Drainage Information Management Systems Strategy

While a formal strategy document is still underway, significant progress has been made on the Information systems that from the lifeblood of Drainage Services:

DRAINS – The graphical and text database of all underground sewer Infrastructure. Progress over the last few years includes:

- Digital Submission of Developer Drawings: Each year, developers build many kilometers of sewer that are eventually added to the City's inventory – 104 km were added in 2004. In the past, City draftsmen were required to draw out all of these new lines to add them in to the inventory. A new system that started production in late 2005, moves developer drawings directly into our database and performs many data quality checks automatically that were done manually in the past. The benefits of this system are:
    - Saves drafting time,
    - Improves data quality through automatic quality checks,
    - Reduces development approval time through faster automatic quality checks, and allows our draftsmen to focus on the quality of the DRAINS data.

- Mobile DRAINS – Late in 2004, the DRAINS database was made available to Drainage Operations crews through the use of truck mounted laptops and wireless communication technologies. This system provides our crews with instant access to network mapping and helps them find sewers in the field. The benefits of this system are:
    - Saves time in calling to the office to get copies of plans or locate facilities,
    - Saves clutter in the trucks from paper drawings,
    - Empowers crews by making them more independent.

- Digital Drawing Access – Completed by mid 2005, this initiative saw all of Drainage Services' critical facility plans scanned and connected to the DRAINS database. Users can now click on a facility in DRAINS and bring up all associated drawings. The benefits of this system are:
    - Save on space for housing drawings,
    - Improves security for drawings against loss due to fire, etc,
    - Simplifies retrieval of drawings

- User Friendly Drawings – Completed in 2003, this initiative consists of simplified drawings that demonstrate how a facility operates. Engineering drawings and operation manuals for complex facilities such as pumping stations can be many pages long and extremely detailed. Trying to understand these detailed drawings can be difficult and frustrating at the best of times, and impossible when things go wrong (e.g. during a major storm in the middle of the night). The user friendly drawings capture the essentials of the facility and identify what things should look

like if they are operating properly. These drawings were made available through the DRAINS database in 2005. The benefits of this system are:
    - Quick identification of problems,
    - Improving the understanding of our facilities by our Operations crews,
    - Providing and additional resource to crews responding to an emergency.

WASS (Water and Sewer Services) – The inventory of all home and building connections to the sewer system:

- Database Creation – A database was created within the POSSE corporate data system to house this information prior to 2000. Data was added as it came in, and old servicing reports were scanned on to provide detail. The system worked, but was cumbersome and slow, and still required staff to interpret the writing and cryptic notes on antique documents.

- Database Population – Over the course of 2004, 2005 and into 2006 we have been working to push paper records dating from as far back as the turn of the century into the database. This is a massive project in terms of data entry and quality control, and moves the paper data to a true database. The benefits of this system are:
    - Improving access to records,
    - Improving record accuracy,
    - Quicker customer response to inquiries.

Wastewater Treatment Plant IT systems:

- Fibre Optic Connection – In 2003, the Gold Bar Wastewater Treatment Plant was connected to the city network with a Fibre Optic cable. This improved network speed and communication between the plant and the downtown office.
- Pearl Document Management System – Manages and protects essential documents used in running the plant such as operating procedures.
- SCADA Upgrade – Provides control and data to plant operators.

SHAPES (Sewer Hydraulic Performance Evaluation System) – Sewer flow and water level database.

- First developed in 1992, this system is used by Drainage Services' staff to:
    - Collect raw data from the field,
    - Record particulars of the site and installation of the monitor,
    - Convert the data to a format compatible with the database,
    - Calculate flow parameters from measured values,
    - Create reports for Alberta Environment,
    - Determine how full the sewers are and to identify performance problems.

- System Review – In 2003, outside experts were retained to review the current custom system as it was aging and in need of updating. The conclusion was that

the needs could only be met through custom software, and that the current system could be upgraded to meet the needs of Drainage and meet the standards of IT.

- SHAPES Upgrades – The system has been upgraded as follows:
    - UM4 (Utilities for Monitoring version 4) – Starting in 2003, UM4 has been developed to replace particularly archaic piece of the SHAPES software. UM4 is a utility program that:
        - ◊ Performs data base viewing/reporting,
        - ◊ Performs scheduled data checks (Quality Assurance & Quality Control) – This new feature automated the checking of data and the marking of poor or questionable data. It has improved data quality and reduced manual checking through scheduled QA/QC data marking – checking – reporting,
        - ◊ Site configuration history and
        - ◊ Scheduled data imports.

    - Tabular Reporting Upgrade – In 2005, the software component used to produce daily, monthly and annual reports for the sites was re-written into code that meets the IT standard by IT staff. This product also analyses our data and produces proficiency reports that indicate the amount of good data recovered.
    - Data Translators – This software component was developed in 2005 to translate into Oracle a variety of raw files from the field flow monitors. It is developed software that meets the IT standard. This utility allowed SHAPES to capture data from outside systems that produce comma separated variable files and other data formats.
    - Automated download of Dolphin logger sites.

- Web Page Data Display – A display of rainfall data in near real time was developed in 2003 through the work of a contractor and housed on their site. Work is now underway to convert this system to operate on City servers.

SIIM (Sewer Inspection Information Management) – The capture and storage of video inspections of sewer systems, and making the images easily available for evaluation.

<u>Phase I</u> (Completed in 2002):

The Concept Plan phase of the project developed a plan to digitally store and retrieve sewer inspection records. Sewers are given structural and service condition ratings and their maintenance, rehabilitation and repairs needs are identified and prioritized. The plan took into consideration the need to:

- Review all sewer inspection methodologies and detail the advantages and disadvantages of each,
- Select a digital video application to collect sewer inspection images,
- Evaluate a methodology to store these images,
- Determine types of images to be available for retrieval,

- Organize video image database for condition ratings, and
- Integrate with existing drainage systems and databases.

Phase II (Completed in 2004):

In the Second phase, the City's three Aries equipped trucks were converted to record future CCTV inspections in digital format. In addition, specialized software was installed on designated office workstations for quality control, report generation and general viewing of information on the network.

Phase III (Ongoing):

The third phase of the project developed selection criteria and evaluated options for converting the CCTV inspection tapes for sewer pipes to digital format. The following tasks were completed:

- Develop criteria for selecting CCTV tapes for conversion.
- Investigate options for data storage and conversion of tapes.
- Estimate conversion costs.
- Investigate various CCTV inspection report storage methods.
- Investigate current computer aided detect detection methods.

In 2005, the City hired a contractor to perform the digital conversion and indexing of previous tapes (CCTV) and inspection reports. This work is still underway.

Phase IV (To start in 2006):

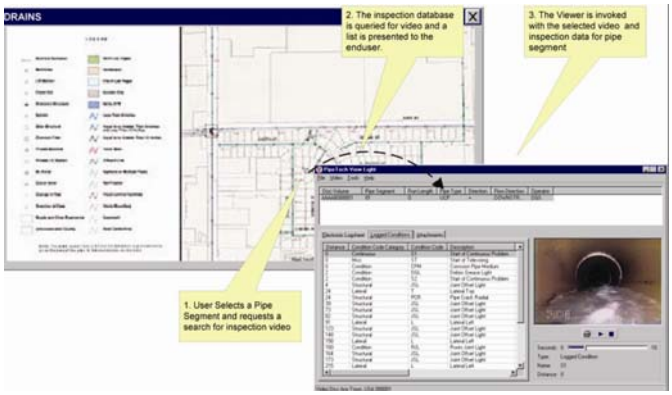
The fourth phase of the project will create a sewer inspection and condition database. With the implementation of this stage, the inspection data will be accessible by all users through reporting tools and will integrate with DRAINS and Maintenance Management systems.

Phase V (To start in 2006):

With the completion of the fifth phase, inspection video will be accessible at the end user's desktop. Major tasks in this phase are:

- Network capacity study,
- Implement a central video server and video index integrated with the inspection and condition database,
- Customize a video viewer to support the central video server, and
- Integrate the customized video viewer with other City's sewer applications.

Digital technology provides quality pipe images making it easier to detect defects



Storing the digital images electronically allows for the creation of a database where searches and queries can easily obtain an archived image greatly increasing the opportunity for preventive maintenance.

The following pages are the examples for User Friendly Drawings - Lago Lindo Lift Station & Storage Tank:

LAGO LINDO LIFT STATION & STORAGE TANK

SENSOR STATION PL529

9059 – 167 AVENUE

What is it?

- It is a Lift Station and storage tank that transfers sewage flow from the Lago Lindo and Klarvatten Neighbourhoods (North of 167 Ave, between 97 and 82 Street) into the 97 Street Trunk Sewer.

Why is it here?

- It is here to collect the excess sewage that the 97 Street Trunk Sewer can not handle, and to help stop basement flooding to the connected buildings. (Many flooded basements in 1986 caused this to be built).

How does it work?

- During dry weather sewage levels are confined to the bottom 1.80 meters of the wet well.
- During wet weather, flows will increase and overflow to large storage “cells” if the 97 Street Trunk is surcharging.
- Stored sewage is transferred to the 97 Street Trunk Sewer at a maximum rate of 99 L/sec during and after a storage event.
- The Lift Station and storage tank have been designed for fully automatic operation based on level controls in the wet well and in the downstream trunk sewer.
- The Lift Station discharges all flow into a 525mm Gravity Trunk Sewer on 167 Ave that connects to the 97 Street Sewer.

What needs to be checked and maintained?

- Check to make sure no storage in cells 1 to 6.
- Requires occasional cleaning after wet weather storage cycle to prevent odour
- Switch control valve (FCV-706) from 100% open to 100% close, then re-open valve and place it into remote mode. Check for any unusual noises.
- Open pump well hatches and inspect wet well for any unusual conditions…(e.g. Sewage in storage cells).
- Sewage level in wet well (normal operation level: 1.45 meters to 0.50 meters)
- Sewage level in 97 Street Trunk Sewer manhole #303383 (less than 1.3m deep)
- 97 Street sensor (PL529) is properly controlling pumps.

Emergency response notes:

- Nearest manhole not draining to the same pump station:
  167 Avenue Northwest of pump station (manhole #301924)
- Emergency bypass pumping connection does not exist.
- Pumping heads: Wet well to surface: 12.75m (at pump station)
  Wet well to forcemain outlet: 9.352m
- Emergency pumpset:

LAGO LINDO LIFT STATION & STORAGE TANK

SENSOR STATION PL529

9059 – 167 AVENUE

Alarm/Status Description

ALARM ZONE CODE	ALARM/STATUS DESCRIPTION		ALARM TYPE CODE
	COMMUNICATIONS TEST FAILED	:Work hours-list 2	CTF/0
0	COMMUNICATIONS TEST / RESTORED SIGNAL		CTS/0
1	UNINTERRUPTIBLE PWR BATTERY LOW	:Work hours-list 2	USM/0
B	UNINTERRUPTIBLE POWER SUPPLY BATTERY RESTORED		USR/0
F	PUMP 2 HIGH TEMPERATURE HALTED		T2R/0
10	PUMP 1 MOTOR STATOR LEAKING	:Work hours-list 1	M1L/0
11	HIGH WATER: STORAGE TANK FILLING	:Work hours-list 1	ESF/0
13	DRY WELL FILLING	:Work hours-list 1	DWF/0
14	PUMP 1 FAILED	:Work hours-list 1	P1F/0
15	PUMP 2 FAILED	:Work hours-list 1	P2F/0
16	DOOR OPEN		OPN/0
17	SMOKE ALARM ON	:Work hours-list 1	FIR/0
18	VENTILATION AIR FLOW FAILED	:Work hours-list 1	VEF/0
19	PUMP 1 HIGH TEMPERATURE	:Work hours-list 1	H1T/0
1B	PUMP 2 HIGH TEMPERATURE	:Work hours-list 1	H2T/0
1C	PUMP 2 MOTOR STATOR LEAKING	:Work hours-list 1	M2L/0
1D	MAIN ELECTRICITY SUPPLY FAILED	:Work hours-list 2	MEF/0
1E	LOW BUILDING TEMPERATURE	:Work hours-list 1	LWT/0
1F	ALL PUMPS SWITCHED OFF	:Work hours-list 1	APO/0
21	PUMP 3 FAILED	:Work hours-list 1	P3F/0
22	PUMP 3 MOTOR STATOR LEAKING	:Work hours-list 1	M3L/0
23	PUMP 3 HIGH TEMPERATURE	:Work hours-list 2	H3T/0
24	VARIABLE FREQUENCY DRIVE FAILED	:Work hours-list 2	PDF/0
25	EMERGENCY STORAGE TANK FULL	:Work hours-list 1	DPT/0
2B	AUTODIALER BATTERY EXHAUSTED	:Work hours-list 2	ABF/0
2C	AUTODIALER AC POWER FAILED	:Work hours-list 2	APF/0
61	PUMP 3 OPERATION RESTORED		P3R/0
62	PUMP 3 MOTOR STATOR LEAK HALTED		L3H/0
63	PUMP 3 PUMP 3 HIGH TEMPERATURE HALTED		T3R/0
64	VARIABLE FREQUENCY DRIVE & DUTY PUMP RESTORED		
65	EMERGENCY STORAGE TANK DRAINING - FROM FULL		ESD/0

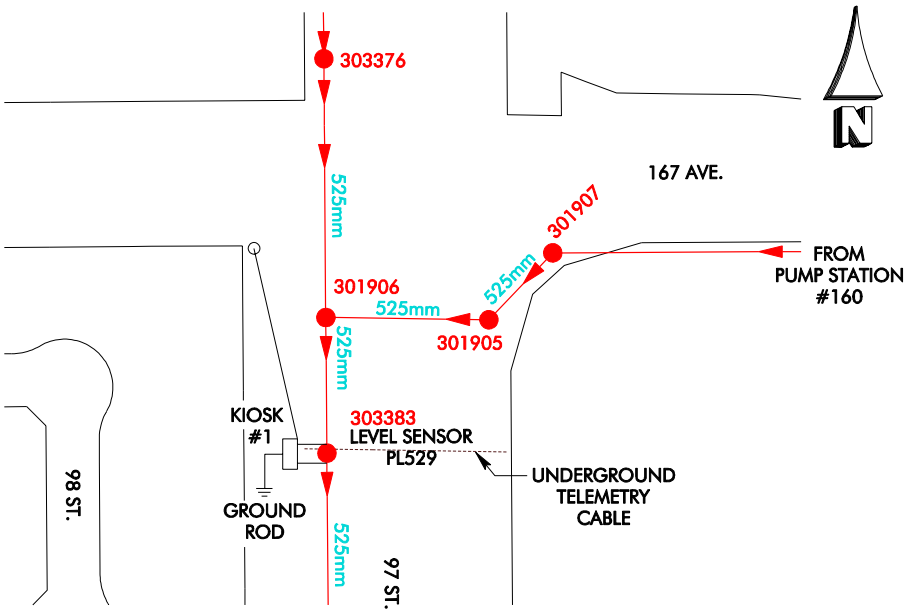
LAGO LINDO LIFT STATION & STORAGE TANK

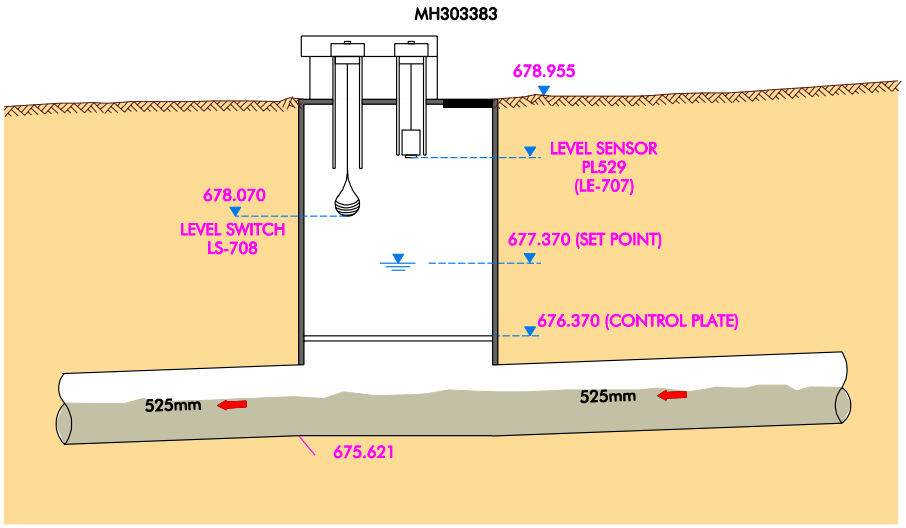
SENSOR STATION PL529

9059 – 167 AVENUE

Alarm/Status Description

ALARM ZONE CODE	ALARM/STATUS DESCRIPTION		ALARM TYPE CODE
B0	PUMP 1 MOTOR STATOR LEAK HALTED		L1H/0
B1	HIGH WET WELL WATER LEVEL & STORAGE FILLING HALTED		DPX/0
B3	DRY WELL DRAINING		DWD/0
B4	PUMP 1 OPERATION RESTORED		P1R/0
B5	PUMP 2 OPERATION RESTORED		P2R/0
B6	DOOR CLOSED		CLO/0
B7	SMOKE ALARM OFF		FRR/0
B8	VENTILATION AIR FLOW RESTORED		VER/0
B9	PUMP 1 HIGH TEMPERATURE HALTED		T1R/0
BB	AUTODIALER BATTERY RESTORED		ABR/0
BC	PUMP 2 MOTOR STATOR LEAK HALTED		L2H/0
BD	MAIN ELECTRICITY SUPPLY RESTORED		MER/0
BE	BUILDING TEMPERATURE RESTORED		PTH/0
BF	PUMP SWITCHED ON		APX/0
CC	AUTODIALER AC POWER RESTORED		APR/0





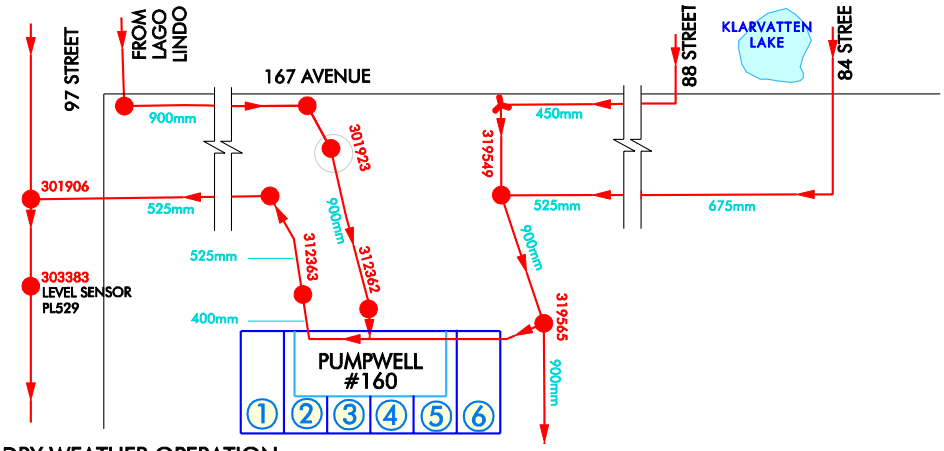
LAGO LINDO SENSOR STATION

16520 – 97 STREET

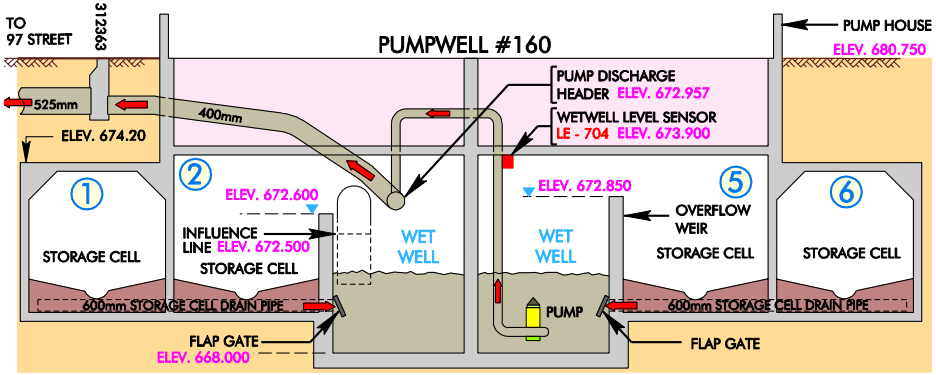
- Control set point is at elevation 677.370m.
- Control Sequence (depth above 525mm trunk sewer obvert):
  - Lead pump starts at 1.15m
  - Lead pump speed reduce to 60% at 1.30m
  - Lead pump stops if depth >1.30m
  - Lag pump starts at 0.850m
  - Lag pump stops at 1.00m
- A proportional band set point or reference point of 1.0m is set from the control plate to either open or closed the motorized valves (FCV-706). The range in use is 0.3m below or 0.3m above the set point.
- If manhole #303383 is empty or level is below the bottom of the set point, the motorized discharge valve FCV-708 will be fully opened, allowing pump station #160 to drain the storage tank.
- When the manhole level increase toward the top of the set point, the valve will be fully closed to stop the discharge.
- Level switch's functions:
  - backup high level alarm
  - ensure motorized discharge valve FCV-706 is closed
  - shut down lead and/or lag pump for 15 minutes

Note: valve FCV-706 is provided with a manual override to allow manual operation in case of electric operator failure or high torque alarm.

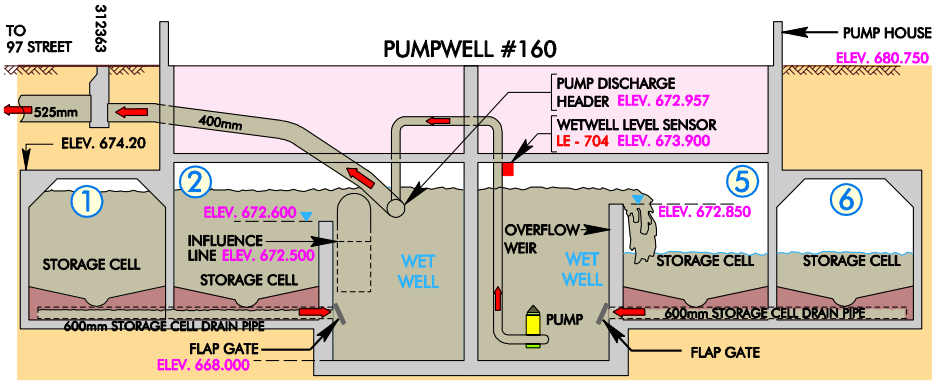
LAGO LINDO LIFT STATION & STORAGE TANK



DRY WEATHER OPERATION



WET WEATHER OPERATION



DRY WEATHER OPERATION

- The wet well level should be less than 1.85m above its base. High Level Alarm, Elevation 669.850m
- Pump sequence (measured from base of wet well):
  - Lag Pump starts at 1.80m
  - Lead Pump starts at 1.45m
  - Lead pump stops at 0.50m
  - Lag pump stops at 0.60m
- Storage main cells 1 to 6 should be empty
- Dry weather flow capacity to 97 Street Trunk is from 142 L/sec to 170 L/sec.
- Normal operating level for wet well is 1.45m to 0.50m.
- In the normal single pump operating mode station pumps at average flow of 94 L/sec (3.3cfs)

WET WEATHER OPERATION

- The wet well may rise up to 1.85m (High Level Alarm).
- 99 L/sec is pumped continuously to 97 Street Trunk.
- If the 97 Street Trunk is full (1.3 meters deep at elev. 677.670), discharge valve FCV-706 is closed, and pumps are shut down for 15 minutes or until trunk level drop.
- Storage tank will fill up due to 97 Street Sewer Trunk's limited capacity during severe rainfall.
- The storage cells fill up one at a time to minimize cleaning in the storage facility.
- Once the pumps lower the wet well level, flap gates from the storage cells will flap open to drain cells into wet well.