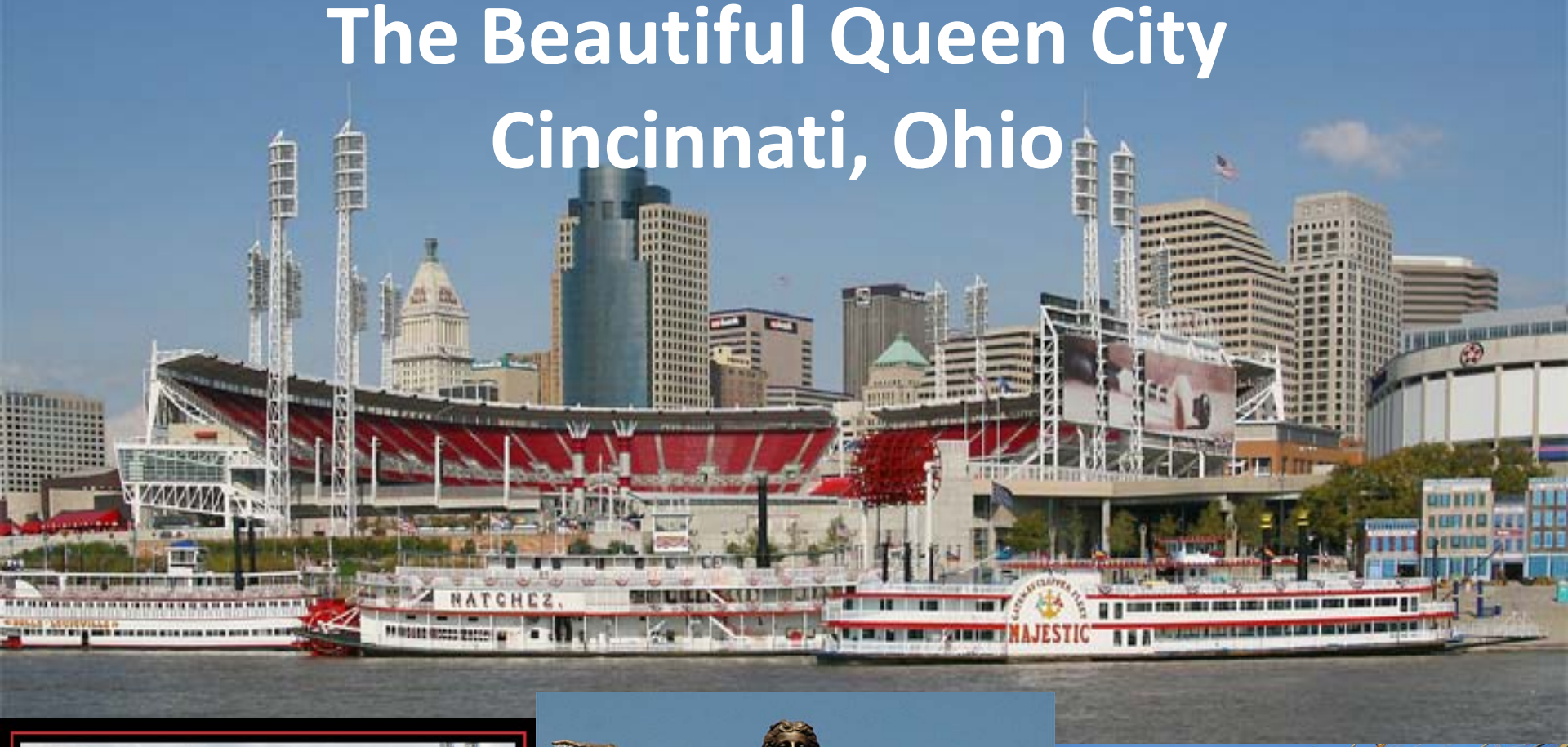
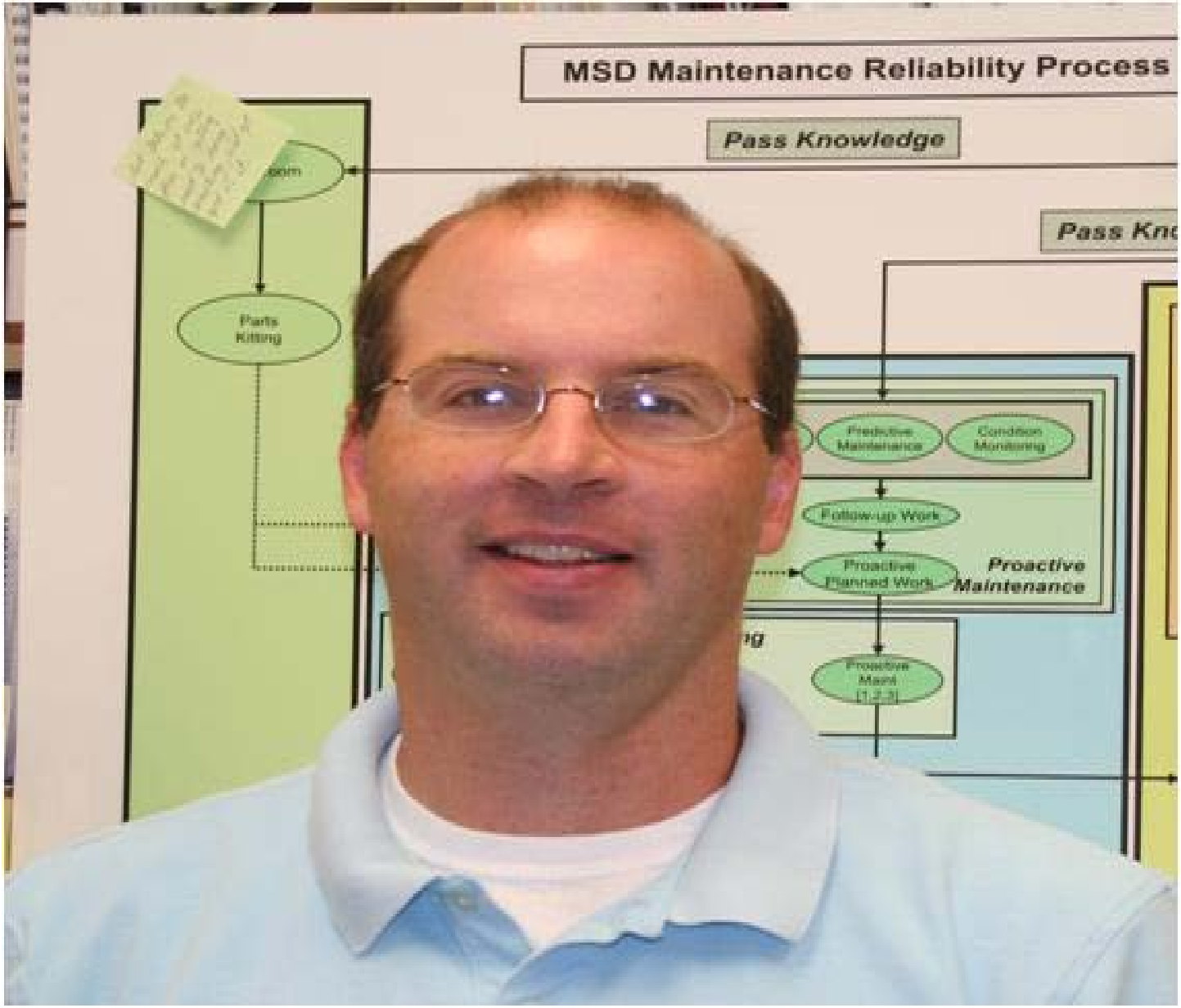
The Beautiful Queen City
Cincinnati, Ohio



Biju George
MSD Deputy Director



Scott Maring
Wastewater Treatment Division

CHERYL TOWNSEND-BRAUN
Wastewater Collection Division

Eric Saylor
Project & Business Development Division

MSDGC – an overview

- 7 Treatment Plants
- Over 100 pump and lift stations
- Over 3,000 miles of sewer
  - 45% of sewers are combined sewers
  - Over 200 CSO's
  - 70 SSO's
- Serve a population of 850,000 people
- Covers an area with 49 municipalities

I. GETTING STARTED

•CINCINNATI•

FLYING PIG MARATHON

METROPOLITAN SEWER DISTRICT of greater CINCINNATI

Asset Management Best Practices
Seattle Public Utilities & MSD Collaboration
September 2007

IWA – WSAA 2008 ASSET MANAGEMENT PROCESS BENCHMARKING PROJECT

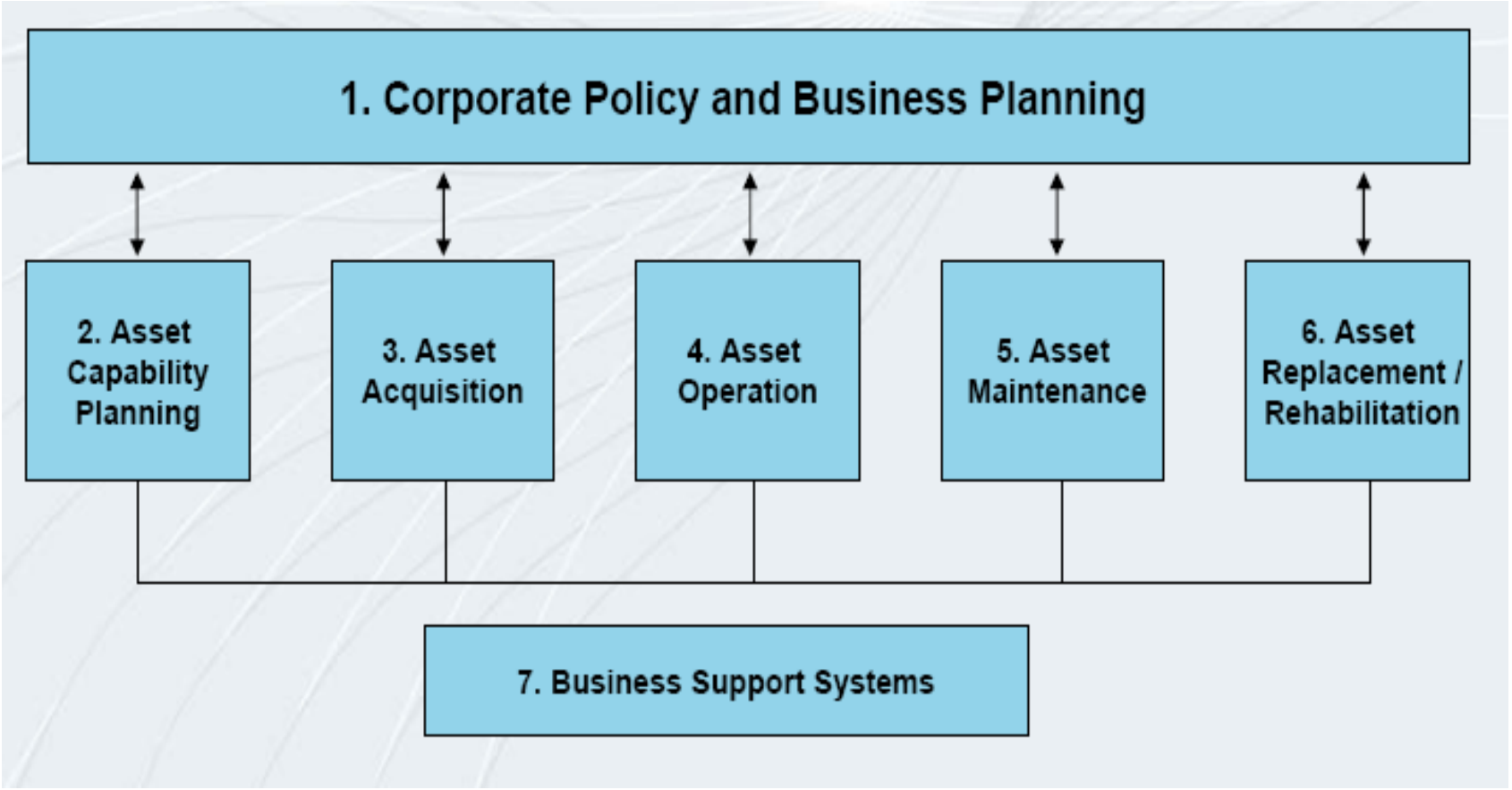



WATER SERVICES ASSOCIATION OF AUSTRALIA

IWA International Water Association

The participant group of 44 spanned Australia, New Zealand, USA, Canada, Hong Kong, UAE and Oman.

The Aquamark Framework is designed to examine "whole of business" process capability, documentation, and execution.



II. Integrated MSDGC Asset Management Approach

METROPOLITAN SEWER DISTRICT of greater CINCINNATI

We Needed to Develop a Sustainable, Asset-Centric, MSD Strategic Plan

We collected the thoughts and ideas of employees throughout MSD

- GE CAP Sessions & Level of Service Workshop
- Asset Management Boot Camp Week

We brought in local universities and nationally-recognized experts

- University of Cincinnati (NPV)
- Miami University ($$ sessions)
- Xavier University (CIP workflow)
- John Fortin and Scott Haskins

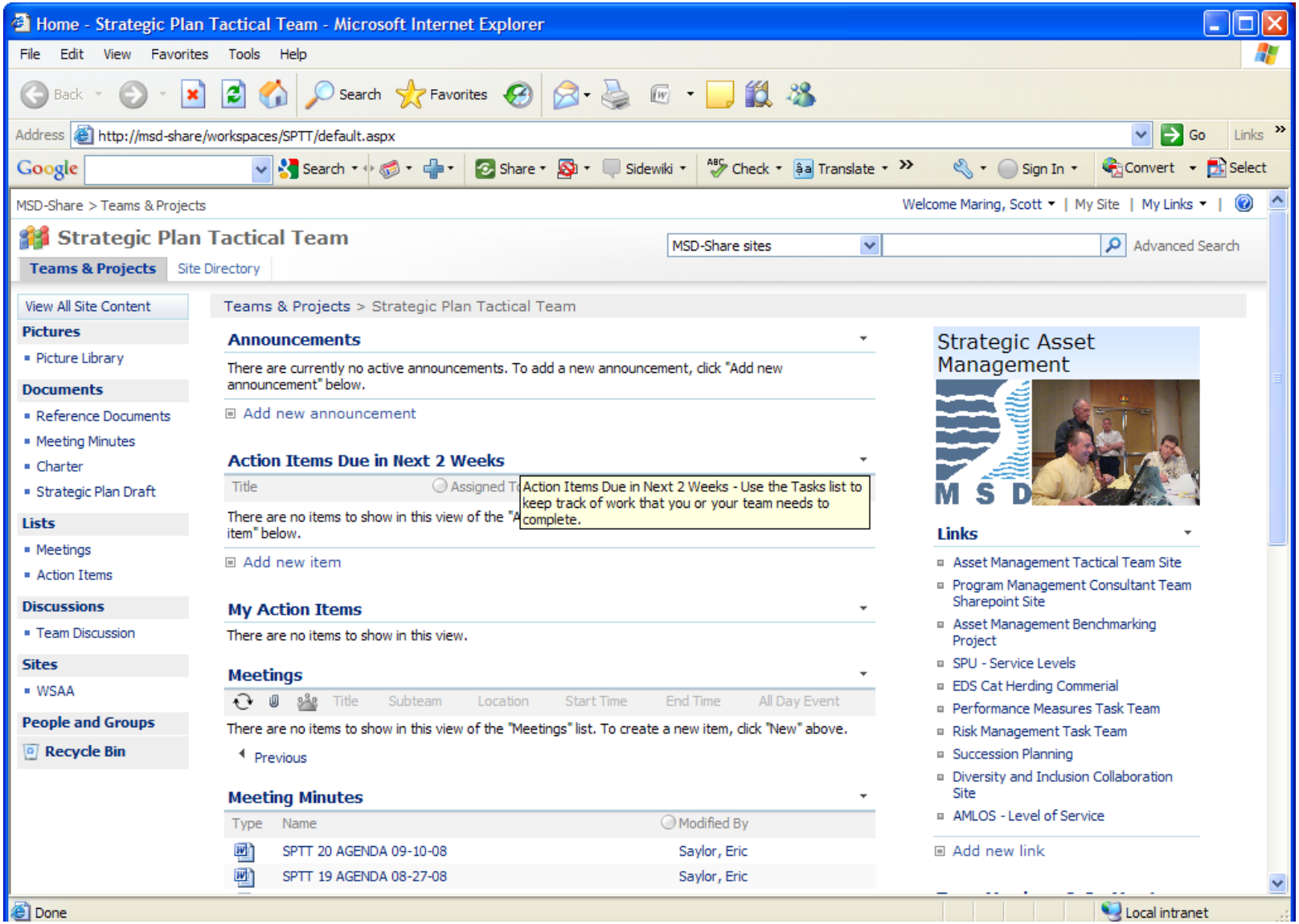
How are we going to pull all of this information together?

We formed two tactical teams that with one member representing each division.

In three months we had developed the framework of the Strategic Plan.

The tactical team then merged with division heads into one team and the Strategic Plan was born.

Sharepoint Site



How are we going to implement this?

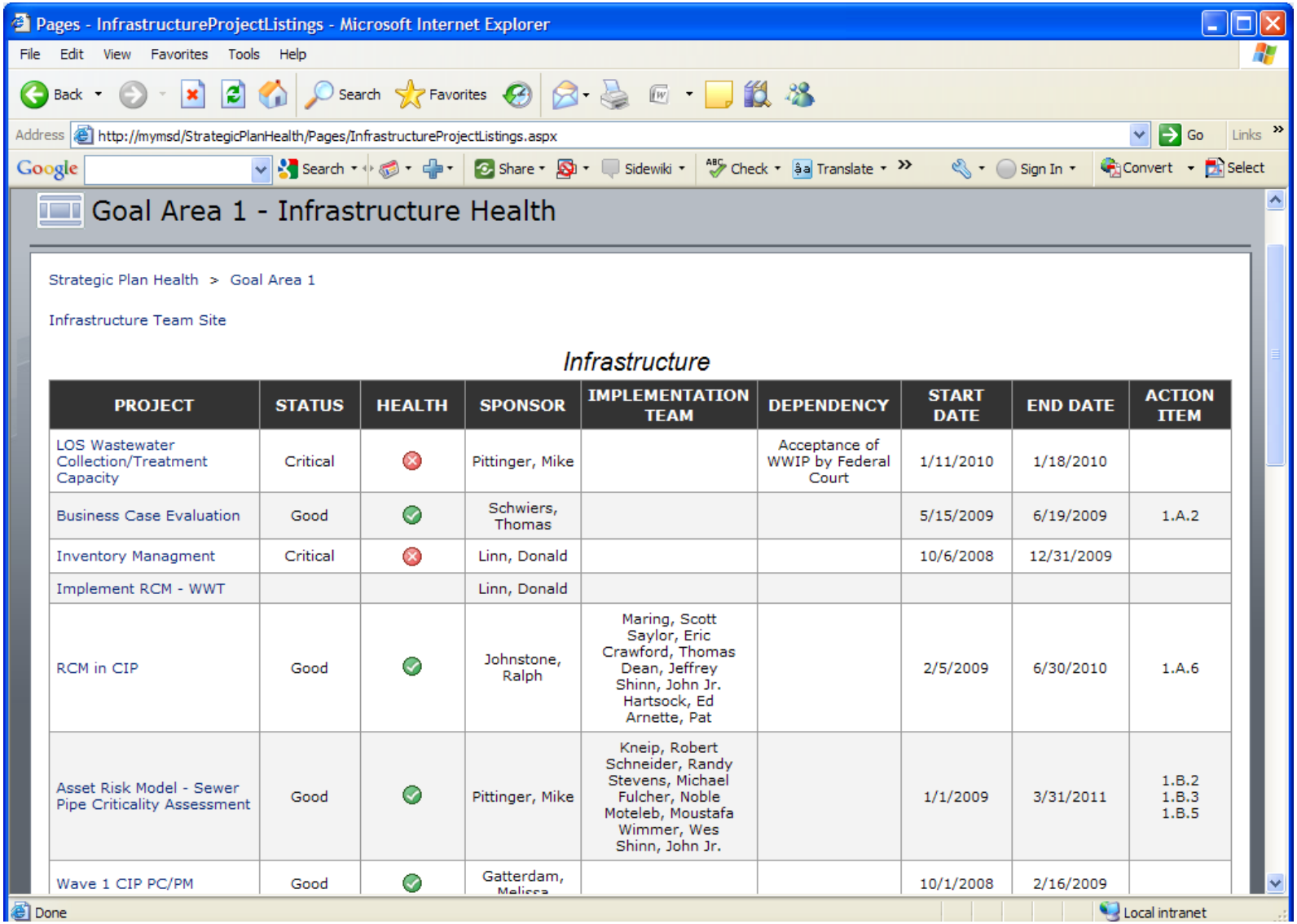
Goal Area Team Leaders

1. Infrastructure
2. Workforce
3. Stakeholders and Sustainability
4. Communications
5. Financial
6. Continuous Improvement

Goal Team Leaders oversee cross-divisional Task Teams with, when needed, consultant support.

Goal Team Leaders report out to the Director and Deputy Director each month on the progress of their goal area.

Strategic Plan SharePoint Site

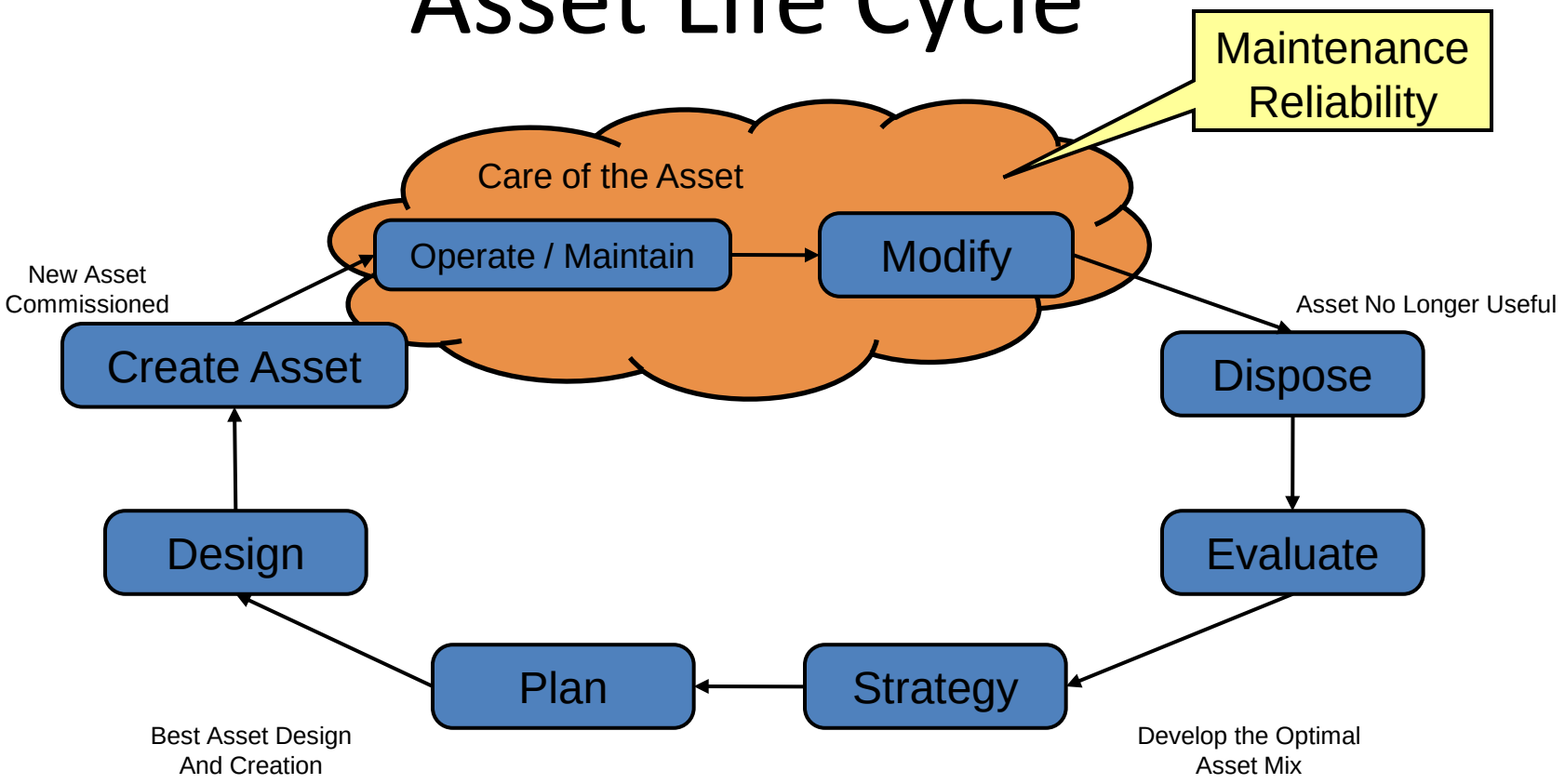


PROJECT	STATUS	HEALTH	SPONSOR	IMPLEMENTATION TEAM	DEPENDENCY	START DATE	END DATE	ACTION ITEM
LOS Wastewater Collection/Treatment Capacity	Critical		Pittinger, Mike		Acceptance of WWIP by Federal Court	1/11/2010	1/18/2010	
Business Case Evaluation	Good		Schwiers, Thomas			5/15/2009	6/19/2009	1.A.2
Inventory Managment	Critical		Linn, Donald			10/6/2008	12/31/2009	
Implement RCM - WWT			Linn, Donald					
RCM in CIP	Good		Johnstone, Ralph	Maring, Scott Saylor, Eric Crawford, Thomas Dean, Jeffrey Shinn, John Jr. Hartsock, Ed Arnette, Pat		2/5/2009	6/30/2010	1.A.6
Asset Risk Model - Sewer Pipe Criticality Assessment	Good		Pittinger, Mike	Kneip, Robert Schneider, Randy Stevens, Michael Fulcher, Noble Moteleb, Moustafa Wimmer, Wes Shinn, John Jr.		1/1/2009	3/31/2011	1.B.2 1.B.3 1.B.5
Wave 1 CIP PC/PM	Good		Gatterdam, Melissa			10/1/2008	2/16/2009	

III. ACCOMPLISHMENTS

METROPOLITAN SEWER DISTRICT of greater CINCINNATI

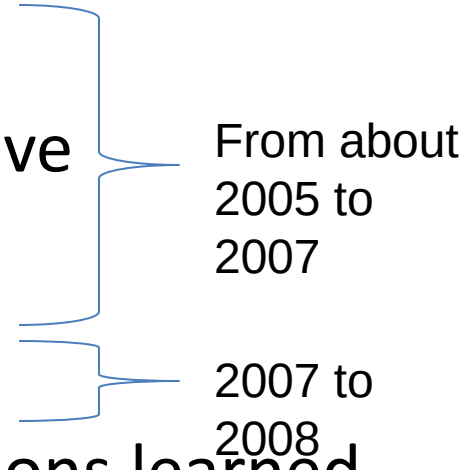
Asset Life Cycle

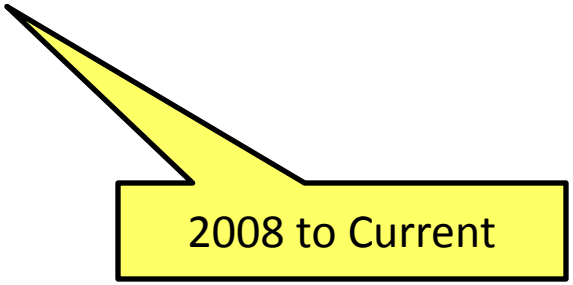


Source: *Sustainable Asset Management*, Roopchan Lutchman

Maintenance Reliability

- Transition from reactive to proactive maintenance
  - Know what you have
  - How important is what you have
  - Develop strategy
  - Implement strategy
  - Continuous improvement/lessons learned





Maintenance Reliability

MSD Treatment Division Journey Highlights

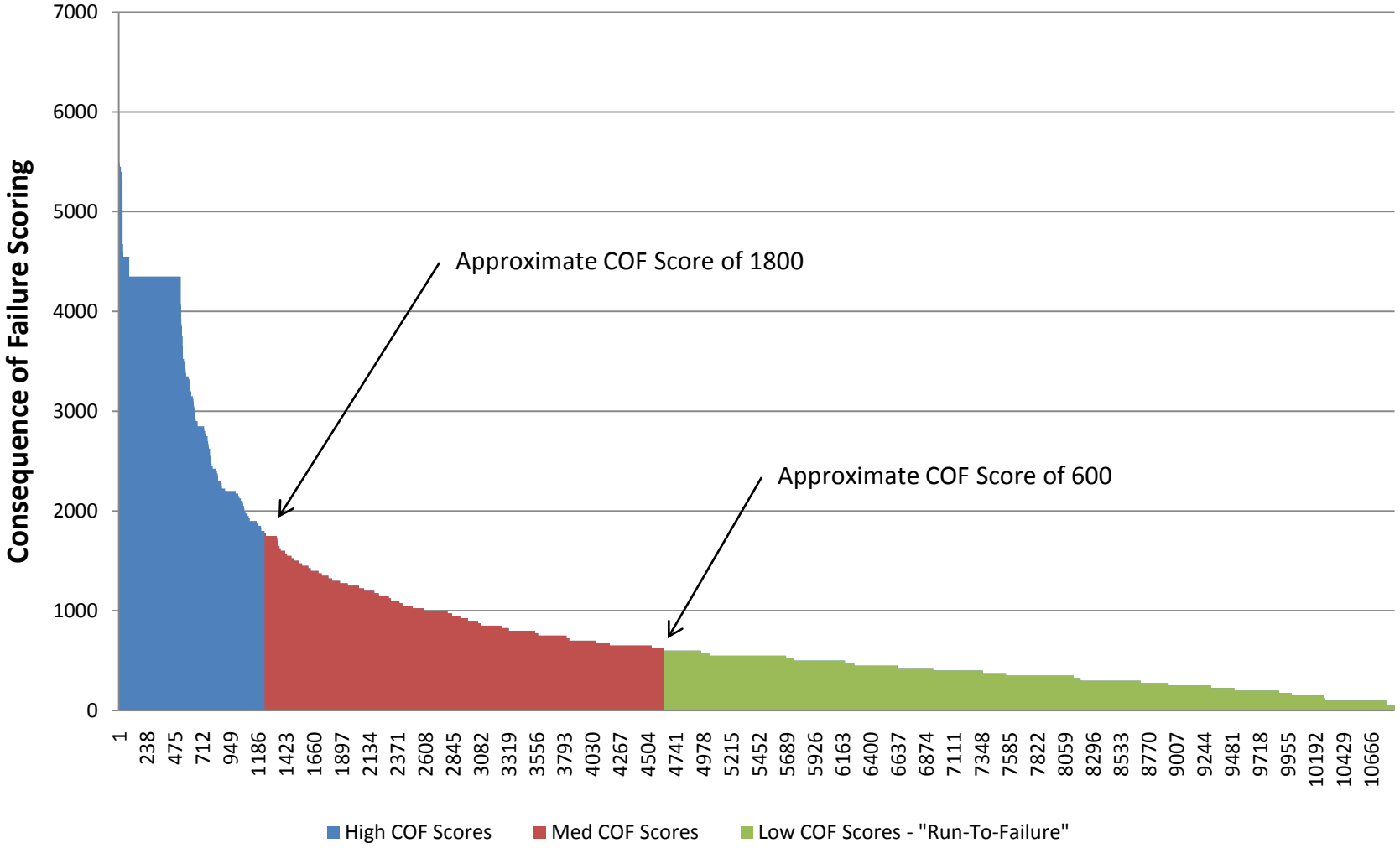
- Know what you have
  - Identified and tagged almost 20,000 assets
  - Developed detailed asset tagging specification. Continuously improved and updated specification.

Maintenance Reliability

MSD Treatment Division Journey Highlights

- How important is what you have?
  - Developed Consequence of Failure tool
    - 23 questions covering maintenance, operations, safety, and environmental impact.
    - Scoring integrated into CMMS
  - Allowed for “top down” development of maintenance strategy

MSD of Greater Cincinnati
Division of Wastewater Treatment
Consequence Failure Scoring Summary

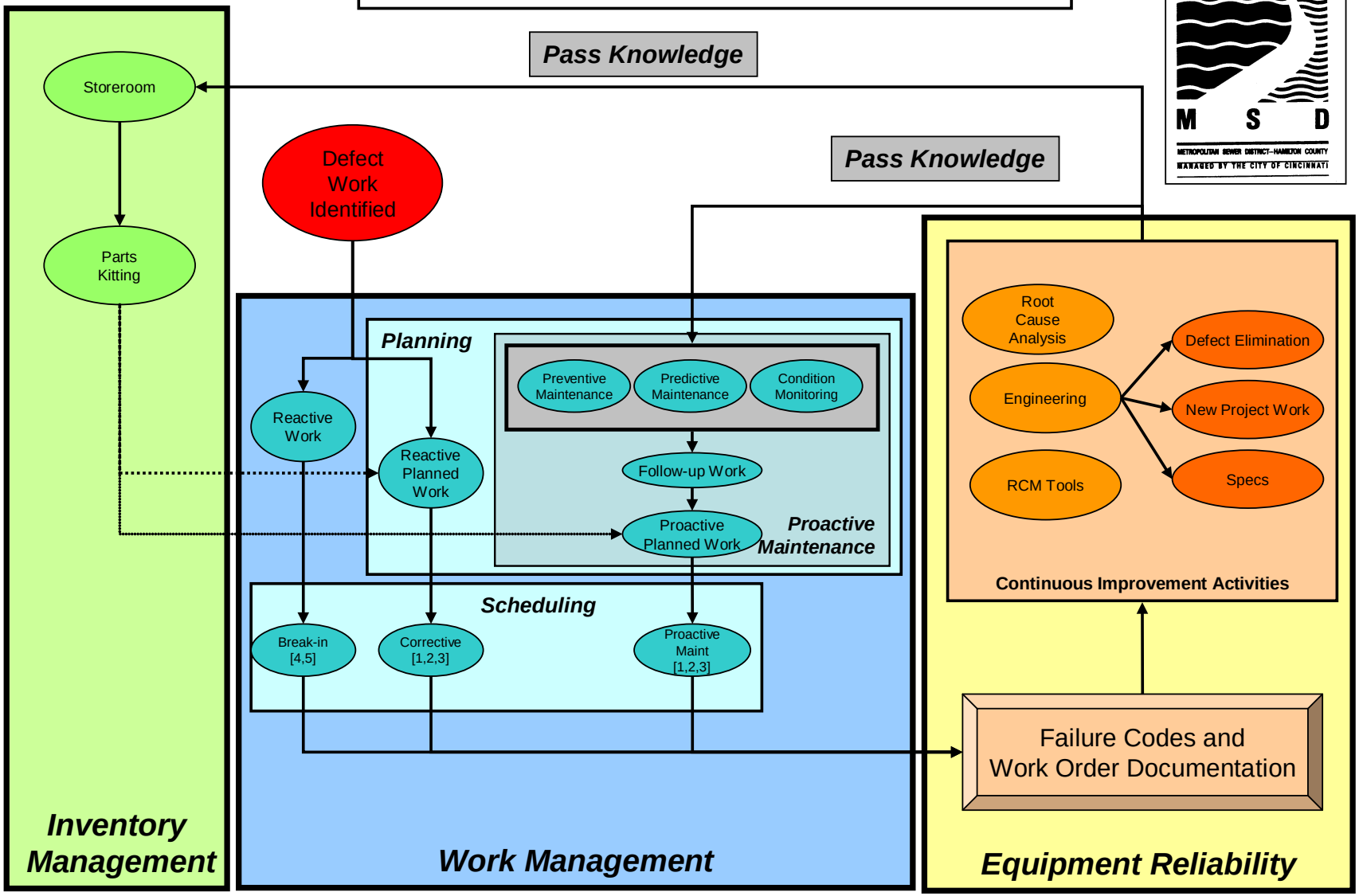


Maintenance Reliability

MSD Treatment Division Journey Highlights

- Develop maintenance strategy
  - Maintenance workflows
  - Preventive and predictive maintenance routes and job plans
  - Identify run-to-failure assets
  - Think of the maintenance program as a “process”.

MSD Maintenance Reliability Process Map



Maintenance Reliability

MSD Treatment Division Journey Highlights

- Implement maintenance strategy
  - Planning and scheduling team
  - Predictive maintenance vendor(s) in place
  - Predictive maintenance in-house development
  - Lubrication program development
  - Motor management program
  - Strategic repair contracts
  - Integrate maintenance reliability into capital projects

Maintenance Reliability

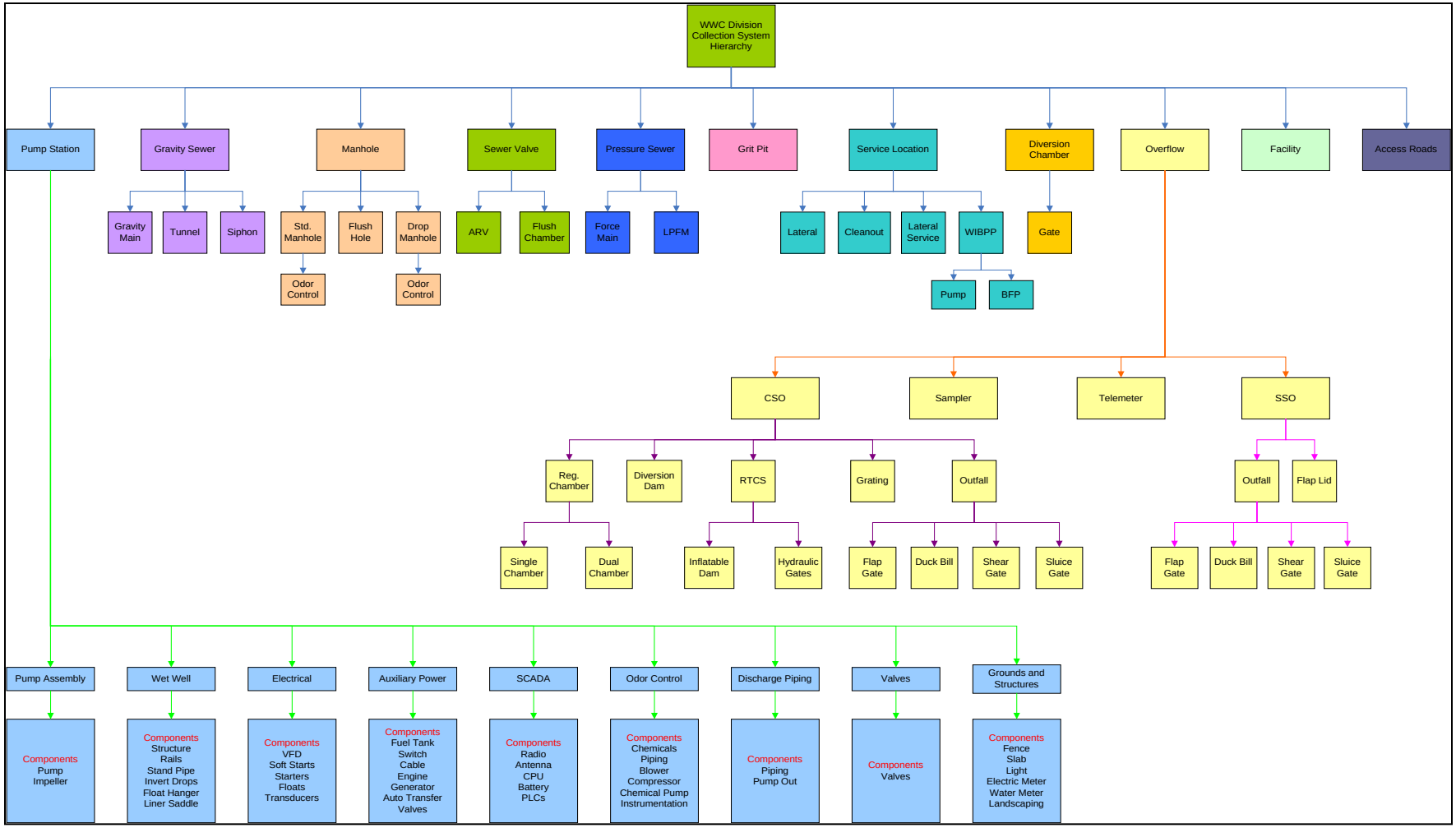
MSD Treatment Division Journey Highlights

- Continuous improvement
  - RCM Sessions
    - Utilize data to find problem systems
    - Perform detailed RCM analysis to enhance operational and maintenance strategies
  - Measures
    - Develop KPI's along the maintenance process map to track progress and ensure data quality
    - Establish targets for work groups

LINEAR ASSET RISK MODEL

- Develop Asset Hierarchy
- Define Risk
  - Consequence of Failure (Criticality)
  - Likelihood of Failure (Probability)
- Develop Risk Model
- Implement Risk Model
- Review and Refine Model

Linear Asset Hierarchy



Risk Defined ……

- The terms ‘Risk’ and ‘Criticality’ are often used interchangeably. For the purpose of this team ‘Risk’ is a function of criticality and probability

  Risk = Criticality x Probability

- Criticality is often defined as “the consequence of failure”. Probability is often defined as “the likelihood of failure” and generally refers to the condition of the asset.

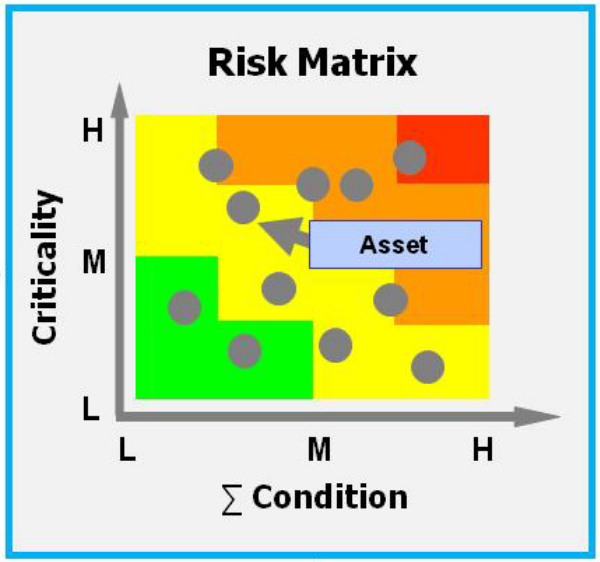
  Risk = Consequence x Likelihood

Development of the Risk Model for Gravity Sewers

Risk =(∑Condition) x Criticality

Criticality Criteria

- Pipe attributes – size, # of connections.
- Location – proximity to structures, roadways, waterways and CSO/SSOs.
- Capacity – DWF & WWF

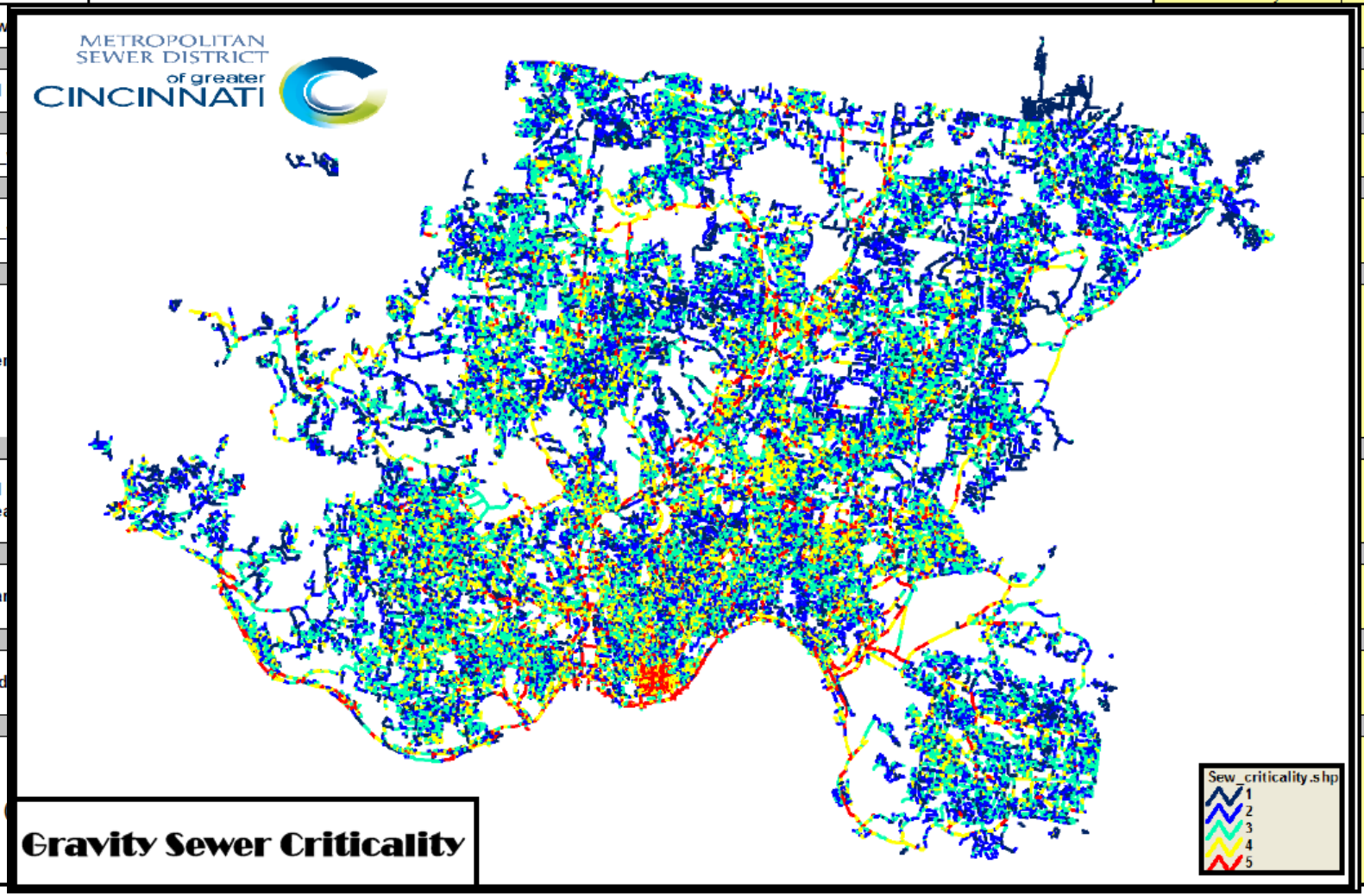


Condition Criteria

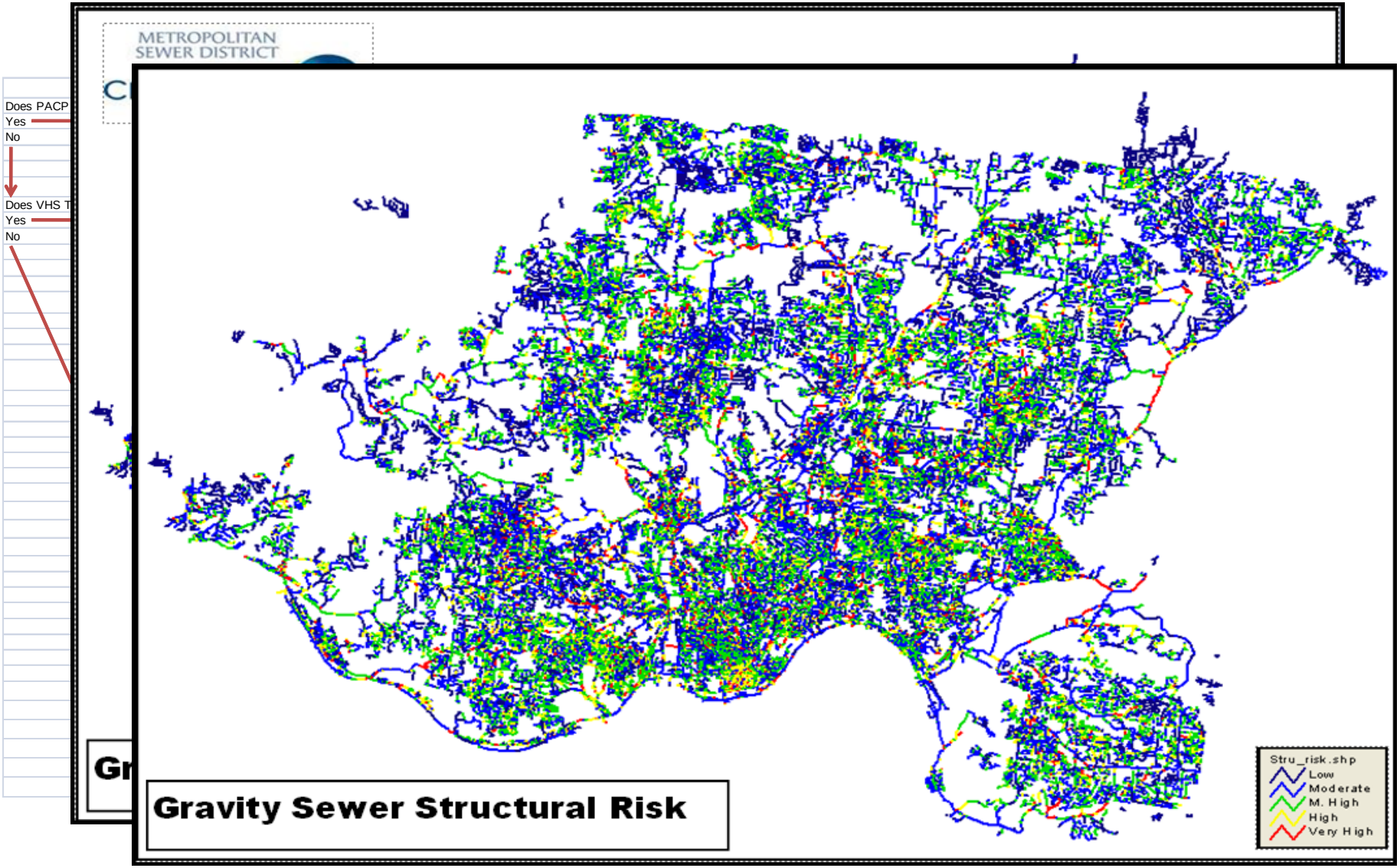
- Physical – PACP Quick Structural Score
- Maintenance – PACP Quick Maint. Score
- Maintenance History

Criticality Matrix

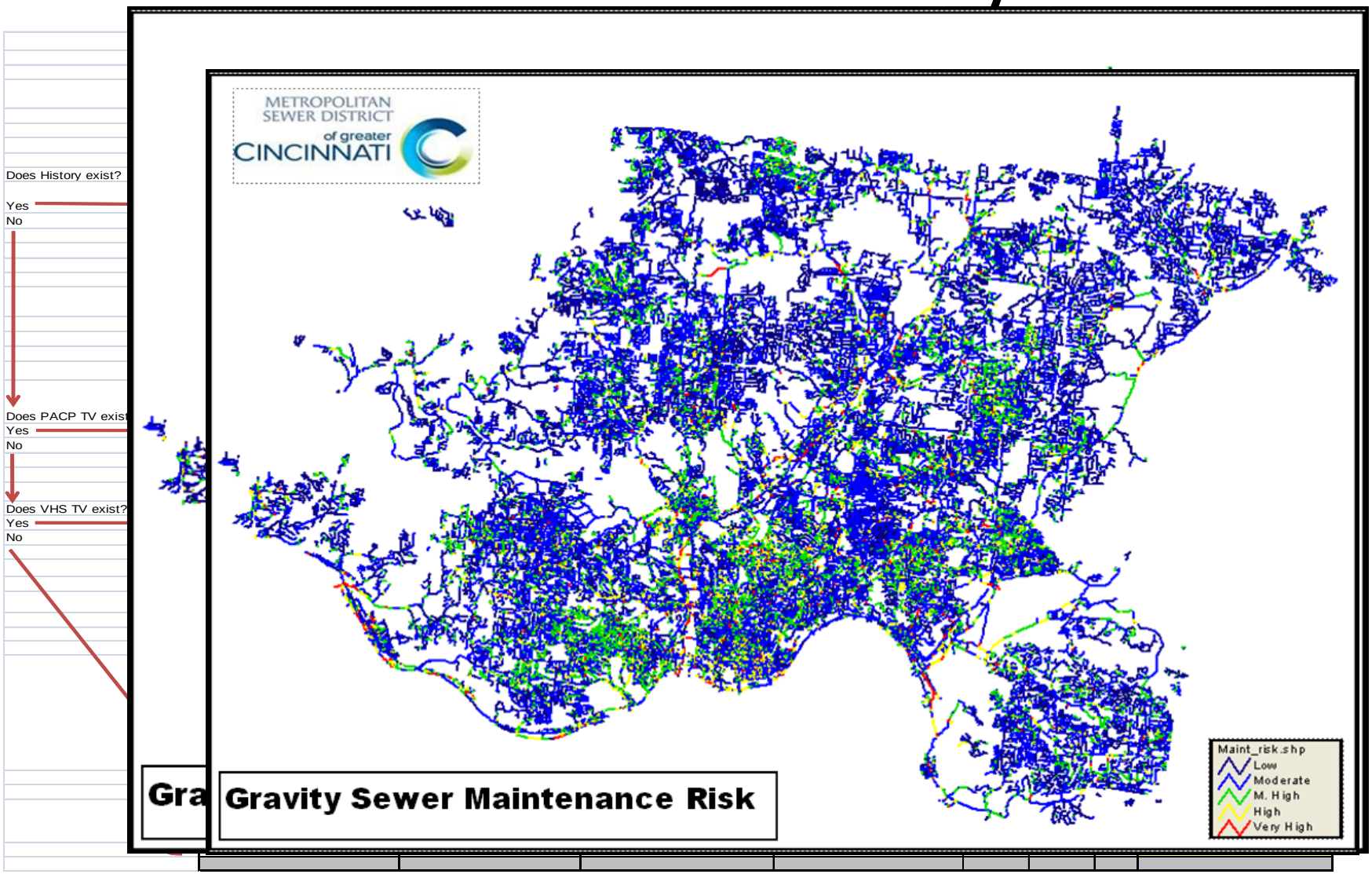
Cagis Theme	Scoring Matrix	Weighting Factors	
		Sanitary	Combined
Sew			6
Msd			0
Ca_mhs_			1
Ca_mhs_			1
Paver			10
Buffered Strea			2
Par			5
Build			8
Buildings (			1



Structural Probability Matrix



Maintenance Probability Matrix



Criticality Definitions

Score	*Rate*	*Definition*
1	Low	Failure of this asset would pose insignificant environmental impact, no health/safety risk to the public, minimal social impact (traffic, recreation, etc.) and poses a very low financial risk to the District.
2	Moderate	Failure of this asset would result in a **site** controlled discharge with associated negative environmental impact, minimal health/safety risk to public, minimal social impact (traffic, recreation, etc.) and poses a minimal financial risk to the District.
3	Moderate High	Failure of this asset would result in a **local** discharge with associated negative environmental impact, moderate health/safety risk to public (SBUs), moderate social impact (traffic, recreation, etc.) and poses an increasing financial risk to the District.
4	High	Failure of this asset would result in **regional** discharge with associated negative environmental impact, moderate health/safety risk to public (SBUs), major social impact (traffic, recreation, etc.) and poses a major financial risk to the District.
5	Very High	Failure of this asset would result in a **regional/statewide** discharge with associated irreversible negative environmental impact, serious health/safety risk to public (widespread SBUs), major social impact (traffic, recreation, etc.) effecting thousands of people and poses extreme financial risk to the District (claims, fines, potential lawsuit).

Maintenance Probability Definitions

Score	*Rate*	*Definition*
1	Low	0% Obstruction
2	Moderate	5% Obstruction
3	Moderate High	10% Obstruction
4	High	25% Obstruction
5	Very High	50% Obstruction

Structural Probability Definitions

Score	*Rate*	*Definition*
1	Low	Remaining Useful Life (RUL) ≥ 30 Years
2	Moderate	20 ≤ RUL <30
3	Moderate High	10 ≤ RUL <20
4	High	5 ≤ RUL <10
5	Very High	0 < RUL <5

The Risk Model at Work ….

CIP Projects

Sewer Segment	Date	Crit Score	CIP name	Quick Rating	Risk Score	Municipality	Neighborhood
37801006-37801017	10/28/2009	2057	Ledgewood	5	25	Cincinnati	
36509006-34212009	11/03/2009	2390	James street and Mcgregory Ave	5	25	Cincinnati	
36516001-36509006	11/03/2009	3572	James street and Mcgregory Ave	5	25	Cincinnati	
37701030-37701031	01/13/2010	3800	Dana Ave	5	25	Cincinnati	
25013012-25013013	04/08/2009	1498	Quebec Ave	5	20	Cincinnati	
28409006-28409007	05/20/2009	1601	Mchenry Ave	5	20	Cincinnati	
38207019-38207020	10/07/2009	1433	Woodbine	5	20	Cincinnati	
28110001-28107007	02/25/2010	2098	Colerain Ave	4	20	Cincinnati	Mount Airy
32504002-32504001	06/01/2010	1566	Station Ave	5	20	Cincinnati	Spring Grove Village
24312016-24312017	07/23/2010	1572	Leath Av	5	20	Delhi	
37907038-37907033	08/23/2010	2019	Berkley Ave	4	20	Cincinnati	Bond Hill
29503016-29503015	06/23/2009	1340	Spring Grove Ave	4	16	Cincinnati	
28516003-28516004	08/17/2009	1407	Saffer Street	4	16	Cincinnati	
23701042-23701044	12/31/2009	1338	Gamble Ave	4	16	Cheviot	
32812001-32812002	02/26/2010	1573	Brookline Drive	4	16	Cincinnati	
32504002-32504001	06/10/2010	1566	Station Ave	4	16	Cincinnati	
33013017-33013016	02/11/2009	1267	Loth Street	5	15	Cincinnati	
37114013-37115042	04/08/2009	1279	Upland Ave	5	15	Cincinnati	
36705008-3605003	04/21/2009	1185	Stratford Place	5	15	Cincinnati	
33908003-33909043	08/19/2009	1036	Vine Street	5	15	Cincinnati	
28814044-28814043	10/07/2009	975	Underwood Ave	5	15	Cincinnati	
36707010-36707036	11/06/2009	992	Red Bud Ave	5	15	Cincinnati	
37801005-37801006	12/31/2009	1284	Ledgewood	5	15	Cincinnati	
25013013-2503014	01/14/2010	963	Quebec Ave	5	15	Cincinnati	
45516002-45516004	01/22/2010	1192	Erie Av	5	15	Cincinnati	Hyde Park
40307019-40307020	05/12/2010	1108	Hammel Av	5	15	Golf Manor	
32505001-32504002	06/01/2010	1062	Station Ave	5	15	Cincinnati	
32505001-32504002	06/01/2010	1062	Station Ave	5	15	Cincinnati	Spring Grove Village
23701032-23701042	05/09/2006	1168	Gamble Ave	4	12	Cheviot	
29710016-29709011	04/14/2009	1092	Colerain Ave	4	12	Cincinnati	
32812023-32812015	06/02/2010	1254	Bishop Street	4	12	Cincinnati	
38102046-38015027	05/31/2005	700	Glenmeadow Ln	5	10	Cincinnati	Bond Hill
43115007-43115006	03/16/2006	684	E Columbia Ave	5	10	Reading	
29814046-29814019	04/27/2009	903	Springdale Ave	5	10	Cincinnati	Northside
28811040-28811041	05/05/2009	737	Matson Place	5	10	Cincinnati	

The projects that are proposed for referral to CIP are first sorted by Risk score, then sorted by the Structural Probability score. This allows WWC to prioritize the projects that are submitted to WWE based on the overall structural risk of the asset.

The Risk Model at Work ….

WWC Repairs

SEG_ID	AVG_DEPTH	SEGSIZE	SEGLENGTH	REPAIR_COM	REPAIRTYPE	CRIT_SCORE	CRIT_RATE
37902013-37902012	12.0	18.00	253.64	m/l repair @ 242.0' - 248.0' ds of mh 37902013 due to broken pipe. 8-5-09 tkr	Main Line	2618	Very High
39902006-39902007	7.0	8.00	345.95	ML REPAIR, OFFSET AND VOIDED JOINT LOCATED 278.5' UPSTM OF MH #39902007.	Main Line	2310	Very High
33416107-33213059	12.0	12.00	133.35	M.L. REPAIR 17.1' -19.2' US OF MH 33213059 BROKEN PIPE WITH SOIL VISIBLE .NOTE: DEPTH TAKEN FROM TV REPORT REFER TO MENTS.	Main Line	2158	Very High
36515024-3				FOR TAP IN ML IS LARGER THAN TAP. VOID AND SOIL VISIBLE ND TAP AND TAP DOES NOT REACH ML.	Main Line	2131	Very High
37608001-3				ork missing in main @ 14' DS from MH 37608001.	Main Line	2097	Very High
37413041-3				EPAIR 0' - 18' DS OF MH 37413041, FRACTURED M.L. PIPE.	Main Line	2082	Very High
37413041-3				EPAIR 40' - 50' DS OF MH 37413041 TO INCLUDE TAP ECTION AT 46.7' DS, VOID UNDER TAP.	Main Line	2082	Very High
38304011-3				ne repair, hole in pipe, soil visible	Main Line	2027	Very High
42307022-4				EPAIR 77' - 79' DS OF MH 42307022 TO INCLUDE TAP ECTION AT 78.0' DS, BROKEN TEE CONNECTION OF M.L. WITH EN LATERAL PIPE AT POC.	Main Line	1943	Very High
23802015-2				h pipe with soil visible 239.8' ds of 23802015. Reinstate tap. - 3/2010	Main Line	1942	Very High
37514018-3				e b/i taps with new tee and wye connections.	Main Line	1862	Very High
37514018-3				loss exceeds 10% and has buckling.	Main Line	1862	Very High
48102008-4				EPAIR 65' - 73' DS OF MH 48102008 TO INCLUDE TAP ECTIONS AT 68.1' AND 69.2' DS, VOID AROUND BREAK IN TAP 2'.	Main Line	1862	Very High
42206004-4				EPAIR 98' - 106' DS OF MH 42206004, CRACKED M.L. PIPE.	Main Line	1860	Very High
39902008-39902014	8.0	8.00	298.76	Main line repair 236'-242' DS due to offset joint.	Main Line	1848	Very High
32712005-32712006	11.0	12.00	348.49	M.L. REPAIR 63' - 65' DS OF MH 32712005 TO INCLUDE TAP CONNECTION AT 64.3' HEAVY CRACKED M.L. PIPE .	Main Line	1837	Very High
32712005-32712006	12.0	12.00	348.49	M.L. REPAIR 148' - 150' DS OF MH 32712005 TO INCLUDE TAP CONNECTION AT 149.1' VOID AROUND B/I TAP.	Main Line	1837	Very High
32812009-32812005	8.0	12.00	228.10	Main line repair 221'-227' DS from MH 32812009, broken pipe, jagged edges.	Main Line	1831	Very High

The Maintenance Management Group (MMG) sorted the backlog of modeled point repairs by Criticality Score, allowing them to submit the "most critical" projects to the WWC Repair Section.

The Risk Model at Work ….

Large Diameter CCTV

The MMG is using the Risk Model to help develop the Scope of Services for the Large Diameter Sewer Cleaning contracts. Large diameter sewer mains are sorted by Criticality Score, thus ensuring that the most critical mains will be cleaned and televised first. This will help WWC to develop future maintenance schedules that will reduce the overall risk posed by the highly critical assets.

			SEW_NAME	INST_YEAR	DRAIN_AREA	CRIT_SCORE	CRIT_RATE
29208			Outfall	1959	SOUTH BRANCH MILL CREEK	3957	Very High
36508			Int to Aux Int	1964	SOUTH BRANCH MILL CREEK	3820	Very High
33512			o River Interceptor	1959	SOUTH BRANCH MILL CREEK	3670	Very High
37209			o River Interceptor	1959	SOUTH BRANCH MILL CREEK	3498	Very High
36508			eek Interceptor 5A	1962	SOUTH BRANCH MILL CREEK	3490	Very High
33503			ve Interceptor	1955	SOUTH BRANCH MILL CREEK	3475	Very High
34211			eek Interceptor 5	1962	SOUTH BRANCH MILL CREEK	3418	Very High
29206			VE SEWER	1922	SOUTH BRANCH MILL CREEK	3350	Very High
38201			eek Interceptor 7	1968	SOUTH BRANCH MILL CREEK	3254	Very High
37503					SOUTH BRANCH MILL CREEK	3201	Very High
38202			eek Interceptor 7	1968	SOUTH BRANCH MILL CREEK	3173	Very High
38202			nterceptor	1932	SOUTH BRANCH MILL CREEK	3150	Very High
34211			eek Interceptor 5	1962	SOUTH BRANCH MILL CREEK	3050	Very High
37501					SOUTH BRANCH MILL CREEK	3050	Very High
37216			o River Interceptor	1959	SOUTH BRANCH MILL CREEK	3034	Very High
33509			MAIN ST	1927	SOUTH BRANCH MILL CREEK	3008	Very High
33503			ve Interceptor	1955	SOUTH BRANCH MILL CREEK	3006	Very High
37216			o River Interceptor	1959	SOUTH BRANCH MILL CREEK	2974	Very High
34101			Relief Sewer	1914	SOUTH BRANCH MILL CREEK	2926	Very High
37209			o River Interceptor	1959	SOUTH BRANCH MILL CREEK	2922	Very High
37216			o River Interceptor	1959	SOUTH BRANCH MILL CREEK	2911	Very High
37110			o River Interceptor	1959	SOUTH BRANCH MILL CREEK	2844	Very High
29206			hmond Sts	1891	SOUTH BRANCH MILL CREEK	2815	Very High
37503					SOUTH BRANCH MILL CREEK	2800	Very High
34207001-34115025	1116.25	Aux Mill Creek Interceptor 4		1962	SOUTH BRANCH MILL CREEK	2788	Very High
38116005-36412009	1544.72	Aux Mill Creek Interceptor 6		1966	SOUTH BRANCH MILL CREEK	2770	Very High

BUSINESS CASE EVALUATION

1.0 Executive Summary
2.0 The Problem
3.0 Strategies
    3.1 Initial Screening of the Strategies
        3.1.1 Operations
        3.1.2 Maintenance
        3.1.3 Equipment
        3.1.4 Training
        3.1.5 New Construction
    3.2 Analysis of the Strategies
4.0 Development of Alternatives
    4.1 Methodology
    4.2 Alternatives
    4.3 Summary
    4.4 Recommendation
5.0 Execution Plan
    5.1 Steps
    5.2 Timeline
    5.3 Roles and Responsibilities
    5.4 Budget timeline/source
6.0 Program Advisory Committee Meeting Summary
MAJOR REFERENCES

IV. CHALLENGES AND LESSONS LEARNED

METROPOLITAN SEWER DISTRICT of greater CINCINNATI

Lessons learned

- Define what you are trying to accomplish.
- Understand what you are going to use the tool for. Have the end result in mind.
- May need to adapt existing workflows to align with new strategies.
- Prioritize the effort based on organizational need.

Maintenance Reliability

MSD Treatment Division Journey Highlights

- Lessons Learned
  - Communicate, communicate, communicate
    - Develop a communication strategy and keep at it
    - Revise strategy as needed
    - Involve as many as possible
  - Get the right people in the right roles as soon as possible
  - Plan for initial and follow-up training
  - Do not get discouraged when people push back

Transition From:

Reactive Maintenance Culture → Proactive Maintenance Culture =

Long, difficult road…

V. Next Steps

1. Wastewater Collection Division CMMS

2. SAMPs

3. Improvements to the Commissioning Process

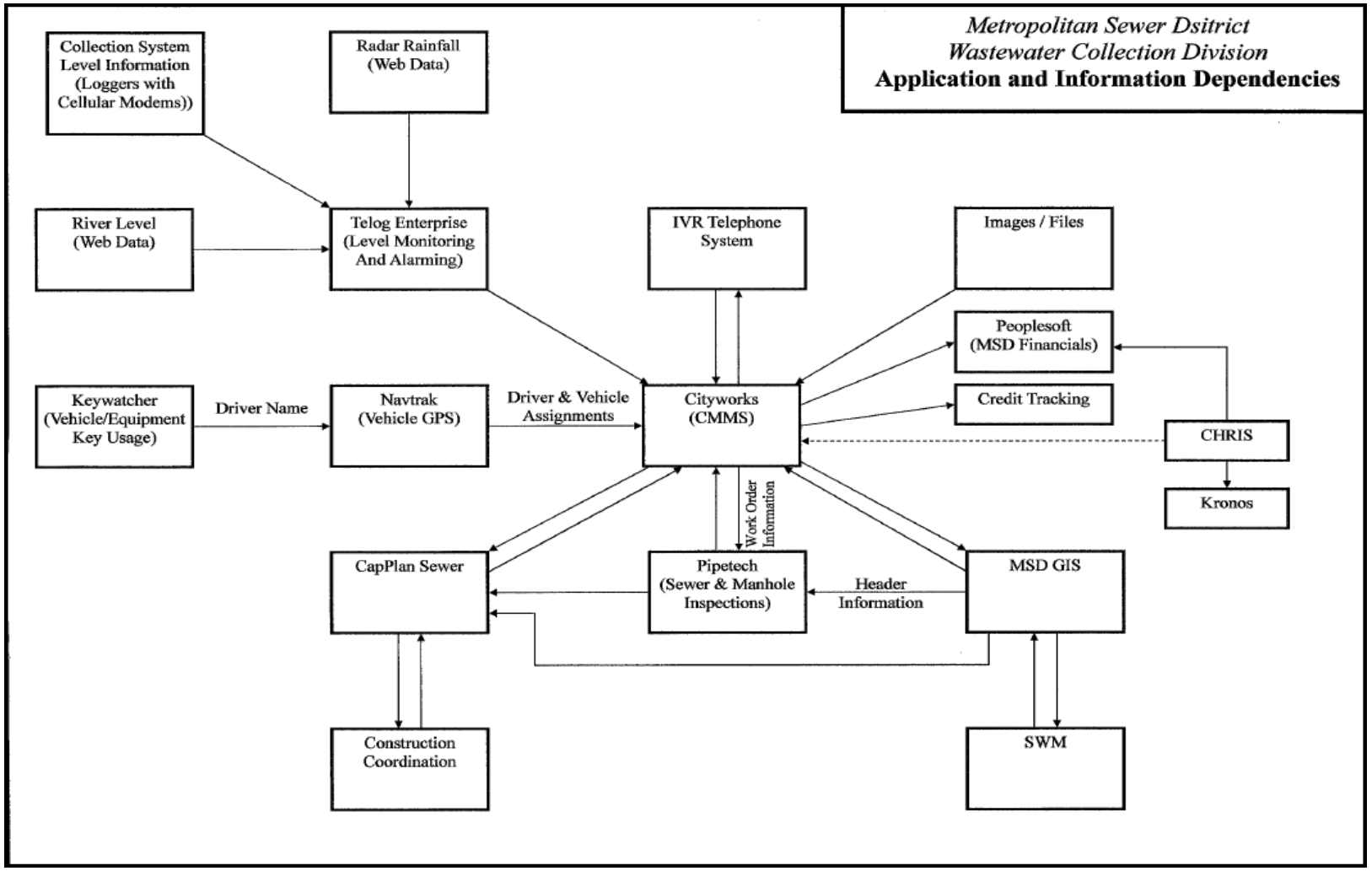
4. Level of Service

5. Watershed Prioritization and Implementation Plan

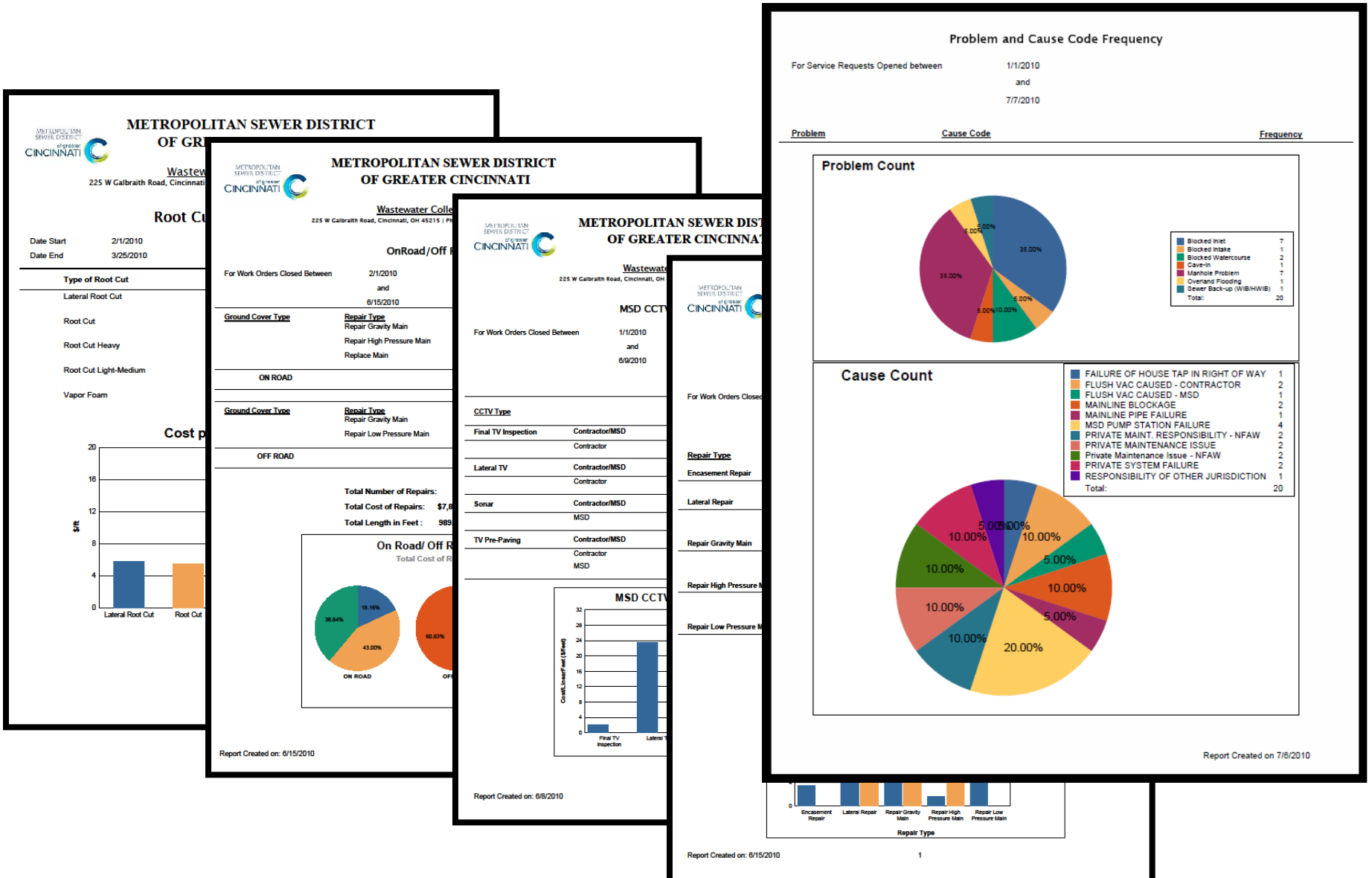
6. Vision for the next Strategic Plan

METROPOLITAN SEWER DISTRICT of greater CINCINNATI

Next Steps …..
Wastewater Collection Division CMMS



Reporting ....


METROPOLITAN SEWER DISTRICT OF GREATER CINCINNATI
Root Cut
Date Start 2/1/2010
Date End 3/25/2010
Type of Root Cut
Lateral Root Cut
Root Cut
Root Cut Heavy
Root Cut Light-Medium
Vapor Foam
Cost p
$/ft
Lateral Root Cut
Root Cut
METROPOLITAN SEWER DISTRICT OF GREATER CINCINNATI
OnRoad/Off
For Work Orders Closed Between 2/1/2010 and 6/15/2010
Ground Cover Type
Repair Type
Repair Gravity Main
Repair High Pressure Main
Replace Main
ON ROAD
Ground Cover Type
Repair Type
Repair Gravity Main
Repair Low Pressure Main
OFF ROAD
Total Number of Repairs:
Total Cost of Repairs:
Total Length in Feet :
On Road/ Off R
Total Cost of R
18.16%
38.84%
43.00%
ON ROAD
Report Created on: 6/15/2010
METROPOLITAN SEWER DIST OF GREATER CINCINNA
MSD CCT
For Work Orders Closed Between 1/1/2010 and 6/9/2010
CCTV Type
Final TV Inspection Contractor/MSD
Contractor
Lateral TV Contractor/MSD
Contractor
Sonar Contractor/MSD
MSD
TV Pre-Paving Contractor/MSD
Contractor
MSD
MSD CCT
Final TV Inspection
Report Created on: 6/8/2010
For Work Orders Closed
Repair Type
Encasement Repair
Lateral Repair
Repair Gravity Main
Repair High Pressure M
Repair Low Pressure M
Encasement Repair
Lateral Repair
Repair Gravity Main
Repair High Pressure Main
Repair Low Pressure Main
Repair Type
Report Created on: 6/15/2010
1
Problem and Cause Code Frequency
For Service Requests Opened between 1/1/2010 and 7/7/2010
Problem
Cause Code
Frequency
Problem Count
35.00%
35.00%
5.00%
5.00%
5.00%
10.00%
Blocked Inlet 7
Blocked Intake 1
Blocked Watercourse 2
Cave-in 1
Manhole Problem 7
Overland Flooding 1
Sewer Back-up (WIB/HWIB) 1
Total: 20
Cause Count
FAILURE OF HOUSE TAP IN RIGHT OF WAY 1
FLUSH VAC CAUSED - CONTRACTOR 2
FLUSH VAC CAUSED - MSD 1
MAINLINE BLOCKAGE 2
MAINLINE PIPE FAILURE 1
MSD PUMP STATION FAILURE 4
PRIVATE MAINT. RESPONSIBILITY - NFAW 2
PRIVATE MAINTENANCE ISSUE 2
Private Maintenance Issue - NFAW 2
PRIVATE SYSTEM FAILURE 2
RESPONSIBILITY OF OTHER JURISDICTION 1
Total: 20
5.00%
10.00%
10.00%
5.00%
10.00%
10.00%
5.00%
10.00%
20.00%
Report Created on 7/6/2010

V. Next Steps (Asset Management)

1. Wastewater Collection Division CMMS

2. SAMPs

3.Improvements to the Commissioning Process

4.Level of Service

5.Watershed Prioritization and Implementation Plan

METROPOLITAN SEWER DISTRICT of greater CINCINNATI

Vision for Next Strategic Plan

- Preparing the organization
  - Preparing the strategic planning team
    - Transformational Leadership Program
    - Involving future members
  - Creating a shared vision for the next plan
  - Aligning the external stakeholders

QUESTIONS?
CONSIDERATIONS?
CONGRATULATORY REMARKS?

METROPOLITAN SEWER DISTRICT of greater CINCINNATI