



**Water and Waste Department
Business Intelligence and Analytics – Phase 1**
Current State Assessment Report

December 21, 2018

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Executive Summary

Project Background and Objectives

Winnipeg's Water and Waste Department is developing a strategic and tactical plan to build Business Intelligence and Analytics capabilities to aid in transforming into a Utility of the Future.

Project Background

As Water and Waste Department (WWD) transitions to a Utility of Future, Business Intelligence and Analytics (BIA) is essential to optimize its services across its service lines, reduce maintenance costs and meet demands of a growing population. To ensure that WWD is able to capitalize on its information assets through BIA, it requires leadership, BIA talent, processes, governance, data assets and a modern solution architecture. In order to inform this approach, WWD has embarked upon BIA Strategy project with Deloitte.

Project Objectives

- Determine what **BIA capabilities** across people, process and technology dimensions WWD will enhance, and to what extent, in order to meet demands of its stakeholders and adapt to changing industry landscape
- Assess how WWD can **democratize the process of generating insights** across the department, enabling stakeholders with self-serve capabilities while maintaining a high level of quality through governance, methodologies, processes and standards
- Truly understand what **WWD's business and technical requirements** are for BIA, to be able to unlock insights from its data

Project Outcomes

- A comprehensive view of WWD's **current state** BIA ecosystem, how it supports WWD's business needs, strengths and challenges
- **Target state** recommendations on capabilities across strategy, people, process, data and technology
- **BIA roadmap, prioritized initiatives, business requirements and execution plan** to operationalize the target state
- **Proof of concepts** to enable WWD to visualize the capabilities of a modern solution architecture and integrated data in WWD's context

Current State Assessment And Approach

A repeatable framework ensures a pragmatic and prescriptive approach in assessing the current state of analytic capabilities across all WWD divisions.

09
Divisions

25
Interviews

36
Stakeholders

35
Dimensions

50
Hours

950
Pages

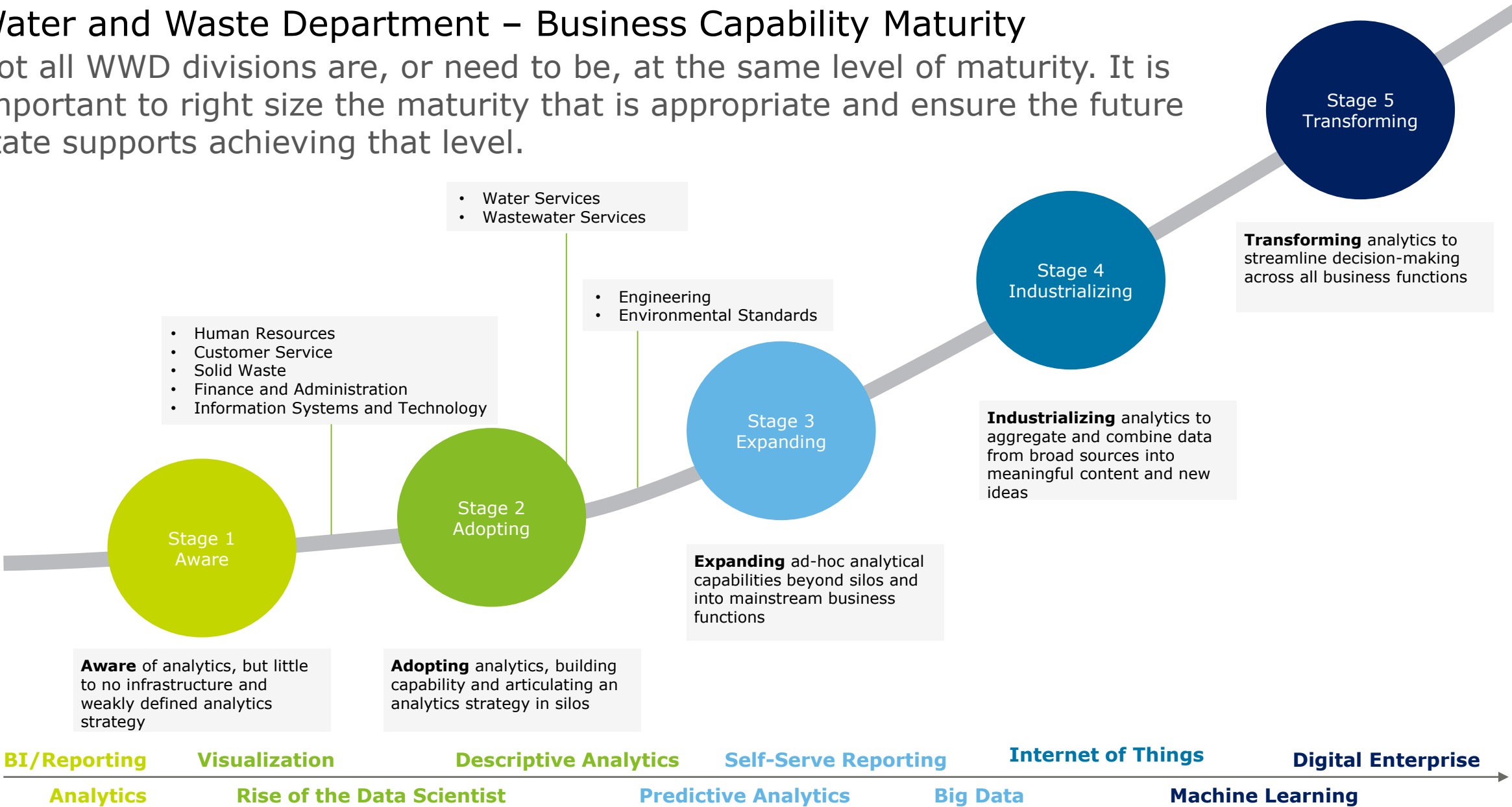
Areas of Review for Current State Assessment

Dimensions	Key Questions
Business Capabilities and Initiatives	What are the business capabilities and priorities that BIA capabilities serve in your division ?
Stakeholders Ecosystem	Who are your analytical and data partners ? What is the extent of their involvement ?
Customers/Users	Who are the customers / users (internal or external) who consume BIA outputs from your division ? Do they have any challenges ?
Cost Drivers and Investments	What are the cost drivers and recent investments in Business Intelligence and Analytics ?
Process	How do you get your reports or analytics today? (e.g. reports, data extract, analytics model)? What are the positives of the process and what are some of key challenges or opportunities ?
Resources	What resources do depend on today (e.g. data sources, analytics tools)

Strategy	People	Process	Data	Technology
Vision	C-Suite Leadership	Enterprise Science	Information Model	Reference Architecture
Value Drivers	Organization Design	Demand Management	Data Sources	Value Proposition
Stakeholder Management	Talent	Enterprise Process Re-engineering	Data Quality	Vendor Landscape
Operating Model	Change Journey	Governance	Privacy & Security	Delivery Model
Innovation	Knowledge Management	Agility/ Scalability	Ethics & Sharing	Reliability & Continuity
		Decision Process	Regulation & Compliance	Sandbox & Innovation

Water and Waste Department – Business Capability Maturity

Not all WWD divisions are, or need to be, at the same level of maturity. It is important to right size the maturity that is appropriate and ensure the future state supports achieving that level.



Water and Waste Department – Business Capability Maturity Breakdown













Engineering, Environmental Standards, Wastewater Services and Water Services are leading on the maturity scale. Other WWD divisions have descriptive analytics capabilities with an ambition to grow their data management, reporting and predictive analytics capabilities.

Division	Business Capability					
Water Services	Water supply	Managing water distribution systems	Water treatment	Emergency services		
Finance and Administration	Capital planning and budgeting	Operational planning	Customer meter and meter reading	Financial services	Billing and collection	Rates and rate structure
Solid Waste	Solid waste planning	Landfill management	Monitoring of closed landfills	Solid Waste collection	Recycling	Waste minimization
Environmental Standards	Regulatory compliance and reporting	Licensing	By-law enforcement	Analytical services	Emergency response	Security governance and safety plans
Customer Service	Support utility billing enquiries	Manage the department's website and intranet	Coordinate public engagements			
Human Resources	Safety planning	Return to Work planning	Human resource management			
Wastewater Services	Wastewater collection system	Land drainage and flood control operations	Wastewater treatment operations	Environmental policy and public awareness	Public reporting	Training
Engineering	Planning and conservation related activities	Surveys, project management and engineering consulting	Product and material related activities	Drafting and GIS services	Flood Control	Regulatory and compliance reporting
Information Systems and Technology	Planning, development and support of IT systems	IT infrastructure management and security compliance				

■ Stage 1: Aware
 ■ Stage 2: Adopting
 ■ Stage 3: Expanding
 ■ Stage 4: Industrializing
 ■ Stage 5: Transforming

Water and Waste Department – Key BIA Challenges





Although there are some specific divisional concerns, there are a number of common themes across all WWD divisions.

#	Themes	Impacted IDO Dimension	Challenges
1	Central repository in support of BIA	 	Across Water and Waste Department’s (WWD) divisions, staff members lack the ability to link datasets together in a central repository for reporting and analytics. This challenge limits depth of analysis and insights, impacts the staff’s ability to share data across the department, inhibits the department in exploiting 3 rd party data sources, and creates data, reporting and analytics governance issues.
2	Data storage	 	Datasets are largely stored in managed operational systems, but a number of critical datasets (e.g., vertical assets (i.e., pump stations, buildings, etc.), safety root cause analysis, water quality results, job planning, safety inspections, etc.) being stored in unmanaged data stores such as Excel, Access databases, PDFs and paper. This leads to lack of audit trail, emergence of version control challenges, and limits WWD’s reporting capabilities.
3	Data governance	 	WWD hasn’t designed and implemented a mature data governance framework. Absence of such a framework (and its components such as data standards, data governance policies, organization structure, etc.) leads to incoherent development and management of data assets and reports.
4	Business Intelligence and Analytics (BIA) program governance	  	BIA projects and activities are managed internally within divisions and not through a formal governance structure. Lack of central governance impacts the ability of BIA project members to escalate project and data issues, meet BIA talent and technology needs and ensure that outcomes of these projects are aligned with objectives outlined in business cases.
5	Self-serve data prep/reporting	  	Excel is primarily used across the department for reporting purposes with exception of Environmental Standards and Wastewater Services, who are implementing e.RIS. Use of Excel as a reporting tool limits reporting functionality for the department, lowers data quality, creates version control and audit trail challenges, and lowers trust in analytical outputs.

 Strategy
  People
  Process
  Data
  Technology

Water and Waste Department – Key BIA Challenges

WWD is limited in capabilities to exploit analytics and master data capabilities to potentially save on operational costs involved in service delivery and maintenance of its assets.

#	Themes	Impacted IDO Dimension	Challenges
6	Data Quality		Trust in data quality varies significantly across the divisions. Some of the divisions (e.g., Water Services, FA) have trust in their data, whereas other WWD divisions face significant issues with data quality (e.g., Solid Waste). A data quality framework, which ensures trust and integrity of datasets, isn't defined. Majority of the divisions conduct ad-hoc data quality checks. Lack of well defined data quality rules and automated testing leads to significant manual effort (e.g., 4-5 FTE in Environmental Standards) and lack of in trust in datasets and reporting and analytics outcomes.
7	Reference Architecture		IST has invested in strategy and implementation of BIA projects, however it doesn't have a reference architecture that prescribes set of tools and technologies to enable divisional capabilities. This leads to divisional procurement, or procurement of tools without clear alignment. Enterprise Architecture and Application Data and Integration development projects have been planned in WWD's Enterprise IT Architecture Roadmap.
8	Analytics		Given gaps in foundational data management capabilities, it is virtually impossible for WWD to effectively leverage their data for analytics. Divisional staff has expressed interest in the use of analytics to support meaningful business decisions specifically for process optimization, predictive maintenance, cost containment and education, and annual budgetary planning.
9	360 degree view of Assets		Multiple WWD divisions have expressed concerns in the number of disparate systems that contain pieces of asset information, but no one system is able to provide a complete picture of WWD's assets. WWD manages a significant number of assets across all divisions, and this makes up a significant portion of their annual operating budget in maintenance and support. There isn't a central repository where WWD has all of its linear and vertical assets linked with other datasets such as condition data, work orders, drawings, etc.

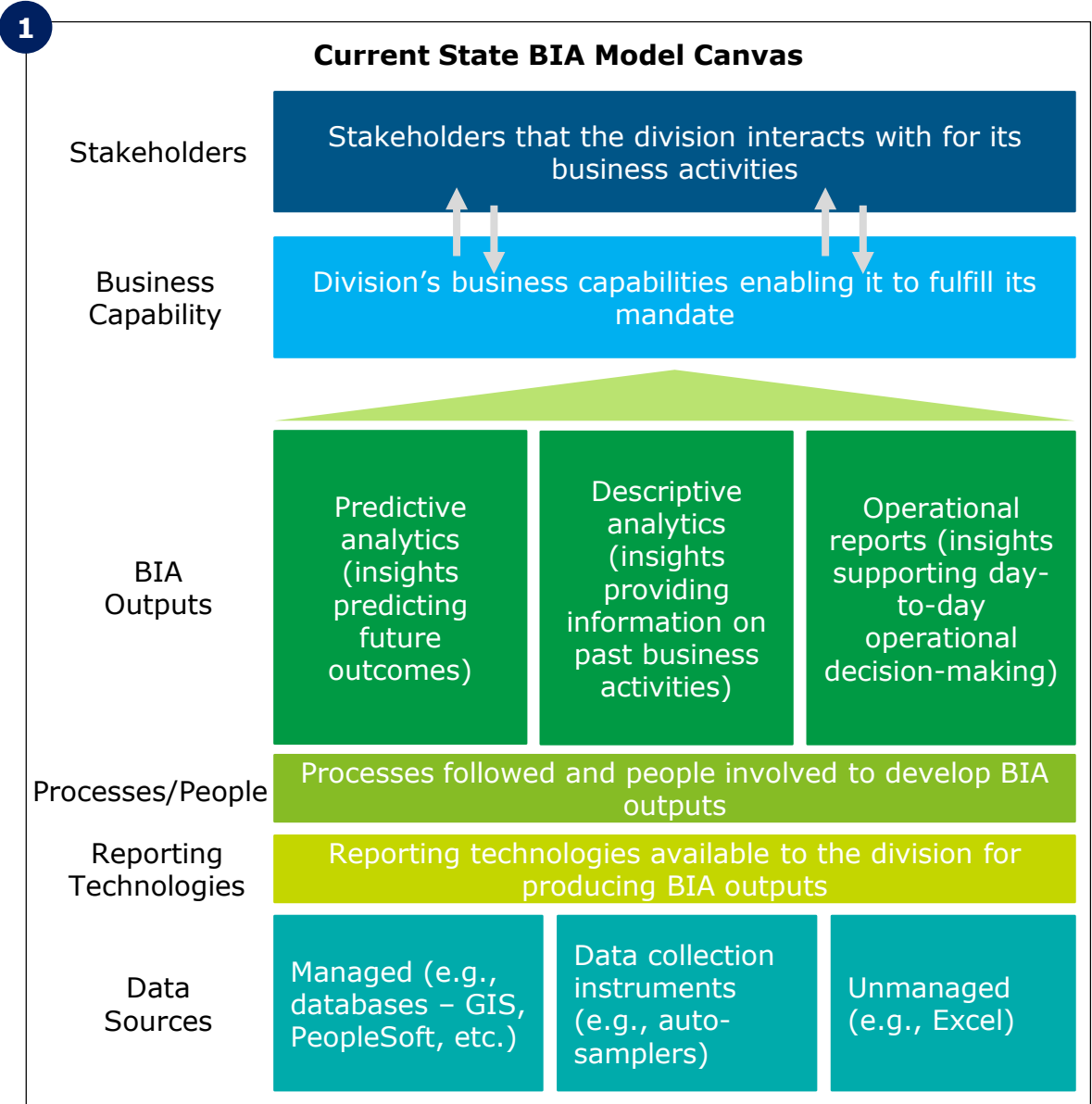
 Strategy
  People
  Process
  Data
  Technology

WWD's Current State BIA Model Canvases, Key Challenges and Initiatives

WWD's Current State BIA Model Canvas, Key Challenges and Initiatives

Interviews were conducted with nine divisions by leveraging BIA Ecosystem Framework, to gauge their:

1. Current BIA model
2. Key challenges impacting their ability to deliver on business mandate
3. Initiatives undertaken to further enhance their capabilities



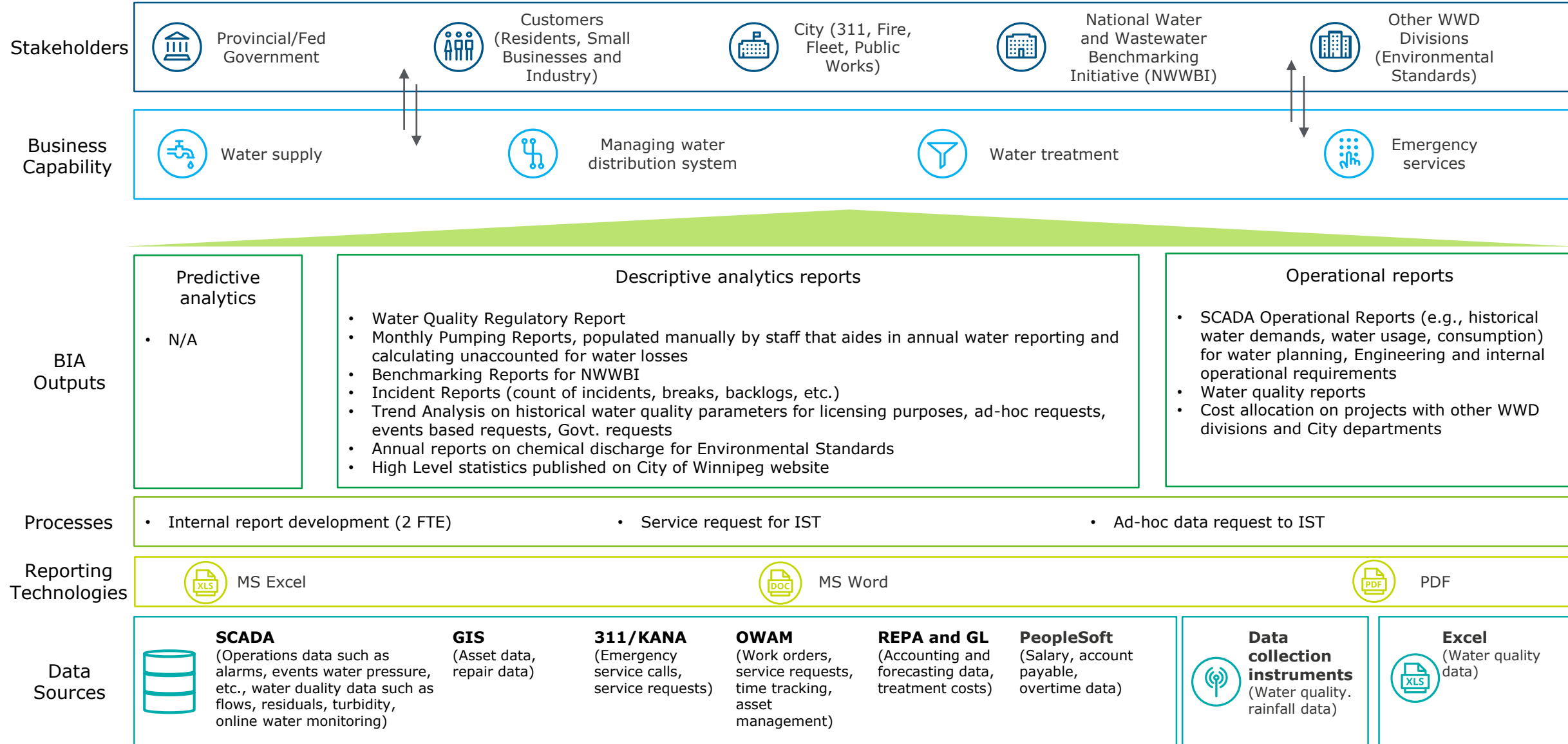
2

Key initiatives undertaken or planned by WWD divisions to further enhance their capabilities to deliver on mandate.

3

Key challenges faced by WWD divisions impacting their ability to perform business activities.

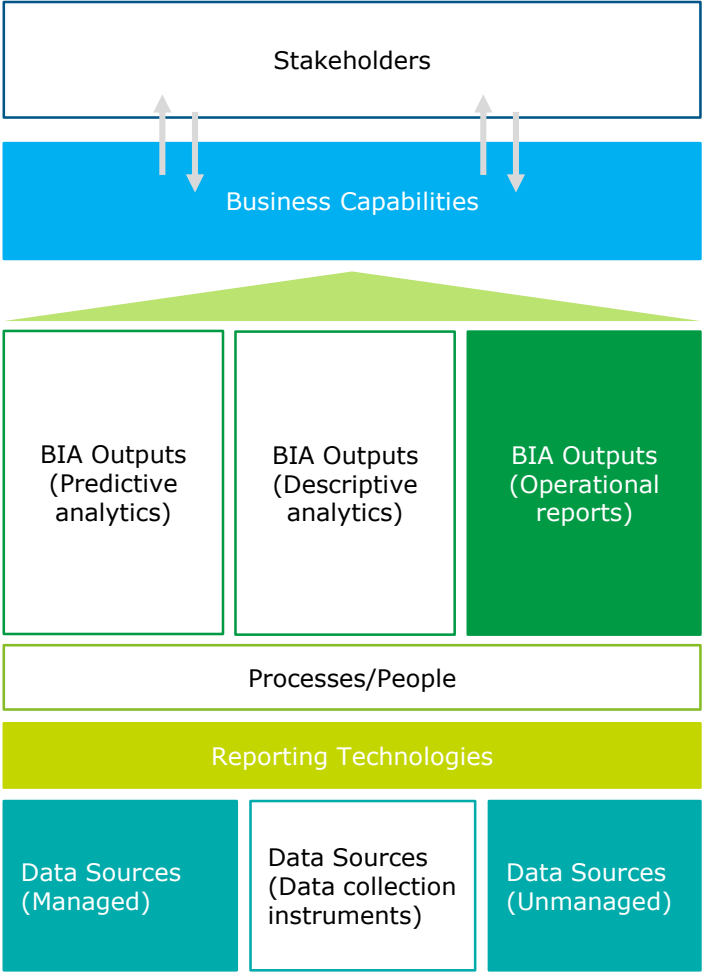
Water Services | Current State BIA Model Canvas



Water Services | Key Initiatives

Water Services has a number of initiatives planned and has significant interest in expanding capabilities to support business planning.

#	Impacted Business Model Layer*	Initiative	Description
1	Business Capabilities (Water supply)	Water reuse / recycling	In this initiative, Water Services division intends to protect, maximize and supplement city's existing water supply by re-processing waste-stream water.
2	Data Sources (Managed)	SCADA system upgrade	The division plans to upgrade regional SCADA instance in the next 3 years.
3	Reporting Technologies, Operational Reports and Data Sources (Managed)	Water Information System	Division plans to implement an application that will assist them in dispatching resources to work sites and inform 311 about resources in the field.



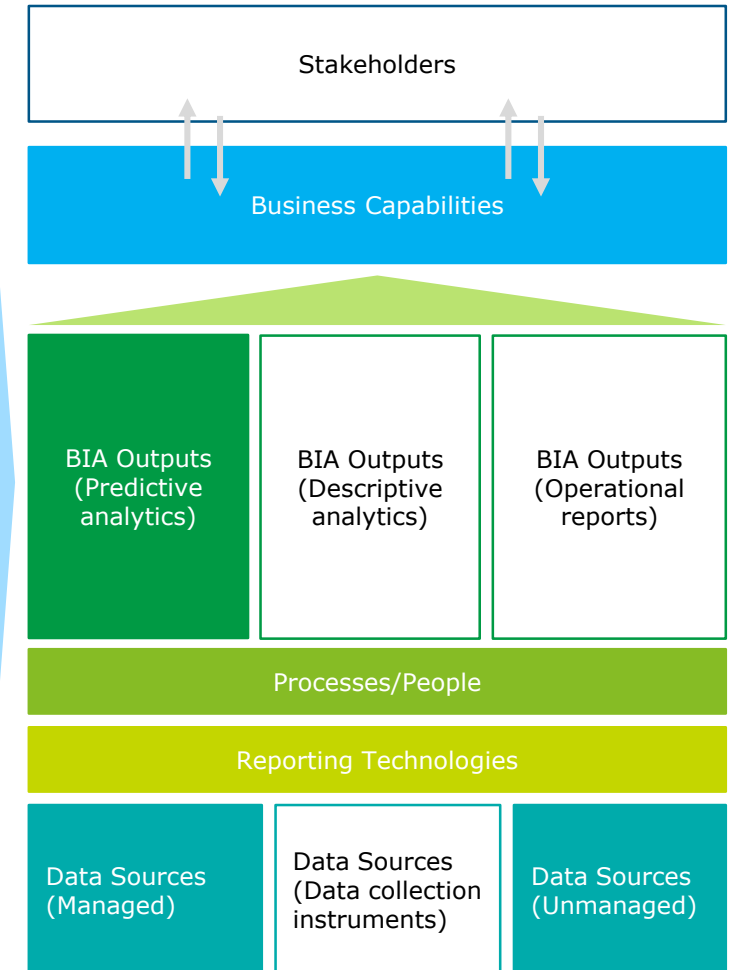
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Water Services | Key Challenges

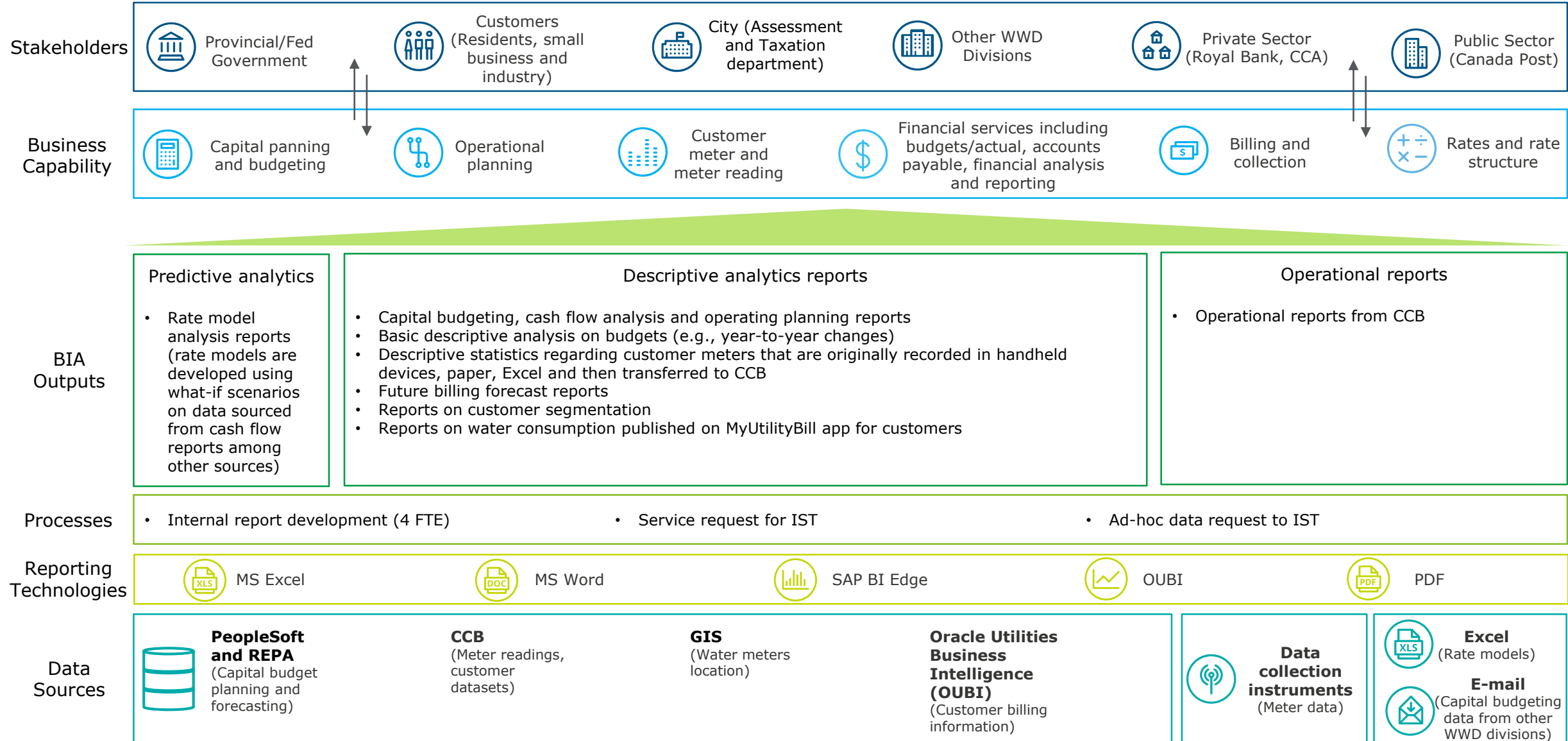
Foundational data management capabilities preventing the ability to link datasets from diverse sources, build insightful dashboards, predictive analytics and self-serve capabilities.

#	Impacted Business Model Layer*	BIA Themes	Challenges
1	Business Capabilities (Managing Water Distribution System), BIA Outputs (Predictive)	Analytics	At present, the division maintains its assets either based on past experiences or customer complaints as opposed to maintaining them based on available datasets (i.e., it lacks predictive analytics capabilities, leading to higher maintenance costs).
2	Reporting Technologies	Dashboards	The division lacks dashboard capabilities for management decision-making.
3	Data Sources (Managed)	Central data repository	The division doesn't have a central data repository to link datasets distributed over multiple databases and Excel files. This creates challenges for the division to create live dashboards (e.g., water quality monitoring dashboard, work management dashboard), develop predictive analytics reports (e.g., projecting costs for water treatment by orders using treatment costs, chemical procurement costs, historical chemical volumes used for water treatment, past work orders, etc.) and link costs to capital and operational budgets.
4	Data Sources (Managed)	Data storage	The division's data is captured in unmanaged data sources such as Excel files, emails, etc., which poses issues such as lack of audit trail, absence of version control, etc.
5	Data Sources (Managed)	Data management	In the division, data is duplicated among systems due to lack of integration between key systems such as GIS, SCADA, and OWAM.
6	Reporting Technologies	Self-serve data prep / reporting	Division's staff members lack self-serve data prep capability to access data assets owned by other divisions (e.g., PeopleSoft, LIMS), which delays decision-making or leads to maintenance of shadow datasets (e.g., safety incidents not distributed to Branch Heads which require them to maintain their own copy of safety incidents datasets).
7	Process/People	BIA talent	The division spends considerable effort (~2 FTE) on data extraction, consolidation, cleansing and analysis that inhibits its ability to spend effort on high value BIA activities such as descriptive/predictive analytics.

* Impacted business model layers are highlighted on the right



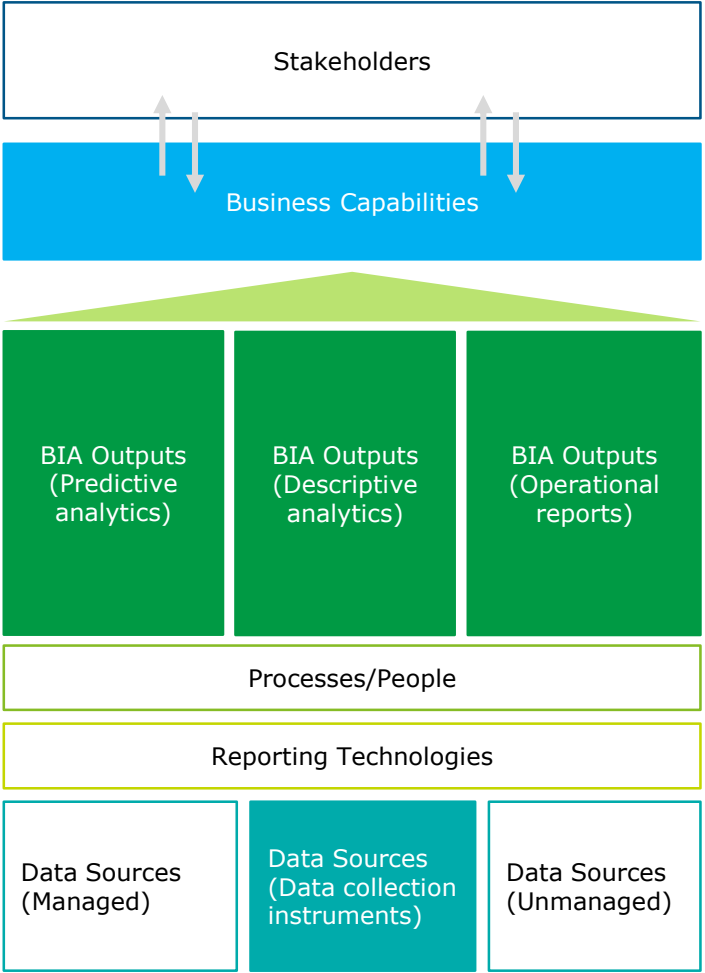
Finance and Administration | Current State BIA Model Canvas



Finance and Administration | Key Initiatives

The division plans to replace existing manual meters with automated meters. This will reduce the operational costs involved in collecting meter readings and increase accuracy of consumption information.

#	Impacted Business Model Layer*	Initiative	Description
1	Business Capabilities (Meter reading), BIA Outputs	Automated Metering Infrastructure Initiative (AMII)	The division plans to replace existing manual meters with automated meters. This will reduce the operational costs involved in collecting meter readings and increase accuracy of consumption information.



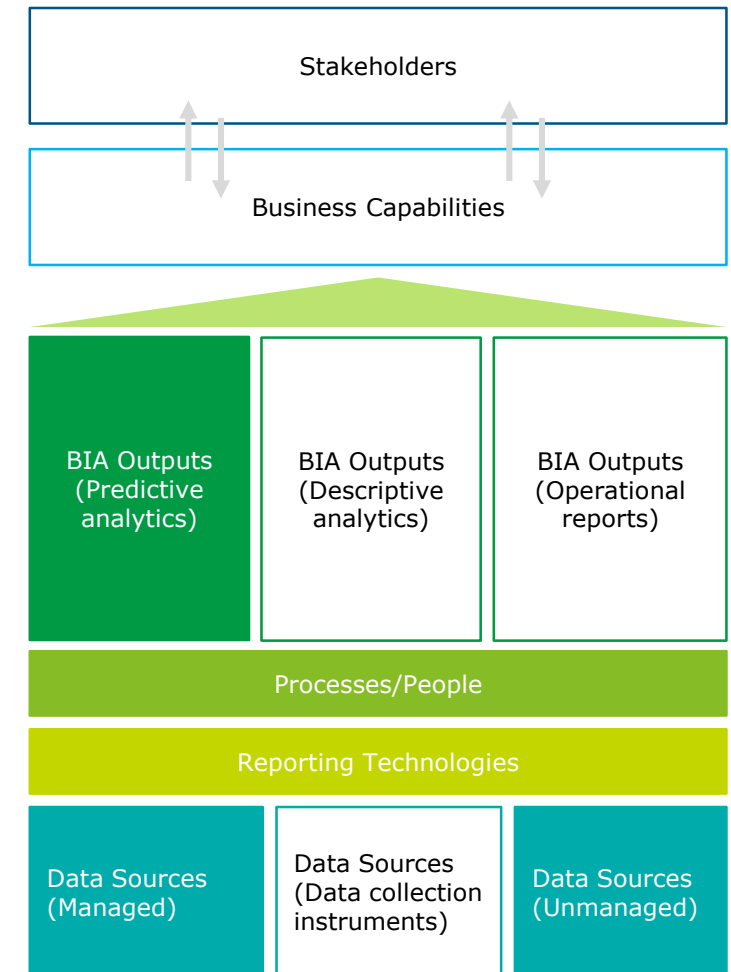
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Finance and Administration | Key Challenges

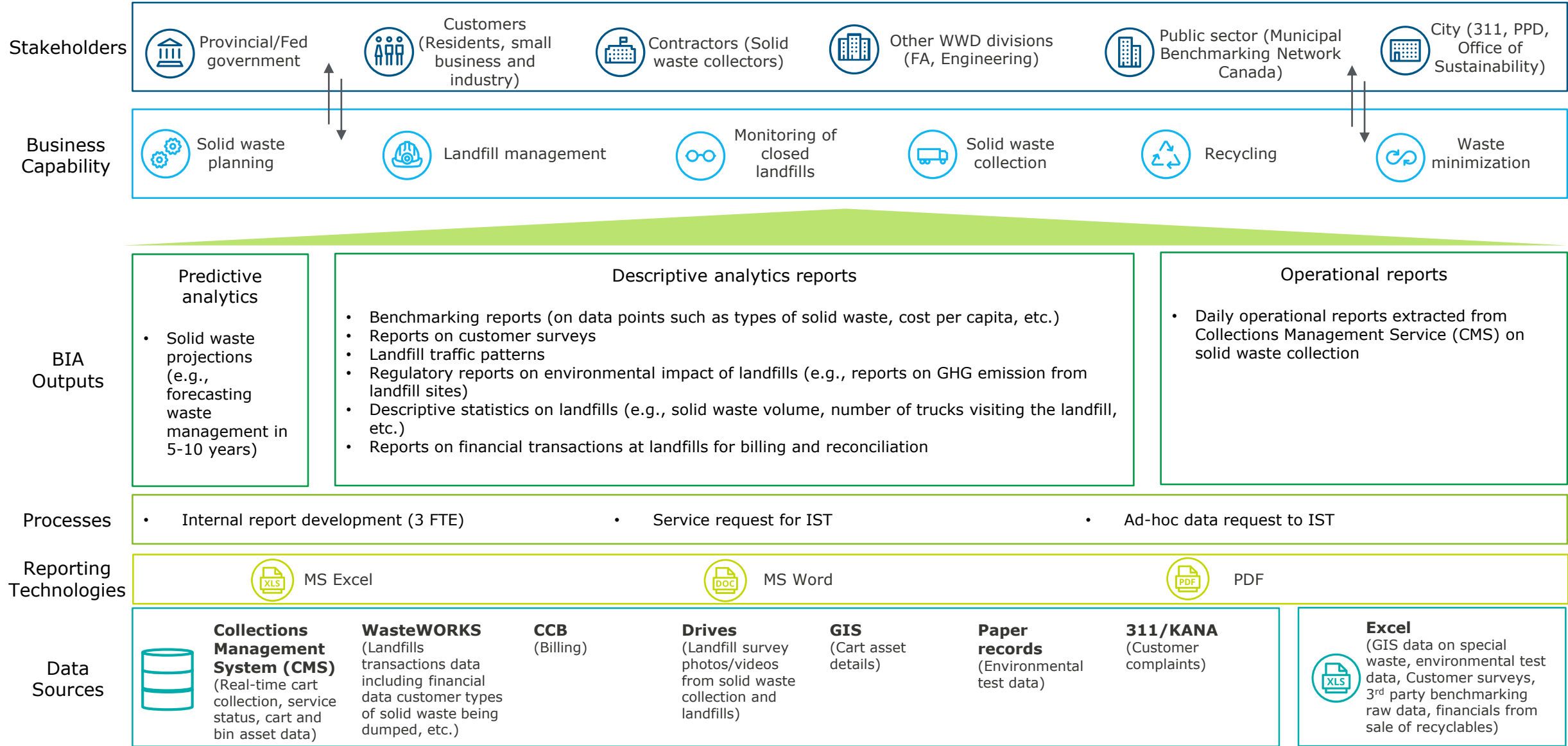
Finance and Administration (FA) division is constrained by lack of access to Customer Care and Billing (CCB) data, and doesn't have reporting/analytics capabilities to meet its business needs such as revenue audit, customer billing forecasting, etc.

#	Impacted Business Model Layer*	BIA Themes	Challenges
1	Data Sources (Managed)	Data access	FA division's staff members don't have direct access to CCB data, and have to request IST to obtain CCB's data extracts. Lack of direct access to CCB creates dependency on IST, delays report development and requires FA staff to make repeated requests to IST for up-to-date data.
2	BIA Outputs (Predictive analytics)	Analytics	The division lacks capabilities and resources to develop analytics models, affecting its ability to embed analytical insights (e.g., data driven budget forecasting, unrealized customer billing forecasting) in its business capabilities.
3	Reporting Technologies	Self-serve data prep / reporting	Due to absence of an enterprise self-serve reporting technology at WWD, critical reports such as capital budgeting and cash flow analysis are created in Excel spreadsheets. This situation creates challenges such as absence of version control, lack of audit trail, poor data quality, etc.
4	Data Sources (Managed)	Central data repository	FA division doesn't have a central repository to link datasets, which are stored in multiple databases (e.g., CCB, CMS, datasets from Assessment and Taxation department), limiting its ability to derive meaningful insights. For example, the division isn't able to audit revenue by linking water and waste collection, and billing datasets.
5	Data Sources (Unmanaged)	Data storage	Significant data is captured in unmanaged data sources such as Excel files (automated meter data), emails, etc., that leads to challenges in management and use of data.
6	Process/People	BIA talent	Division's staff members spend considerable time and effort on data extraction, consolidation, cleansing and information requests. This inhibits their ability to spend effort on high value BIA activities such as forecasting water consumption, analyzing meter right-sizing requirements, etc.

* Impacted business model layers are highlighted on the right



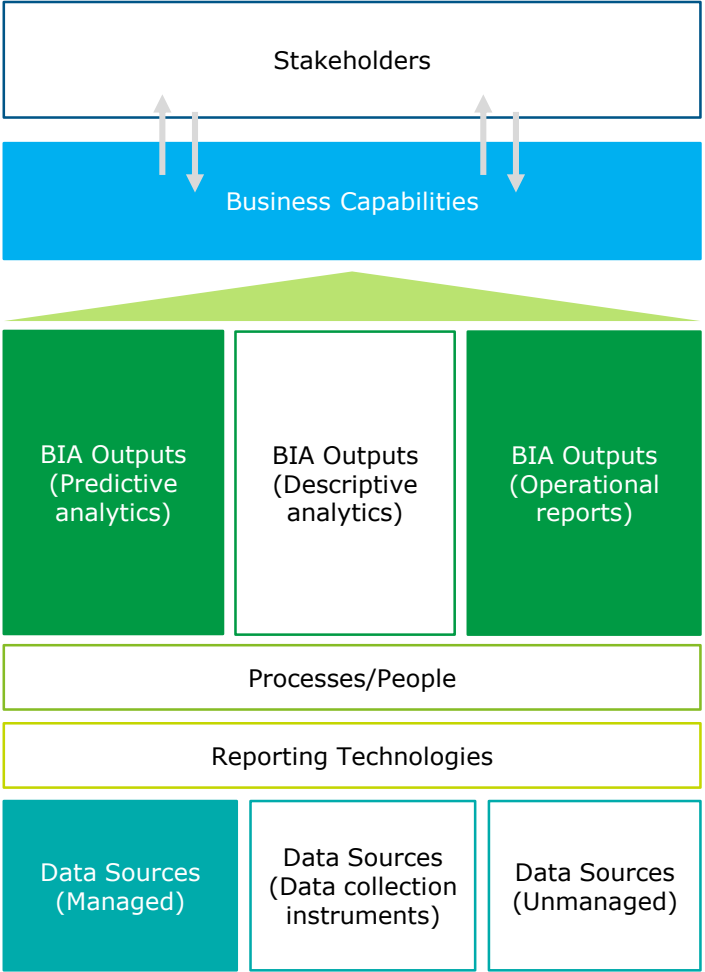
Solid Waste | Current State BIA Model Canvas



Solid Waste | Key Initiatives

Solid Waste division is building a catalogue of data assets in an effort to understand what potential insights will guide and inform future operational decisions, processes, and revenue optimization opportunities.

#	Impacted Business Model Layer*	Initiative	Description
1	Business Capabilities (Solid waste planning)	Waste diversion and demand management	In the waste diversion and demand management initiative, Solid Waste division plans to reduce costs and effort required in processing solid waste by exploring waste diversion and demand management opportunities. For example, the division could tailor its collection services based on customer needs (e.g., reduce frequency of collection according to waste produced by customers). This initiative will enter the planning stage within next 6 months.
2	Business Capabilities (Landfill management), BIA Outputs (Predictive analytics)	Landfills traffic patterns analysis	As part of this initiative, the division intends to generate insights on traffic pattern at landfills to tailor services to generate further revenue. This initiative is at the conceptual stage.
3	Data Sources (Managed)	Data quality improvement	The division is continuously transferring data from spreadsheets into the Collections Management System (CMS). This initiative has led to improvements in quality of the data.
4	BIA Outputs (Predictive and descriptive analytics)	Paid data procurement	The division is making an effort to procure additional data from its solid waste collection contractors. Additional datasets enable the division to supplement its existing datasets and improve its ability to predict customer demand accurately.



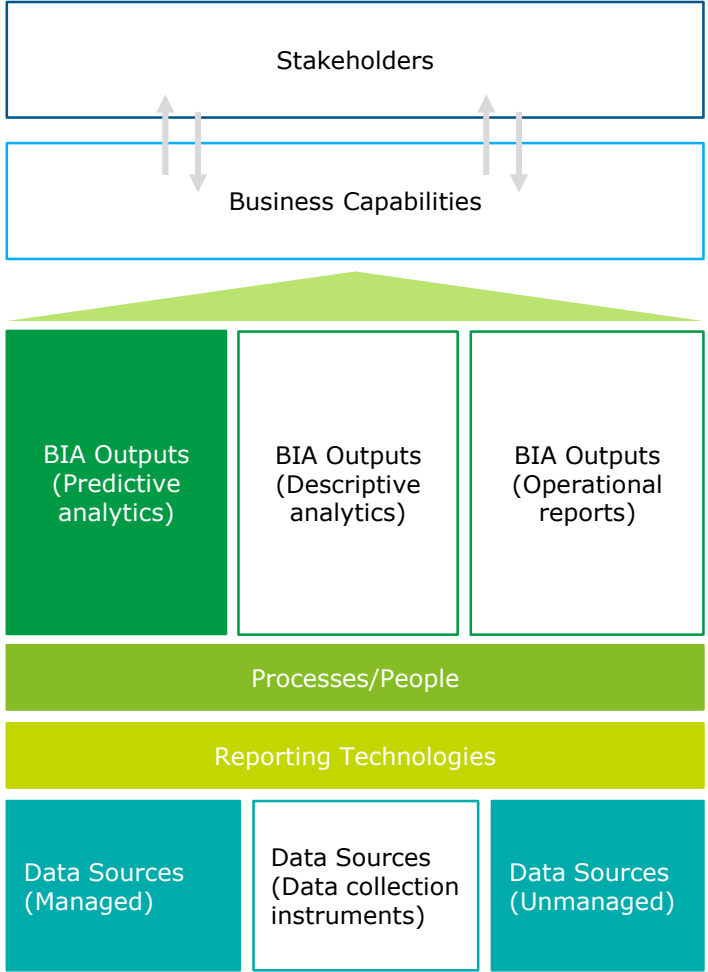
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Solid Waste | Key Challenges

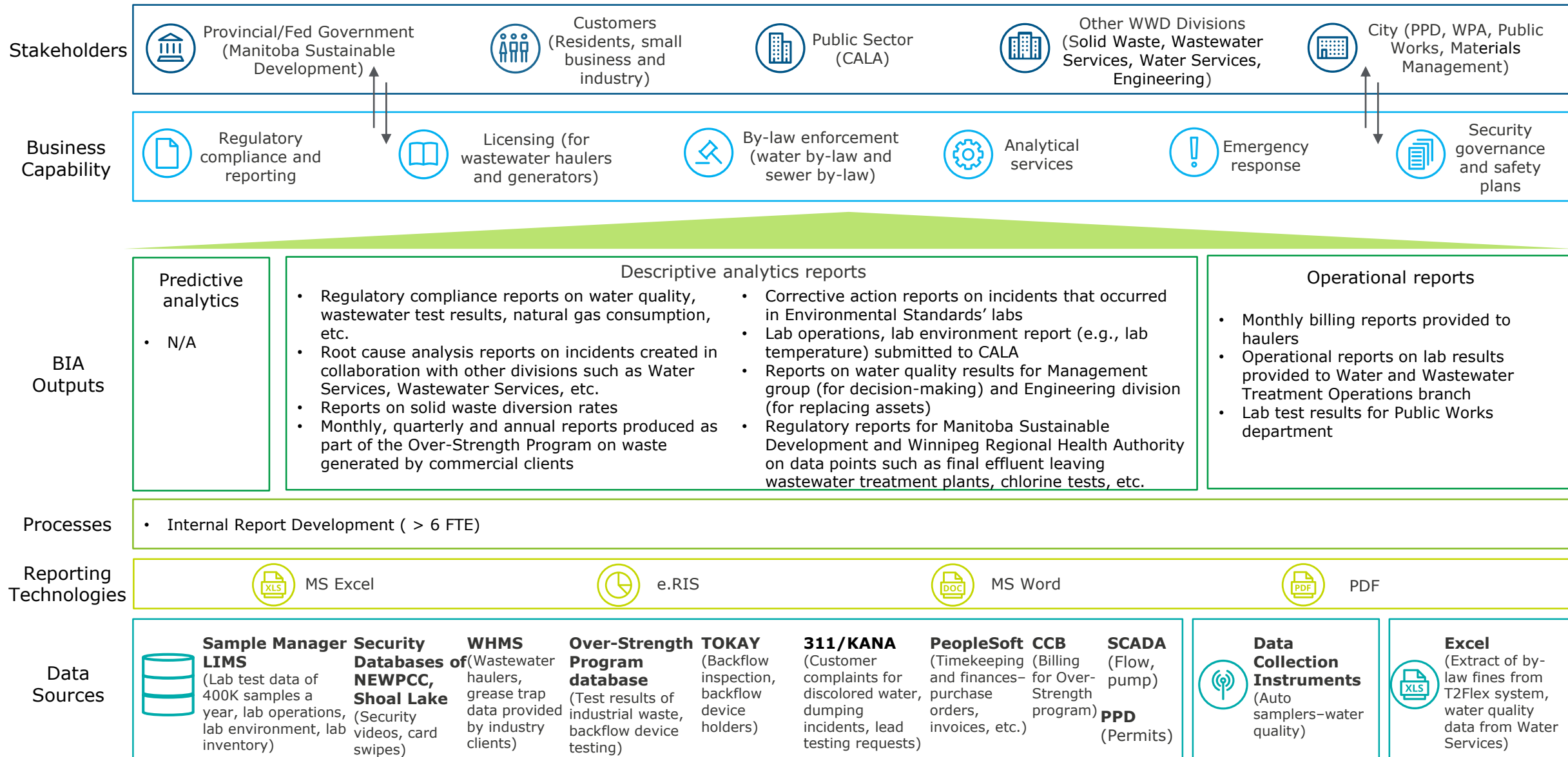
Lack of foundational data management capabilities is preventing the Solid Waste division from developing meaningful analytical insights based on data assets stored across multiple operational systems.

#	Impacted Business Model Layer*	BIA Themes	Challenges
1	BIA Outputs (Predictive analytics) and Processes/People	Analytics and BIA talent	The Solid Waste division lacks technologies and resources to develop predictive analytics models (e.g., demand projections, landfill traffic patterns), affecting its ability to embed analytical insights in its business decisions. Although the division does develop solid waste projection reports, the report can be further enhanced by using analytics modelling techniques and by leveraging full breadth of available data.
2	Reporting Technologies	Self-serve data prep / reporting	Due to absence of an enterprise self-serve reporting technology at WWD, reports such as solid waste projections are designed in Excel spreadsheets. This creates challenges such as absence of version control, lack of audit trail, poor data quality, etc.
3	Data Sources (Managed)	Central data repository	The division doesn't have a central repository to link datasets, which are stored in multiple databases (e.g., CMS, PeopleSoft, Synergen, CCB). This situation requires staff members to spend considerable effort in manually linking these datasets and limits their ability to create useful insights.
4	BIA Outputs (All)	Analytics	The Solid Waste division has a vast amount of unmanaged data assets such as high quality landfill photos, which are stored in drives. These unmanaged data assets, if co-located with managed datasets and harnessed appropriately, could be used to design analytics and Artificial Intelligence (AI) based insights for various use cases (e.g., functioning of landfill sites).
5	Data Sources (Managed)	Data quality	The division doesn't have a formally defined data quality framework, inhibiting its ability to have standardized datasets and measured data quality. Lack of such a framework leads to considerable data quality issues.
6	Processes/People	BIA talent	The division spends considerable effort on obtaining datasets, enhancing existing reports and fixing data quality issues. This inhibits the division's ability to spend effort on high value BIA activities

* Impacted business model layers are highlighted on the right



Environmental Standards | Current State BIA Model Canvas

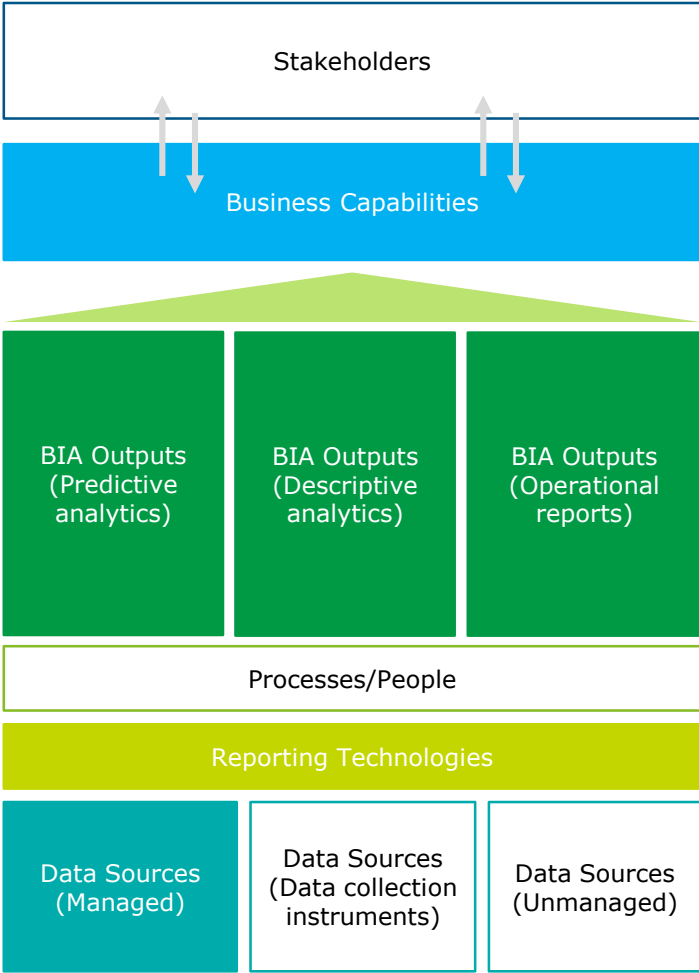


Environmental Standards | Key Initiatives

Environmental Standards has undertaken a number of technological initiatives to improve collection of inspection data, increase availability of collected data for customers, and produce more insightful analytics and trend analysis reports out of existing lab data.

#	Impacted Business Model Layer*	Initiative	Description
1	BIA Outputs (Predictive and descriptive analytics)	e.RIS implementation	In this initiative, Environmental Standards is working with IST and Wastewater Operations to operationalize e.RIS, a self-serve reporting tool, to improve data sharing capabilities and to meet real-time data feed requirements of Wastewater Services division (for treatment and maintenance purposes).
2	Data Sources (Managed)	IWMS replacement	The Industrial Waste Management System (IWMS) initiative will consolidate four different databases used by Industrial Waste Services into a single database. This initiative will decrease redundancies, reduce effort required in reporting and improve operational efficiencies.
3	Data Sources (Managed)	TOKAY CCB link	Environmental Standards is planning to integrate data residing in TOKAY database with the data stored in CCB. This integration will enable the division to compare data captured in TOKAY database (e.g., inspection information on backflow devices) with data stored in CCB (owner data such as address, meter number, owner’s name, etc.).
4	Data Sources (Managed)	TOKAY	The division is planning to implement a frontend system for testers (i.e., certified plumbers) to capture backflow device test and inspection data.
5	Reporting Technologies	Self-serve portal	In this initiative, the division is planning to implement a self-serve portal for commercial property owners, enabling owners to enter their backflow device information, add/change contact phone number, inform the division of property transfer, etc.
6	Data Sources (Managed)	Mobile interface to LIMS system	This initiative is designed to provide water sample collectors with a mobile interface to LIMS system. This interface will allow collectors operating in the field to record sample information through their mobile devices.

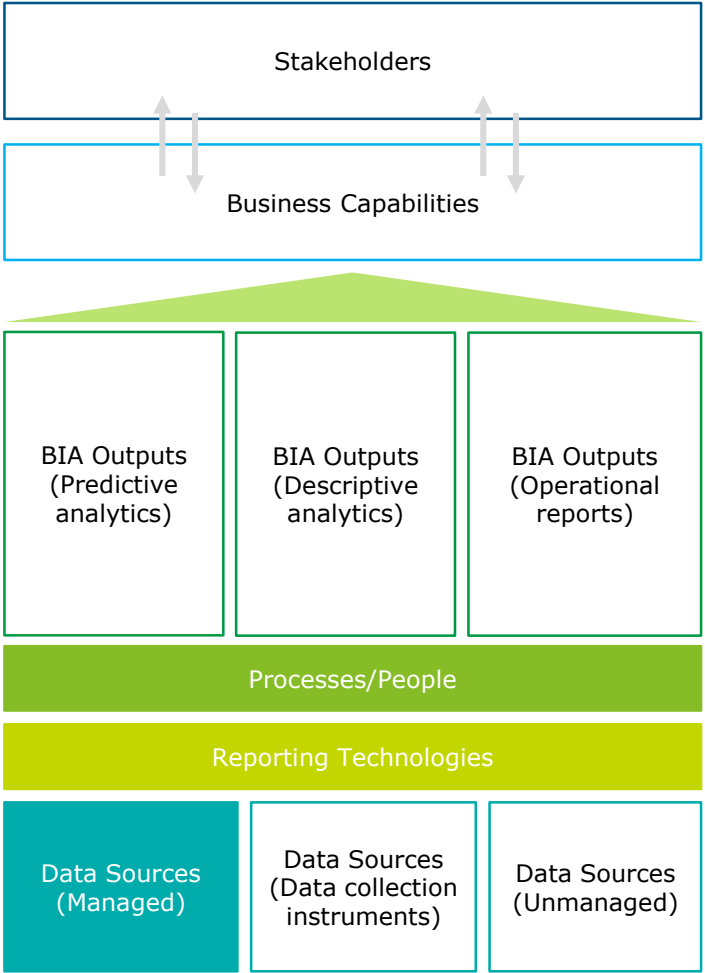
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Environmental Standards | Key Challenges

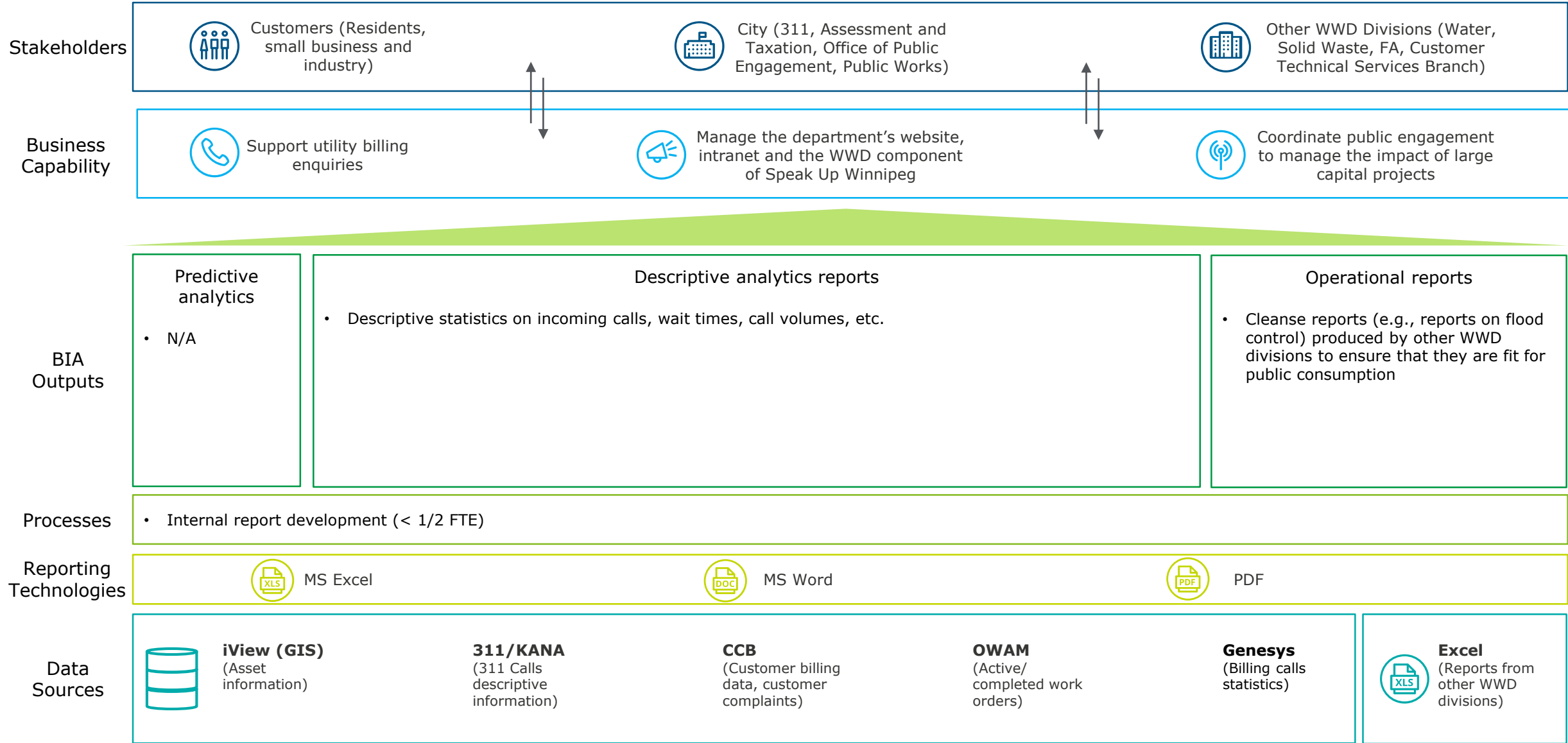
Environmental Standards spends considerable effort in validating quality of its data, preparing validated lab results and developing internal and external reports. Although the division is ahead of the curve as compared to other divisions, it lacks a holistic approach for managing its BIA

Impacted # Business Model Layer*	BIA Themes	Challenges
1 Processes/People and Data Sources (Managed)	BIA talent, operating model and data quality	The division spends considerable effort on manually validating Environmental Standards lab results. For preparing lab results, 25 resources spend 5 FTE worth of effort on BIA activities, whereas for other BIA needs, resources spend 1 FTE effort (this effort doesn't include effort spent by the Industrial Services branch resources on BIA activities). Such effort leads to increase in cycle time for validating lab results and forces the division to report on interim lab results (i.e., results in process of being validated). This challenge can be potentially mitigated by designing a holistic data quality framework that is composed of various components such as data quality rules, automated data quality checks, data standards, etc.
2 Processes/People	Data storage	Ten percent of the water quality results are stored outside of LIMS. These results are provided by Water Services division. Storage of data in unmanaged technologies leads to challenges in management and use of data.
3 Processes/People	Self-serve data prep / reporting and analytics	The division is leveraging e.RIS (self-serve reporting tool), a Wastewater Services initiative, to store and share its lab results with its stakeholders. The division is also developing tags that will assist its data consumers to effectively use self-serve capabilities for sourcing datasets. But the division lacks a coherent overarching approach for procuring and implementing self-serve technologies, defining processes around self-serve capabilities and implementing disciplines of data management such as metadata management, reference data management, data quality, etc.



* Impacted business model layers are highlighted on the right

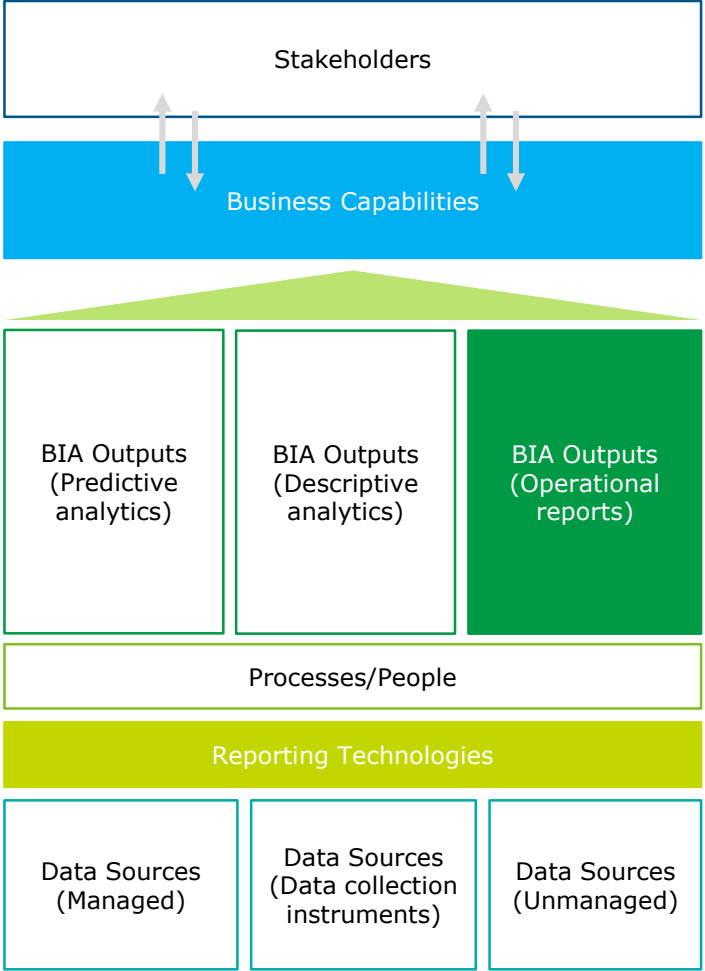
Customer Service | Current State BIA Model Canvas



Customer Service | Key Initiatives

Customer Service has taken the initiative to create MyUtilityBill, a self-serve portal that provides billing information for clients and reduces the burden on the call center by empowering the customers with self-serve capabilities.

#	Impacted Business Model Layer*	Initiative	Description
1	Business Capabilities, Reporting Technologies and BIA Outputs (Operational reports)	Self-serve portal (MyUtilityBill)	The initiative is designed to enable WWD’s customers to view their billing information and setup their pre-authorized payments online. In addition, the portal also allows the division to divert a percentage of customer billing enquiries from the Call Center to the online portal itself, reducing effort required by the Call Center’s employees in responding to customer enquiries.

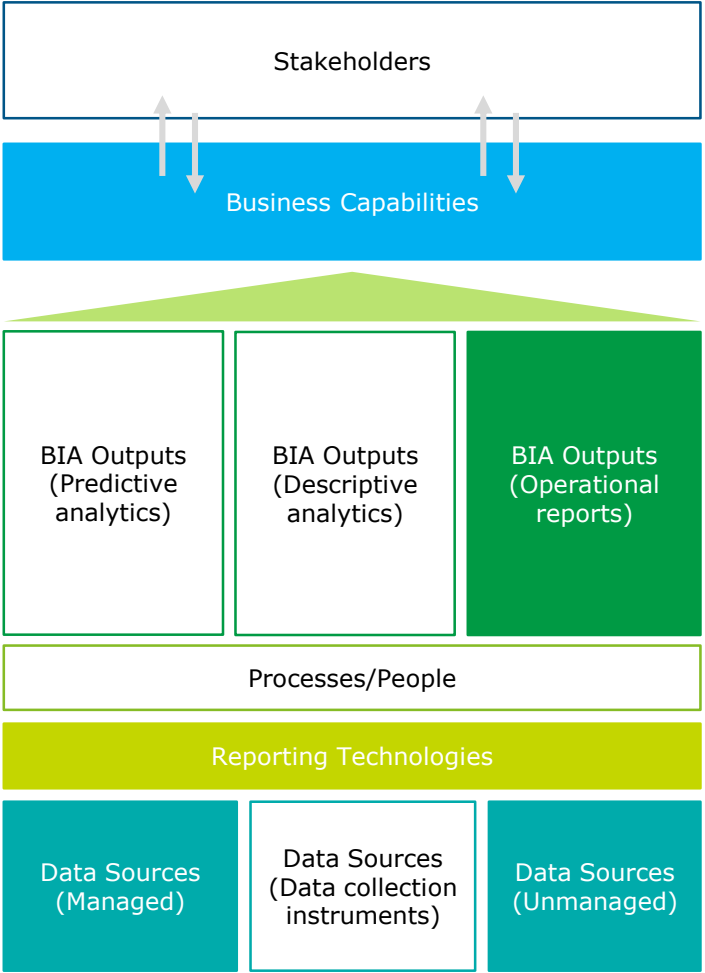


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Customer Service | Key Challenges

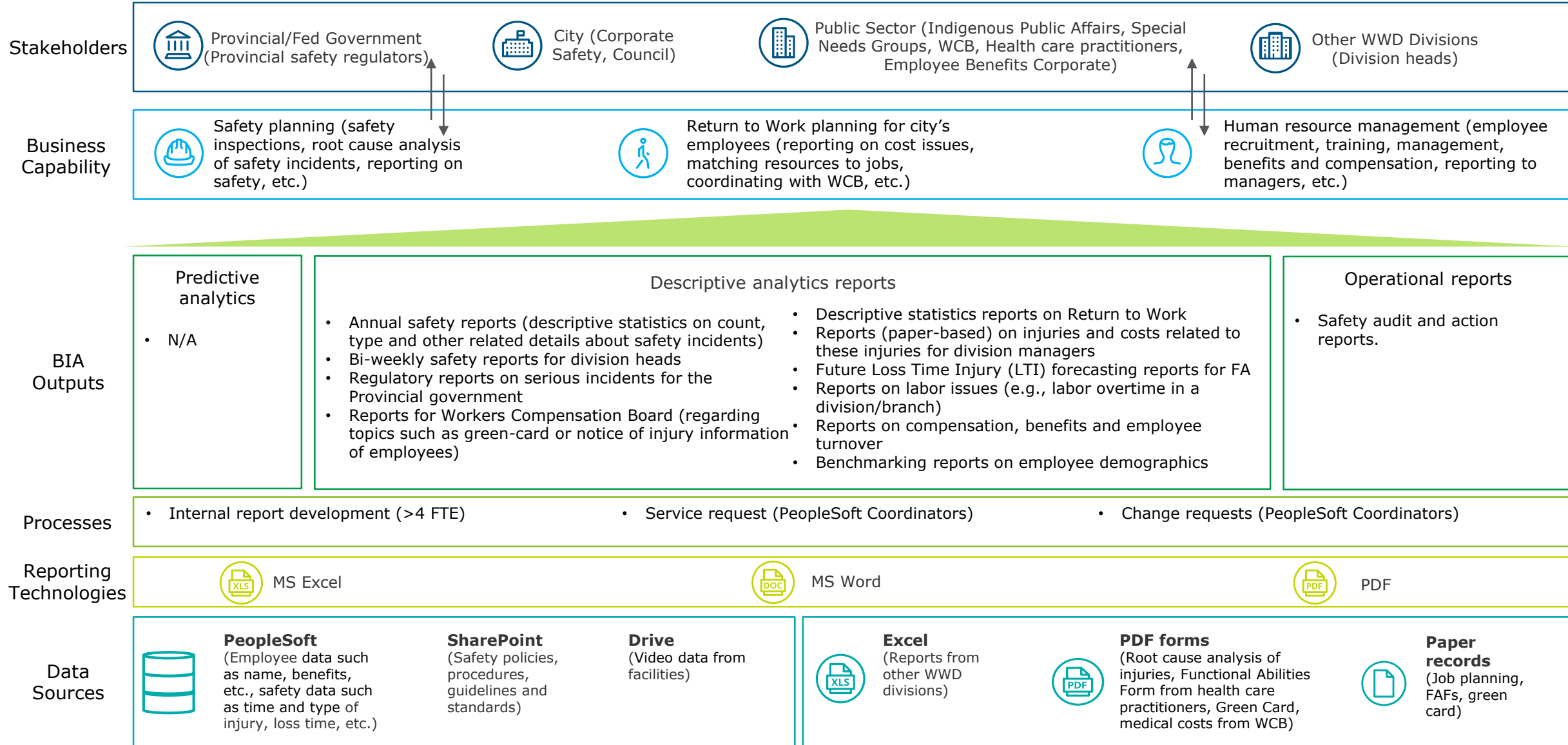
Customer Service has launched a self-serve portal to divert its call traffic and meet its 80/60 mandate. Integration of data sourced from disparate sources and data governance will play a crucial role in the success of the self-serve portal.

#	Impacted Business Model Layer*	BIA Themes	Challenges
1	Business Capabilities, Reporting Technologies, BIA Outputs (Operational reports) and Data Sources (Managed and unmanaged)	Data governance and data integration	Customer Service has a service target of 80/60 (i.e., 80% of calls should be answered in 60 seconds). In order to meet this mandate, Customer Service has launched a self-serve portal (MyUtilityBill). The portal is meant to divert calls to the website and reduce the overall burden on the Call Center. Despite the launch of the portal, Customer Service hasn't observed a significant drop in calls to the Center. Further enhancements are planned to divert further traffic to MyUtilityBill. Data integration and data governance will be critical to the success of the self-serve portal.



* Impacted business model layers are highlighted on the right

Human Resources | Current State BIA Model Canvas

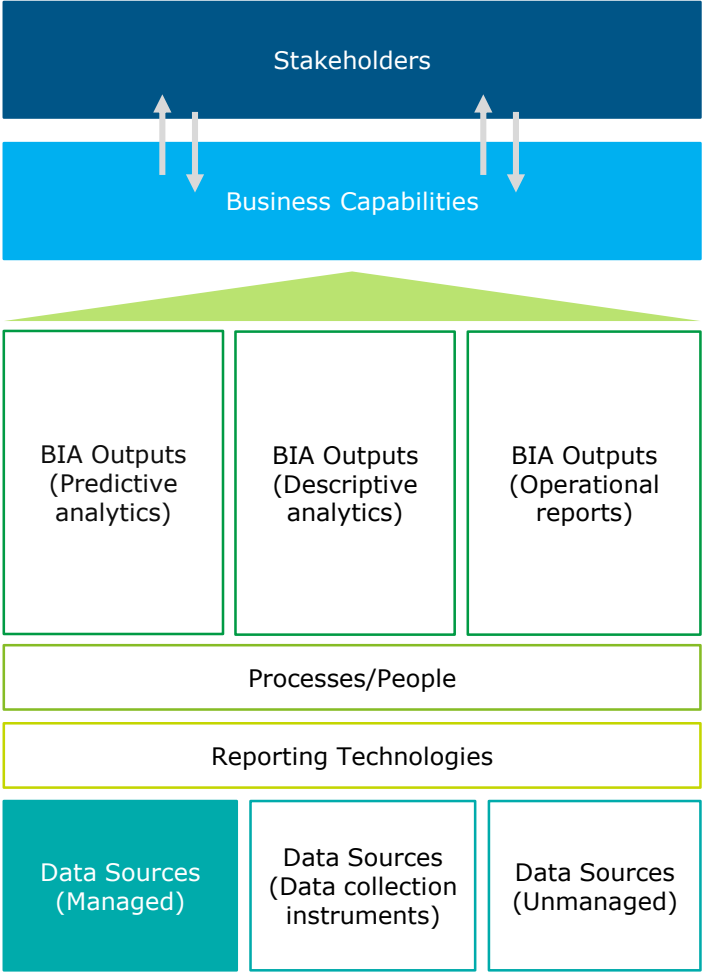


Human Resources | Key Initiatives

Human Resources has taken some key technological initiatives to digitize employee information on SharePoint, optimize employee training lifecycle through a 3rd party application and to digitally capture safety information in real time.

#	Impacted Business Model Layer*	Initiative	Description
1	Business Capabilities	HRDMS	As part of this initiative, the Human Resources division plans to reduce the effort required to maintain employee paper records (e.g., root cause analysis of incidents) and capturing employee details manually in PeopleSoft. This initiative is an ongoing endeavor.
2	Business Capabilities	SmarterU	The division plans to implement a solution for employee training and training results. A cloud service (SmarterU), already being used by Wastewater Services, will be leveraged for this.
3	Data Sources (Managed)	Operational technology to store safety asset (personal protection equipment) inspection data	At present, safety inspection data is captured on paper. This initiative is aimed at moving this data from paper to an operational technology. This initiative is in the planning stage.
4	Data Sources (Managed)/Stakeholders	Mobile safety	In this initiative, the division intends to implement a mobile interface for capturing safety data (e.g., safety forms) digitally in real time. It is in the planning stage.
5	Business Capabilities	SafeWork certification	The division plans to acquire safety certification from the province for City of Winnipeg's Water and Waste Department. This initiative is currently in progress and needs to be completed by 2020.
6	Data sources (Managed)	Data storage	Digitization (SharePoint) of employee forms for recruitment and termination.

* Impacted business model layers are highlighted on the right

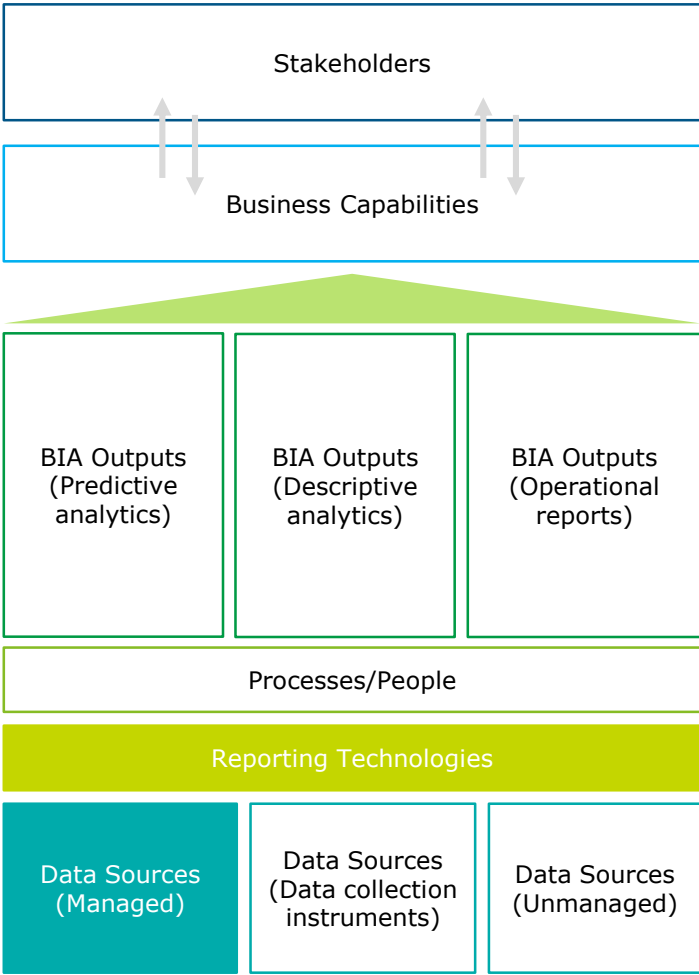


Human Resources | Key Challenges

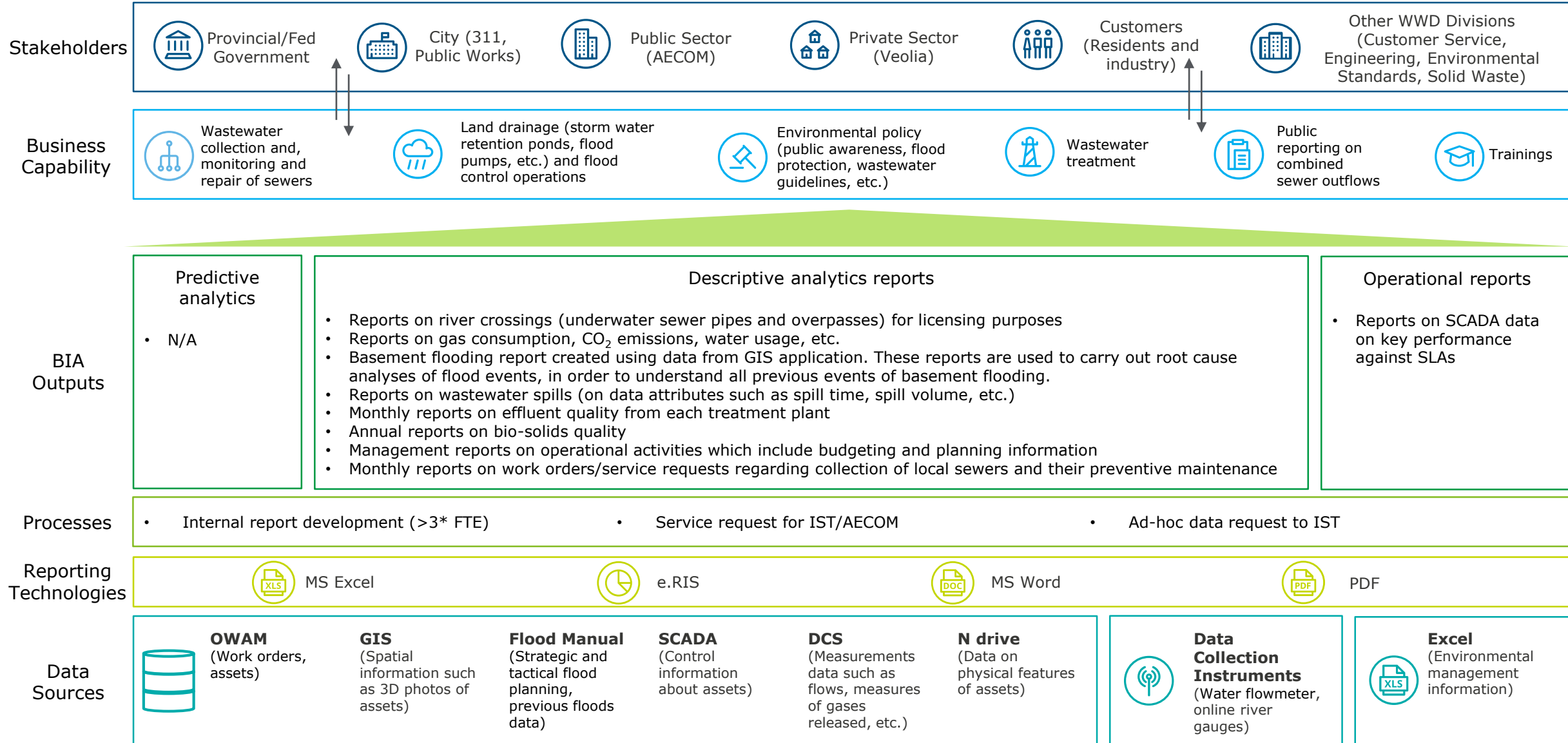
Human Resources (HR) faces BIA challenges in promoting insights driven safety practices, disseminating safety information to branch heads and in unlocking the true value of safety analytics by linking costs with incidents.

#	Impacted Business Model Layer*	BIA Themes	Challenges
1	Data Sources (Managed)	Data quality and data standardization	Due to absence of established data standards, the quality of data residing in the PeopleSoft system is dependent on the quality of data entered by system users. This leads to significant information being captured in an unstandardized format (e.g., data attributes such as safety incident types), requiring the HR division’s staff members to manually cleanse and standardize the datasets for reporting purposes.
2	Data Sources (Managed)	Data access	At present, the division doesn’t have an effective mechanism to access PeopleSoft for sourcing data about safety audits and follow up on action reports that are produced as a result of these safety audits.
3	Reporting Technologies	Data storage	Data stored in PDF forms (e.g., Functional Abilities Form (FAF), data sent by health care practitioners, and data about injury-related costs incurred received from WCB) has to be regularly transferred from these PDF forms to PeopleSoft. No data collection/storage (e.g., portal, API) solution is being employed that would allow such information to be digitally captured in the PeopleSoft system by the stakeholders.
4	Data Sources (Managed)	Data storage	Given some of the safety data and WCB costs data is stored in PDF files and/or on paper, the division isn’t able to fully exploit these data assets for deriving analytical insights.

* Impacted business model layers are highlighted on the right



Wastewater Services | Current State BIA Model Canvas

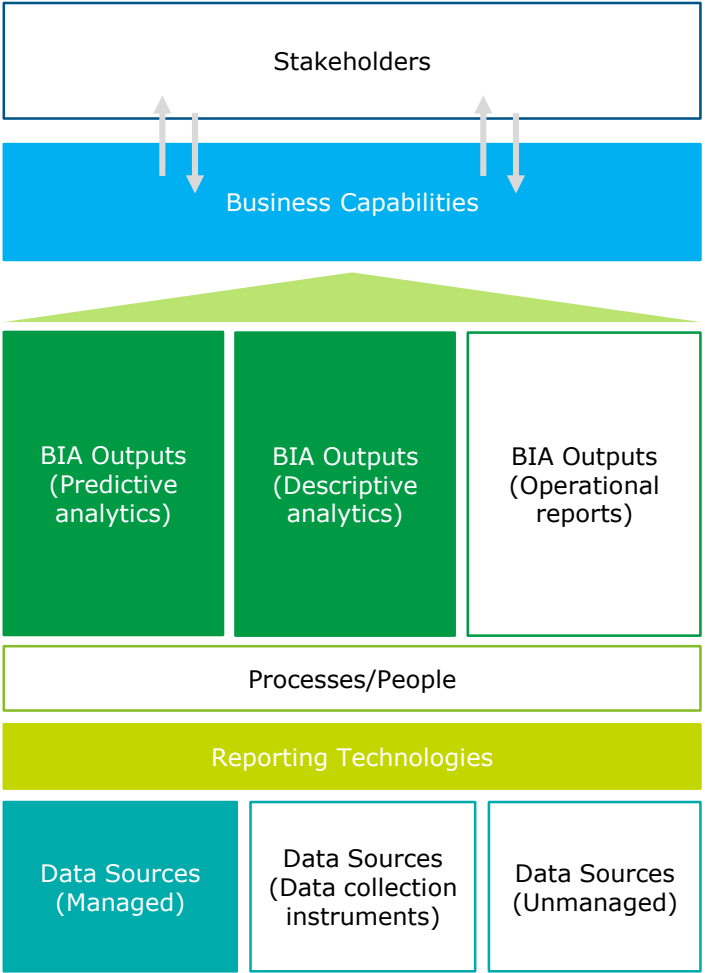


Wastewater Services | Key Initiatives

Wastewater Services has taken the lead in exploration of self-serve reporting capabilities by implementing e.RIS for lab results and operational data.

#	Impacted Business Model Layer*	Initiative	Description
1	Business Capabilities (Wastewater treatment)	Nutrients reduction in effluent generated from City of Winnipeg's wastewater treatment plants	In this initiative, the division plans to protect the health of local rivers and Lake Winnipeg by reducing nutrients in effluent generated from the City of Winnipeg's wastewater treatment plants.
2	Data Sources (Managed)	e.RIS implementation	As part of this initiative, the division will create reports on wastewater quality and sample test results, based on DCS and LIMS data.
3	Reporting Technologies	Reporting dashboard	The division is planning to define additional metrics (e.g., ETA vs actual time spent on work orders) in OWAM system so that more insightful predictive and descriptive analytics reports can be produced using the data collected on these metrics.
4	BIA Outputs (Predictive and descriptive analytics)	Implementation of additional modules in OWAM system	The purpose of this initiative is to increase reliability of treatment plant assets through improved maintenance practices and expanded use of OWAM system.
5	Data Sources (Managed)	Maintenance strategy and new assets management practices	In this initiative, the division plans to collect and consolidate additional information on assets to generate insights such as asset condition.

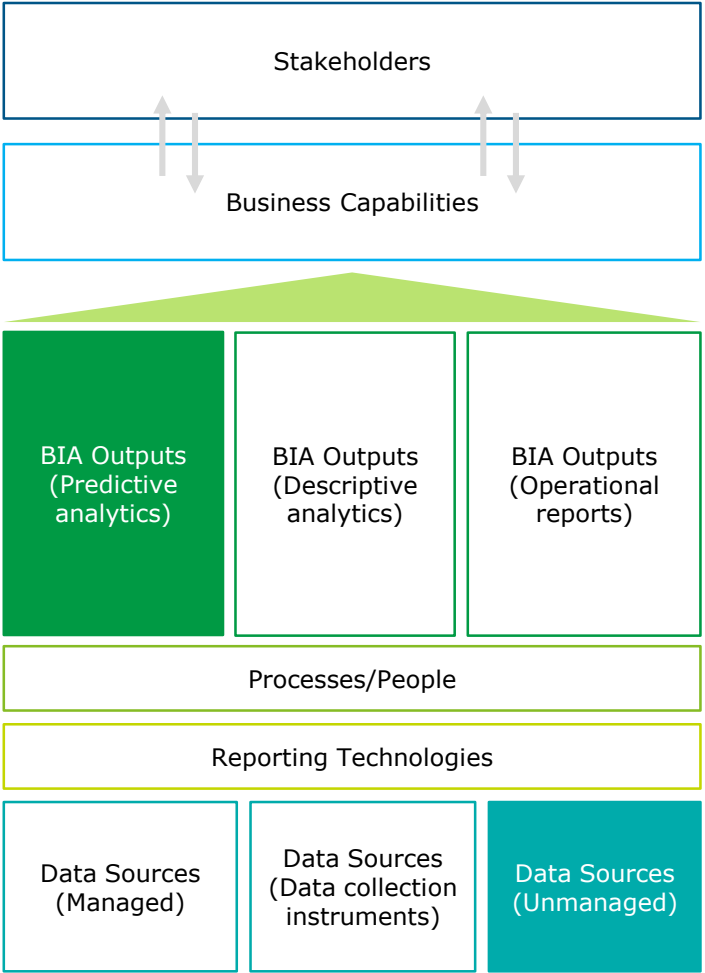
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Wastewater Services | Key Challenges

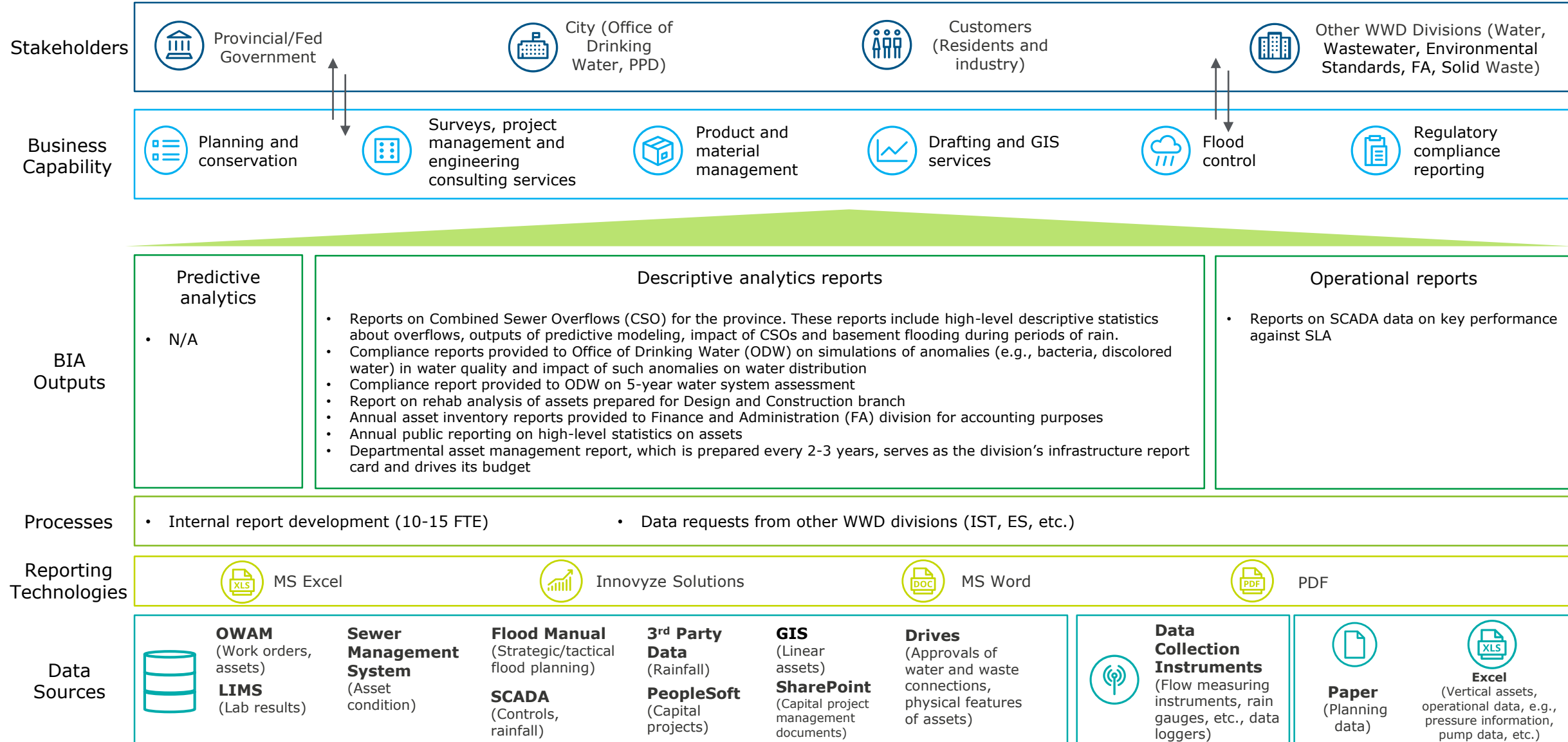
Wastewater Services doesn't have modelling capabilities and centralized datasets to reduce maintenance costs by moving from preventive and reactive maintenance to predictive maintenance.

#	Impacted Business Model Layer*	BIA Themes	Challenges
1	BIA Outputs (Predictive analytics)	Analytics	The division doesn't have a mechanism for designing data driven predictive insights about health and maintenance of its physical assets. The division has datasets that can be leveraged for these insights, but absence of a defined analytics solution inhibits the division to generate such insights.
2	Data Sources (Unmanaged)	Central data repository	Data on features of physical assets is spread over multiple disparate locations (N drive, a drawing dataset maintained by Engineering as well as paper-based resources maintained by Wastewater division). Lack of a central data repository for storing these datasets prevents the division from effectively utilizing this information to derive useful predictive insights.



* Impacted business model layers are highlighted on the right

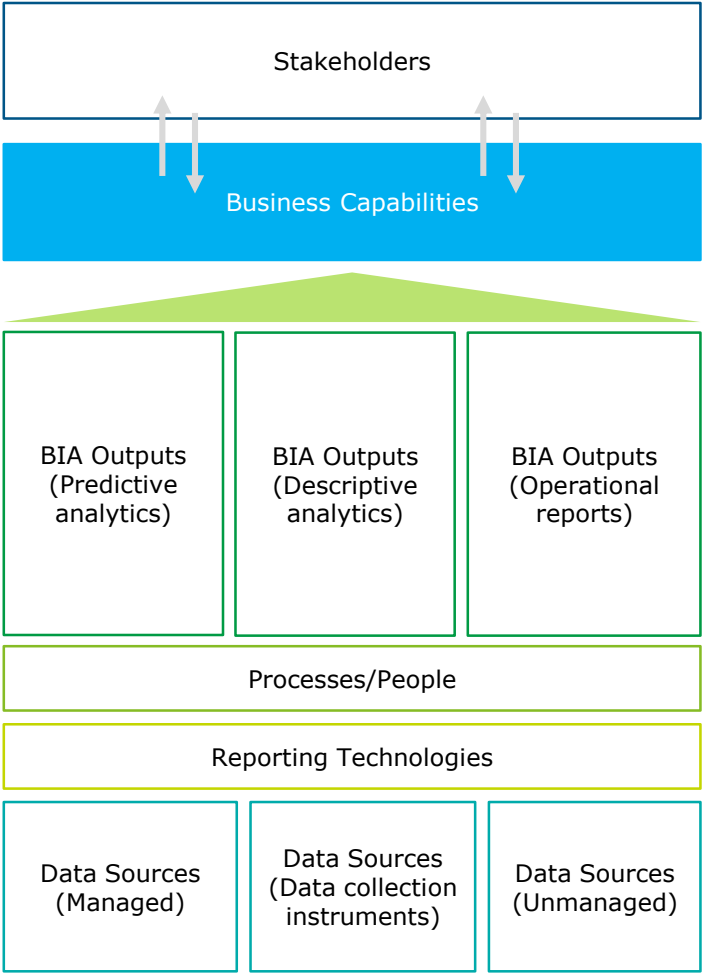
Engineering | Current State BIA Model Canvas



Engineering | Key Initiatives

Engineering is planning to embark upon Combined Sewer Overflow (CSO) / Basement Flooding Protection Program to meet CSO license requirements and provide further protection from basement flooding.

#	Impacted Business Model Layer*	Initiative	Description
1	Business Capabilities (Planning)	Combined Sewer Overflow / Basement Flooding Protection Program	<p>This initiative has following objectives:</p> <ul style="list-style-type: none"> • Meet CSO licensing requirements • Provide protection against sewage backup caused by heavy rain as per pre-defined standards <p>As part of this initiative, Engineering will produce a report that will describe the impact on CSOs of various factors such as rainfall, snowfall, etc. This project is in progress.</p>
2	Business Capabilities	Document management system	As part of this initiative, Engineering division plans to implement a system that will address its document version control, document persistence and workflows (approval and distribution process) requirements for awarding contracts.



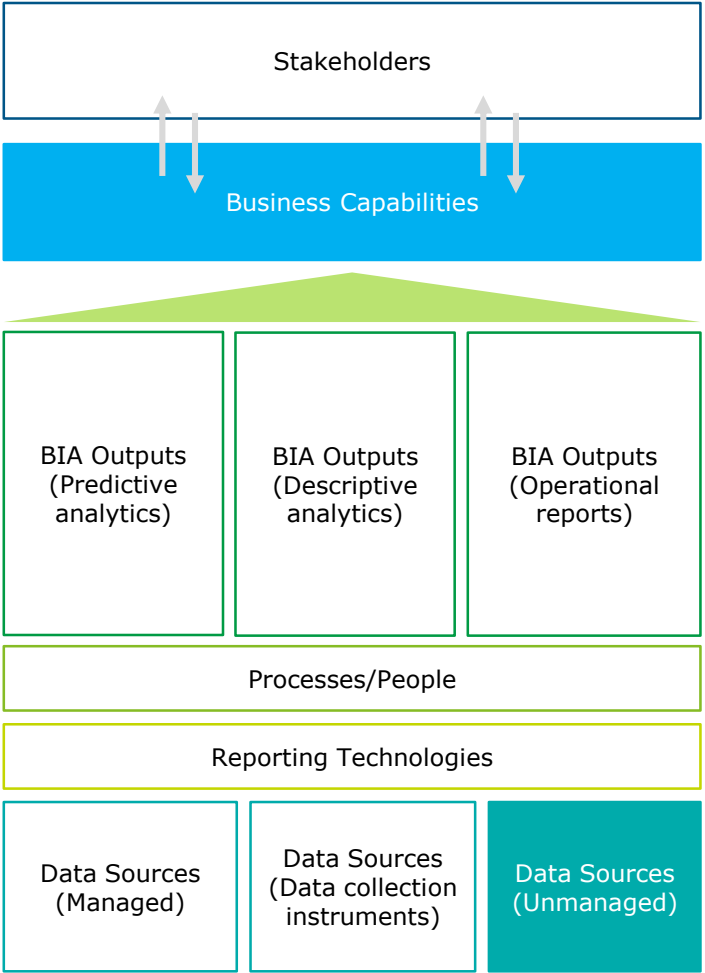
* Impacted business model layers are highlighted on the right

Engineering | Key Challenges

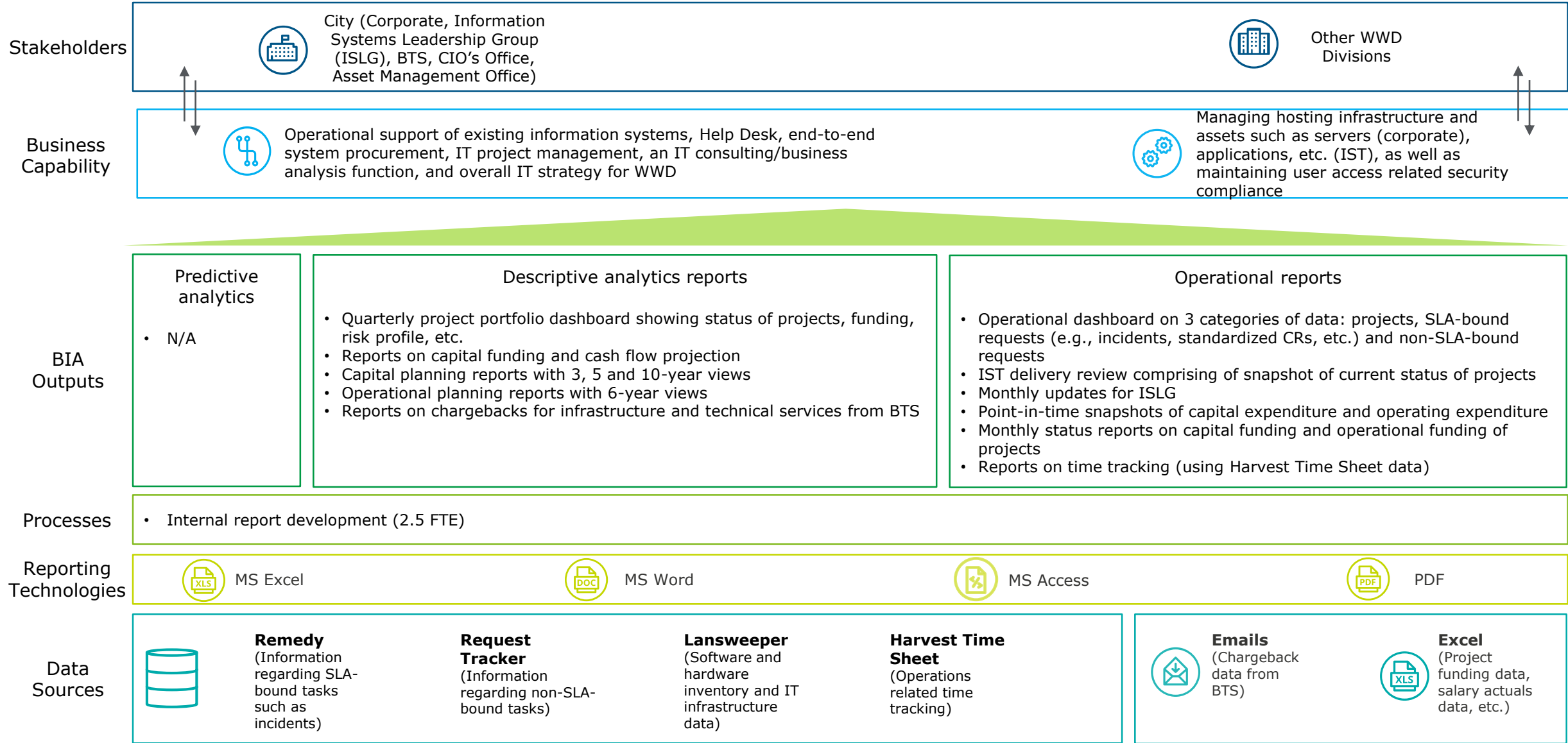
Engineering division is facing challenges in using analytical insights for making capital planning and operational decisions due to lack of a 360 degree view of WWD’s assets.

#	Impacted Business Model Layer*	BIA Themes	Challenges
1	Business Capabilities	Document management	The Engineering division doesn’t have a centralized document management system, and the division members often store project related documents on their local drives. Such inconsistent document management practices prevent the division from having an effective audit trail of sensitive information and standardized project management workflow capabilities. IST is mitigating this challenge by implementing a document management project for HR this fall. It will be rolled out to other divisions subsequently.
2	Data Sources (Unmanaged)	Central data repository and data storage	Awards (contracts data) and business case data reside in multiple spreadsheets. Given that these datasets reside in multiple spreadsheets and are not linked through a central repository, it is challenging for the division to track and link their contracts to relevant business cases and derive meaningful insights.
3	Data Sources (Unmanaged)	360 degree view of assets	<p>The Engineering division doesn’t have a central repository where it has all of its assets. Its assets are stored in multiple systems (e.g., GIS, OWAM, CMS, etc.) and Excel sheets, linked with other datasets such as condition data, work orders, engineering drawings, etc. Absence of such a system is inhibiting the division to answer questions such as – ‘What assets do we have? Which asset is not insured and which one is over-insured? When should we replace these assets? Which assets are costly to maintain and negatively impacting budget costs?’.</p> <p>Other WWD divisions have also expressed the same concern. This system could assist other divisions in their business capabilities (e.g., dispatching resources in fields, conducting predictive maintenance and adding their assets that are currently not managed by Engineering (e.g., lab instruments) in a central system).</p>

* Impacted business model layers are highlighted on the right



Information Systems and Technology | Current State BIA Model Canvas



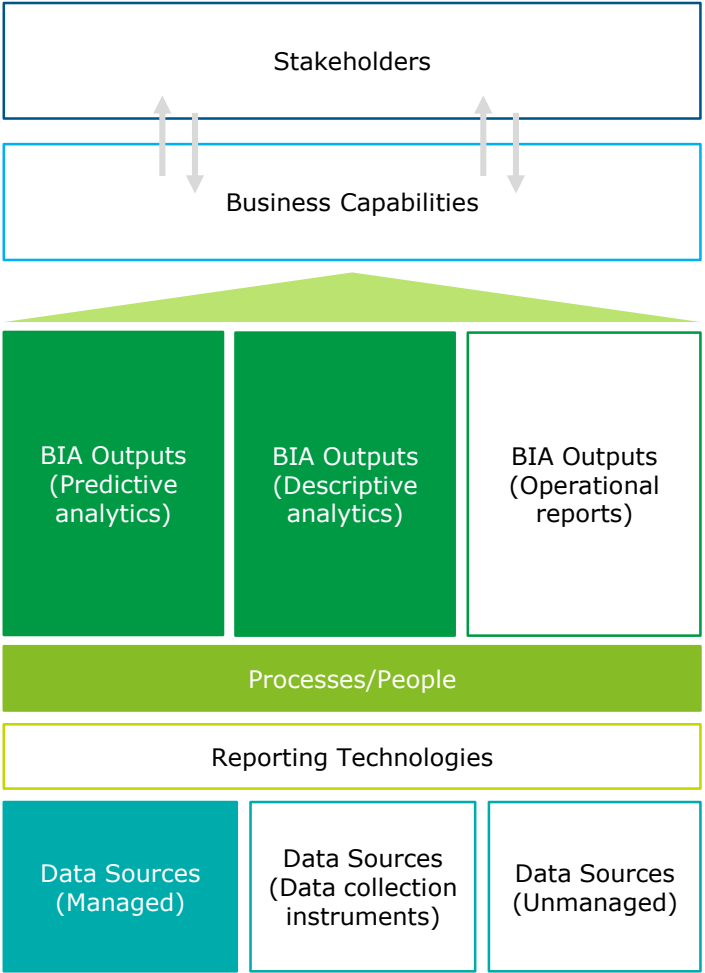
Information Systems and Technology | Key Initiatives

Information Systems and Technology division has a number of initiatives in planning and implementation stages to develop project and asset management, and BIA capabilities for the department.

#	Impacted Business Model Layer*	Initiative	Description
1	BIA Outputs (Predictive and descriptive analytics)	WWD Business Intelligence Solution**	Develop governance, methodologies, processes, architecture, skills and technologies to transform WWD’s data assets into accurate, trusted and assured insights.
2	Processes/People	WWD Document and Records Management System**	Assess, select and deploy a capable document and records management capability within WWD.
3	Data Sources (Managed)	WWD Cloud Strategy	Afford WWD improved solution agility and speed of implementation as well as product IT cost savings.
4	BIA Outputs (Predictive and descriptive analytics)	Financial Budgeting and Forecasting Improvements**	Perform a gap analysis between the current state financial budgeting and forecasting toolset (primarily REPA) and future state needs vis-à-vis improvement of WWD’s financial budgeting and forecasting capabilities.
5	Processes/People	WWD Portfolio and Project Management Tool**	Select and adopt a PPM tool that meets WWD’s needs, scaled appropriately for the magnitude and complexity of WWD’s project portfolio.
6	Processes/People	Learning Management System**	Select and adopt a Learning Management System that meets WWD’s needs.

* Impacted business model layers are highlighted on the right

** These initiatives, enabled by IST, address needs of divisions across WWD and aren’t limited in scope to IST only.

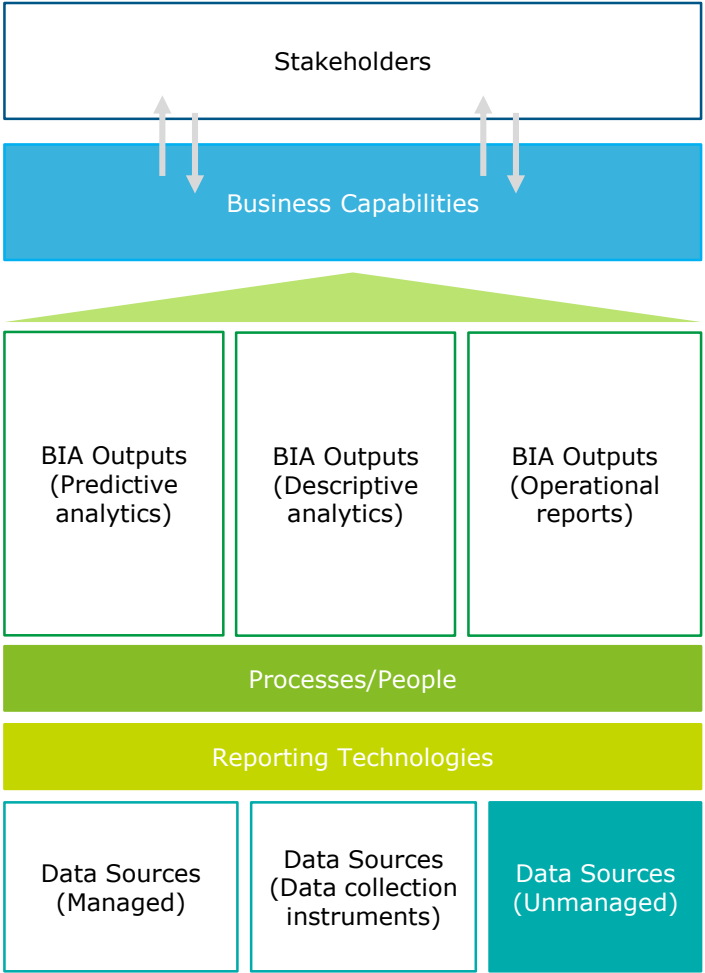


Information Systems and Technology | Key Challenges

The division faces considerable data availability, access and management challenges, making it difficult for it to come up with comprehensive and consolidated views of project status, funding and operating budgets.

Impacted # Business Model Layer*	BIA Themes	Challenges
1 Data Sources (Unmanaged) and Business Capabilities	Data storage and analytics	Majority of data such as capital and operational funding, project status information, and salary actuals are present in multiple spreadsheets and emails, sourced from different systems such as PeopleSoft and REPA. Hence significant amount of data consolidation and manipulation need to be carried out on data thus received, to create meaningful reports. This leads to challenges in capital and operational funding reconciliation, and prevents the division from effectively utilizing this information to derive useful predictive insights.
2 Business Capabilities	Document Management System	Communication regarding non-SLA-bound requests is carried out with business users mainly via emails and Word documents, which are only tracked sporadically. Such inconsistencies in document management practices make it challenging to keep track of request and project status.
3 Processes/ People	Data access	IST is dependent on other divisions and departments for accessing data (e.g., on Finance and Administration for salary data and on BTS for chargeback data), which causes delays in its decision-making processes.
4 Reporting Technologies	Data storage	The division doesn't have an effective IT asset management tool, which results in a lack of visibility over WWD's application assets and infrastructure.

* Impacted business model layers are highlighted on the right

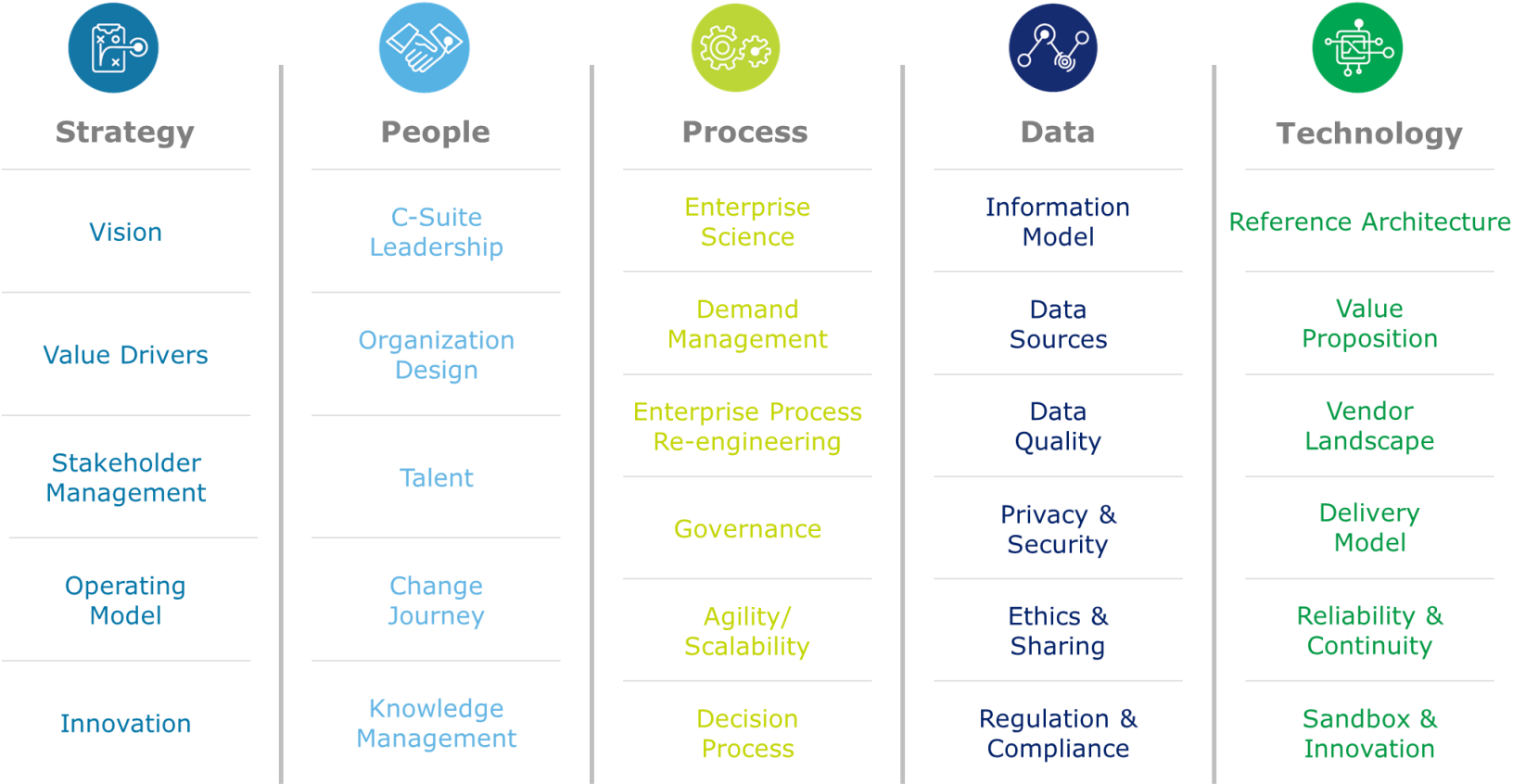


Key Observations and Business Impact by IDO Dimensions

Analysis Domain for Key Observations and Business Impact

Interviews and offline surveys were conducted with all of nine WWD divisions and Business Technology Services by leveraging the Insight Driven Organization (IDO) Framework to derive BIA observations and the business impact across following dimensions:

- Strategy
- People
- Process
- Data
- Technology





Key Observations and Business Impact | Strategy

A single articulation of the BIA vision along with goals and objectives is not defined. In addition, staff members at present are constrained in embedding analytics in managerial and operational decision-making process.

IDO Building Blocks	Key Observations	Business Impact
<p>Vision <i>Supporting the overarching business strategy by embedding insights into the underlying drivers that advance an organization</i></p>	<ul style="list-style-type: none">• Strategy documentation: WWD currently has two strategic documents that reference analytics as a focus and/or enabler to achieving strategic objectives:<ul style="list-style-type: none">• CoW Water and Waste Department Enterprise IT Architecture Roadmap (2017) – The strategy document recommends a number of BIA initiatives (e.g., WWD Business Intelligence Solution, Application and Data Integration) to embed analytics in decision-making process and digital initiatives (e.g., Digital enablement for Plant and Field Employees, Digital Customer Solutions and IoT Study) for transitioning employees to digital technologies which would further lead to surge of datasets.• CoW BI Strategy (2018) – The document captures high level BIA requirements, their business value, pain points those requirements resolve and their impact. Based on documentation, there is a clear understanding that BIA is a key requirement for WWD. The department is actively implementing recommendations defined in these strategy documents, and while a single articulation of a BIA vision, and supporting goals and objectives are not defined, they are being developed under the WWD BIA project.• BIA constraints: Staff members find themselves constrained in embedding analytics in decision-making processes due to a lack of BIA capabilities (e.g., Engineering division doesn't have a 360 degree view of its assets impacting its ability to measure depreciation, gauge capital needs, etc.).	<ul style="list-style-type: none">• The perceived value of BIA driven approaches tends to vary across a public sector organization depending on individual impact (e.g., data may impact certain divisions more than others). A clearly defined BIA vision could result in organizational alignment to optimize service delivery and reduce costs. Without a single vision, WWD is potentially missing an opportunity to collaborate across and outside of the organization to unlock key insights that can lead to improvements in decision-making.• A single BIA vision will assist with level-setting expectations about the need to invest in modernizing current data/technical architecture and undertaking key analytics initiatives.• Aligning leadership and staff behind a single vision will assist with defining a change strategy to engage the organization and its partners to adopt changes that will arise from acting on insights.



Key Observations and Business Impact | Strategy

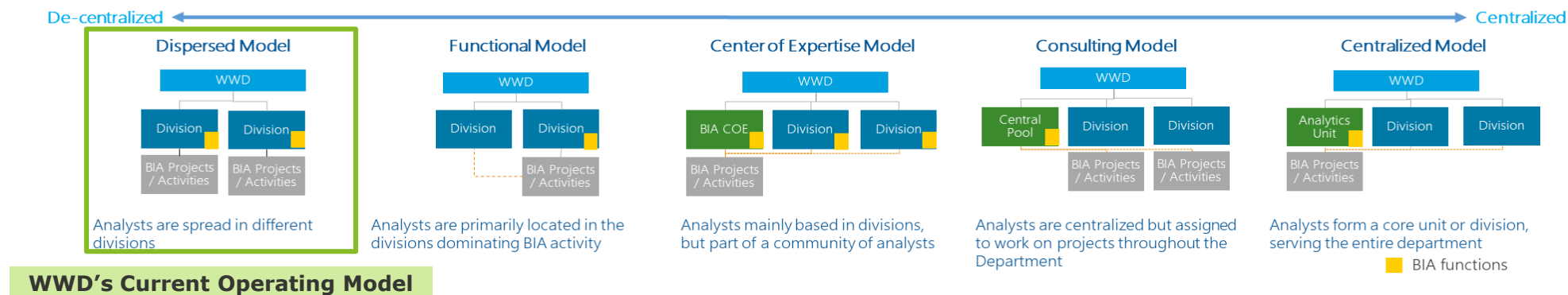
Among division managers and staff there is considerable support for enhancing BIA capabilities. Such support will play a significant role in realizing BIA roadmap, adopting insights in decision-making and overcoming change barriers.

IDO Building Block	Key Observations	Business Impact
<p>Value Drivers <i>Aligning on BIA initiatives that drive the most value across the department</i></p>	<ul style="list-style-type: none"> Process and frameworks are in place for capital projects, change requests to IST and technology procurement. Although most BIA projects, (i.e., new initiatives such as District Prioritization Matrix initiative in Engineering division) and BIA activities (i.e., operational activities such as regulatory reporting, benchmark studies, etc.) are owned and delivered by the division itself. There isn't a prioritization framework based on well defined value drivers and risk factors for such BIA projects and activities. 	<ul style="list-style-type: none"> A tailored prioritization framework for BIA projects and activities inline with existing processes can enable WWD department to appropriately allocate resources and gain synergies among BIA projects and activities. A BIA prioritization framework needs clearly defined value drivers such as cost reduction, strategic alignment, impact on citizens, etc. These value drivers coupled with risk factors such as reputation risk, security risk, etc., can assist the department in prioritizing BIA projects inline with its strategic plans.
<p>Stakeholder Management <i>Aligning the leadership and staff behind BIA vision and support for the journey required to realize the vision</i></p>	<ul style="list-style-type: none"> Among division managers and staff there is a considerable support for accurate insights and consistent reporting to inform managerial decisions. Some of the divisions (e.g., Environmental Standards and Wastewater Services) are planning and implementing initiatives (e.g., use of e.RIS for self-serve data access of LIMS data) to move ahead on this journey. 	<ul style="list-style-type: none"> Such support will play a significant role in realizing BIA roadmap, adopting insights in decision-making and overcoming change barriers.



Key Observations and Business Impact | Strategy

Although a dispersed operating model enables divisions to prioritize their own internal BIA needs, increased collaboration between divisions can help WWD achieve cross-division synergies.



IDO Building Block	Key Observations	Business Impact
<p>Operating Model <i>Identifying the structure for a BIA function that has the size, scale, and influence to drive BIA initiatives across the department</i></p>	<ul style="list-style-type: none"> • Dispersed operating model: Majority of BIA projects and activities are owned and delivered by individual divisions. Although projects are owned by divisions internally, they do depend on other divisions for datasets. Request for datasets is usually communicated via phone/email on an ad-hoc basis and often adds to delay in delivery of these projects. • Data owners: Divisions own the data falling in their well-defined jurisdiction. If the division staff members come across data quality issues, they amend these issues on their own. These issues and amendments aren't recorded in a formal incident management system. • Application owners: Applications (e.g., CCB, LIMS, etc.) are owned by divisions and any access request for these systems goes through a pre-defined process. • BIA talent: BIA talent resides within WWD divisions, but it isn't a formally recognized responsibility. Staff members who need BIA for their operational and managerial needs assume this responsibility. Majority of these resources are occupied with daily operations and are constrained due to lack of time and capabilities to leverage their data assets beyond operational needs. 	<ul style="list-style-type: none"> • Internal context and prioritization: Dispersed operating model enables divisions to prioritize their own internal BIA needs, leverage in-house business context effectively and reduce their dependency on other divisions. • Lack of cross-division synergies: Current operating model constraints staff members across divisions to coordinate with each other, gain synergies, initiate coherent BIA programs (e.g., central data repository, common self-serve tool), allocate scarce BIA resources and tools across divisions, and learn from each other's experiences.



Key Observations and Business Impact | Strategy

Establishment of the City’s Innovation Group is a positive step towards innovation and anticipating future business needs. However, the group is currently in the infancy stage and in the process of exploring use cases across various departments.

IDO Building Block	Key Observations	Business Impact
<p>Innovation <i>Assessing and enhancing the degree to which department’s culture critically looks at existing models and produces new insights that anticipate future business needs and deliver value across the department</i></p>	<ul style="list-style-type: none"> • City’s Innovation group: The City has recently staffed a Chief Innovation Officer position at a leadership level and created an innovation group. The innovation group is engaging various City of Winnipeg departments to gauge opportunities where innovation can enhance their capabilities. Building general innovation capabilities by training and certifying individuals in Innovation Engineering is ongoing. The group is establishing its delivery capabilities by recruiting data scientists and other roles. • Limited BIA innovation within WWD: There are very limited cases of BIA innovation within WWD’s divisions (e.g., Engineering team is investing in reporting capability for CSO’s overflows by re-calibrating their models based on its output, Environmental Standards is exploring self-serve capabilities of e.RIS, IST is investing in pilot projects). Practices such as collaboration with universities on innovation projects, encouraging staff to attend BIA conferences, exploring new technologies, undertaking BIA pilots and re-engineering existing operational processes is very minimal. 	<ul style="list-style-type: none"> • Pilot projects: Calculated and controlled risk-taking, and small-scale investments in pilots can help build a culture of innovation and mature BIA capabilities. Continued investments in pilot projects aligned with WWD’s strategic plans may provide insights to evolve the value proposition of BIA for reducing costs, optimizing services and enhancing operations. • Collaboration with universities and participation in forums: As WWD enhances its BIA capabilities in the near future, it could consider collaboration with universities, encouraging participation in internal and external BIA discussions, etc. Such practices will enable the department to learn about investments that other similar municipalities (e.g., Edmonton, Calgary, etc.) are making in BIA capabilities.



Key Observations and Business Impact | People

Majority of BIA projects and activities occur in silos, inhibiting the department from having a holistic view of BIA to fully exploit its data and create a coherent approach. Modifications in organizational design can encourage collaboration, represent BIA at appropriate levels in WWD, and provide a complete view of BIA.

IDO Building Block	Key Observations	Business Impact
<p>C-Suite Leadership <i>Representing BIA at the highest levels in the organization to drive BIA from a people, process, data, technology and strategy lens</i></p>	<ul style="list-style-type: none"> The Innovation Group was assembled by the Chief Innovation Officer to put together a corporate wide BIA strategy and plan. Within WWD, each Manager represents its division's BIA needs and capabilities at the management level. 	<ul style="list-style-type: none"> BIA representation at C-level enables fundamental change in public-sector organizations and moves them from gut based to insights based decision-makers. Collaboration of efforts between WWD and the City can enable both to move ahead on their agenda of transitioning into an insight based decision-makers.
<p>Organization Design <i>Implementing an organizational structure that enables optimization of BIA initiatives through visibility, use of scarce BIA resources, and ensuring use of common technologies</i></p>	<ul style="list-style-type: none"> At WWD, majority of BIA projects and activities occur in silos within divisions and branches, inhibiting the department from having a holistic view of BIA. This also limits WWD's capability to fully exploit its datasets, establish a coherent set of technologies, processes and tools, and develop BIA talent. 	<ul style="list-style-type: none"> Modifications in organizational structure can encourage use of common tools and processes across the department, and assist in representing BIA at appropriate levels within a public sector organization. A modified org-structure could potentially enable the organization to have a holistic view of BIA (i.e., projects, resources, etc.) across the department.



Key Observations and Business Impact | People

Existing talent within WWD divisions are primarily equipped to work on descriptive analytics reports. In the future, WWD should train existing talent on modern BIA technologies and/or hire new talent to support its BIA ecosystem.

IDO Building Block	Key Observations	Business Impact
<p>Talent <i>Enhancing BIA talent's technical skills for handling sophisticated data analysis, and communication skills and business acumen for understanding business' needs</i></p>	<ul style="list-style-type: none"> • Existing talent: Existing talent within WWD divisions are primarily equipped to work on descriptive analytics reports with exception of the Engineering division which has resources who are proficient in developing and managing predictive models and simulations. IST resources and talent aren't trained in advanced BIA capabilities such as self-serve reporting tools, predictive modelling, Big Data, machine learning, etc. • Recruitment: At present, the department doesn't have strategic plans to recruit BIA talent, but has existing contracts with multiple vendors through which it can source resources for short term staff augmentation. • Training: The department has various online training and 3rd party training capabilities at its disposal. PeopleSoft is its primary training tracking database. WWD is investing in a Learning Management System (LMS) called 'SmarterU', which can be used for specific tactical certification tracking/reporting needs, and is being further leveraged to deliver electronic training which PeopleSoft does not do. But a formal BIA training path for IST and other WWD divisions doesn't exist. 	<ul style="list-style-type: none"> • Given that various WWD divisions have expressed that they are constrained on resources and lack talent with advanced BIA skills, WWD will need to consider how (recruitment/staff augmentation/training) to grow a talent-base of BIA professionals. WWD should consider following types of roles: <ul style="list-style-type: none"> • Data Scientist – Skilled in quantitative analysis and data management • Technologist/Data Architect – Skilled in Data Management and/or Tech Integration and Application Development • Data Engineers/Developers – Maintain the link between data storage architectures and analytics platforms
<p>Change Journey <i>Managing change, overcoming resisters, and breaking down silos to transition into an Insight Driven Organization (IDO)</i></p>	<ul style="list-style-type: none"> • Customer Service Manager has an overall CM lead for the department, managing large systemic changes, and every IT-related capital project has a Prosci-patterned OCM stream in it. Certified OCM practitioners exist within most divisions, and IST has invested in certifying a number of staff to apply it in support of project delivery. 	<ul style="list-style-type: none"> • Change management capabilities are essential for WWD's ability to promote use of analytics and build momentum. Equally important is communication and education, which must take place both from the top-down and bottom-up.



Key Observations and Business Impact | People

As WWD advances further on its BIA journey, it will be critical to develop knowledge management capabilities to gain synergies among BIA projects and continue the momentum required to realize the BIA roadmap.

IDO Building Block	Key Observations	Business Impact
Knowledge Management <i>Harnessing and disseminating external and internal BIA knowledge</i>	<ul style="list-style-type: none">WWD at present largely uses Excel for reporting purposes, and its divisions rely on IST for complex SQL queries to provide them with required datasets. Hence a formal BIA knowledge management capability (e.g., repositories, knowledge sharing sessions, external trainings) doesn't exist. An informal BIA group meets sporadically and shares BIA knowledge on topics such as modern reporting tools, data sources, etc., but at present only a few WWD divisions participate in this group. IST has a practice of cross-training teams and documenting the knowledge acquired from such sessions, for future use. In future, this practice can be leveraged for managing BIA knowledge.	<ul style="list-style-type: none">Knowledge management capability: As WWD moves forward in its BIA journey, it is essential that WWD develops knowledge management capability to gain synergies among BIA projects.Tools and programs: Using centralised tools to manage knowledge helps retain and share knowledge amongst BIA teams. More engaging methodologies should also be explored such as external training, field trips, lunch and learn sessions, blogs, videos, programming competitions, etc.Management of tools: Development and ongoing management of a repository should also be considered to ensure availability of relevant and up to date material. IST is leading an initiative for document management, which could be leveraged to create a central repository for BIA knowledge management.



Key Observations and Business Impact | Process

At present, each division manages its own BIA projects and activities. Users have an informal process for dealing with requests and there isn't a standard forum to raise roadblocks. WWD should consider formalizing delivery of BIA projects.

IDO Building Block	Key Observations	Business Impact
<p>Enterprise Science <i>Establishing and executing a repeatable process for industrializing data and analytics projects in organization</i></p>	<ul style="list-style-type: none"> For large capital projects, a formal project management practice exists but many BIA efforts would be under the threshold for this level. This practice currently lacks processes and solutions for document management. The City is executing an Enterprise Content Management project, but it won't be rolled out to WWD in short term. Hence, WWD, in the interim, is implementing a Document Management System (DMS) project. 	<ul style="list-style-type: none"> WWD doesn't have formal process for industrializing BIA projects, with exception of large capital projects. This impacts ability of WWD to industrialize these projects and manage its costs, timeline and resources effectively. WWD should consider formalizing delivery of these projects through its existing project management capabilities.
<p>Demand Management <i>Defining a prioritization criteria and model to determine the relative importance of BIA projects and activities</i></p>	<ul style="list-style-type: none"> Forum for prioritization of BIA projects and activities: At present, each division manages its own BIA project and activities. A forum to prioritize BIA projects and activities and allocate resources doesn't exist. Prioritized list of analytics use cases haven't yet been articulated: WWD hasn't developed a prioritized list of analytics use cases that will assist them in answering key business questions (e.g., what will water consumption be in the next 5 years?, What are the key parameters causing safety incidents?, etc.). 	<ul style="list-style-type: none"> A forum for prioritization of BIA projects is critical to ensure that the resources are allocated to the projects based on a defined prioritization framework. A prioritized list of defined use cases can assist the department in prioritizing a roll out of BIA capabilities and build the momentum for adoption of analytical insights in decision-making.



Key Observations and Business Impact | Process

Data ownership is clearly defined among WWD divisions but a central data governance approach is not. A governance structure for BIA can also provide a formal forum to escalate project issues and data needs.

IDO Building Block	Key Observations	Business Impact
<p>Enterprise Process Re-Engineering <i>Improving business processes by leveraging data assets</i></p>	<ul style="list-style-type: none"> • Surveys: A few WWD divisions such as Human Resources, Information Systems and Technology and Customer Service conduct surveys to gauge employee and customer experience. But results of these surveys aren't linked with other datasets to gain insights beyond results of these surveys. • Benchmarking studies: WWD divisions such as Solid Waste and Water Services participate in 3rd party benchmarking studies and have access to insights and datasets of other participants (i.e., other municipalities). Due to BIA constraints and lack of an insight driven culture, the divisions aren't able to leverage these datasets to drive change. 	<ul style="list-style-type: none"> • Process re-engineering driven by insights can play a crucial role in reducing operational costs and streamlining business processes. Such process re-engineering, if executed by using a data driven approach and modern BIA technologies, can significantly lower operational cycle time. Environmental Standards is already working towards reducing its cycle time for delivery of validated lab results by investing in new LIMS and e.RIS projects. Data quality checks and report development are some of the major contributors to the division's cycle time for delivery of validated lab results. The division could advance this cause further by generating insights on its current operations processes, automating some of its data quality checks and further empowering its stakeholders with self-serve reporting capabilities.
<p>Governance <i>Establishing a formal structure to govern datasets, and BIA projects and activities</i></p>	<ul style="list-style-type: none"> • BIA governance: BIA projects and activities are managed internally within WWD divisions, but not through a formal governance structure that oversees delivery of all such projects. • Data governance: Data ownership is clearly defined among divisions, but the department lacks a central data governance program. This results in lack of data standards, emergence of informal data issue management practices, absence of a data dictionary and business glossary, etc. 	<ul style="list-style-type: none"> • Planning, governance and management of BIA projects: A governance forum for management of on-going BIA projects and future pipeline is essential to ensure successful project delivery. Although IST has a formal governance structure for projects, BIA projects and activities are frequently managed informally within WWD divisions, and these projects face challenges and roadblocks. A governance structure for BIA can provide a formal forum to escalate project issues and data needs, fulfil BIA talent and technology needs, and ensure that these projects are meeting their objectives as outlined in business cases. • Data governance: Lack of a well defined data governance model impedes the ability of WWD divisions to share datasets, develop trust in the data and insights, and have a formal structure to govern their datasets.



Key Observations and Business Impact | Process

WWD, at present, faces challenges such as lack of well defined data standards, absence of technical and business metadata, and redundancies and inconsistencies across data sources. These challenges can lead to risk of data misinterpretation and loss of analysis opportunities.

IDO Building Block	Key Observations	Business Impact
Governance <i>Establishing a formal structure to govern datasets, and BIA projects and activities</i>	<ul style="list-style-type: none">• Process and tools: At present, WWD doesn't have business or technical metadata management capabilities. WWD does have data dictionaries for some systems but they are siloed, and aren't used, maintained and updated regularly.• Standards: The department lacks standards for technical metadata and business metadata.• Understanding of data assets and lineage: Knowledge of datasets and their appropriate usage, and operational and technical metadata rests largely with individuals. No standard documentation or enterprise view is available. Comprehensive data dictionary is also not available.• Inconsistency across data sources: There are known challenges in misaligned data across multiple sources (e.g., in Engineering division, there isn't a central repository to store all assets. Some high value assets are stored in Excel sheets that leads to inconsistency, version control issues and duplication of data), and significant effort is required to decide on a data set to use, clean and integrate.• Data standardization: Some efforts are in place to standardize datasets in silos (e.g., Environmental Standards is standardizing some of the terms in LIMS), though there isn't an enterprise drive for standardizing datasets.	<ul style="list-style-type: none">• Additional redundant effort required to use/understand data and develop models: Within WWD divisions, users of data have developed an understanding of data based on their experience, but it requires an individual to go through a learning curve to gain required understanding. When datasets are circulated outside of the division, lack of business and technical metadata could result in additional time required for end users to understand the context of data sets, and the information available for modelling or exploratory data analysis.• Risk of data misinterpretation: Without all details on data context, there is a dependency on individual knowledge of the analyst to correctly interpret the data and use it appropriately.• Risk of lost analysis opportunities: Without a comprehensive view of data available, there are variables not considered that can refine or enhance an analysis.• Adoption of industry best practices can support metadata management: A robust data dictionary that includes operational/technical metadata, and a business glossary providing context may be useful. Metadata management technology is available, and can be incorporated into data integration processes to help automate and bring insight into data relationships, visualize data flows, and provide a single source of truth for data assets within an organization.



Key Observations and Business Impact | Process

Knowledge of an agile delivery process within WWD divisions is limited, and a well defined project delivery process to deliver BIA projects and activities isn't established. Lack of agility with respect to changing requirements can lead to inefficiencies in delivery of analytics projects.

IDO Building Block	Key Observations	Business Impact
<p>Agility/Scalability <i>Employing a consistent and repeatable process that enables the department in failing fast and learning quickly</i></p>	<ul style="list-style-type: none"> IST does follow hybrid-agile methodology to deliver its projects, but knowledge of agile delivery processes within WWD divisions is limited, and a project delivery process to implement BIA projects and activities isn't established. Engineering division does re-calibrate some of its predictive models based on business context, models results, and actual results. Another example of agility is the Flood Manual system, which is iteratively improved every year based on annual maintenance activities and flood events. 	<ul style="list-style-type: none"> Lack of a repeatable process for developing data and analytics projects could lead to inefficiencies in delivery of these projects. These inefficiencies could primarily arise due to lack of agility with respect to change in business requirements and inability to adapt to context developed during data discovery process. Other factors include lower productivity due to improper planning, and misalignment between the insights developed from the data and division's decision-making needs. WWD should consider developing an agile process tailored to BIA projects.
<p>Decision Process <i>Using data and analytics to make managerial decisions</i></p>	<ul style="list-style-type: none"> Multiple WWD divisions acknowledge use of descriptive analytics in decision-making, although it is usually manually compiled for specific needs. There is neither much use of predictive analytics in decision-making nor a formal feedback loop to improve the datasets that led to the decision. 	<ul style="list-style-type: none"> Use of data driven decision-making can assist WWD in making cost effective, faster, and better informed decisions. As an example, WWD maintains its water and wastewater assets through either preventive or reactive maintenance. These maintenance activities account for significant costs and are an important input for capital planning. The department may be able to reduce these costs by leveraging its asset data (e.g., age, vendor, design parameters, etc.) coupled with weather data, condition data, analytical instruments data (e.g., flows, pressures, etc.) and work orders data to predict likelihood of asset breakdown. Such decision-making can enable WWD to move from experience based and reactive decision-making to becoming an insight driven decision-making department.



Key Observations and Business Impact | Data

Trust in data quality varies significantly across WWD divisions. A data quality framework to implement various data quality disciplines doesn't exist. Some teams spend significant amount of time performing manual data quality checks.

IDO Building Block	Key Observations	Business Impact
<p>Information Model <i>Standardizing data storage and enabling data users to understand how they should manage emerging datasets</i></p>	<ul style="list-style-type: none"> • Information model: IST has information models for some systems, but divisions usually don't use these the models. • Data storage: Datasets are largely stored in managed systems, but still significant critical datasets (e.g., vertical assets, safety root cause analysis, water quality results, etc.) are stored in unmanaged data stores such as Excel spreadsheets, Access databases, PDFs and paper (e.g., job planning, safety inspections, etc.). • Central data repository: At WWD, a central data repository for analysis and reporting doesn't exist. This creates a lot of dependency on use of Excel for data sharing and linking. • Data access: Accessing large data sets leads to performance issues (e.g., pulling 1-2 years of data from DCS, unarchive data from SCADA, etc.). • Data redundancy: Some of the data entities such as customer information and work orders are stored in multiple repositories (e.g., CCB, CMS, LIMS/Sample Manager), leading to data redundancy. 	<ul style="list-style-type: none"> • Data Storage: Lack of standardized information model and databases/operational technologies for storing data is leading to storage of data in unmanaged data stores (e.g., Excel). Such practice leads to lack of audit trail and inhibits the ability of staff to trust the data. It could have significant impact on business such as unaccounted business assets as they aren't stored in a managed database. • Central data repository: Lack of central data repository inhibits staff's ability to link datasets for BIA and access other division's datasets through a self-serve capability. Such challenge adds significant delay in delivery of BIA projects and activities.
<p>Data Quality <i>Measuring, improving and certifying quality and integrity of data through analysis, anomaly identification, defining business requirements and rules, etc.</i></p>	<ul style="list-style-type: none"> • Trust in data quality: Data quality varies significantly across WWD divisions. Some of the divisions (e.g., Water Services, Wastewater, FA) have trust in their data (e.g., SCADA, CCB), whereas some divisions face significant issues. • Data quality framework: At WWD, a data quality framework to implement various data quality disciplines doesn't exist. Some of components of data quality framework includes definition of data quality business rules, data quality checks, thresholds, etc. 	<ul style="list-style-type: none"> • Manual data quality checks: Environmental Standards spend significant time in performing data quality checks manually (majority of 5 FTE effort spent on preparing lab results). These checks aren't well defined and other than some data quality investments in the LIMS replacement project, the division hasn't invested in automating data quality checks and documenting data quality requirements.



Key Observations and Business Impact | Data

In addition to relational data, WWD’s data assets include unstructured and GIS datasets. Manual effort is required to link structured and unstructured data. For example, Engineering has to go through eDocs, Excel spreadsheets and GIS to draw a complete picture of its assets.

IDO Building Block	Key Observations	Business Impact
<p>Data Quality <i>Measuring, improving and certifying quality and integrity of data through analysis, anomaly identification, defining business requirements and rules, etc.</i></p>	<ul style="list-style-type: none"> • Data quality checks: Some of the divisions execute data quality checks on their datasets by applying business context and manually comparing their data with other datasets. Environmental Standards has a robust process of validating their datasets though a process that is largely manual. 	<ul style="list-style-type: none"> • Setup of a data quality framework: Formalization of a data quality framework can enable WWD to bring its systems under a formal data quality framework, define and execute data quality rules, report on the results of data quality and strategically fix data quality issues. Lack of such framework creates challenges for WWD divisions to validate their datasets, and share them with other divisions.
<p>Data Sources <i>Collecting and making available all relevant internal, external, structured and unstructured information</i></p>	<ul style="list-style-type: none"> • Unstructured data: WWD has videos (e.g., videos of wastewater and water assets), photos (e.g., meter readings, drone images of landfills, etc.), engineering drawings and emails/call logs stored on network drives, local drives and systems (e.g., eDocs). Currently, WWD doesn’t link these datasets with structured datasets or exploit advanced Artificial Intelligence capabilities such as video analytics, image recognition, etc., to gain insights from these unstructured datasets. • GIS datasets: WWD has robust GIS system that is used to capture linear assets and assist field workers for their operational needs (e.g., asset repair, etc.). At present, GIS data isn’t directly linked to structured datasets such as asset details, vertical assets, etc., inhibiting a central reporting capability for assets. 	<ul style="list-style-type: none"> • Linking structured and unstructured data: Lack of ability to link structured with unstructured data leads to increase in effort for linking these datasets manually and limits WWD’s ability to implement analytical reporting. For example, Engineering division has to go through eDocs, Excels and GIS to draw a complete picture of its assets.



Key Observations and Business Impact | Data

A 360 degree view of assets offered by a master data system could enable WWD divisions to answer critical questions that can help them to unlock value from their data assets. Currently, lack of ability to exploit analytics capabilities leads to increased effort for maintenance of assets.

IDO Building Block	Key Observations	Business Impact
<p>Data Sources <i>Collecting and making available all relevant internal, external, structured and unstructured information</i></p>	<ul style="list-style-type: none"> • Data collection instruments: Various WWD divisions have invested in use of data collection instruments (e.g., automated meter reading instruments, auto samplers for checking water quality, etc.). Some of the data generated from these instruments is stored in Excel sheets (e.g., automated meter reading instruments) and some is directly stored in operational technologies (e.g., water quality in LIMS, control information in SCADA, etc.). Divisions have expressed interest in leveraging these datasets to generate insights (e.g., predictive maintenance) and install further such instruments across the city (e.g., at present only one-third of commercial meters are automated and an initiative at present is being pursued to install more of such automated meters). • Master data management: City of Winnipeg did initiate a conversation for implementing a master data management program focused on citizens, but it hasn't been planned yet. Engineering division has a need to have a central repository for its assets, which at the moment are stored in multiple data stores such as GIS (linear assets), OWAM (e.g., wastewater plants assets), Excel sheets (some of vertical assets), CMS, etc., and link these datasets with other datasets such as condition data, work orders, drawings, etc., to have a 360 degree view of its assets. • Reference data management: At present, the department does not have reference data repositories. For example, the department uses multiple repositories (e.g., CMS, CCB, Taxation & Assessment database, AMANDA, etc.) to store and retrieve customer address information inconsistently, as opposed to having a single source of truth. 	<ul style="list-style-type: none"> • Exploiting unstructured datasets for insights: WWD lacks ability to exploit advanced Artificial Intelligence capabilities (e.g., image recognition) for unlocking value of its unstructured data. For example, image recognition and video analytics can assist the department in generating insights about condition of its assets and saving on maintenance costs. • 360 degree view of assets: A Master data system for assets could enable Engineering division to answer questions such as – “What are all the assets we have? Which assets are not insured and which are over-insured? When shall we replace these assets? Which assets have been draining our budgets the most?” Such a system could also assist WWD in other diverse set of use cases such as predictive asset maintenance and extension of the system to assets (e.g., lab instruments) that aren't managed by Engineering division at the moment. • Customer reference data: Lack of a reference data system for customer information requires WWD divisions to go through a tedious process of gathering information from CCB's extracts, CMS, Assessment and Taxation department's systems, etc., to paint a complete picture of customer's properties and addresses.



Key Observations and Business Impact | Data

Some of the WWD divisions enrich their data sources with 3rd Party data. A study hasn't been undertaken to fully exploit breadth of 3rd party data sources.

IDO Building Block	Key Observations	Business Impact
<p>Data Sources <i>Collecting and making available all relevant internal, external, structured and unstructured information</i></p>	<ul style="list-style-type: none"> • 3rd party data sources: Some of the divisions enrich their data sources with 3rd party data. For example, Engineering division currently sources rainfall data for reporting on Combined Sewer Overflows (CSOs). A study hasn't been undertaken to fully exploit the breadth of 3rd party data sources. 	<ul style="list-style-type: none"> • Study to unearth 3rd party data sources: A study on 3rd party data sources with focus on specific analytics use cases can assist WWD to deliver richer insights (e.g., weather data for safety analytics, demographics data for customer default analysis).
<p>Privacy and Security <i>Preventing misuse of data considering reputation, regulatory and legal risks and existence of security capabilities such as authentication, authorization and audits</i></p>	<ul style="list-style-type: none"> • Data security: Divisions consult with the FIPPA coordinator before releasing any information externally as well as the use of information for internal purposes. Data and application access is managed through active directory. Any security breaches are required to be reported to the Manitoba Ombudsman. • Data residency: City of Winnipeg has a process in place to evaluate data residency needs for its datasets as and when needed. • Data privacy: Human Resources is bound by Personal Health Information Act (PHIA) to maintain health-related data privacy. 	<ul style="list-style-type: none"> • Privacy and security for a central repository and advanced analytics: Going forward WWD needs to consider the impact of linking datasets in a central repository and conducting advanced analytics as it could lead to data privacy issues.
<p>Ethics and Sharing <i>Collecting and using data ethically and developing an environment of trust</i></p>	<ul style="list-style-type: none"> • Data ethics: Ethics policy is defined at the City of Winnipeg level. • Data sharing: Divisions consult with the FIPPA coordinator before releasing any information externally. 	<ul style="list-style-type: none"> • Ethical dilemmas in advanced analytics: As the department leverages advanced analytics in decision-making, it needs to be considerate of human aspect as well. For example, safety analytics could reveal that a lot of safety incidents are occurring under a particular supervisor. The decision to manage such a situation warrants human inputs.



Key Observations and Business Impact | Data

Development of regulatory reports require considerable effort across WWD divisions due to lack of self-serve reporting tools and data quality capabilities.

IDO Building Block	Key Observations	Business Impact
Regulation and Compliance <i>Meeting regulation and compliance needs</i>	<ul style="list-style-type: none">The majority of divisions need to submit regulatory reports to provincial and federal governments (e.g., water quality results, CSOs, budgetary data, etc.).	<ul style="list-style-type: none">Due to lack of self-serve reporting tools and data quality capabilities, development of regulatory reports require considerable effort across divisions and these reports assume the risks involved with uncertain data quality.



Key Observations and Business Impact | Technology

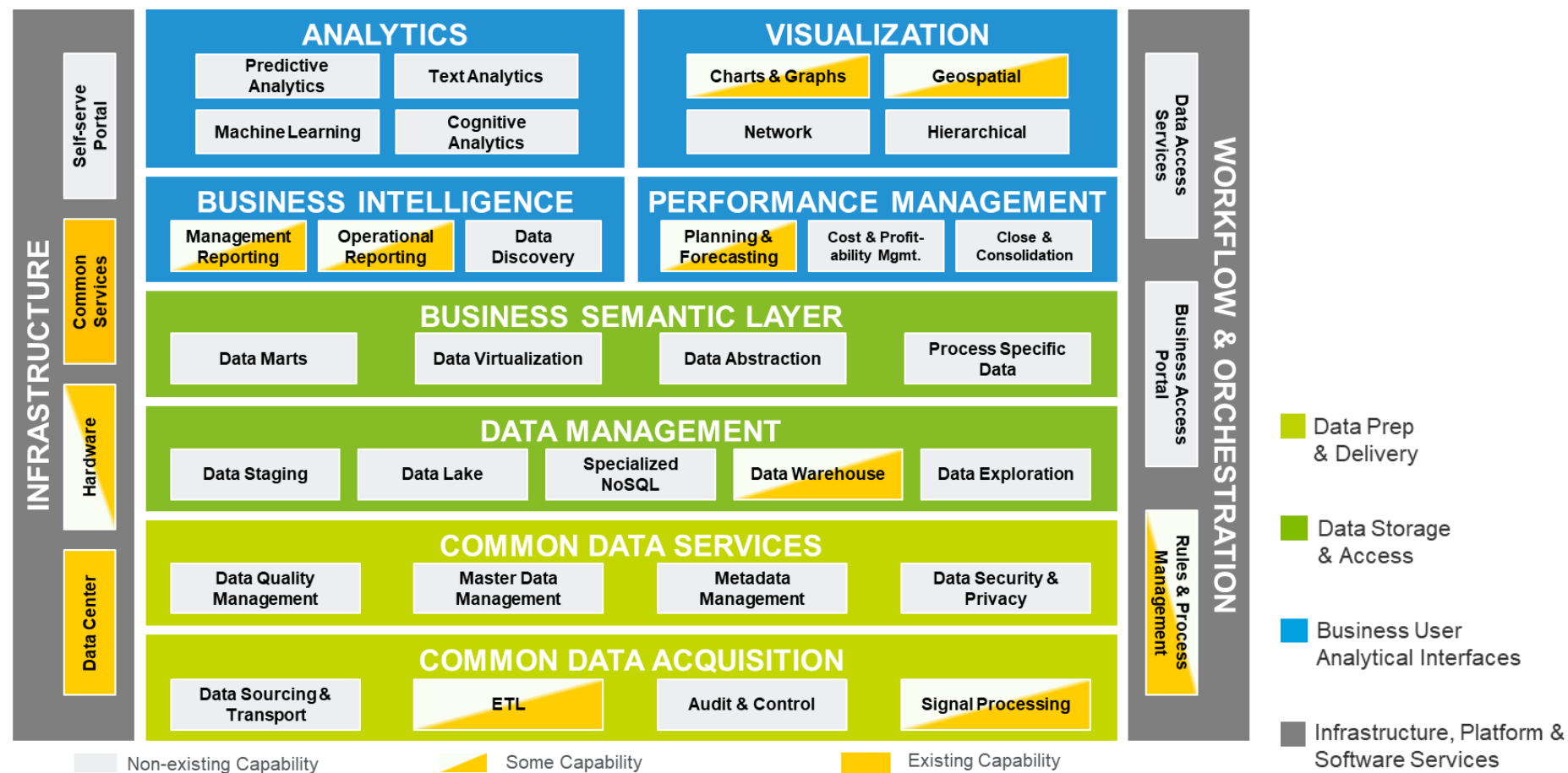
WWD has invested in strategy and implementation of BIA projects however, it doesn't have a reference architecture that prescribes the tools and technologies to enable divisional business capabilities. This leads to multiple divisions pursuing an inconsistent approach towards BIA.

IDO Building Block	Key Observations	Business Impact
<p>Reference Architecture <i>Designing a common model encompassing tools and technologies to deliver BIA projects and activities</i></p>	<ul style="list-style-type: none"> WWD does not have a BIA reference architecture in place. WWD is, however, currently developing a holistic strategy for promoting a common set of tools and technologies to meet growing needs of WWD divisions. This strategy will include the development and implementation of a BIA reference architecture. 	<ul style="list-style-type: none"> Lack of an existing reference architecture has led some of WWD divisions to pursue an inconsistent approach towards BIA.
<p>Value Proposition <i>Identifying set of tools and technologies to meet BIA needs</i></p>	<p>Technologies that supports BIA key capabilities are listed below. Please refer to next slide for a detailed view.</p> <ul style="list-style-type: none"> Data integration tool: WWD has procured licensing for GoldenGate, but it isn't in use at the moment. ETL: City has SSIS/FME for meeting its ETL needs. Data quality and metadata management: WWD and the City don't have data quality and metadata management technologies. Data management: WWD currently has a data warehouse, which has Oracle Utilities Business Intelligence (OUBI) as its reporting layer and receives weekly extracts from CCB. It is required to be replaced immediately, as CCB is planned to be upgraded in 2019. Most of the data assets currently reside in databases, Access, and Excel. Analytics, visualization and BI: WWD is exploring e.RIS to enable self-serve reporting capabilities. Other than e.RIS, it has limited reporting capabilities enabled by tools such as Excel and BI Edge. The department uses Excel and GIS systems primarily for visualization. Engineering division uses Innovyze suite of technologies for predictive modelling (e.g., hydraulic modelling). The department doesn't have a central self-serve reporting tool (e.g., Power BI), advanced visualization tools (e.g., Tableau), and analytics capabilities (e.g., machine learning). 	<ul style="list-style-type: none"> Unmanaged data stores: Storage of datasets in unmanaged data stores (e.g., Excel sheets) leads to lack of audit trail and limits reporting capability to limited datasets. Central data repository: Co-locating the enterprise data into a single data platform will simplify data management, especially where there is a need to identify authoritative sources. Lack of such a repository inhibits WWD from unlocking insights out of its vast unlinked datasets. Self-serve reporting: Lack of a self-serve reporting tool inhibits the ability of staff to create complex reports. Analytics: Lack of analytics limits WWD's ability to make future decisions based on predictive analytics (e.g., predictive maintenance, insight driven safety, etc.).



Key Observations and Business Impact | Technology

WWD should explore opportunities to invest in modern technologies* such as predictive analytics, visualizations, and self-serve reporting to meet its strategic goals and business needs.



* Please refer to Appendix A for viewing technologies supporting these capabilities and Appendix B for further understanding of these capabilities



Key Observations and Business Impact | Technology

Depending upon future strategic BIA direction, WWD needs to consider fostering relationships with cloud, Big data, self-serve reporting, analytics and visualization vendors.

IDO Building Block	Key Observations	Business Impact
Vendor Landscape <i>Creating a vendor ecosystem that supports BIA program</i>	<ul style="list-style-type: none"> IST has relationships with vendors such as Oracle (CCB), Eramosa (e.RIS) and SAP (BI Edge) for technical support and upgrades. 	<ul style="list-style-type: none"> Depending on BIA strategic direction, IST needs to consider fostering relationships with cloud, Big data, self-serve reporting, analytics, and visualization vendors.
Delivery Model <i>Sourcing and delivery model workflow across the analytics lifecycle</i>	<ul style="list-style-type: none"> The City has an established procurement process and have established relationships with multiple vendors for meeting short term staff augmentation needs for a list of defined skillsets. Specific BIA skills have not been defined under the augmentation agreement. 	<ul style="list-style-type: none"> WWD may need to consider exploring relationships with SaaS vendors who provide BIA services, and understand capabilities of WWD's existing and potential future delivery partners to execute BIA projects, to be able to develop a strong BIA delivery model to support emerging needs.
Reliability and Continuity <i>Ensuring infrastructure and platforms' reliability and continuity</i>	<ul style="list-style-type: none"> The City has two data centers and provides the hosting shared services for WWD systems including disaster recovery for selected systems. 	<ul style="list-style-type: none"> WWD may need to consider deploying some of its data on cloud, and in order to do so, work with Corporate to seek timely approval for moving these datasets to cloud.
Sandbox and Innovation <i>Developing a platform for agile development outside of the safeguarded production environment</i>	<ul style="list-style-type: none"> WWD currently doesn't have a sandbox environment for development of BIA on an environment outside of a safeguarded product environment. 	<ul style="list-style-type: none"> Depending upon the BIA capabilities and use cases prioritized on the roadmap, WWD needs to consider deploying a sandbox for promoting innovation within WWD. Such environment can play a key role for WWD divisions to fail fast and learn quickly for developing BIA prototypes and leveraging them to effect change.

Appendix A – Current State Technologies

BIA Technologies

WWD's existing technologies that supports capabilities across industry standard BIA common reference architecture.

#	Layer	Capability	Existing Technologies Supporting the Capability
1	Common Data Acquisition	Data Sourcing and Transport	• N/A
2		ETL	• SSIS/FME*
3		Audit and Control	• N/A
4		Signal Processing	• SCADA
5	Common Data Services	Data Quality Management	• DQ IT*
6		Master Data Management	• N/A
7		Metadata Management	• GeoMedia
8		Data Security and Privacy	• N/A
9	Data Management	Data Staging	• N/A
10		Data Lake	• N/A
11		Data Warehouse	• OUBI
12		Data Exploration	• N/A
13		Specialized NoSQL	• N/A
14	Business Semantic Layer	Data Marts	• N/A
15		Data Virtualization	• N/A
16		Data Abstraction	• N/A
17		Process Specific Data	• N/A

*Indicates technology is available at the city level

The list include core BIA related systems, for an exhaustive list of systems refer to IST APM data

BIA Technologies

WWD's existing technologies that supports capabilities across an industry standard BIA common reference architecture.

#	Layer	Capability	Existing Technologies Supporting the Capability
18	Business Intelligence and Reporting	Management Reporting	<ul style="list-style-type: none"> • Excel • Cognos BI • Crystal Reporting • Reporting modules of operational systems
19		Data Discovery	<ul style="list-style-type: none"> • Apollo*
20		Operational Reporting	<ul style="list-style-type: none"> • BI Edge/Crystal Report • Oracle Reports • e.RIS • MS Excel • MS Access
21	Performance Management	Planning and Forecasting	<ul style="list-style-type: none"> • Info Master • Cognos • MS Access • MS Excel
22		Cost and Profit-ability Mgmt.	<ul style="list-style-type: none"> • REPA • PeopleSoft
23		Close and Consolidation	<ul style="list-style-type: none"> • REPA • PeopleSoft
24	Analytics	Predictive Analytics	<ul style="list-style-type: none"> • N/A
25		Text Analytics	<ul style="list-style-type: none"> • N/A
26		Machine Learning	<ul style="list-style-type: none"> • N/A
27		Cognitive Analytics	<ul style="list-style-type: none"> • N/A

*Indicates technology is available at city level

BIA Technologies

WWD's existing technologies that supports capabilities across an industry standard BIA common reference architecture.

#	Layer	Capability	Existing Technologies Supporting the Capability
28	Visualization Performance Management	Charts and Graphs	<ul style="list-style-type: none"> e.RIS Excel Some operational reports MyUtilityBill COTS products (PeopleSoft, iNovah, etc.)
29		Geospatial	<ul style="list-style-type: none"> GeoMedia Enterprise and departmental GIS databases
30		Network	<ul style="list-style-type: none"> N/A
31		Hierarchical	<ul style="list-style-type: none"> N/A
32	Workflow and Orchestration	Data Access Services	<ul style="list-style-type: none"> N/A
33		Business Access Portal	<ul style="list-style-type: none"> N/A
34		Rules and Process Management	<ul style="list-style-type: none"> Workflow Scheduler
35	Infrastructure	Data Center	
36		Hardware	<ul style="list-style-type: none"> There is some data storage in the cloud
37		Common Services	<ul style="list-style-type: none"> Backup/Recovery Server Provisioning Security Network Service Desk GoldenGate (not in use, only license has been procured).
38		Self-Serve Portal	<ul style="list-style-type: none"> MyUtilityBill

*Indicates technology is available at city level

Appendix B – Stakeholders Consultants and Documents Reviewed

Stakeholders Consultations and Documents Reviewed

In this assessment, a number of stakeholders were interviewed and existing documentation was reviewed.

Stakeholders Interviewed for Current State Assessment

#	Division	Stakeholders
1	Water Services	Michael Szmon, Zeljko Bodiroga and John Parsons
2	Wastewater Services (Collection)	Susan Lambert and Nick Clinch
3	Wastewater Services (Treatment And Maintenance)	Jong Hwang, Richard Ramrattan and Terry Josephson
4	Wastewater Services (Operations)	Cynthia Ritchie
5	Solid Waste	Geoff Reimer, Justin Lee and Melissa Bunkowsky
6	Engineering	Geoffrey Patton, Cynthia Wiebe, Alana Krishka, Linda McCusker and Patrick Coote,
7	Human Resources	Melodie Ralph, Floyd Buhler and MaryAnne Carter-Squire
8	Finance and Administration	Wanda Burns, Angela Smith and Jason Enns
9	Environmental Standards	Courtney Diduck and Nancy Crawford
10	Customer Service	Shannon Atkinson and Lisa Marquardson
11	Information Systems and Technology	Brian Konopski, Nand Kishore, Saumik Gupta, Greg Lyon, Stephane Normandeau, Quyen Nguyen and Muriel Ferrer
12	Business Technology Services	J.P. Robert and Travis Herntier

Key Documents Reviewed

#	Documents
1	WWD Enterprise IT Roadmap 2017
2	WWD Enterprise IT Roadmap 2012
3	CoW BI Strategy 2018
4	Sustainable Water Waste (Direction Strategy) – 2009
5	CoW Website
6	CoW Corporate Organizational Chart
7	APM Sheet
8	APM Analysis Sheet
9	Service Request Process
10	Multiple Reports provided by various divisions



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