Pump Station Condition Assessments (A Proven and Defensible Approach)

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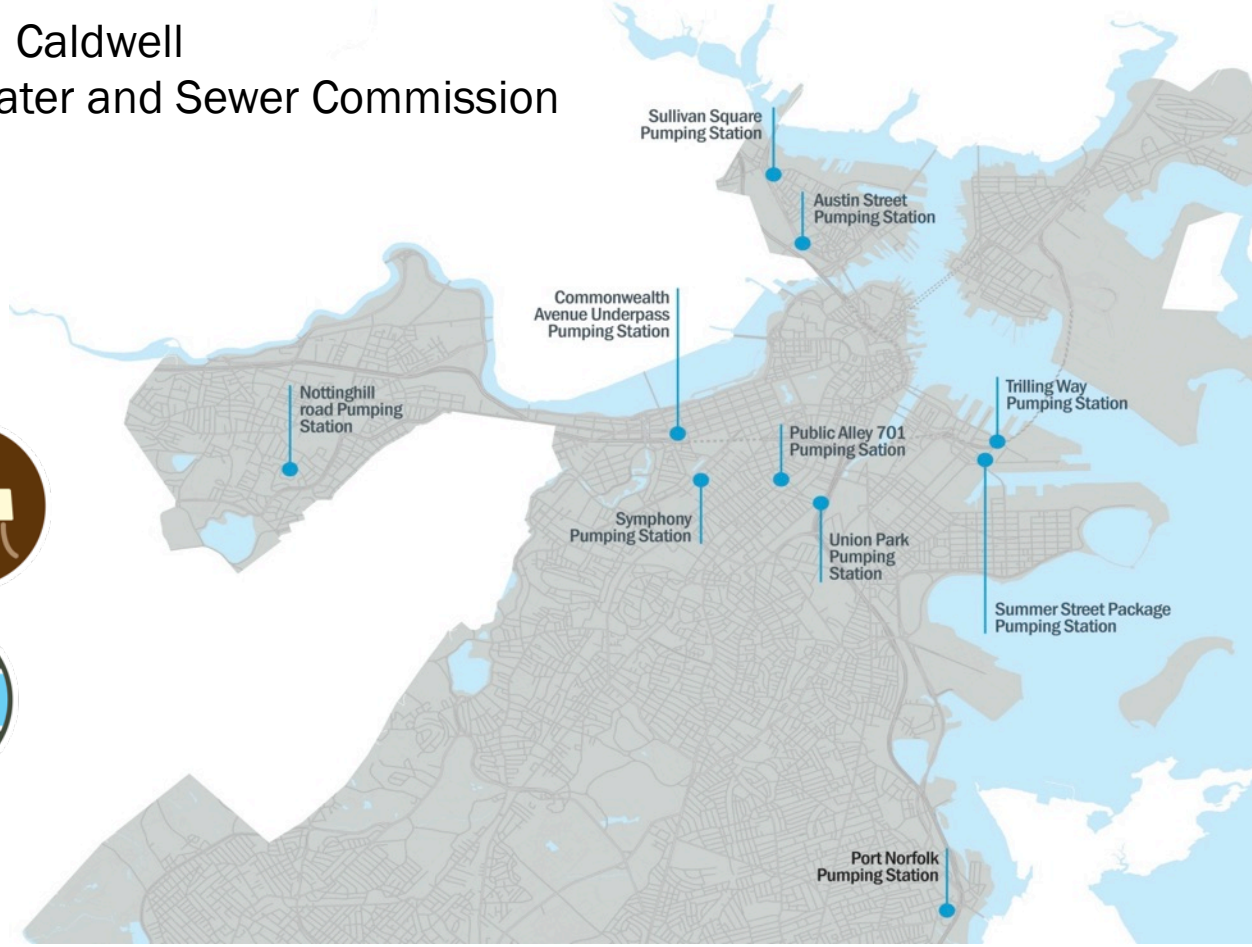
Patrick Greeley – Boston Water and Sewer Commission



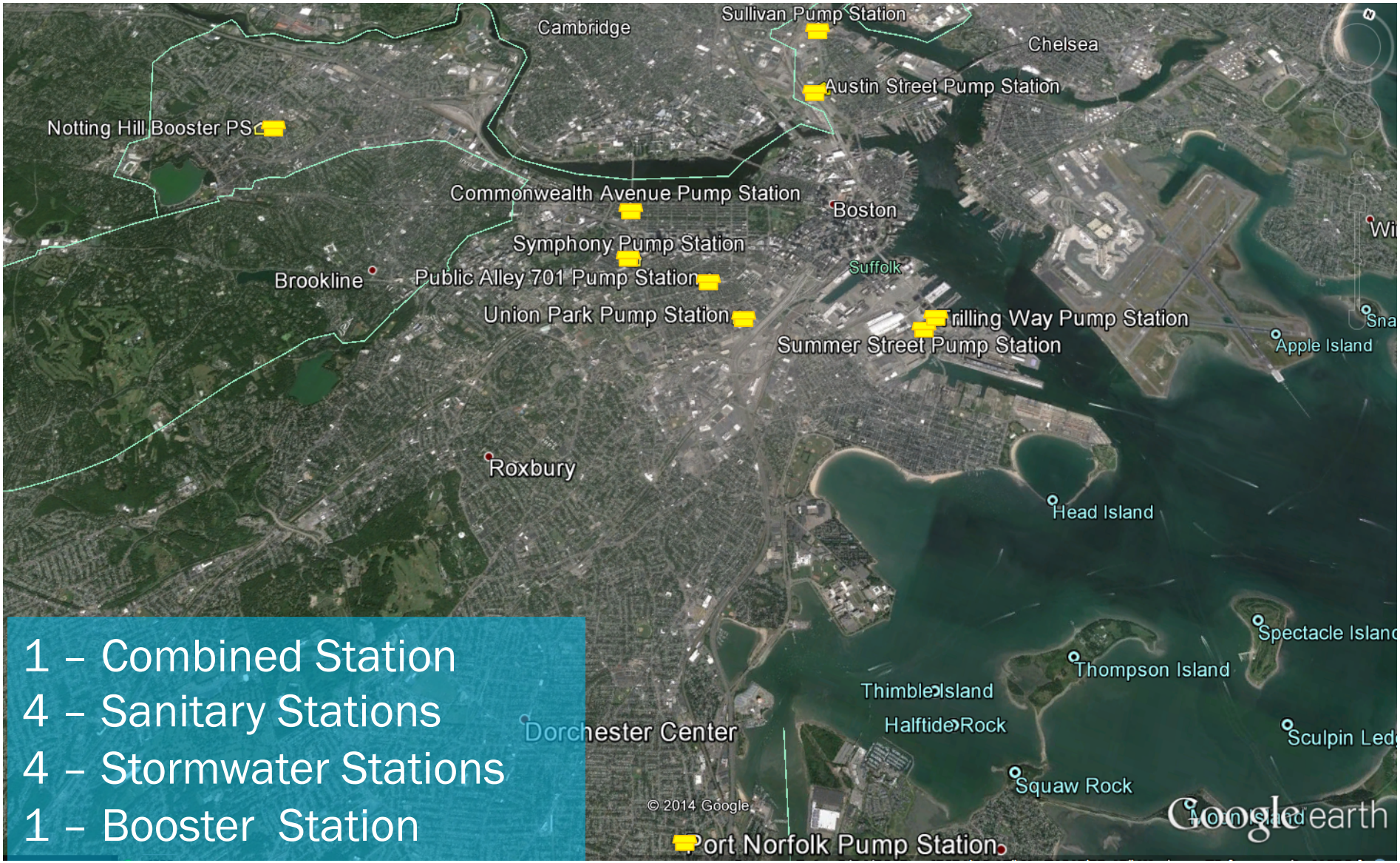
Outline

- Background and Drivers
- Methods
  - Typical Findings
    (non BWSC specific)
  - Prioritization and Grouping
    (non BWSC specific)
- Next Steps

Project Drivers

- Commission funds and maintains CIP
- CIP includes prioritized list of repairs and upgrades
- Independent and defensible review

Background


Cambridge
Sullivan Pump Station
Chelsea
Austin Street Pump Station
Notting Hill Booster PS
Commonwealth Avenue Pump Station
Boston
Symphony Pump Station
Brookline
Public Alley 701 Pump Station
Suffolk
Union Park Pump Station
rilling Way Pump Station
Summer Street Pump Station
Apple Island
Roxbury
Head Island
Spectacle Island
Thompson Island
Thimble Island
Halftide Rock
Dorchester Center
Sculpin Ledge
Squaw Rock
© 2014 Google
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Port Norfolk Pump Station
1 – Combined Station
4 – Sanitary Stations
4 – Stormwater Stations
1 – Booster Station

Section 2: Methods

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Project Methods

Credible, objective data

+

Proven prioritization proce

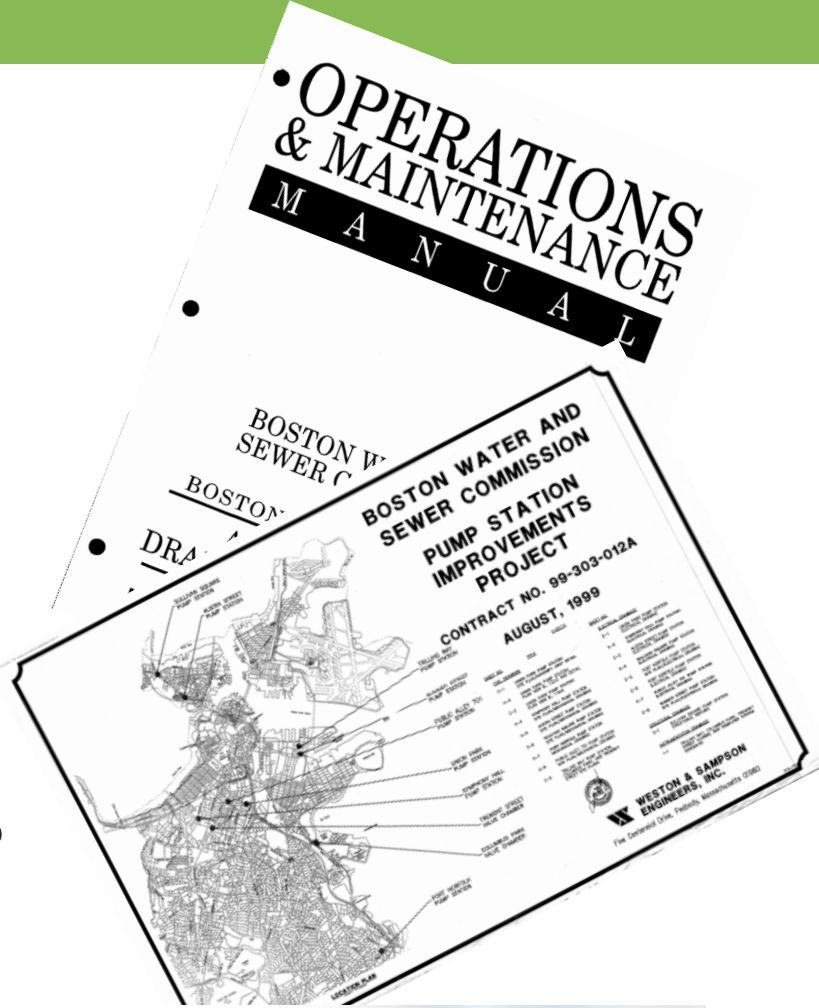
Defensible list of prioritized projects

BWSC : Step-by-Step Procedure

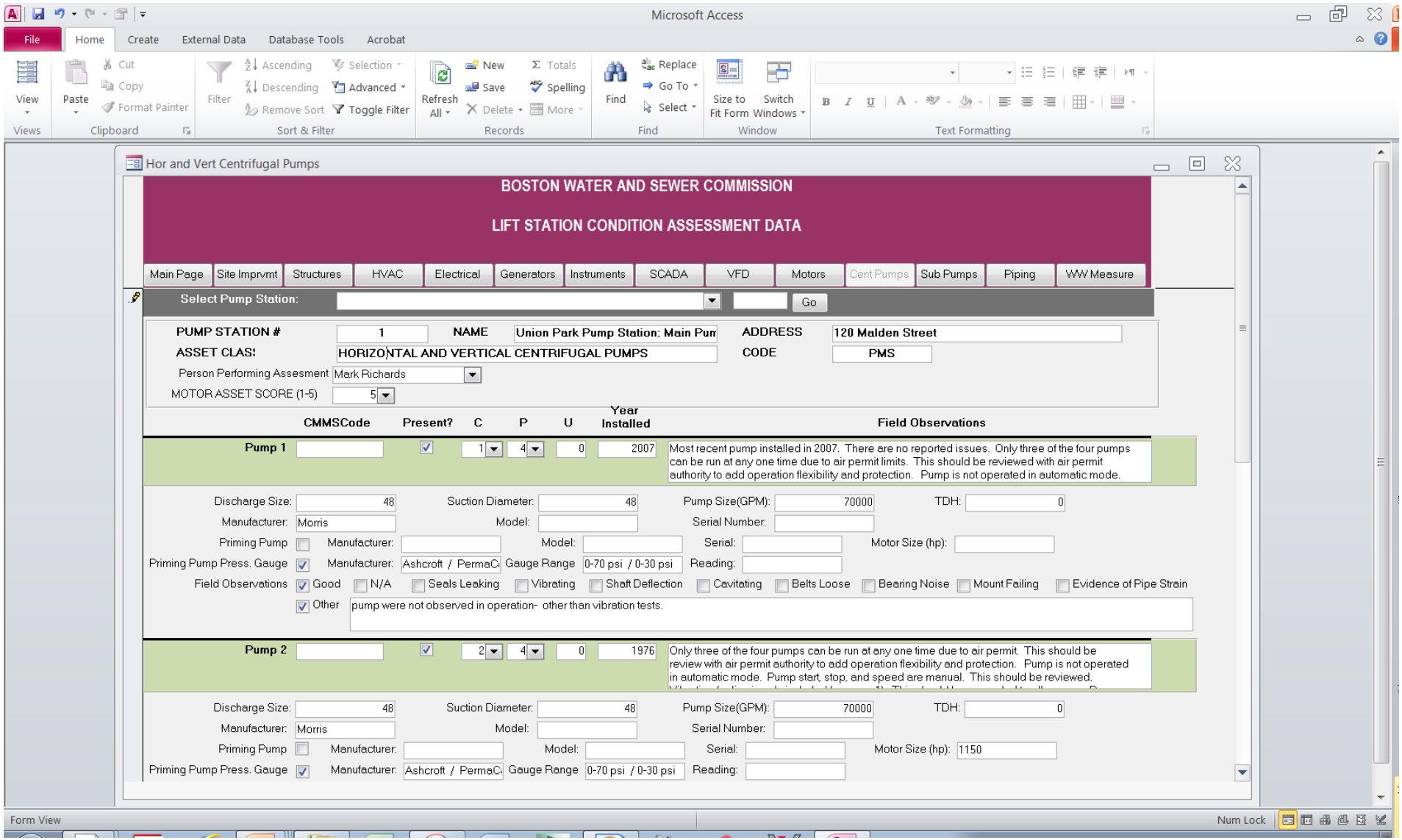
1. Historical Data Review
2. Computerized Database / Tablet
3. Consequence of Failure Review
4. Field Visits
   - Field assessment (Condition and Performance)
   - Field Tests
5. Asset Criticality "model" / Prioritization
6. Projects/ Recommendations

Step 1: Data Review

- O&M Manuals / Reports
- As-built Drawings
- Site visits / traffic review
- Interviews with Operators
- Existing Photos



Step 2: Customize Database / Tablet



Step 3a: Consequence of Failure (Asset Type) – Owner Input

- ✓ Civil/Site Assets
- ✓ Buildings and Structures
- ✓ Pump, Motors, and Equipment
- ✓ Piping and Valves
- ✓ HVAC
- ✓ Electrical Systems, VFDs
- ✓ Standby Power Systems
- ✓ Instrumentation and Control Systems

1: Low Consequence

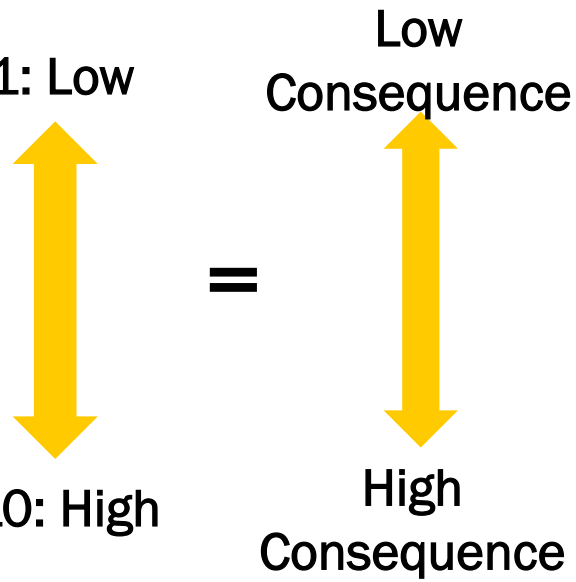
5: High Consequence

Step 3b: Consequence of Failure (Station) – Owner Input

- ✓ **UPPS**
- ✓ **Austin**
- ✓ **Commonwealth**
- ✓ **Sullivan**
- ✓ **Symphony**
- ✓ **Public Alley**
- ✓ **Summer**
- ✓ **Trilling Way**
- ✓ **Port Norfolk**
- ✓ **Notting Hill**

Parameters (weighting) X Parameter Score = Station Score

Station Flow (weight =0.6)
Critical Customers (weight =1.0)
Sensitive Waters (weight =0.8)
Difficulty of Repair (weight =0.4)
Growth Area (weight =0.3)
Response Time (weight =0.8)
etc…
etc…
.
.



Step 4a: Field Visits

Team scoring for each asset

Condition

1. Excellent
2. Slight visible degradation
3. Visible degradation
4. Integrity of component moderately compromised
5. Integrity of component severely compromised

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Step 4b: Field Visits

Team scoring for each asset

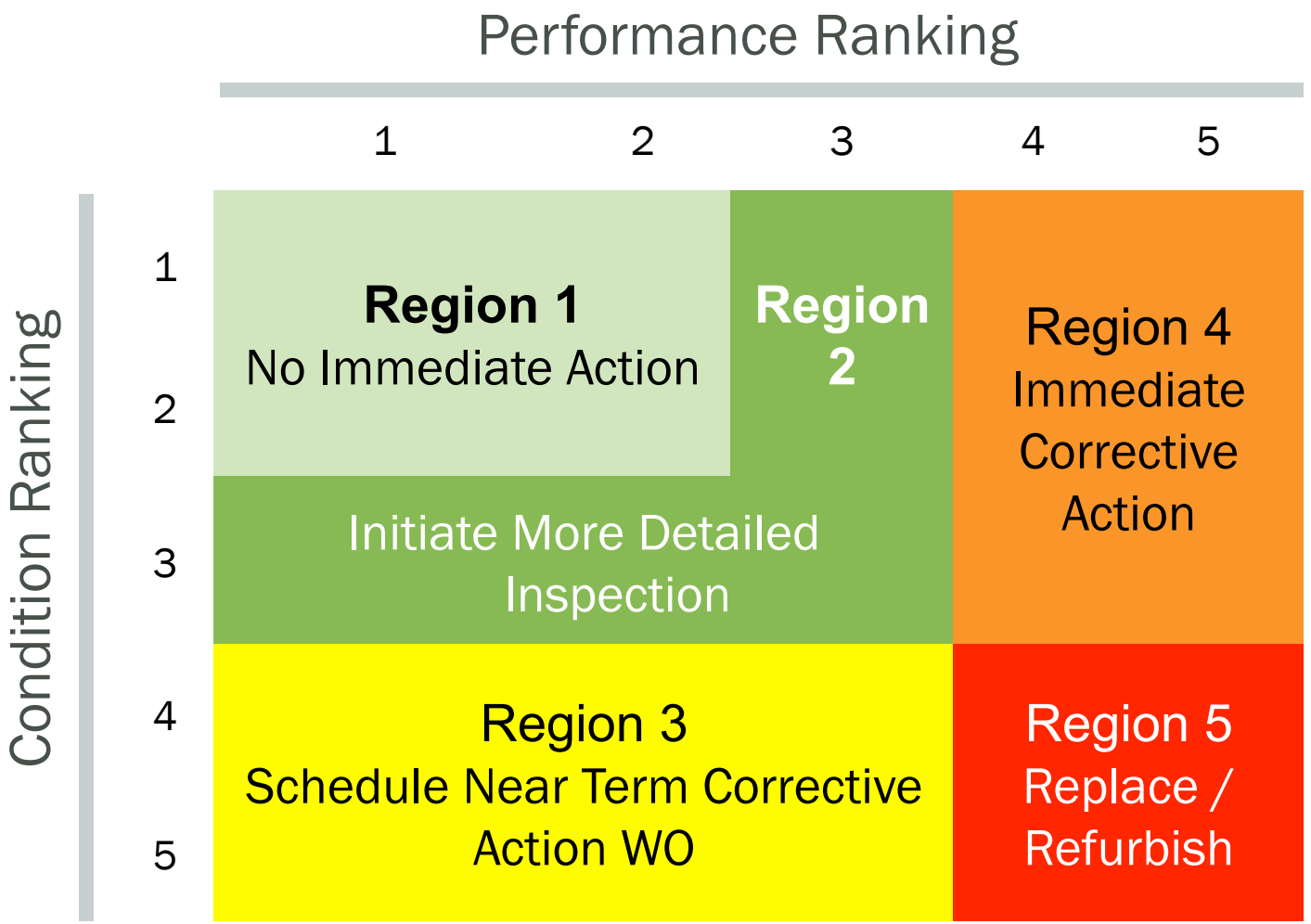
Performance

1. Component functioning as intended
2. In-service, but higher than expected O&M
3. In-service, but function is impaired
4. In-service, but function is highly impaired
5. Component is not functioning as intended

Age Adjustment

- 0- 50% of useful life → No adjustment
- 50-75% of useful life → Performance (+1)
- 75-100% of useful life → Performance (+2)

Step 4c: Field Visit Condition and Performance Regions



Safety, Reliability, Operability

Section 3: Typical Findings (non-BWSC specific)

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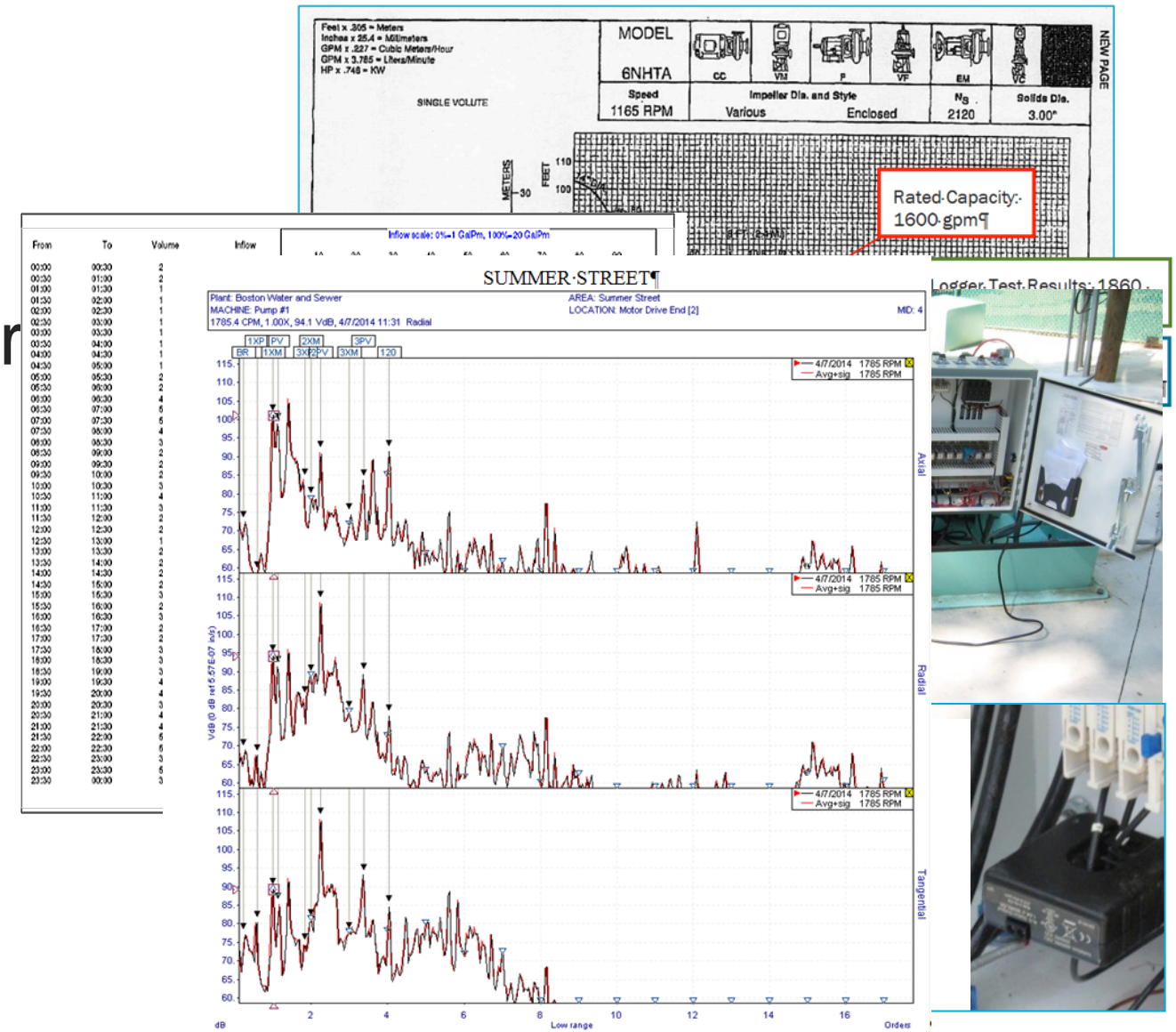
Summary of Common Field Test Findings

1. Capacity / Drawdown Tests
2. Data Logger
3. Vibration

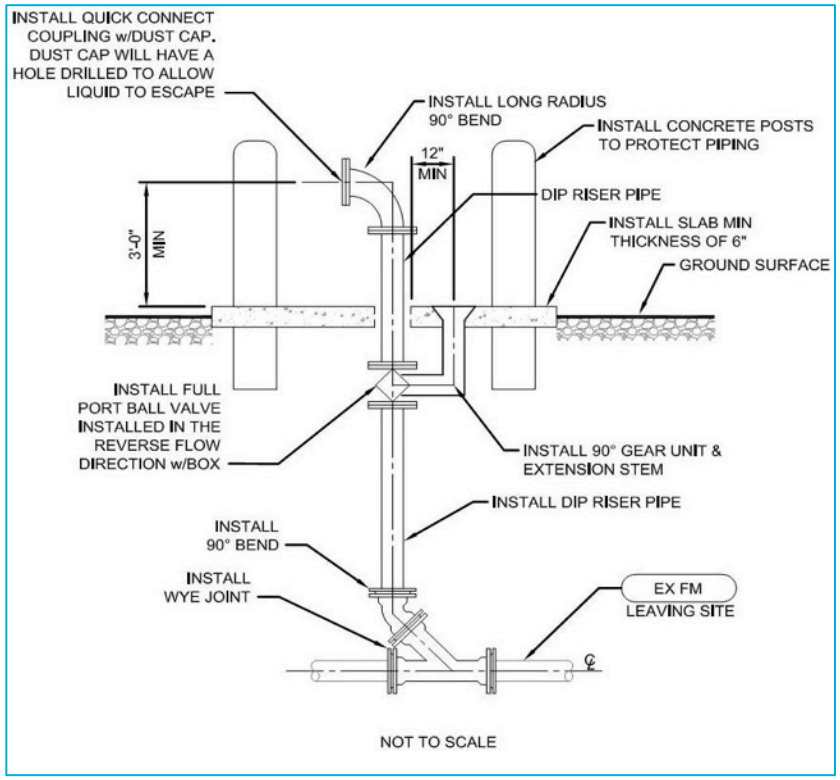


Summary of Common Electrical and HVAC Findings

- Local HMI / local operator interface
- Egress lighting
- NFPA 820 compliance / Intrinsically safe devices / ventilation
- Surge suppression
- Gas monitoring / alarms
- Secondary pump controls
- Smoke vs. fire detectors

Summary of Common Hydraulic / Mechanical Findings

- Station Bypass Potential
- Equipment Assess Removal

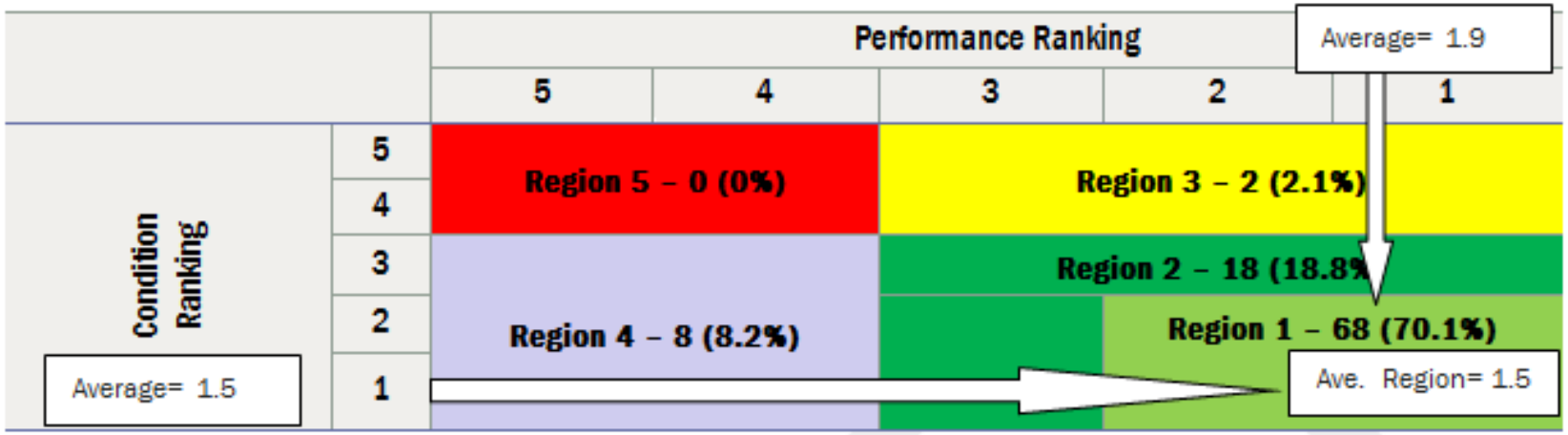


Summary of Common Structural Findings

- Hatches
- Ladders
- Cracked Walls / Structures

Station XYZ

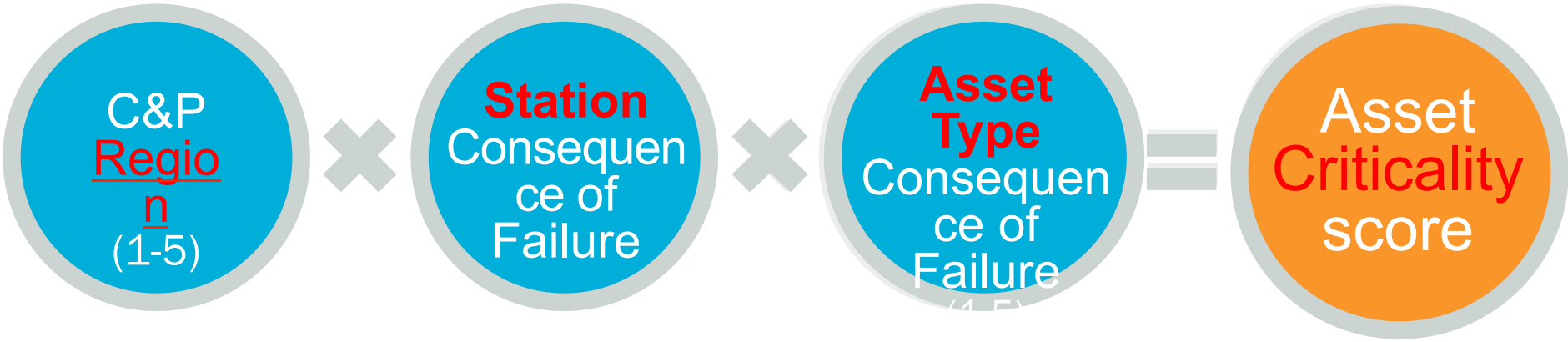
Total Number of Assets Reviewed = 96



Highest Scoring Assets

Asset	Asset Type	Comments	Asset Region
Roof	Structural	Damage membrane, evidence of leakage	4
Pump 2	Pumps	High vibration, leaking seal	4
Control Panel	Electrical	No local HMI	3
Exhaust Fan	HVAC	Noise, No gas monitoring	2

Step 5a: Criticality Review "Model" (Criticality of assets)



Likelihood of failure

Section 4: Prioritization / Grouping

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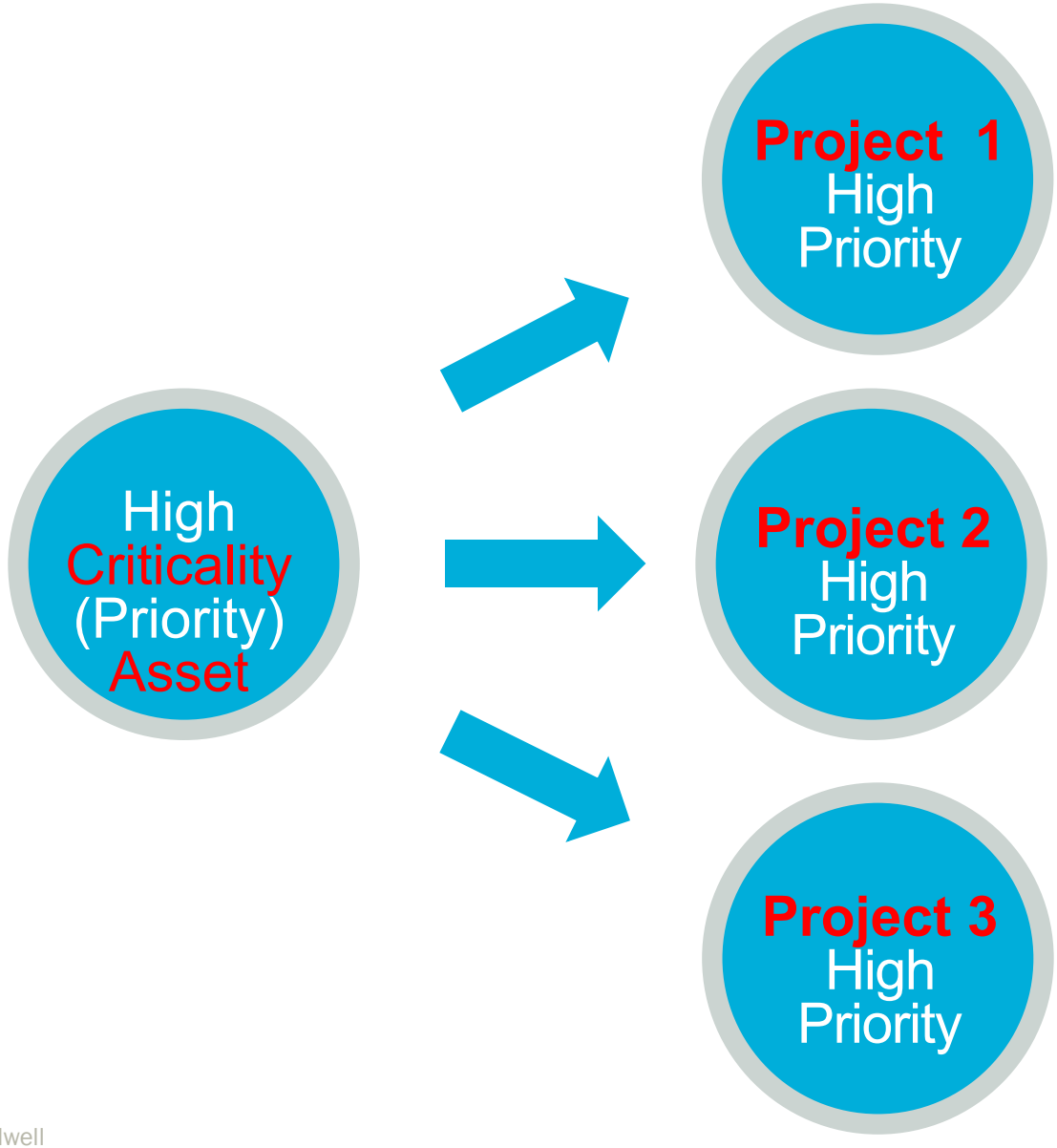
Asset Priority

Asset Prioritization Summary	
Asset Priority	**Percentile**
Priority 1 (0-2 years)	90'th-% to 100'th-%
Priority 2 (2-5 years)	70'th-% to 90'th-%
Priority 3	50'th % to 70'th-%
Priority 4	0-% to 50'th-%

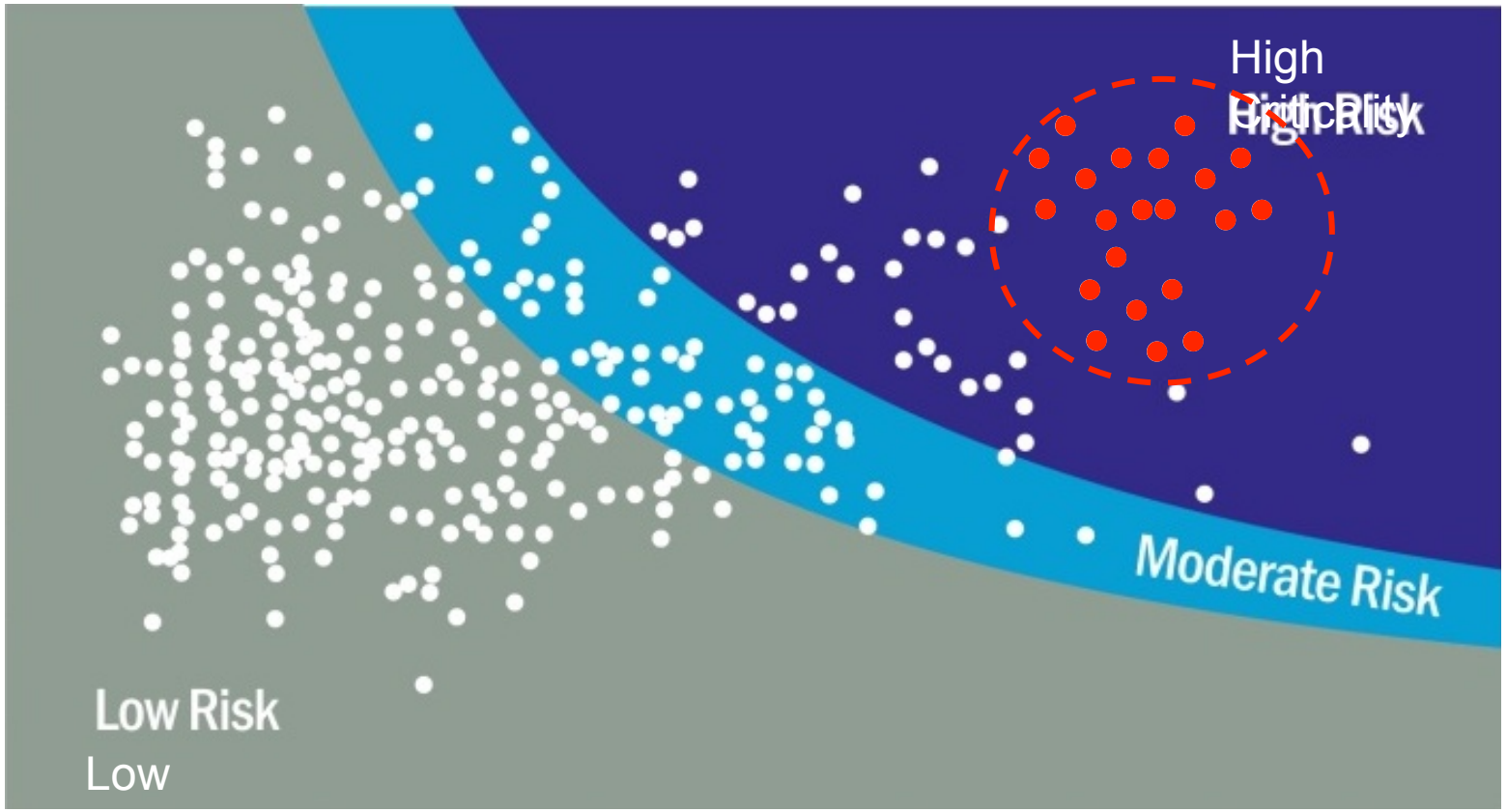
High Criticality Asset and Projects



Overall Summary of Criticality Prioritization

Summary Asset Prioritization Summary and Costs			
Priority	Percentile	Assets Count	Total Cost ($)
Priority 1	90% to 100%	39	$XXX,XXX,XXX
Priority 2	70% to 90%	71	$XXX,XXX,XXX
Priority 3	50% to 70%	102	No cost estimate
Priority 4	0% to 50%	174	No cost estimate

Prioritize CIP expenditures to maximize criticality reduction



Asset Region (G&R)

Likelihood of Failure

Consequence of Failure

Station and Asset Type Score

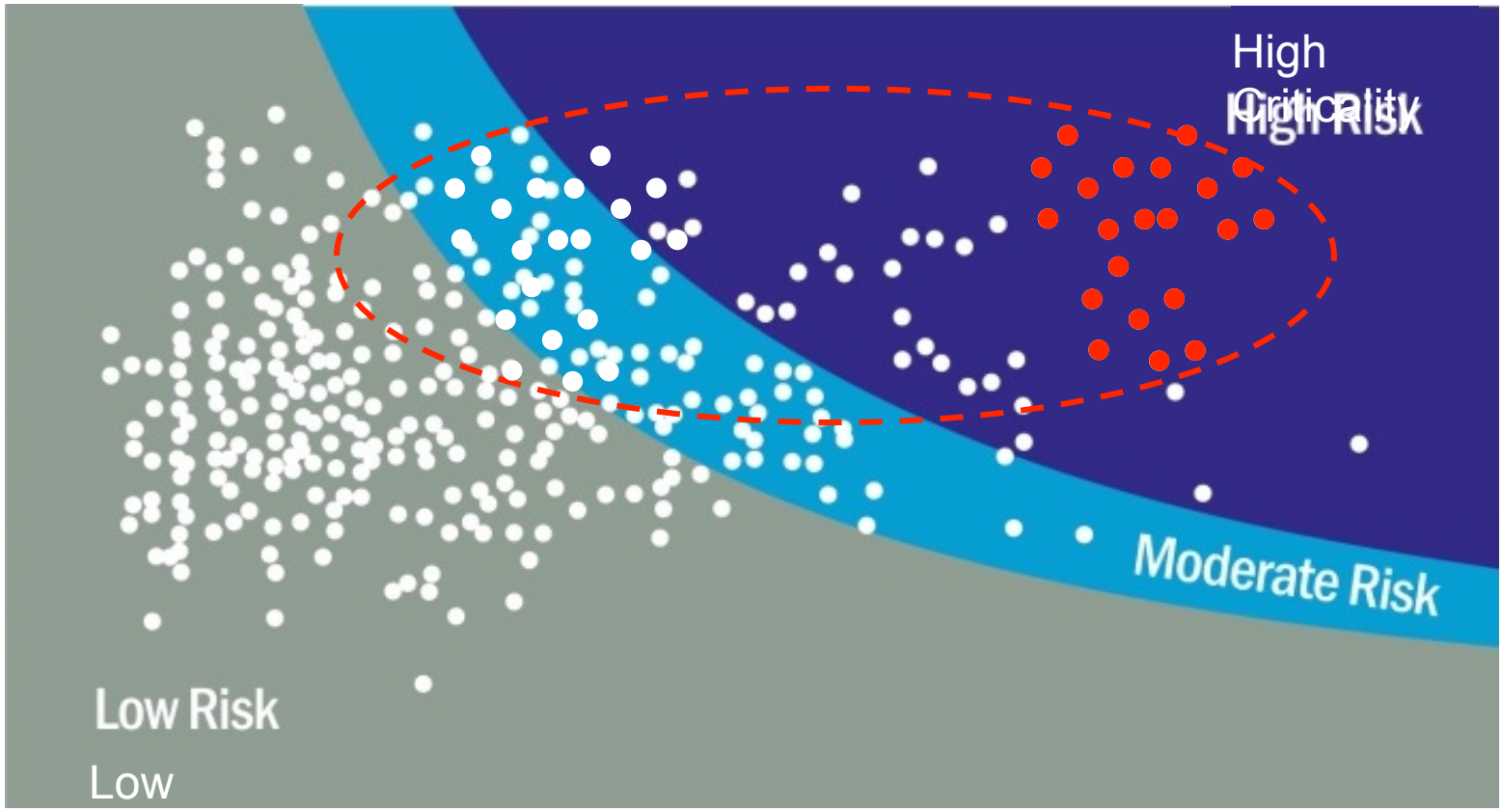
Grouping of Projects By Station

Priority Summary by Pump Station					
Station	Priority 1		Priority 2		Total Cost ($)
	Asset Count	Cost ($)	Asset Count	Cost ($)	
Station 1	3	-------	13	-------	-------
Station 2	4	-------	9	-------	-------
Station 3	9	-------	1	-------	-------
Station 4		-------	4	-------	-------
Station 5		-------	4	-------	-------
Station 6	4	-------		-------	-------
Station 7	1	-------	2	-------	-------
Station 8		-------	2	-------	-------
Station 9		-------	3	-------	-------
Station 10		-------	3	-------	-------
Grand Total	39	-------	71	-------	-------

Grouping of Projects by Asset Type

Priority Summary by Asset Type					
Asset Type	Priority 1		Priority 2		Total Cost ($)
	Asset Count	Cost ($)	Asset Count	Cost ($)	
Building	2	-------	6	-------	-------
Centrifugal Pumps	5	-------	5	-------	-------
Cranes		-------	2	-------	-------
Electrical Infra.	6	-------	10	-------	-------
Electrical Power	3	-------	2	-------	-------
Generators	1	-------	2	-------	-------
HVAC	1	-------	3	-------	-------
Instrumentation	3	-------	4	-------	-------
Motors	3	-------		-------	-------
Odor Control	1	-------		-------	-------
Piping		-------	22	-------	-------
SCADA	2	-------	4	-------	-------
Submersible Pumps	7	-------	2	-------	-------
Wetwell	5	-------	8	-------	-------
VFD		-------	1	-------	-------
Total	39	-------	71	-------	-------

Prioritize and Group expenditures to maximize criticality reduction



Section 5: Next Steps

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Next Steps

- Reviewing higher priority projects with BWSC staff
- Further grouping of project by station
- Further grouping of projects by asset type

Summary

Step 1
Proper planning and input

Step 2
Field time

Step 3
Defensible, prioritized improvements

TOOLS

- Electronic condition assessment forms

- Computer tablet (C&P Regions)
- Data loggers
- Vibration

- Criticality prioritization model

Questions?

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