good House Keeping	5	no	
Good Wire Labeling	5	no	
Operating at Inspection	0	yes	
Proper Drawings Accessible	0	no	Not in cabinet
Appearance (Carbon Dust)	3	Moderate	
Control Gauges (Hour Meters Volts & Amps)	0	Not Found	
Control Lamps	3	Operational	
Control Switches	3	Operational	
Corrosion	2	Minor	
Infrared	2	Normal	
Installation	5	Severe Obstruction Falling apart	
Main Breaker	3	Moderate Defects	Not proper disconnect
Protective Devices	4	Major	Unsafe station electrically
Starter Block	3	Moderate Wear	
Structural (Panel)	3	Moderate Wear	Older panels



# Field Condition Assessment

## Which pump would concern you?

Question	Answer	Description	Comment
Absence of Leaks	0	yes	
Absence of Pump Cavitations	0	yes	
Acceptable Noise	0	yes	
All Safety Guards Present	0	yes	
Operation at Inspection	0	yes	
Accessibility	3	Restricted Access	Typical for can station
Corrosion	1	Negligible	
Mounting	1	Excellent	
Vibration Analysis	1	Smooth <1mm/sec.	



Question	Answer	Description	Comment
Absence of Leaks	0	yes	
Absence of Pump Cavitations	0	yes	
Acceptable Noise	0	yes	
All Safety Guards Present	5	no	Missing drive shaft guards
Operation at Inspection	0	yes	
Accessibility	5	Extremely Difficult to Access	extremely tight quarters in pump station
Corrosion	3	Moderate	Pitting
Mounting	3	Operational	
Vibration Analysis	2	Good 1-4mm/sec.	



# Condition Data is Collected for Each Component

Asset Name	Asset Type	Description	Location	Attribute Weight	Percent Weight	Condition Score	Weighted Condition Score	Total Score	Weighted Total Score
51-0001	SUB PUMP	Pump #1	51-Clackamas	1	2.174	1.4	0.03	0.561	0.012
51-0002	SUB PUMP	Pump #2	51-Clackamas	1	2.174	1.4	0.03	0.561	0.012
51-0003	SUB PUMP	Pump #3	51-Clackamas	1	2.174	1.4	0.03	0.561	0.012
51-0004	CONTROL PANEL	Pump Control Panel	51-Clackamas	1	2.174		0		0
51-0005	AIR COMPRESSOR	Bubbler #1	51-Clackamas	1	2.174	1.55	0.034	0.786	0.017
51-0006	AIR COMPRESSOR	Bubbler #2	51-Clackamas	1	2.174	1.55	0.034	0.786	0.017
51-0007	VAULT	Valve Vault	51-Clackamas	1	2.174	1.44	0.031	0.561	0.012
51-0008	WET WELL	Wet Well	51-Clackamas	1	2.174	1.91	0.042	0.786	0.017
51-0009	REMOTE TELEMETRY UNIT	Telemetry Equipment	51-Clackamas	1	2.174	1.56	0.034	0.786	0.017
51-0010	VALVE	ARV #1 82nd Street	51-Clackamas	1	2.174	1.3	0.028	0.561	0.012
51-0011	VALVE	ARV #2 Edgewater	51-Clackamas	1	2.174	1.3	0.028	0.561	0.012
51-0012	VALVE	ARV #3 High Rock	51-Clackamas	1	2.174		0		0
51-0013	VALVE	ARV #4 By Bridge	51-Clackamas	1	2.174	1.3	0.028	0.561	0.012
51-0014	VALVE	ARV #5 Agness Street	51-Clackamas	1	2.174	1.3	0.028	0.561	0.012
51-0015	VALVE	Vacuum Relief Valve #1	51-Clackamas	1	2.174	1.25	0.027	0.561	0.012
51-0016	VALVE	Vacuum Relief Valve #2	51-Clackamas	1	2.174	1.25	0.027	0.561	0.012
51-0017	VALVE	Vacuum Relief Valve #3	51-Clackamas	1	2.174	5	0.109	2.581	0.056
51-0018	VALVE	Check Valve #1	51-Clackamas	1	2.174	1.25	0.027	0.561	0.012
51-0019	VALVE	Check Valve #2	51-Clackamas	1	2.174	1.25	0.027	0.561	0.012
51-0020	VALVE	Check Valve #3	51-Clackamas	1	2.174	1.25	0.027	0.561	0.012
51-0021	SITE	Pump Station Site	51-Clackamas	1	2.174	1.33	0.029	0.561	0.012
51-0022	VALVE	Isolation Valve #1	51-Clackamas	1	2.174	1.23	0.027	0.561	0.012

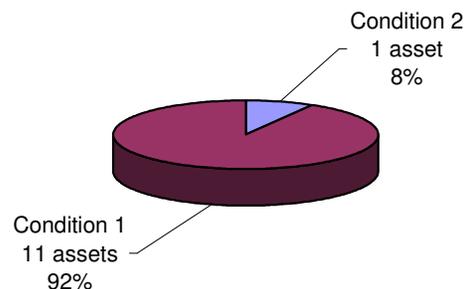
# Data is Rolled up for Condition Score

Asset Name	Description	Rank	Total Score	Consequence Score	Likelihood Score	Trigger Score	Health and Safety of Employees and Public	Compliance with Regulations	Service Reliability	Financial Impact (repair/replace, private property)	Disruption to Community/Public Image	Availability to Return asset to Service	Condition Assessment Overall	Effective Operating Protocols	Reliability	Planned Redundancy	Capacity and Utilization	Obsolescence	Annual Maintenance Cost
LS08-CTP-001	Pump Control Panel	1	3.75	9.17	0.40	1.03	10	7	10	7	10	10	4	4	1	7	1	1	1
LS06-STR-001	Oak Creek Structure	2	3.55	8.00	0.41	1.08	10	7	7	10	7	10	4	4	1	10	4	1	1
LS12-STR-001	Wah Chan Lift Station	3	2.60	8.67	0.26	1.17	7	7	10	10	10	10	2	4	1	10	10	1	1
LS14-STR-001	Charlotte Lift Station	4	2.55	6.00	0.41	1.03	10	4	4	10	4	10	4	4	1	10	1	1	1
LS04-CTP-001	Pump Control Panel	5	2.50	6.00	0.40	1.05	10	4	4	4	7	7	4	4	1	7	1	4	1
LS05-STR-001	Umatilla List Station Structure	6	2.48	5.83	0.41	1.03	7	7	4	10	4	7	4	4	1	10	1	1	1
LS07-STR-001	College Green Lift Station	7	2.48	9.33	0.26	1.03	10	7	10	10	10	10	2	4	1	10	1	1	1
LS08-STR-001	34th Avenue Lift Station	8	2.48	9.33	0.26	1.03	10	7	10	10	10	10	2	4	1	10	1	1	1
LS19-STR-001	North Albany Lift Station	9	2.48	9.33	0.26	1.03	10	7	10	10	10	10	2	4	1	10	1	1	1
LS09-CTP-001	Pump Control Panel	10	2.33	5.67	0.40	1.04	10	4	4	4	4	10	4	4	1	7	1	2	1
LS11-CTP-001	Pump Control Panel	11	2.33	5.67	0.40	1.04	10	4	4	4	4	10	4	4	1	7	1	2	1
CRTL-PMP-021	Pump No 21 Motor Control Center	12	2.22	5.83	0.35	1.08	10	4	4	7	4	10	2	4	10	10	1	10	1
CRTL-PMP-022	Pump No 22 Motor Control Center	13	2.22	5.83	0.35	1.08	10	4	4	7	4	10	2	4	10	10	1	10	1
PMP-DIS-005	Pump No 11 Main Disconnect	14	2.22	5.83	0.35	1.08	10	4	4	7	4	10	2	4	10	10	1	10	1
PMP-DIS-003	Pump No 13 Main Disconnect	15	2.22	5.83	0.35	1.08	10	4	4	7	4	10	2	4	10	10	1	10	1
PMP-DIS-010	Pump No 21 Disconnect	16	2.22	5.83	0.35	1.08	10	4	4	7	4	10	2	4	10	10	1	10	1
PMP-DIS-012	Pump Main Disconnect	17	2.22	5.83	0.35	1.08	10	4	4	7	4	10	2	4	10	10	1	10	1
PMP-DIS-011	Pump No 22 Disconnect	18	2.14	5.83	0.35	1.05	10	4	4	7	4	10	2	4	10	10	1	4	1
LS20-STR-001	Columbus Street Lift Station	19	2.12	8.00	0.26	1.03	10	7	7	10	7	10	2	4	1	10	1	1	1
LS13-STR-001	Century Drive Lift Station	20	2.12	8.00	0.26	1.03	10	7	7	10	7	10	2	4	1	10	1	1	1
PUMP013	CENTRIFUGAL PUMP	21	2.04	9.17	0.22	1.03	10	7	10	7	10	10	2	4	1	2	1	1	1
PUMP014	CENTRIFUGAL PUMP	22	2.04	9.17	0.22	1.03	10	7	10	7	10	10	2	4	1	2	1	1	1
MOTOR014	MOTOR - 3 PHASE	23	2.01	9.00	0.22	1.03	10	7	10	7	10	7	2	4	1	2	1	1	1
LS18-STR-001	Millersburg Lift Station	24	1.99	7.50	0.26	1.03	10	7	7	10	4	10	2	4	1	10	1	1	1
MOTOR011	MOTOR - 3 PHASE	25	1.97	8.83	0.22	1.03	10	7	10	4	10	7	2	4	1	2	1	1	1

# Condition and risk are reported for each asset and facility

18 <sup>th</sup> Street Pump Station									
Facility Conditon Score			Facility Risk Score			Structural Score	Mechanical Score	Electrical Score	Site Score
1.16			3.35			1.28	1.09	1.17	1.00
Asset No.	Asset Type	Description	Attribute Weight	Percent Weight	Condition Score	Weighted Condition Score	Risk Score	Weighted Risk Score	
5192	Pump	Pump	2	13.33	1	0.16	3.25	0.43	
5193	Motor	Motor	2	13.33	2	0.21	4.38	0.58	
5194	Valve	Discharge Valve	1	6.67	1	0.08	3.25	0.22	
5195	Valve	Check Valve	1	6.67	1	0.07	3.25	0.22	
5196	Electrical Equipment	MCC	2	13.33	1	0.15	3.25	0.43	
5197	Instrument	Pressure Transmitter	1	6.67	1	0.07	3.25	0.22	
5198	Building	Building	1	6.67	1	0.09	3.25	0.22	
5199	Instrument	Flow Meter	1	6.67	1	0.07	3.25	0.22	
5200	Site	Site	1	6.67	1	0.07	3.25	0.22	
5201	Pipe	Pipe	1	6.67	1	0.07	3.25	0.22	
5202	Pipe Below Ground	Pipe Below	1	6.67	1	0.07	3.25	0.22	
GRW016	Valve	Added Blowoff MOV	1	6.67	1	0.08	3.25	0.22	

18<sup>th</sup> Street PS  
Condition Rating Spread



# Re-evaluate Risk using Field Condition Assessment Results

ASSETS				CONSEQUENCE								LIKELIHOOD						RISK		
No.	Name	Location	Type	Weight	Health, Safety of public and employees	Financial Impact on Utility	Public confidence	Environmental compliance	System reliability	Consequence Score	Consequence Rank	REFERENCE	Physical Condition	Performance	O&M Protocols	Reliability History: Estimate of proactive maintenance as a % of total maintenance	Likelihood Score	Likelihood Rank	RISK SCORE	RISK RANK
					0.24	0.17	0.15	0.20	0.24				0.40	0.40	0.10	0.10				
51	Clackamas	16460 SE Evelyn Street, Clackamas	Sub		1	4	7	7	7	5.0	1	Workshop	1	1	2	1	1.1	7	5.5	5
					1	4	7	7	7			Field	1	1	2	1	1.3	7	6.8	4
53	Mitchell Creek	8900 SE 155 Ave	Sub		1	4	1	1	1	1.5	11	Workshop	1	1	1	1	1.0	9	1.5	12
					1	4	1	1	1			Field	1	1	1	2	1.1	11	1.7	12
54	Lower Phillips	Beverly St., East of Linwood Ave	Sub		4	1	7	4	7	4.7	5	Workshop	1	1	2	1	1.1	7	5.1	6
					1	4	7	7	7			Field	1	1	2	1	1.3	10	6.1	5
55	Sieben Lane	SE 142 Street	Sub		1	4	7	7	7	5.0	1	Workshop	2	1	4	1	1.7	3	8.5	2
					1	4	7	7	7			Field	1	1	4	1	1.5	6	7.5	3
56	CIA	11436 SE Cappe Road, Clackamas	Sub		1	4	1	4	4	2.8	9	Workshop	1	1	1	1	1.0	9	2.8	10
					1	4	1	4	4			Field	1	1	1	1	1.1	12	3.0	10
61	Boring	Richy Road near Treatment Facility, Boring	Sub		1	1	1	1	1	1.0	12	Workshop	4	1	7	1	2.8	2	2.8	11
					1	1	1	1	1			Field	2	1	7	1	1.8	2	1.8	11
73	ArrahWanna	ArrahWanna Road at Bright Ave., Hoodland	PH-Sub		1	4	7	7	7	5.0	1	Workshop	2	1	4	1	1.7	3	8.5	2
					1	4	7	7	7			Field	2	1	4	1	1.6	4	7.9	2
74	Welches Golf Course	Golf Course on Salmon River, Hoodland	PH-Sub		1	1	4	4	7	3.5	8	Workshop	2	1	4	1	1.7	3	5.9	4
					1	1	4	4	7			Field	2	1	4	1	1.7	3	5.5	6
75	Timberline Rim	Riverside Drive, Timberline Rim	PH		1	4	7	7	7	5.0	1	Workshop	7	4	4	4	5.2	1	26.1	1
					1	4	7	7	7			Field	2	4	4	3	3.0	1	15.2	1
76	Sandy River Lane	64678 Sandy River Lane	Sub		1	1	4	4	10	4.2	6	Workshop	1	1	1	1	1.0	9	4.2	7
					1	1	4	4	10			Field	2	1	1	1	1.3	9	5.2	8
77	Mt. Creek Circle	21351 East Mt. Creek Circle	Sub		1	1	4	4	10	4.2	6	Workshop	1	1	1	1	1.0	9	4.2	7
					1	1	4	4	10			Field	2	1	1	1	1.3	8	5.2	7
78	Golf Club Terrace	Fairway and Highview	Sub		1	1	1	1	7	2.5	10	Workshop	2	1	4	1	1.7	3	4.2	9
					1	1	1	1	7			Field	2	1	4	1	1.5	5	3.7	9

# Assessing the Real Condition of those Assets

- ◆ Helps verify “desk top” condition evaluation
- ◆ Helps point out weak links, components of asset
- ◆ Can be set up to be repeatable to allow trending, forecasting
- ◆ Helps re-define maintenance and replacement schedules

# Thank you!

Dale Jutila  
503.736.4125  
dale.jutila@ch2m.com



# Contrary to what you may have heard

- ◆ Asset management doesn't require upheaval of an organization
- ◆ Asset management is not packaged software
- ◆ Asset management is a practical, knowledge-based approach for improving what utilities have always done
- ◆ Each utility can proceed at its own pace, with methods and tools appropriate for its needs and resources
- ◆ Each utility can begin asset management with any part of its infrastructure, anywhere in the system