Examples of Asset Management Good Practice

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20th Century Hydropower Plant Management approach:

“If it ain’t broke, don’t fix it”.

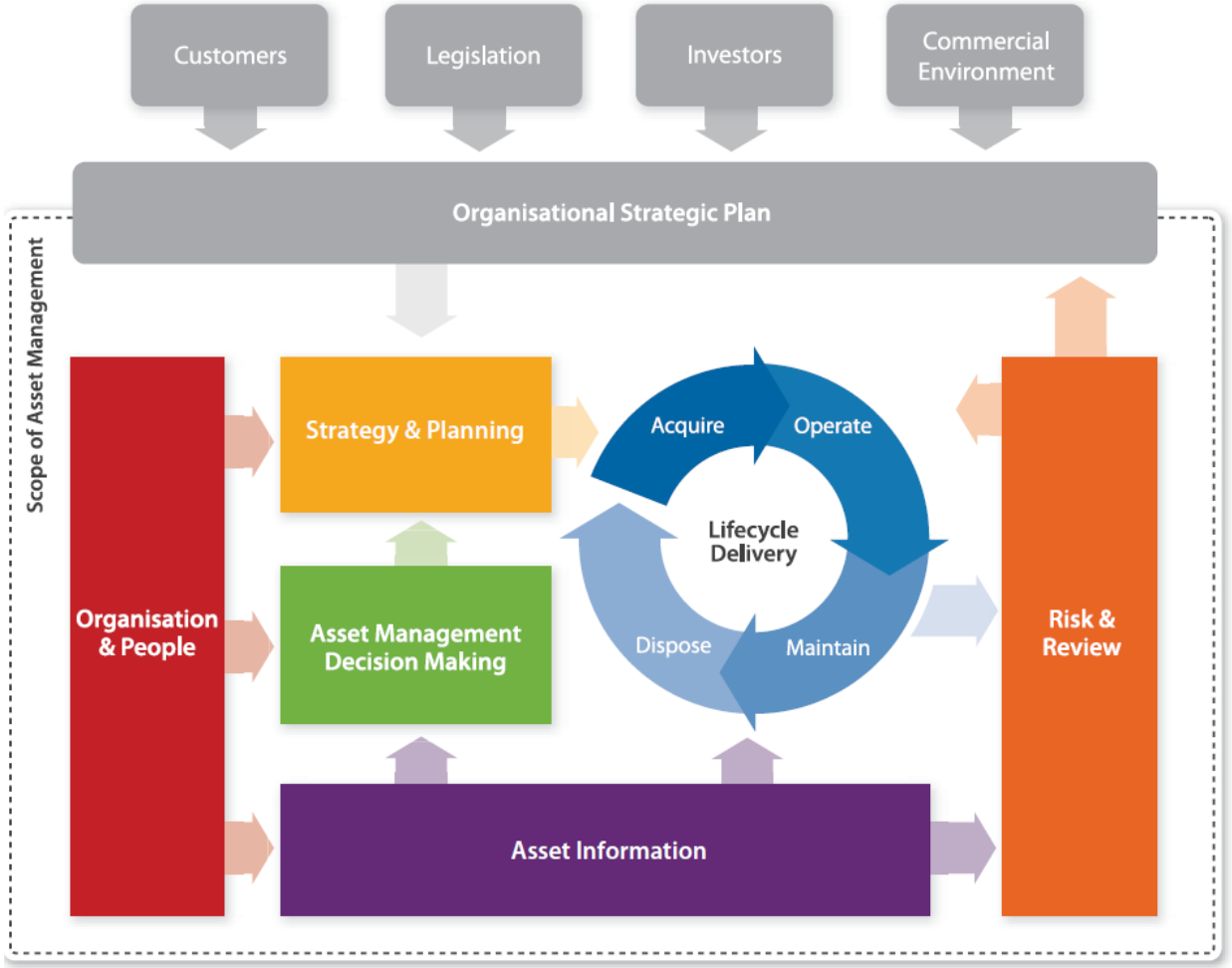
- Maintenance, repairs and replacements focused on direct issues, rather than effects on related equipment
- Hydroplants required near continuous repair to one piece of equipment or another.
- Cumulative costs of repairs could exceed the value of the powerplant over a shortened time frame.

By the mid 1990’s hydroplant management began to move to an asset and risk management approach.

Drivers for Change:

- As fleets of existing hydro plants aged, former management approach became increasingly inflexible and untenable
- Traditional managers retired and were succeeded by staff with experience and focus on business
- External communication and networking showed use and benefits of asset management for infrastructure and industry
- Increasing need to meet statutory obligations drove the adoption of risk-based processes to assess threats to the business.
- Privatization and electricity market deregulated increased the focus on performance and value.
- Boards became responsible for, asset and risk based decisions.

AM Components and Scope



The Institute of Asset Management

Asset Management (AM) Good Practice.

A systematic approach based on considering an individual or fleet of hydro plants from a holistic perspective, with management decisions based on:

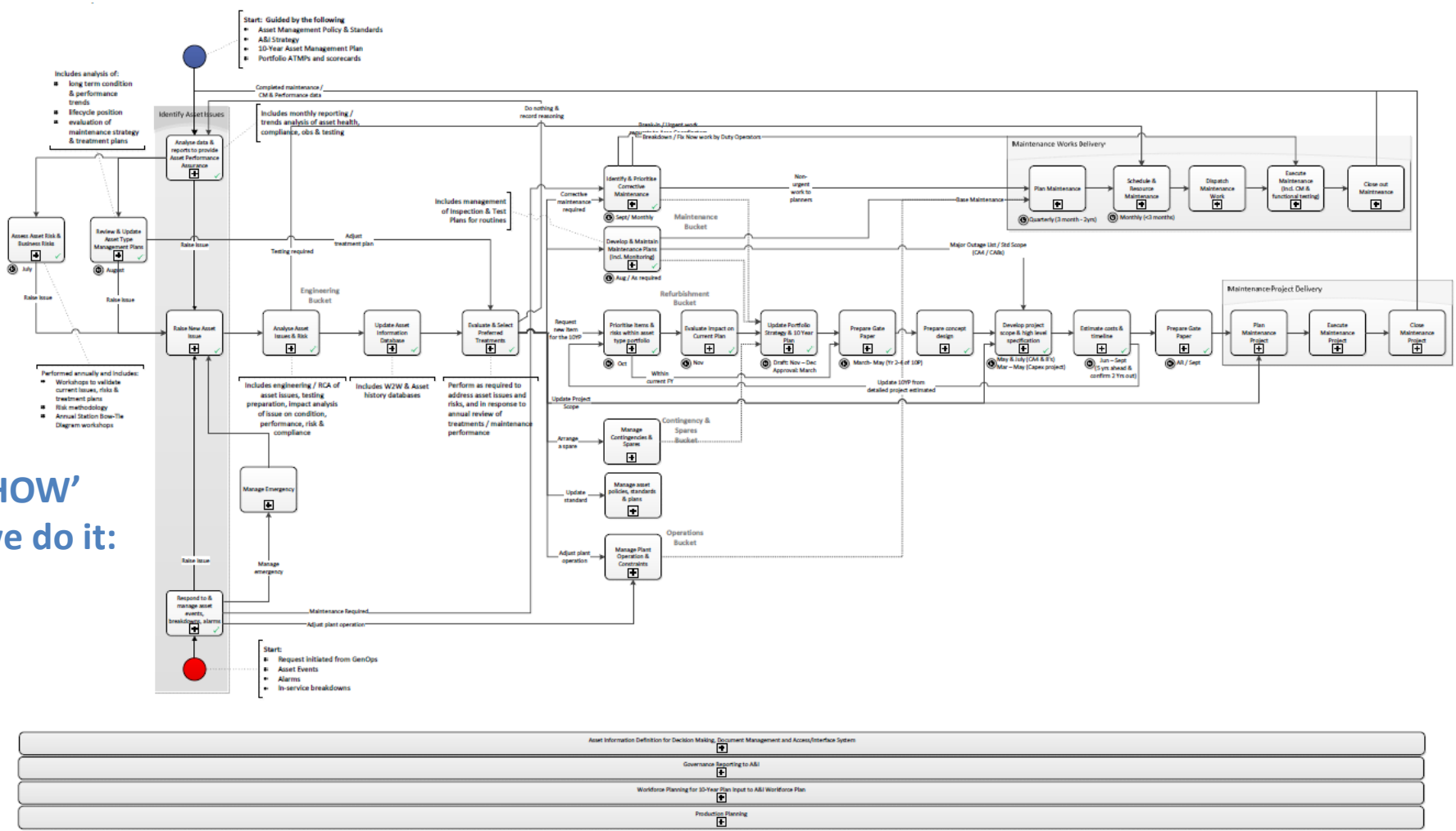
- maximizing level of service (LOS),
- minimizing cost of service (COS),
- managing risk and
- meeting regulatory obligations,

with the overall purpose of meeting corporate objectives and maximizing asset value.

Asset Management Objectives

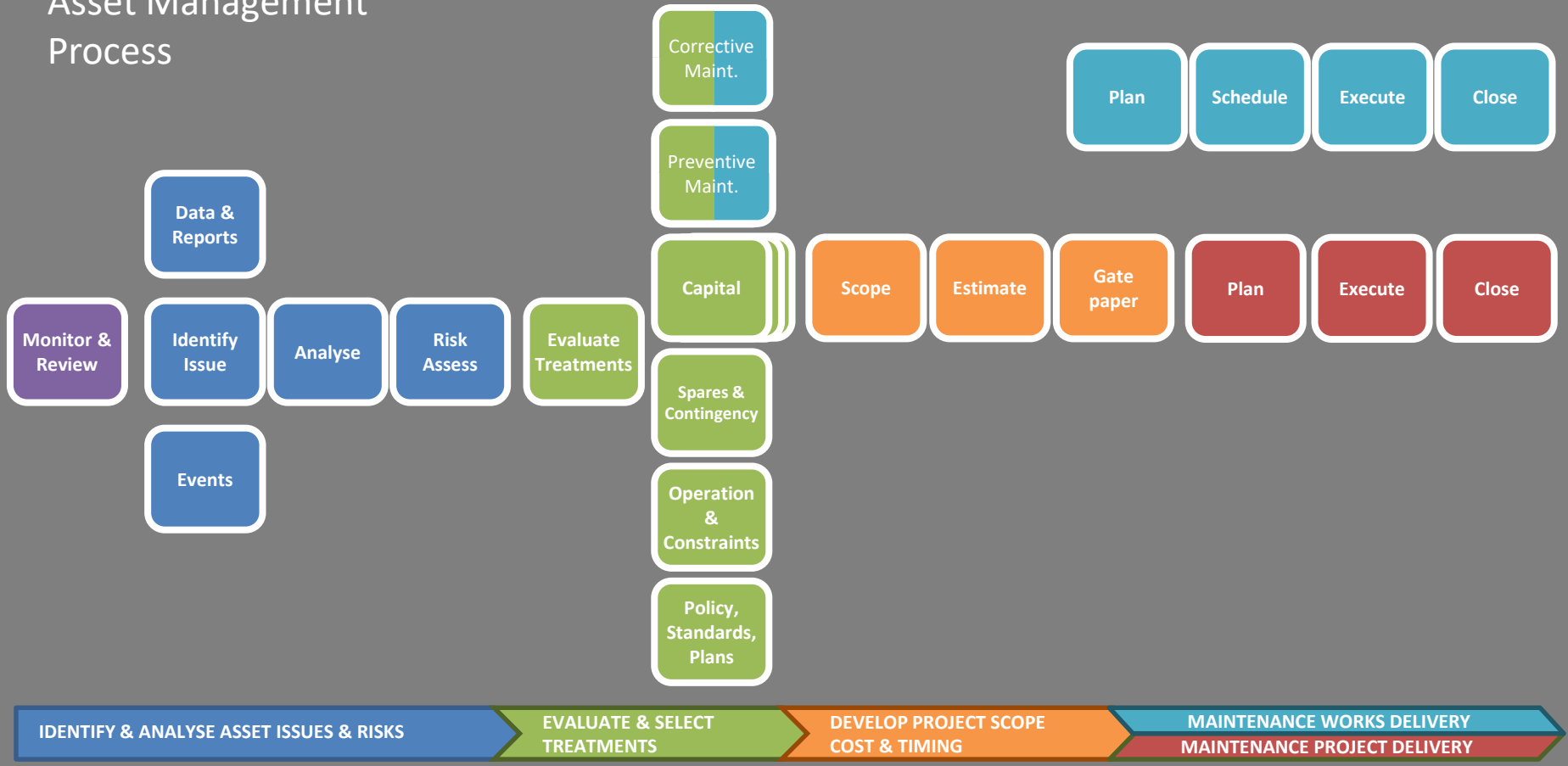
Key Elements of Asset Management include:

- Identifying issues and potential risks that could affect asset performance
- Assess the issues and risks in terms of their importance
- Identify appropriate treatments to manage the issues and risks
- Prioritize between options and alternatives
- Select the project and develop scope, cost and schedule
- Deliver the work plan and evaluate the outcomes


Start: Guided by the following
Asset Management Policy & Standards
A&I Strategy
10-Year Asset Management Plan
Portfolio ATMPs and scorecards
Includes analysis of:
long term condition & performance trends
lifecycle position
evaluation of maintenance strategy & treatment plans
Identify Asset Issues
Completed maintenance / CM & Performance data
Includes monthly reporting / trends analysis of asset health, compliance, obs & testing
Do nothing & record reasoning
Analyse data & reports to provide Asset Performance Assurance
Assess Asset Risk & Business Risks
July
Review & Update Asset Type Management Plans
August
Raise Issue
Testing required
Adjust treatment plan
Includes management of Inspection & Test Plans for routines
Engineering Bucket
Raise New Asset Issue
Analyse Asset Issues & Risk
Update Asset Information Database
Evaluate & Select Preferred Treatments
Performed annually and includes:
Workshops to validate current issues, risks & treatment plans
Risk methodology
Annual Station Bow-Tie Diagram workshops
Includes engineering / RCA of asset issues, testing preparation, Impact analysis of issue on condition, performance, risk & compliance
Includes W2W & Asset history databases
Perform as required to address asset issues and risks, and in response to annual review of treatments / maintenance performance
Manage Emergency
Manage emergency
Respond to & manage asset events, breakdowns, alarms
Maintenance Required
Adjust plant operation
Start:
Request initiated from GenOps
Asset Events
Alarms
In-service breakdowns
Breakdown / Urgent work
Breakdown / Fix Now work by Duty Operators
Identify & Prioritise Corrective Maintenance
Sept/ Monthly
Maintenance Bucket
Develop & Maintain Maintenance Plans (Incl. Monitoring)
Aug / As required
Corrective maintenance required
Non-urgent work to planners
Base Maintenance
Major Outage List / Std Scope (CAM / CAMs)
Maintenance Works Delivery
Plan Maintenance
Quarterly (3 month - 2yrs)
Schedule & Resource Maintenance
Monthly (<3 months)
Dispatch Maintenance Work
Execute Maintenance (Incl. CM & functional testing)
Close out Maintenance
Refurbishment Bucket
Request new item for the 10YP
Prioritise items & risks within asset type portfolio
Oct
Evaluate Impact on Current Plan
Nov
Within current FY
Update Portfolio Strategy & 10 Year Plan
Draft: Nov – Dec Approval: March
Prepare Gate Paper
March- May (Yr 3-4 of 10P)
Prepare concept design
Develop project scope & high level specification
May & July (CAA & R's)
Mar – May (Capex project)
Estimate costs & timeline
Jun – Sept (5 yrs ahead & confirm 2 Yrs out)
Prepare Gate Paper
AR / Sept
Update 10YP from detailed project estimated
Maintenance Project Delivery
Plan Maintenance Project
Execute Maintenance Project
Close Maintenance Project
Update Project Scope
Contingency & Spares Bucket
Arrange a spare
Manage Contingencies & Spares
Update standard
Manage asset policies, standards & plans
Adjust plant operation
Operations Bucket
Manage Plant Operation & Constraints
Asset Information Definition for Decision Making, Document Management and Access/Interface System
Governance Reporting to A&I
Workforce Planning for 10-Year Plan Input to A&I Workforce Plan
Production Planning

‘HOW’ we do it:

Asset Management Process



Issues and Risks

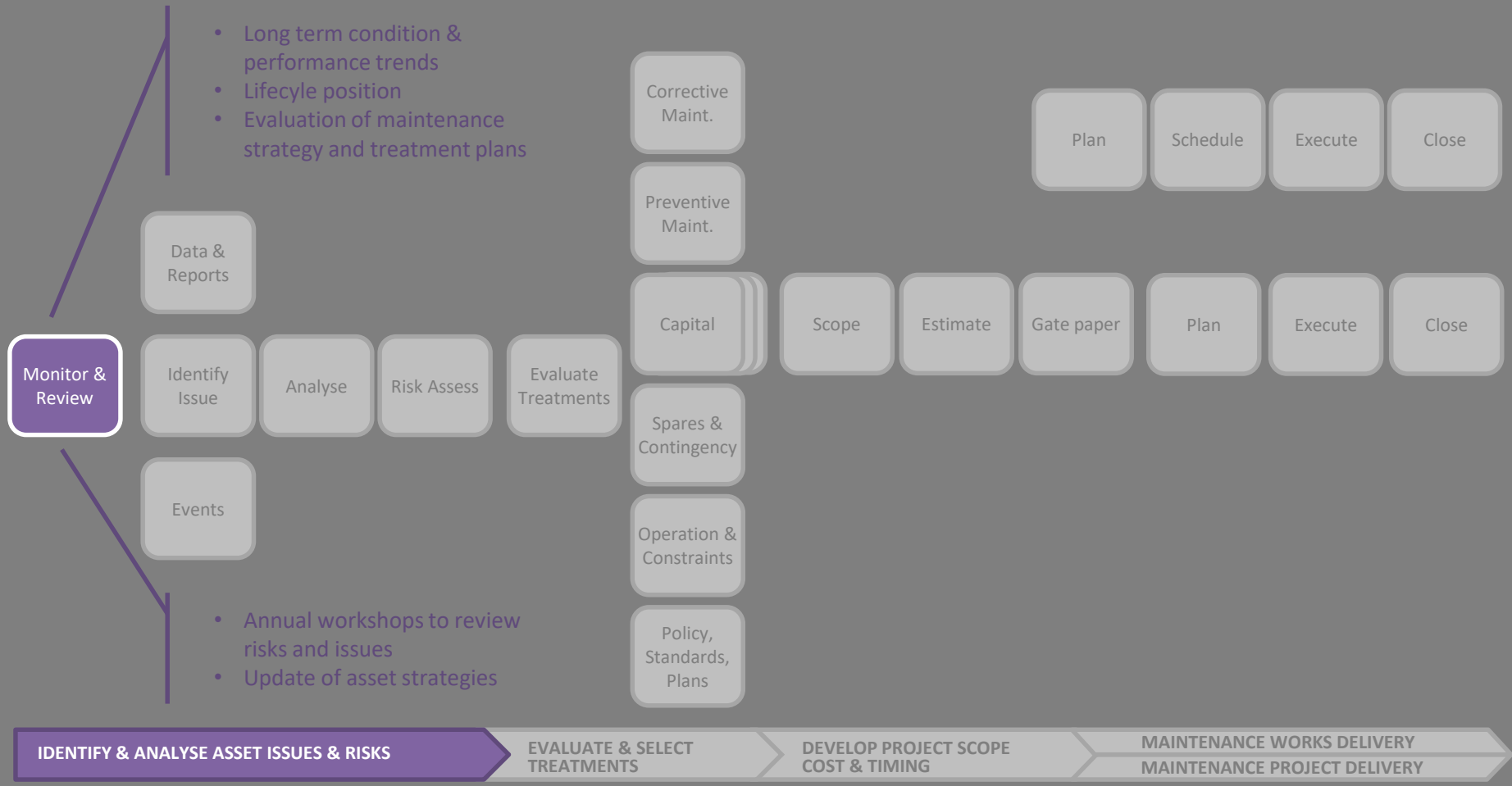
- An Issue is "an event that has happened, is happening or is known to be going to happen"
- A Risk* is "an event that may or may not happen".

*Risks can relate to both the strategic and operational context and be internal or external to the organisation.

Issues and Risk Identification

- Identification of issues normally evolves from routine or corrective maintence and regular condition and performance assessments.

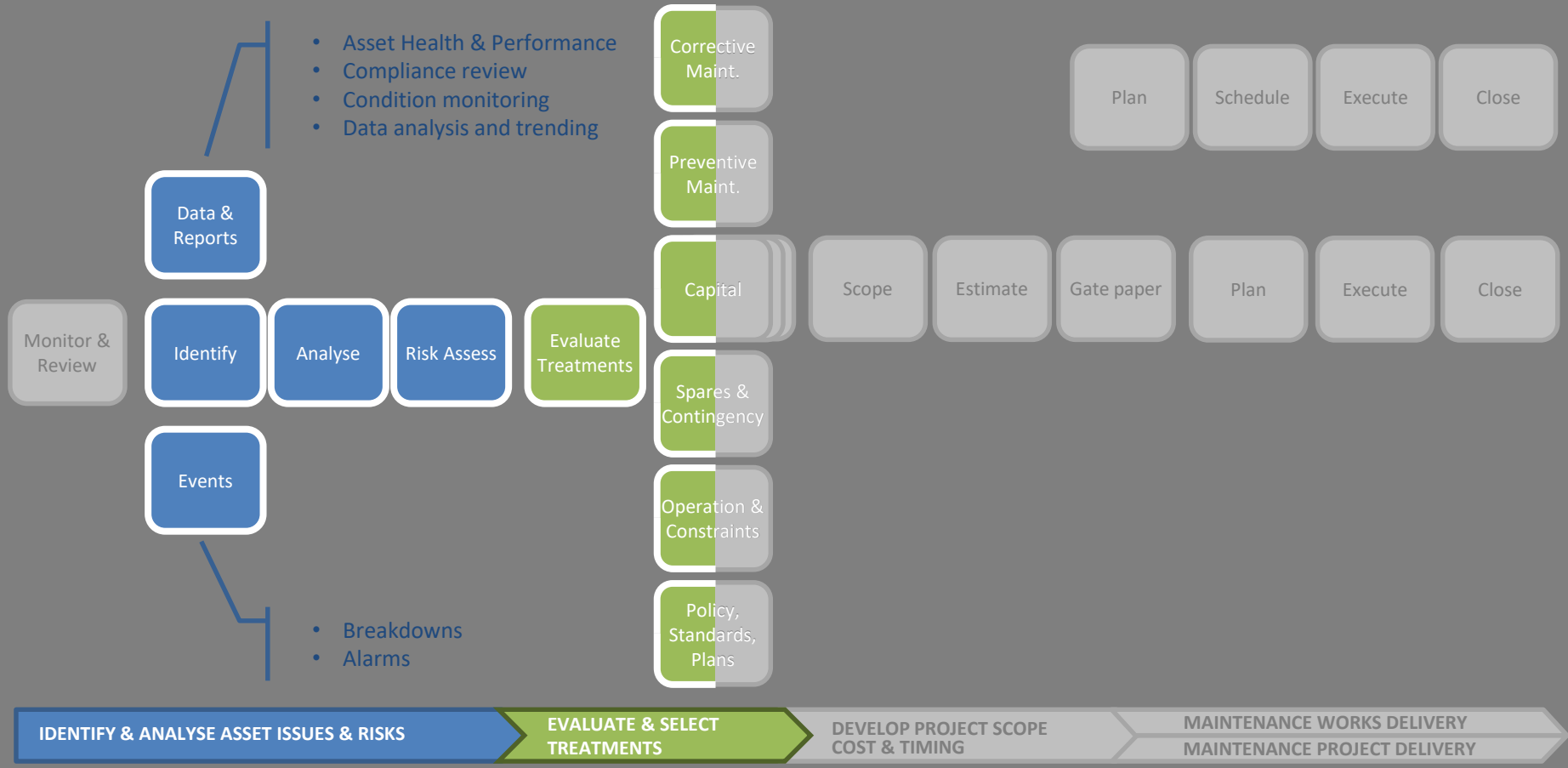
- Risk Identification is the process to document any events that could occur and potentially compromise the capability, safety or performance of the hydroplant


Long term condition & performance trends
Lifecyle position
Evaluation of maintenance strategy and treatment plans
Monitor & Review
Data & Reports
Identify Issue
Analyse
Risk Assess
Evaluate Treatments
Events
Annual workshops to review risks and issues
Update of asset strategies
Corrective Maint.
Preventive Maint.
Capital
Spares & Contingency
Operation & Constraints
Policy, Standards, Plans
Scope
Estimate
Gate paper
Plan
Execute
Close
Plan
Schedule
Execute
Close
IDENTIFY & ANALYSE ASSET ISSUES & RISKS
EVALUATE & SELECT TREATMENTS
DEVELOP PROJECT SCOPE COST & TIMING
MAINTENANCE WORKS DELIVERY
MAINTENANCE PROJECT DELIVERY

Issues and Risk Assessment - Two Approaches

Station Asset Management Plans cover all issues and risks identified at an individual hydro power station, their assessment, analysis and program of treatment. By understand all intervention that is needed to meet the overall strategic objectives of the station, a full plan of activities can be developed. This also enables the station (or asset) value to be established.

Asset-Type Management Plans cover approaches for individual or closely dependant assets, such as turbines and generators across multiple units or the fleet of hydro plants. These plans allow performance and condition comparisons across similar unit types in different hydro power plants. A program to replace Kaplan turbine units across multiple plants allowed a planned program for work crews, cost reductions based on unit volume and a reduction in spare part inventories.


Asset Health & Performance
Compliance review
Condition monitoring
Data analysis and trending
Data & Reports
Monitor & Review
Identify
Analyse
Risk Assess
Evaluate Treatments
Events
Breakdowns
Alarms
Corrective Maint.
Preventive Maint.
Capital
Spares & Contingency
Operation & Constraints
Policy, Standards, Plans
Plan
Schedule
Execute
Close
Scope
Estimate
Gate paper
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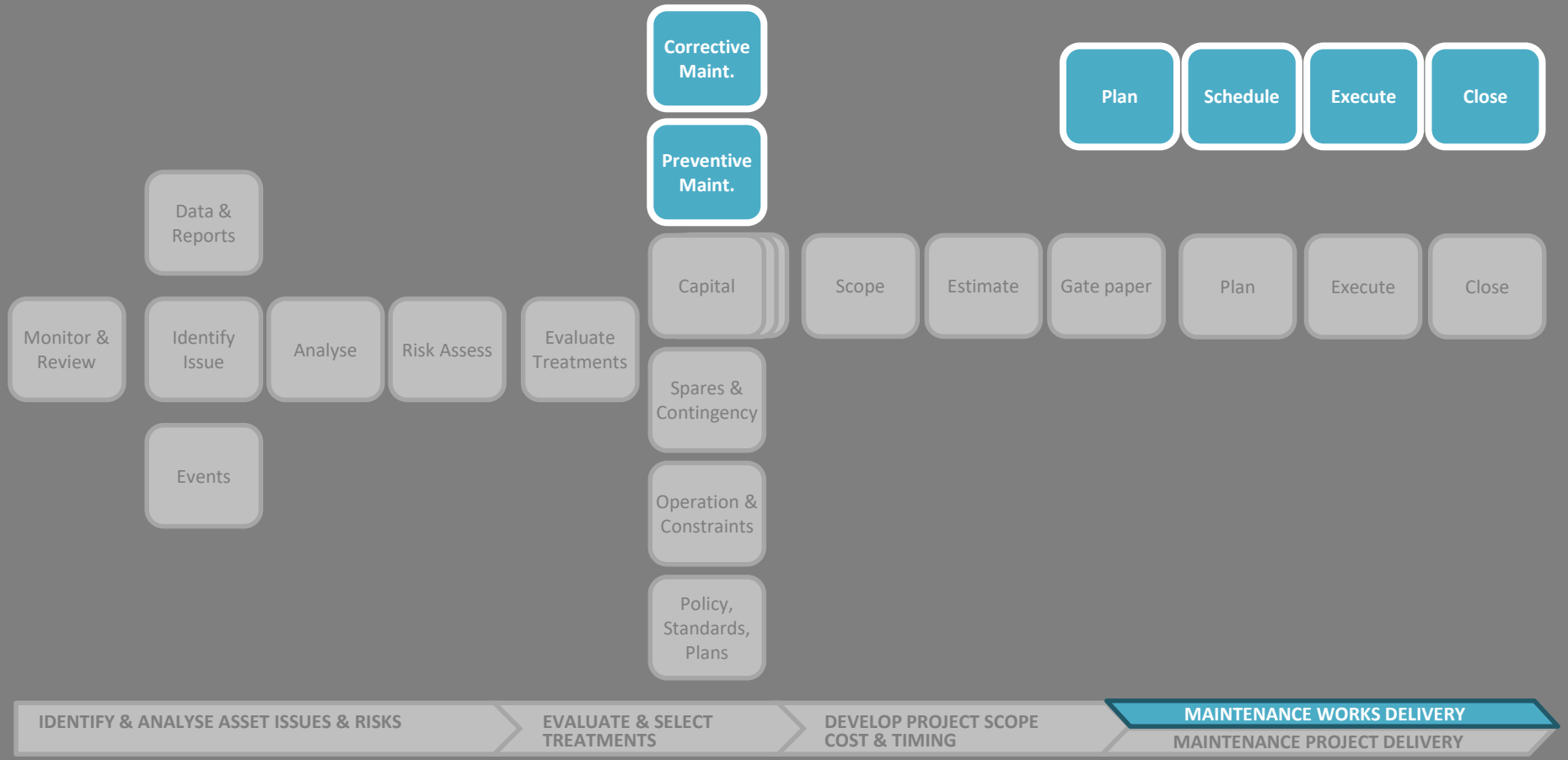
Prioritization

The overall asset management approach is to meet corporate objectives and maximize asset value.

However, with possible constraints (financial, work force etc.,) not all works can be undertaken immediately.

Prioritization helps make good choices, which projects and what order!

- Meeting regulatory requirements (safety, due diligence). If not immediately possible, risk control measures should be considered.
- Addressing high ranking risks at the asset level.
- Selecting projects that maintain or enhance productivity from the most productive, and therefore valuable, hydro plants.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Preventive Maint.
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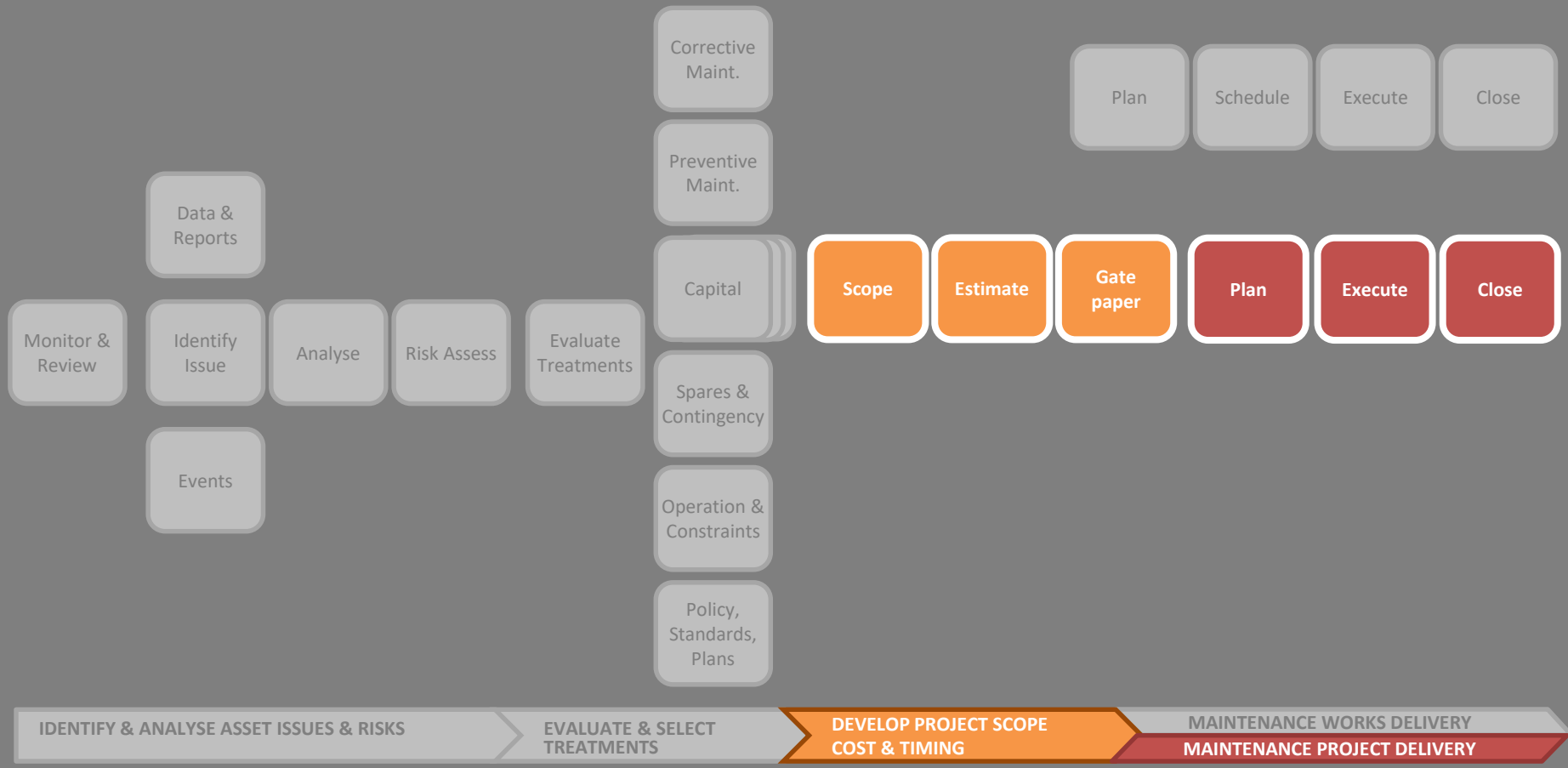
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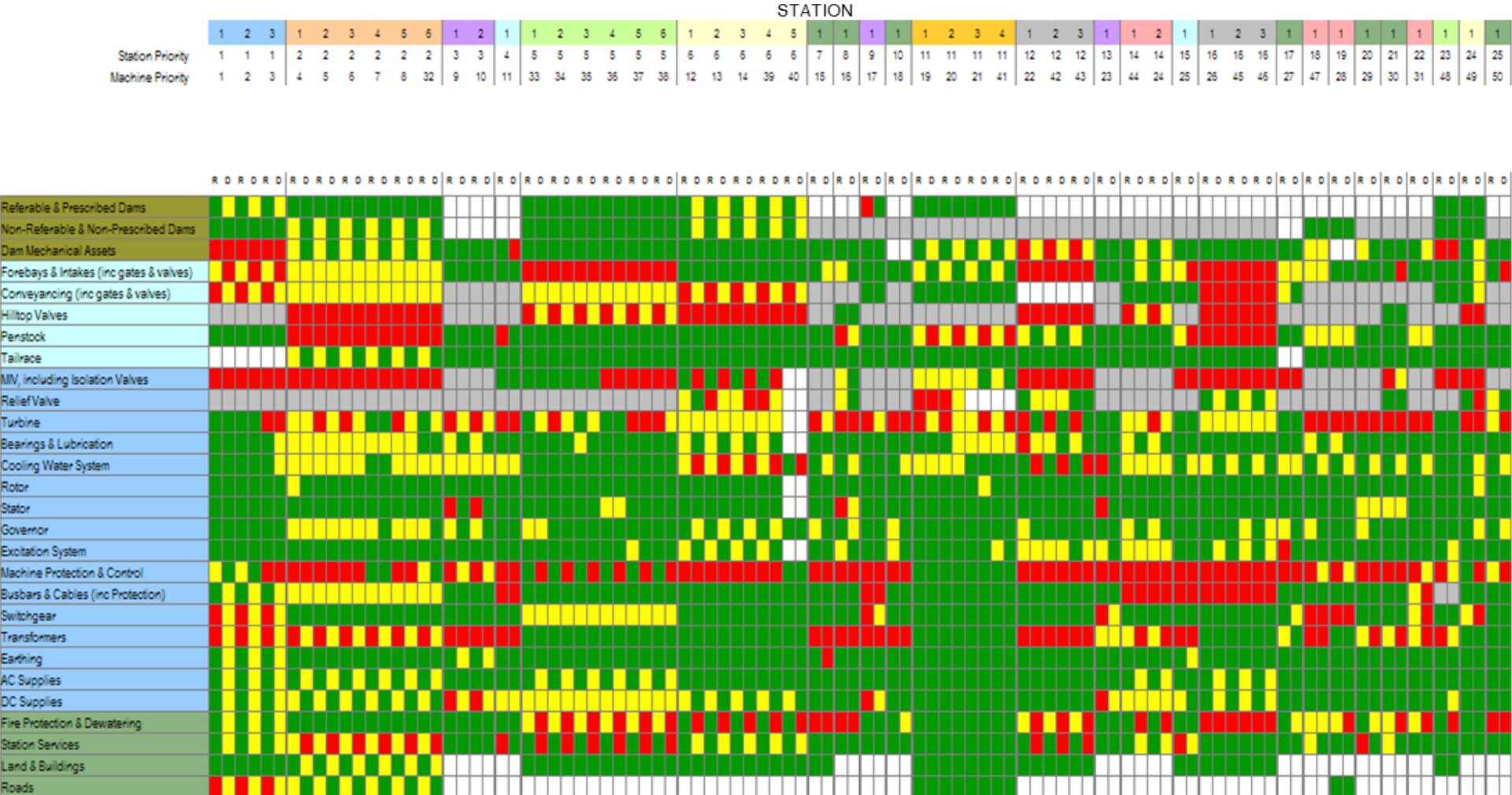
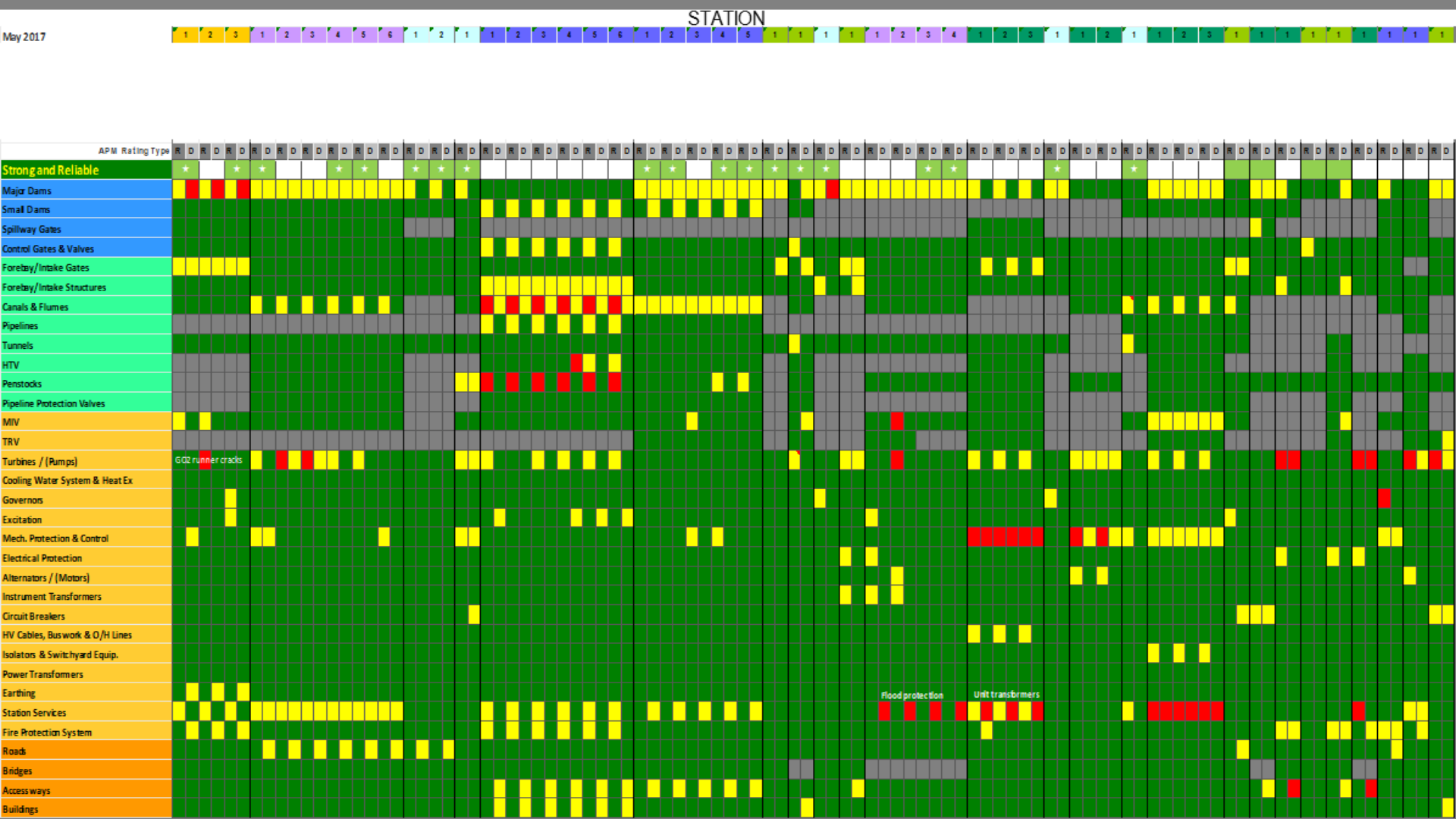
Evaluation of Treatment Effectiveness

Water to Wire (W2W) Risk Map

Progress from 2008 to 2018

W2W Risk Map (Effective Date Wednesday, 30 July 2008)




STATION
May 2017
APM Rating Type
Strong and Reliable
Major Dams
Small Dams
Spillway Gates
Control Gates & Valves
Foreday/Intake Gates
Foreday/Intake Structures
Canals & Flumes
Pipelines
Tunnels
HTV
Penstocks
Pipeline Protection Valves
MIV
TRV
Turbines / (Pumps)
GD2 runner cracks
Cooling Water System & Heat Ex
Governors
Excitation
Mech. Protection & Control
Electrical Protection
Alternators / (Motors)
Instrument Transformers
Circuit Breakers
HV Cables, Buswork & O/H Lines
Isolators & Switchyard Equip.
Power Transformers
Earthing
Station Services
Fire Protection System
Roads
Bridges
Accessways
Buildings
Flood protection
Unit transformers

I hope you have enjoyed

Examples of Asset Management Good Practice

Thank You