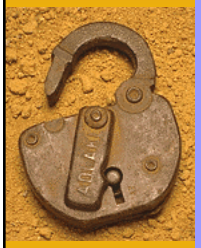


Data Management for Transportation, Water, Sanitary and Storm in ArcSDE

By

Jeff Whiting & Glen Boos

City of Saskatoon, Canada

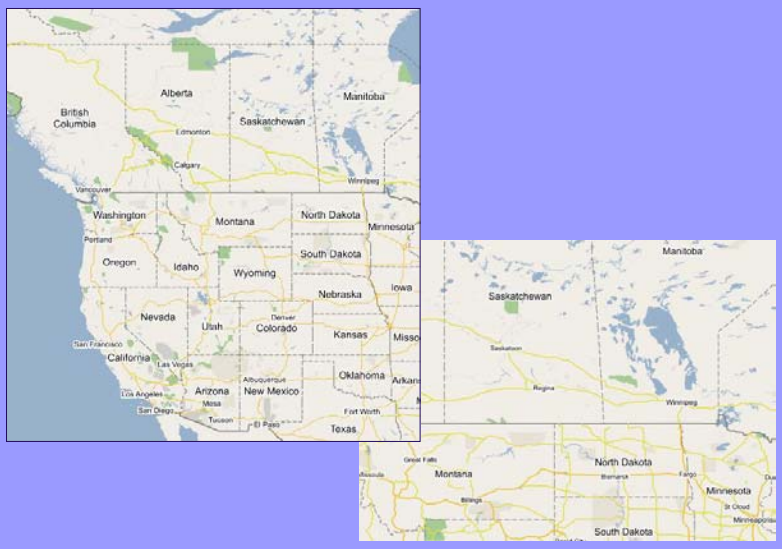
Corporate Information Service

Presentation to ERSI 2005 User Conference

Abstract:

The City of Saskatoon has separate data models for Parcel, Transportation, Water, Sanitary, and Storm in 1 ArcSDE. Transportation data is edited using NovaLIS Editor except for Asset Lines & Points. Asset Lines (for example, curbs, sidewalks, painted lines) are edited in AutoCAD and transferred to ArcSDE using SAFE FME batch program. Asset Points (stop, yield, overhead signs and traffic lights) are edited in MapGuide by field staff and transferred to ArcSDE. Water, Sanitary, and Storm are edited using AutoCAD with an editor extension soon to change to AutoCAD Oracle Locator. The data is then transferred to ArcSDE. The inventory data is completely replaced every four months while operation data (ie., hydrant pressure) persists. Operational data is supported by ArcPad from ten different field groups. Spatial inventory data is not changed by field staff but sent as event tables to data editors. MapGuide uses SAFE SDP to view ArcSDE data.

City of Saskatoon



Source: \\www.google.com\map

City of Saskatoon

Saskatoon:

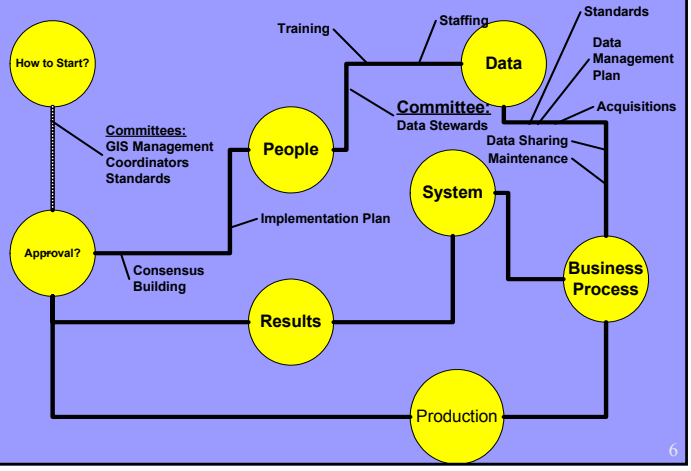
- largest city in Saskatchewan.
- population of 206,000
- 60,000 privately owned parcels of land.
- adjacent to the South Saskatchewan River

The presentation:

- Engineering GIS Objectives
  - Strategies
  - Tactics
  - Status today
- GIS access
- Data Models
- Editing & data transfer
- How is data integrated
- How is data analyzed
- Is the Enterprise integrated & Seamless?

Engineering GIS Objectives

- Everything we do today, we do well, let's do it better
- Concentrate on people and their jobs



How we do our job today:

- MapGuide to every employee
- AutoCAD feeds MapGuide
- ArcSDE feeds MapGuide
- Moving from:
  - paper forms & pin maps to digital forms and analysis maps
  - Excel, Paradox, and MS Access db to MS SQL server & Oracle Locator tables

Stated GIS Enterprise Benefits

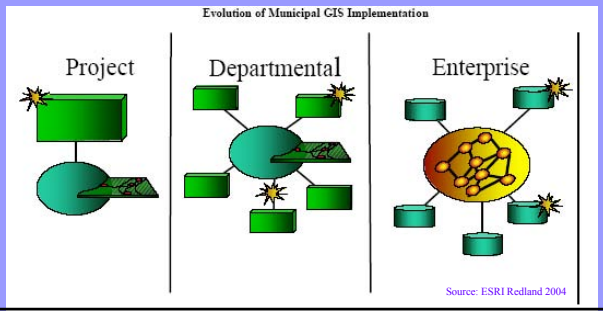
- Removing:
  - In-accuracies
  - Duplicate copies
  - Concurrency
- In reality:
  - Justification for cleaning data both spatial & attribute
  - Moving from central control to field control
  - Building in benchmark reports (read "manager" reports)
  - IT department's desire to control by consolidation to single vendor

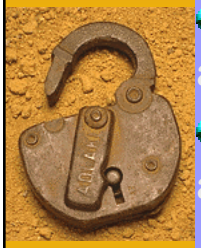
Tactics

- Spatial data accuracy is 99% - standard attained in 2000
- Defining a Maintenance cycle - standard attained in 2004
- Attribute data is 99% accurate by Dec. 2005
- Automatic synchronization of data by Dec. 2005
- Supplying Annualized Reports
- Making more data more readily available to more staff
  - Attribute data is 99% accurate by Dec. 2005
    - Maintained by field staff
    - Changing to PDA or tablet digital forms
    - Reducing bottle necks
  - Automatic synchronization of data
    - Increase concurrency
    - Increase acceptance & buy-in

Background

- GIS use since early 80's
  - highly decentralized with each Business Area maintaining their own (potentially duplicate) data sets
- 1996, move towards a Corporate or Enterprise Model



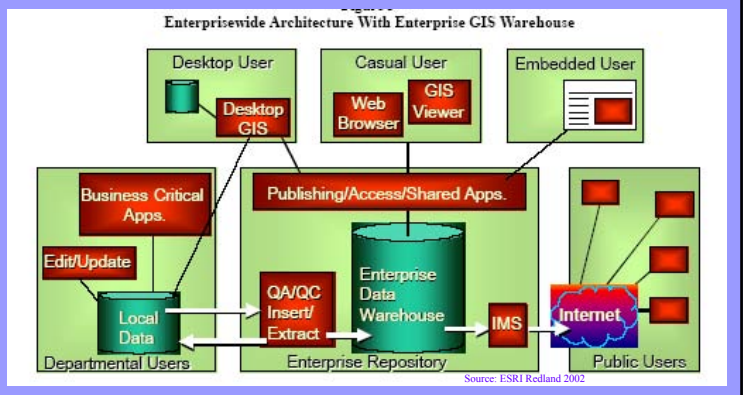


Background (con't)

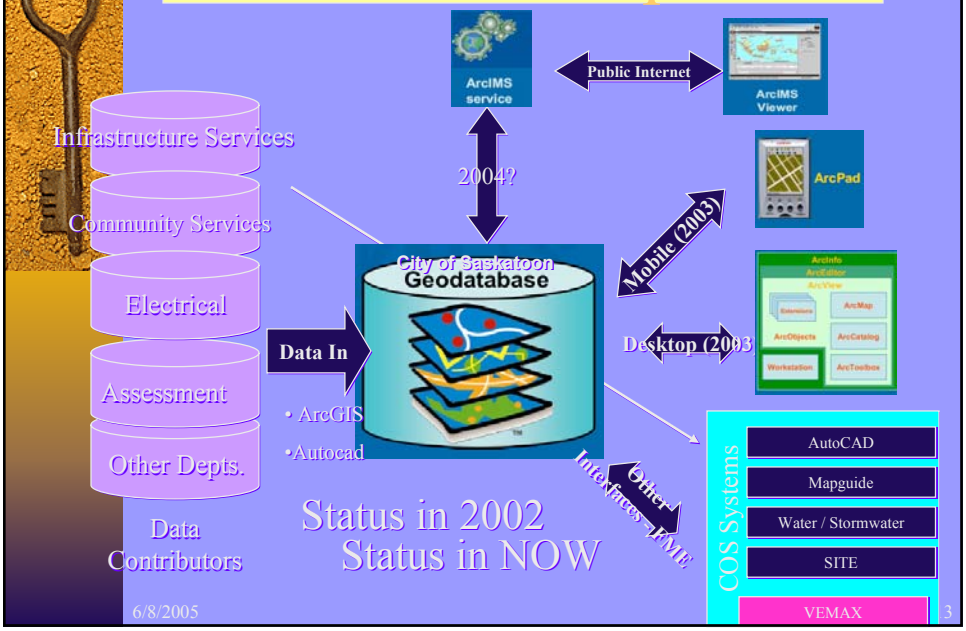
- 1997, Mapguide Enterprise / Intranet applications
- 2000, choose ESRI's SDE data engine and ArcGIS 8 as Enterprise host.

Integration of Data Stores

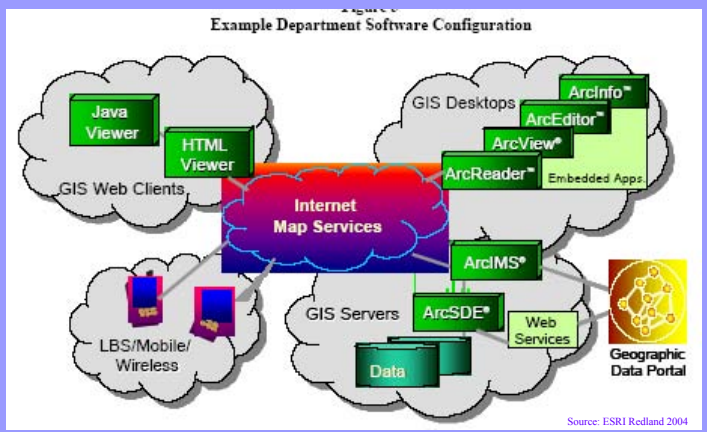
- Where we are now



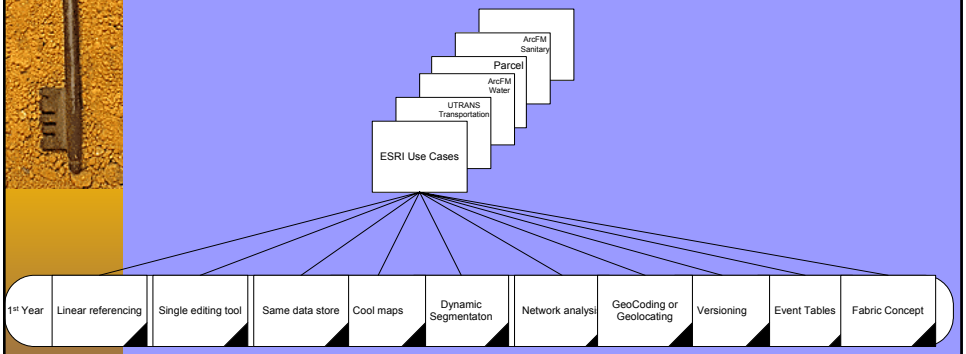
Saskatoon Enterprise



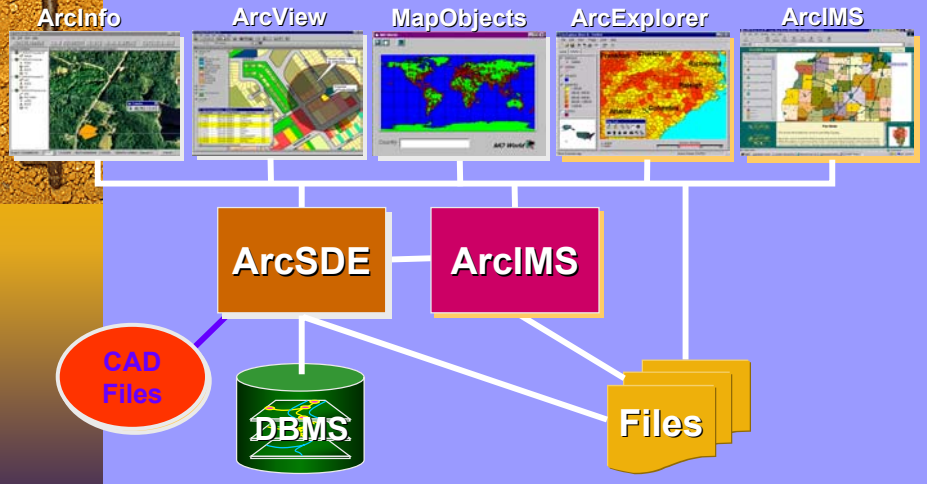
The target – Totally integrated & seamless?



It was ESRI's Strategy that sold us



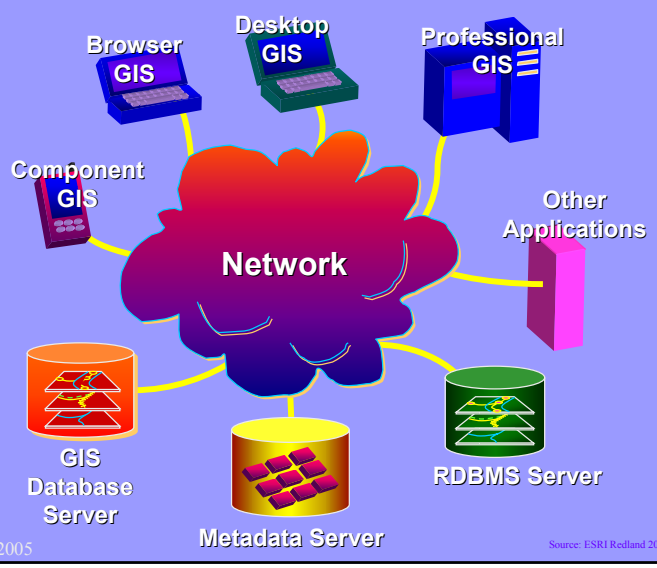
GIS Architecture



Scalable Solution for Comprehensive Geographic Analysis

Source: ESRI Redland 2003

The GIS Enterprise

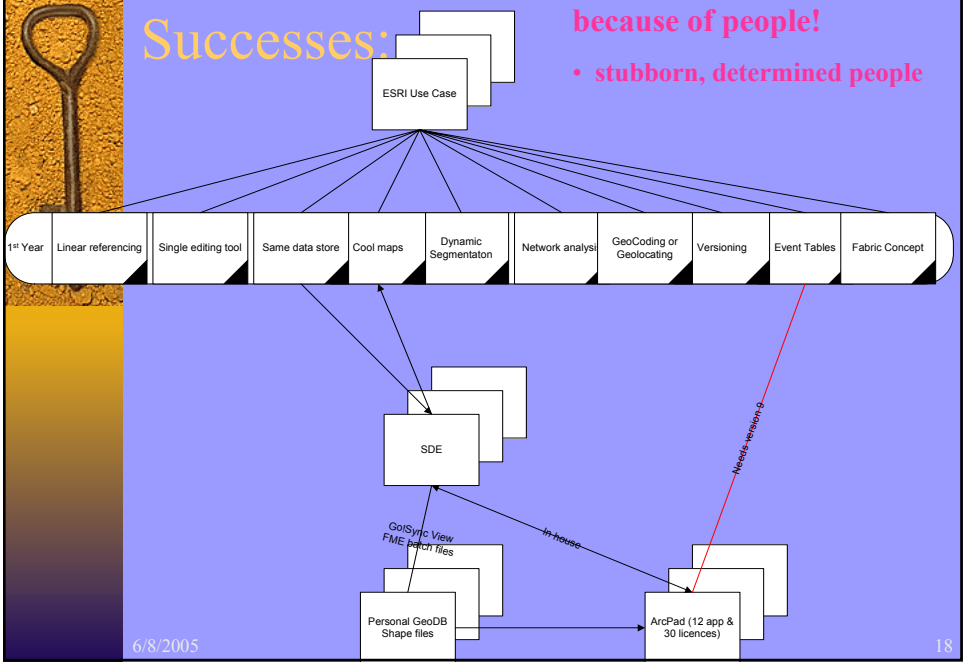


Source: ESRI Redland 2004

Successes:

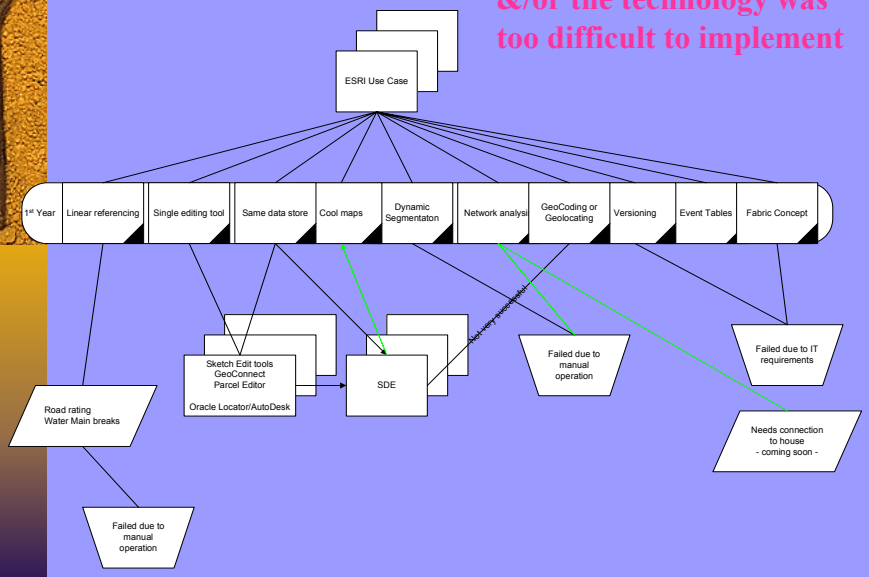
Success came about because of people!

- **stubborn, determined people**



Failures:

Every failure is because nobody took ownership &/or the technology was too difficult to implement



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Staff access thru MapGuide:

Reading directly from SDE using SAFE SDP

View Usage By Month By Map

Tracking Since: 11-Mar-2004

Year	Month:	Unique Users:	Total Hits:
2004	April	329	4852
	May	330	5415
	June	358	6252
	July	346	5416
	August	416	5620
	September	374	5806
	October	332	5206
	November	362	5618
	December	330	4294
2005	January	334	5230
	February	338	5069
	March	367	5611
	Total	**679**	**64389**
	Average	351	

View All Since Tracking Started

Tracking Since: 11-Mar-2004

Map Name:	Unique Users: Count:	%	Total Hits: Count	%
ownerzoning	524	77%	15743	37.50%
IS_Document_Retrieval	221	33%	6334	15.10%
Clearance	168	25%	5817	13.80%
IS_Connection_Cards_Retrieval	155	23%	4633	11.00%
Electrical	90	13%	1858	4.43%
Survey_Benchmarks	91	13%	803	1.92%
Aerial_Photo_Locator	233	34%	789	1.88%
Parks	110	16%	708	1.69%
Stop_Yield_Inspection	44	6%	536	1.28%
Surface_Infrastructure_Features	56	8%	531	1.27%
2004_Const	122	18%	497	1.19%
Lighting	48	7%	373	0.89%
IS_System_Modelling	63	9%	321	0.77%
Traffic_Volume	57	8%	309	0.74%
W_S_Data_Retrieval	35	5%	285	0.68%
RdStructureClass	71	10%	265	0.63%
Sewer_Main_Operations	57	8%	258	0.62%
Catchbasin	86	13%	241	0.57%
Sewer_Camera	35	5%	207	0.49%
IS_System_Modelling_Storm	67	10%	195	0.47%
Hydrant_Inspection	47	7%	191	0.46%
IS_System_Modelling_Water_Dist	59	9%	161	0.38%
Stop_Yield_Inspection_Update	2	0%	133	0.32%
IS_System_Modelling_Waste_Water_Management	46	7%	122	0.29%
Utility_Cuts	42	6%	111	0.26%
Rdwys_Curb_Walk_Segs	34	5%	110	0.26%
Pavement_Mkgs	23	3%	89	0.21%
Transportation_Parking	35	5%	61	0.15%
IS_Treatment_Schedule	28	4%	64	0.15%
Storm_San_IS_Error_Reporting	1	0%	42	0.10%
Municipal_Access_Agree	24	4%	37	0.09%
Solid_Waste	2	0%	30	0.07%
Solid_Waste_Print_App	2	0%	31	0.07%
larry	6	1%	8	0.02%
MH_Restoration	3	0%	7	0.02%
Transportation_Traffic_Guide_Signs_Update	3	0%	9	0.02%
Stop_Yield_Inspection_2	2	0%	4	0.01%
UnknownAttributes	1	0%	3	0.01%
Excess_Load_Permit	1	0%	1	0.00%
ownerzoning_xy	1	0%	1	0.00%
Police	1	0%	2	0.00%
Rdwys_Curb_Walk_Segs_Glens	1	0%	1	0.00%
Sidewalk_Condition	1	0%	2	0.00%
Traffic_Volume_Ray	2	0%	2	0.00%
Transportation_Data_Retrieval	2	0%	2	0.00%
Transportation_Parking_ray	1	0%	2	0.00%
46 Different Map(s)	679		41929	

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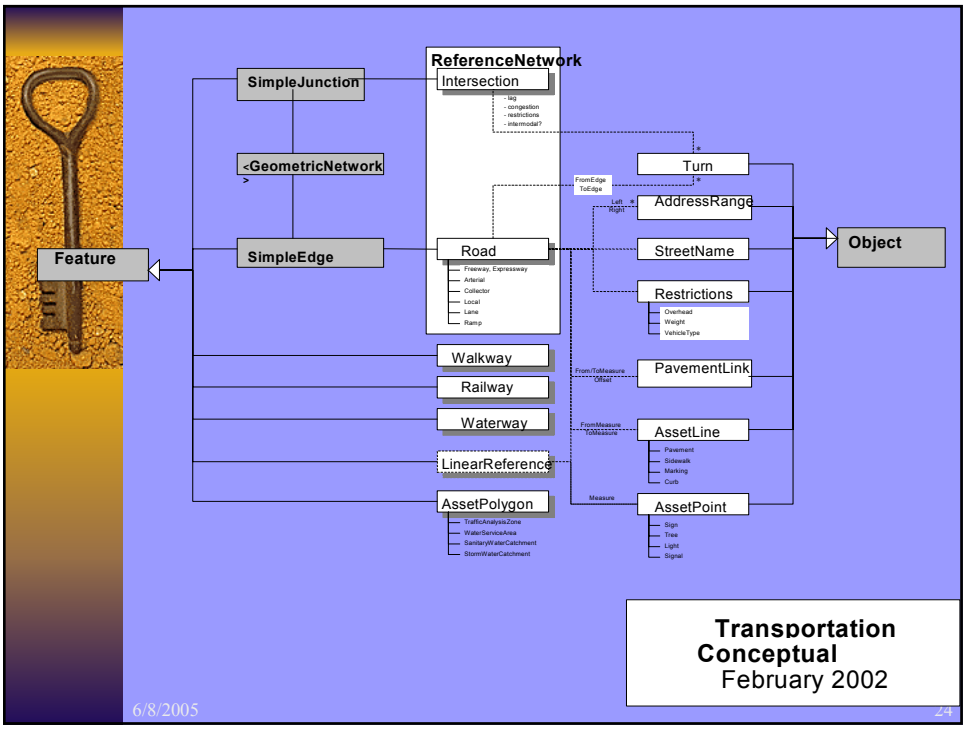
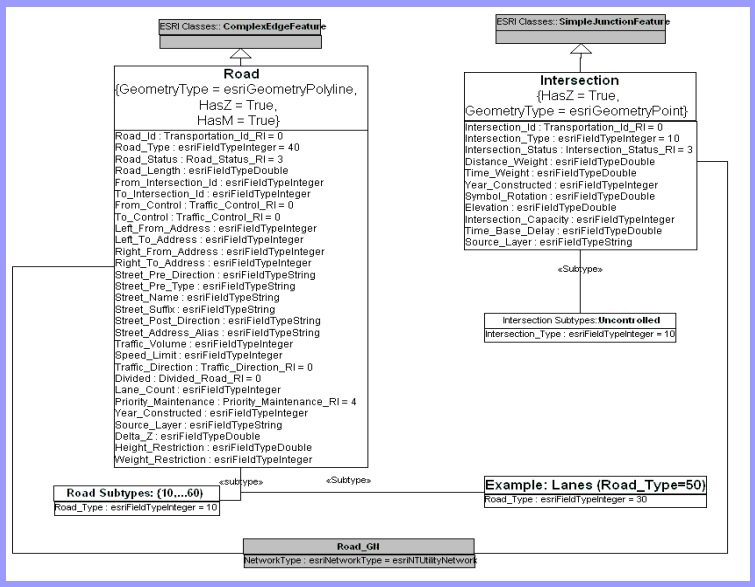


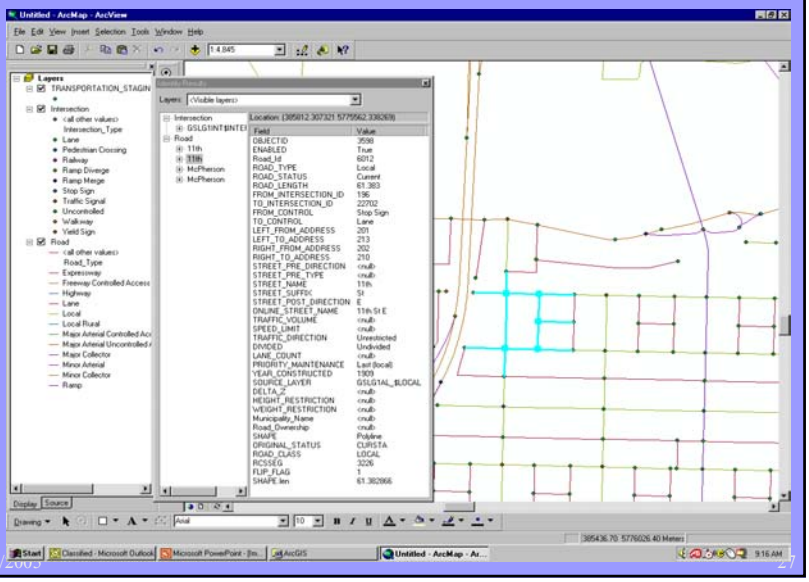
Transportation Use Cases

- Create New Road
- Flip Road Links
- Update Road Status by Graphic Selection
- Create Pavement Link Feature Class
- Populate Turn Table
- Export to TMODEL
- Create / Update Traffic Analysis Zones

Transportation Data Model



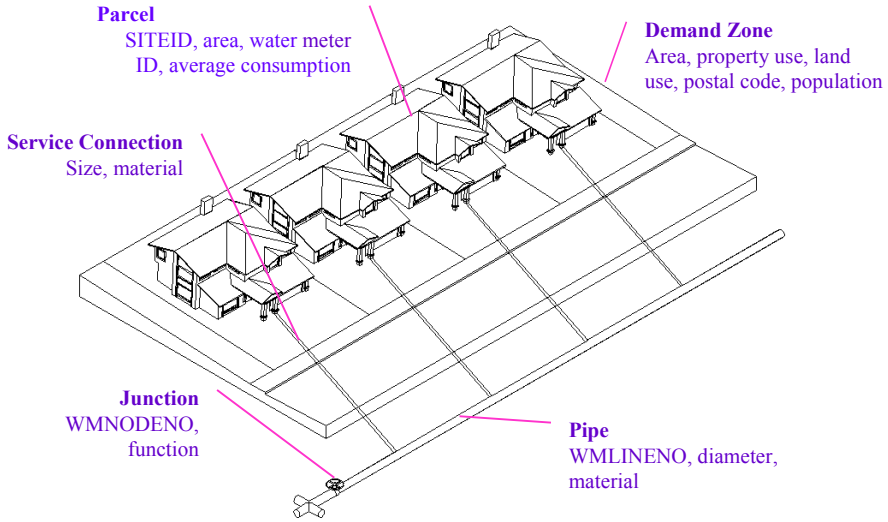
Physical Implementation of Road Network in SDE



Implement Enterprise GIS (Water, Sanitary and Storm Sewer)

- Water Distribution System
  - Primary (Trunk) - operational
  - Secondary – operational
  - Every customer's demand is represented
- Sanitary Sewer Collection System
  - 1 city wide model - end of 2005
- Storm Water Management System
  - 45 catchment-scale models – operational

Water Distribution Modeling



Water Distribution Data Model

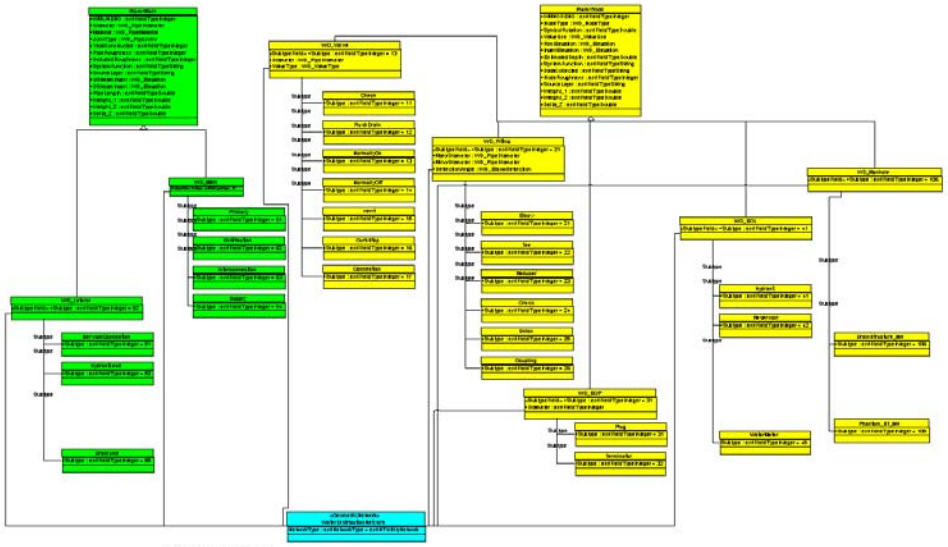
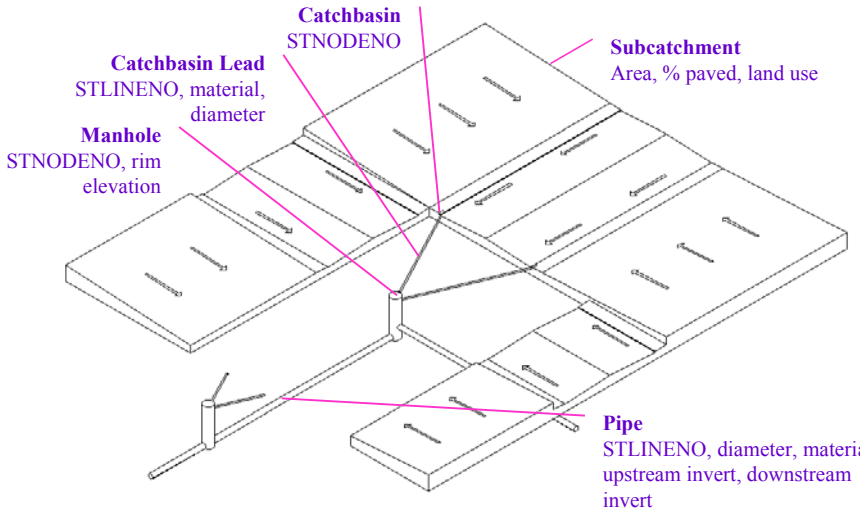
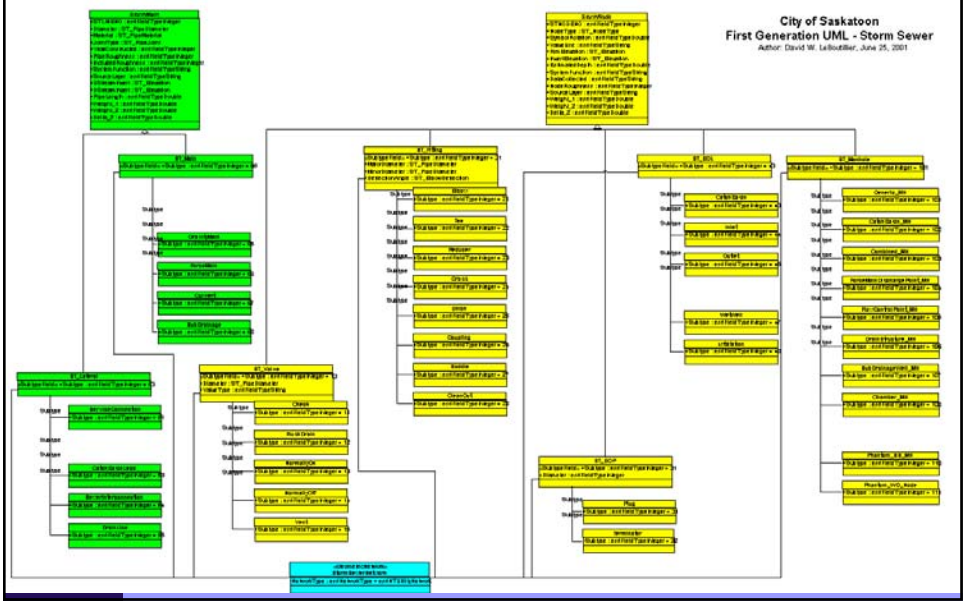


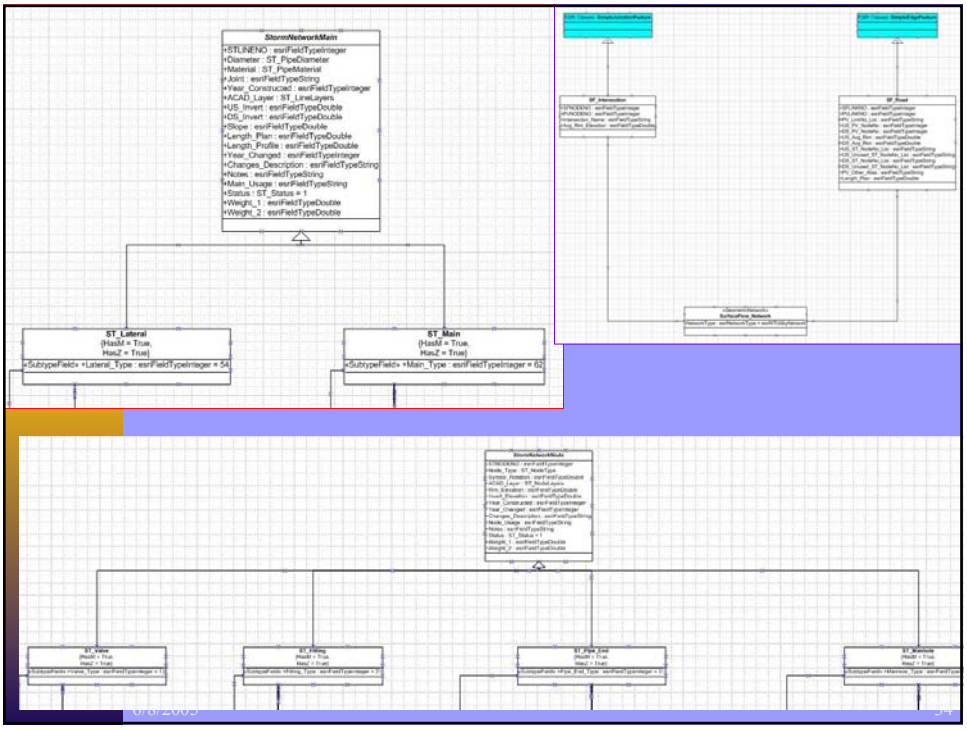
Figure 4.1 City of Saskatoon
First Generation UML - Water Distribution
Author: David W. LeBoutillier, June 26, 2001

Storm Water Modeling



Storm Sewer Data Model





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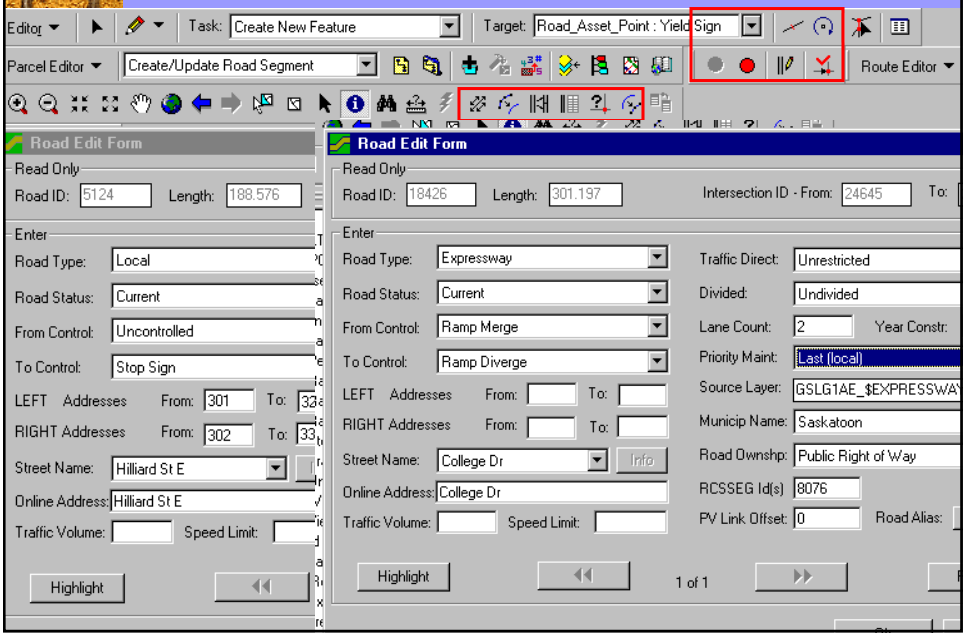
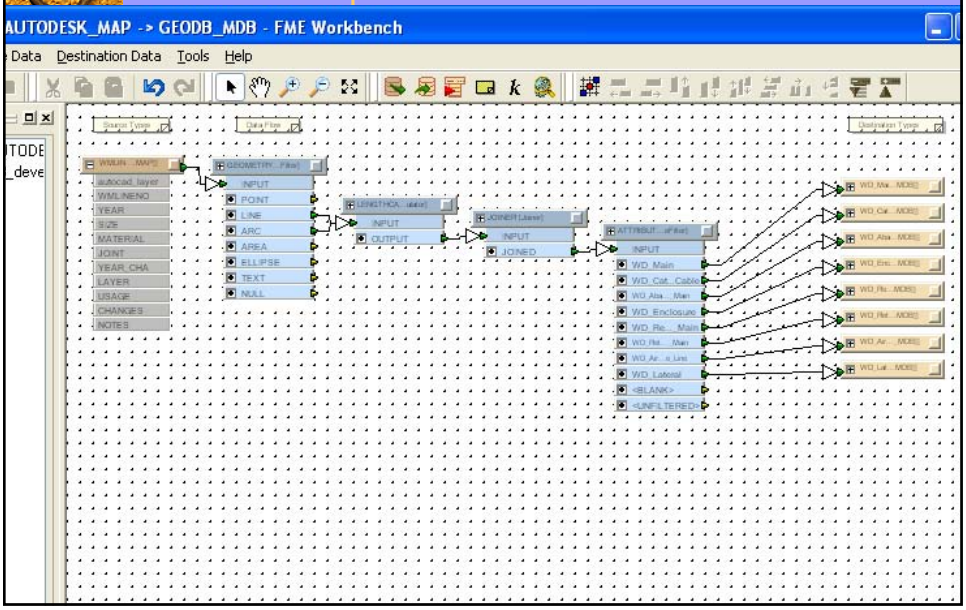
Parcel Editor (NovaLIS)



SAFE FME Workbench

AutoCAD map to Personal GeoDB to SDE and back



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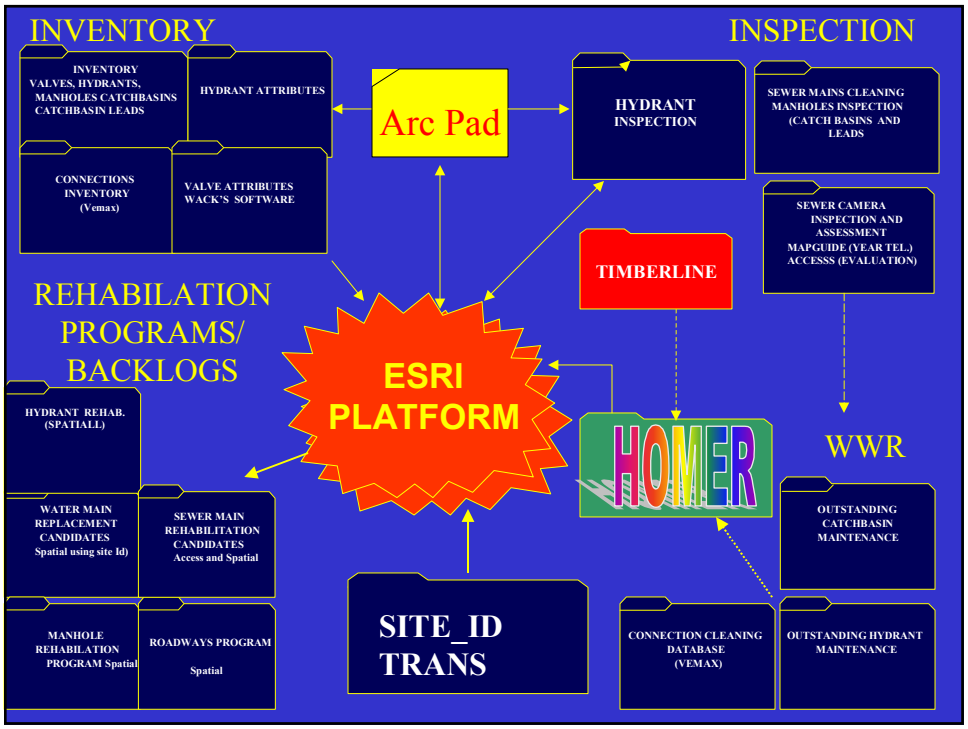
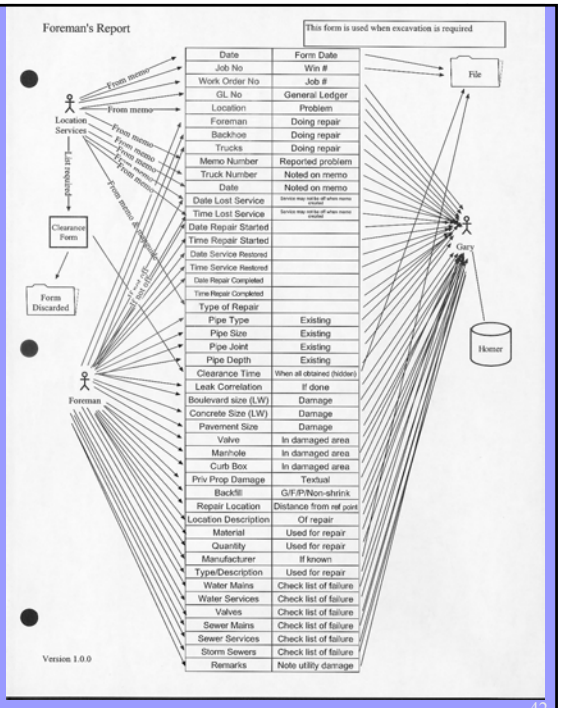


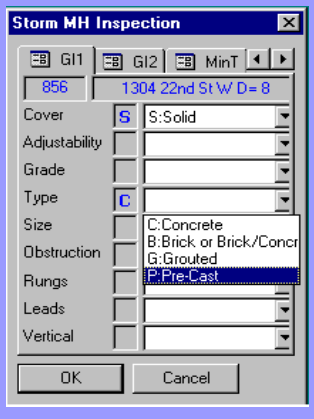
Field Collection applications

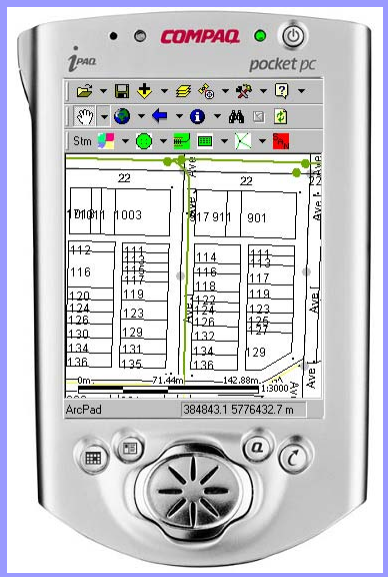
- ArcPad
- Public Works operations
  - Excavation Works
  - Flushing & Brushing
  - Hydrant inspection
  - Valve inspection
  - Video Inspection
  - Manhole Inspection
  - Catch Basin Inspection
  - Road Rating
  - Sidewalk inspection
  - Trouble crews
- Other systems:
- Municipal Engineering
  - Signs
  - Water levels
  - Rain gauges
  - Traffic Volumes
  - Traffic Signal (StreetWise)

Maintenance Memo to Foreman's Report

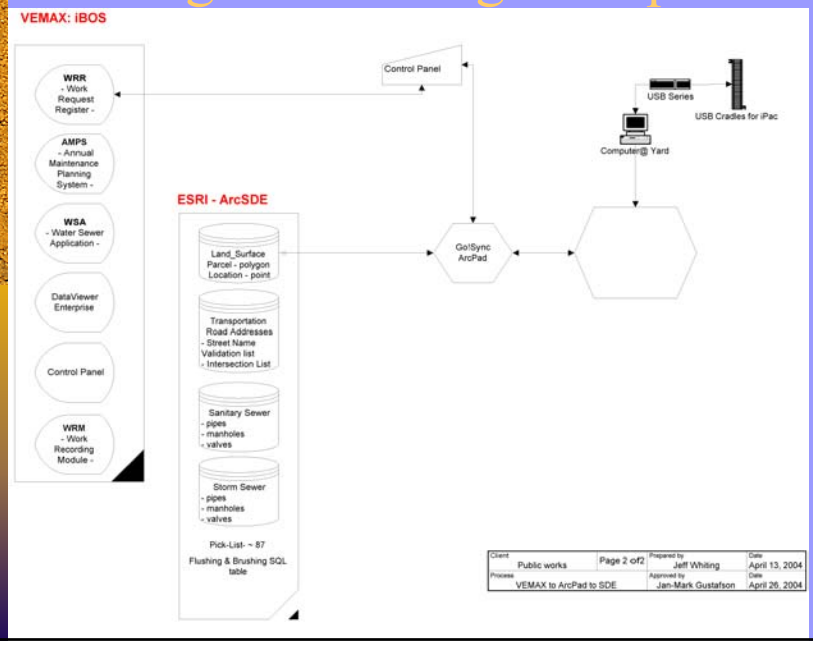


ArcPAD Example





Flushing & Brushing example



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H ole
O pen
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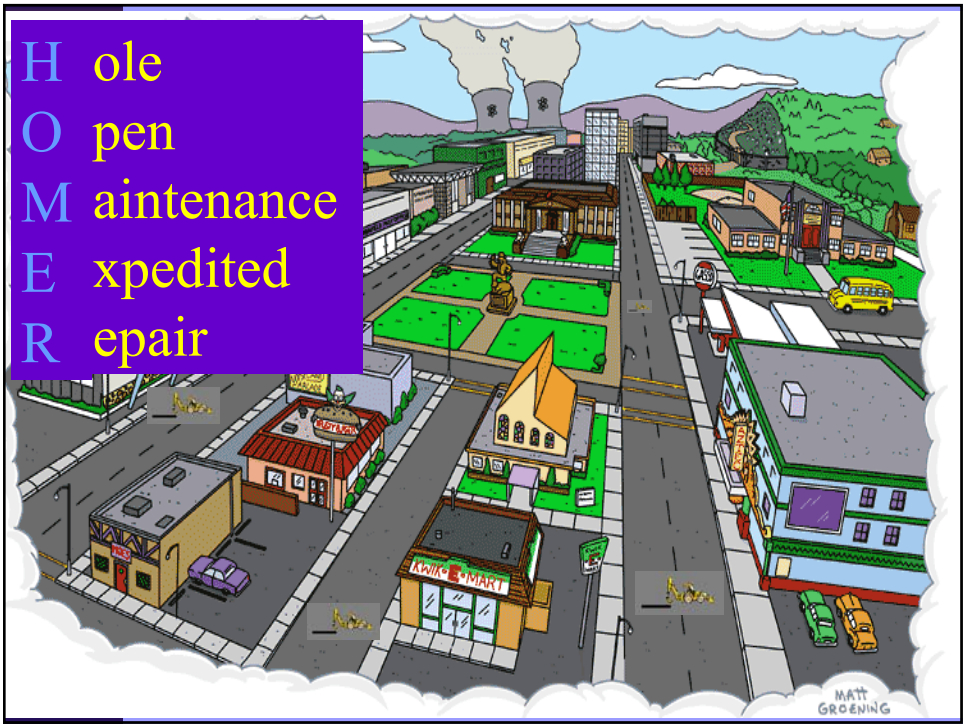
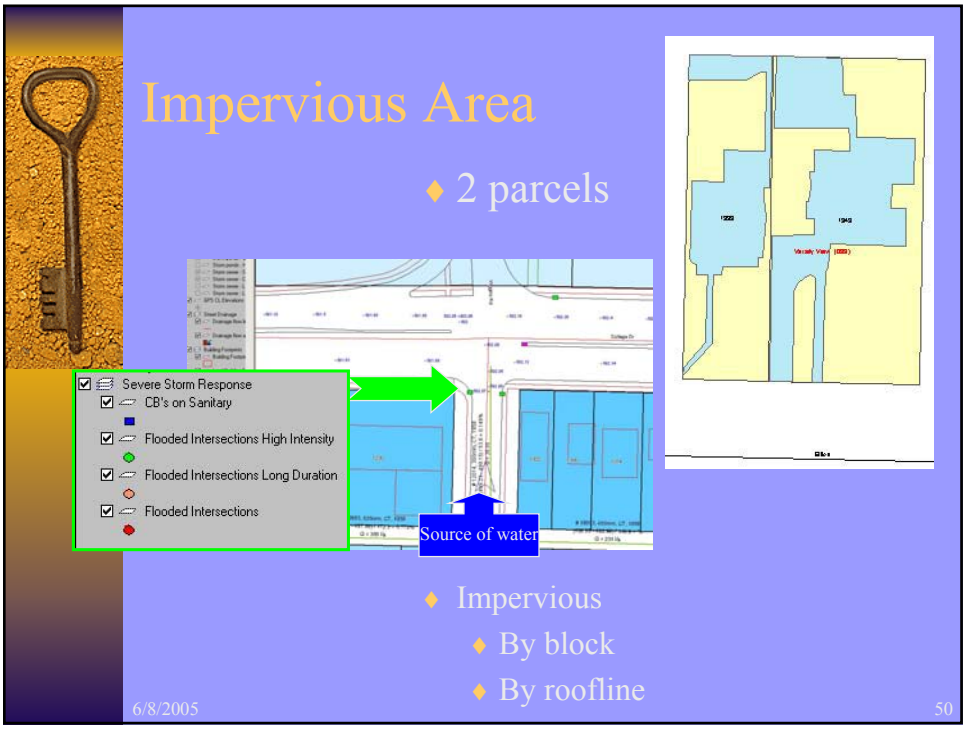
E xpedited
R epair





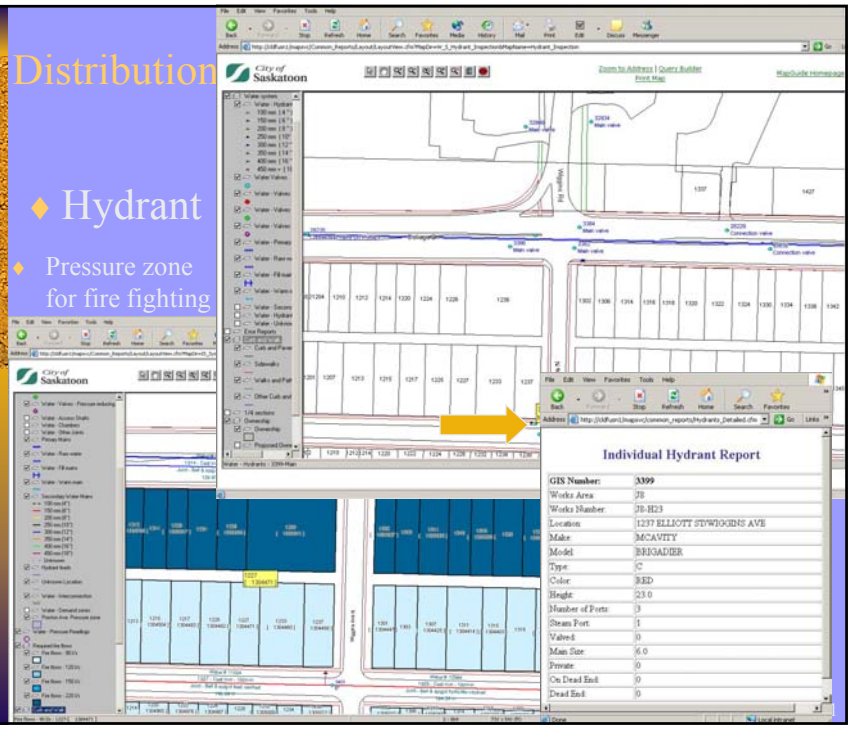
Impervious Area

- 2 parcels

- Impervious
  - By block
  - By roofline

Water Distribution

- Hydrant
- Pressure zone for fire fighting



Water Consumption

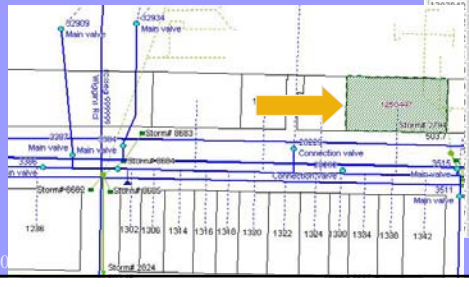
- Individual house
- Block
- Iron pipe connection

Infrastructure Services - Water Consumption Report

Site ID	Site Address	Type	Status	Year	Consumption Amt/Yr (cu. ft.)	Meter Size
1303841	1236 College Dr, Saskatoon, SK CA	WATER	ON	2001	166,574.61	2"
1303841	1236 College Dr, Saskatoon, SK CA	WATER	ON	2002	189,441.16	2"
1303841	1236 College Dr, Saskatoon, SK CA	WATER	ON	2003	201,091.88	2"
1303841	1236 College Dr, Saskatoon, SK CA	WATER	ON	2004	137,350.61	2"

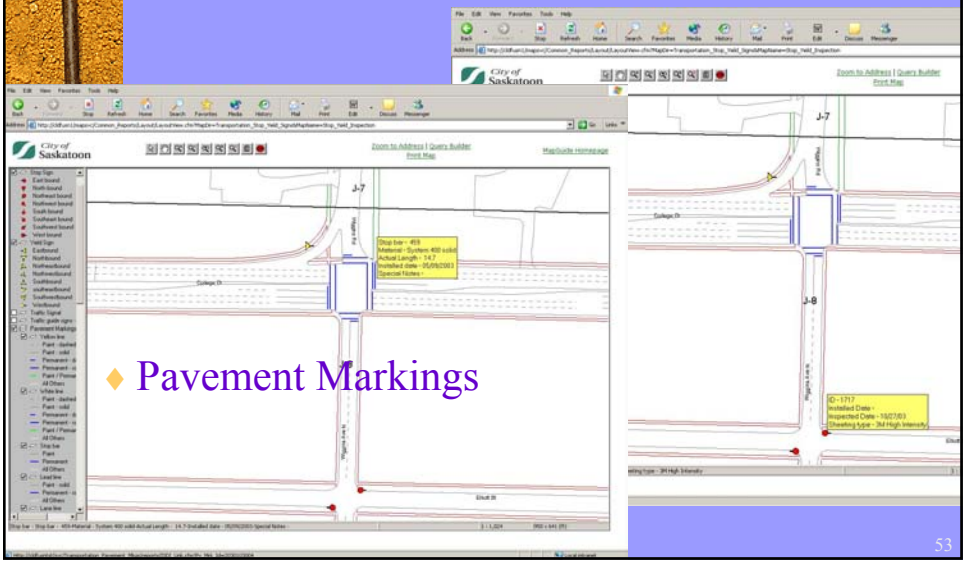
Infrastructure Services - Water Consumption Report

Site ID	Site Address	Type	Status	Year	Consumption Amt/Yr (cu. ft.)	Me
1590827	1302 College Dr, Saskatoon, SK CA	WATER	ON	2001	19,096.62	3/4"
1590827	1302 College Dr, Saskatoon, SK CA	WATER	ON	2002	33,440.96	3/4"
1590827	1302 College Dr, Saskatoon, SK CA	WATER	ON	2003	24,082.38	3/4"
1590827	1302 College Dr, Saskatoon, SK CA	WATER	ON	2004	21,412.88	3/4"
1303953	1342 College Dr, Saskatoon, SK CA	WATER	ON	2001	19,044.58	3/4"
1303953	1342 College Dr, Saskatoon, SK CA	WATER	ON	2002	24,672.42	3/4"
1303953	1342 College Dr, Saskatoon, SK CA	WATER	ON	2003	18,274.21	3/4"
1303953	1342 College Dr, Saskatoon, SK CA	WATER	ON	2004	15,934.88	3/4"
1303942	1338 College Dr, Saskatoon, SK CA	WATER	ON	2001	23,325.37	5/8"
	1338 College Dr, Saskatoon, SK CA	WATER	ON	2002	21,721.90	5/8"
	1338 College Dr, Saskatoon, SK CA	WATER	ON	2003	19,320.78	5/8"
	1338 College Dr, Saskatoon, SK CA	WATER	ON	2004	14,917.83	5/8"
	1334 College Dr, Saskatoon, SK CA	WATER	ON	2001	5,313.04	5/8"
	1330 College Dr, Saskatoon, SK CA	WATER	ON	2001	10,455.14	5/8"
	1330 College Dr, Saskatoon, SK CA	WATER	ON	2002	12,447.49	5/8"
	1330 College Dr, Saskatoon, SK CA	WATER	ON	2003	10,578.95	5/8"
	1324 College Dr, Saskatoon, SK CA	WATER	ON	2001	5,668.87	5/8"
	1324 College Dr, Saskatoon, SK CA	WATER	ON	2002	5,255.10	5/8"
	1324 College Dr, Saskatoon, SK CA	WATER	ON	2003	7,199.01	5/8"
	1324 College Dr, Saskatoon, SK CA	WATER	ON	2004	2,771.09	5/8"
	1322 College Dr, Saskatoon, SK CA	WATER	ON	2001	56,253.06	1"
	1322 College Dr, Saskatoon, SK CA	WATER	ON	2002	65,796.94	1"
	1322 College Dr, Saskatoon, SK CA	WATER	ON	2003	58,361.23	1"
	1322 College Dr, Saskatoon, SK CA	WATER	ON	2004	47,793.02	1"



Traffic system

- Stop/Yield/Traffic Lights



- Pavement Markings

The presentation:

- Engineering GIS Objectives
  - Strategies
  - Tactics
  - Status today
- GIS access
- Data Models
- Editing & data transfer
- How is data integrated
- How is data analyzed
- Is the Enterprise integrated & Seamless?

While the target was seamless, it was not achieved

- **Just want to hide the seams**
- **The user doesn't need to know the seams exist**
- **Not just 1 solution to all our problems ("opportunities"), just a common data store accessed differently!**

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Author Information:

Jeff Whiting
Information Management Consultant
Infrastructure Services
City of Saskatoon
222-3rd Ave., N.,
Saskatoon, Sk. Canada S7K 0J5
306-975-1460 FAX: 306-975-2971
Jeff.Whiting@City.Saskatoon.Sk.Ca

Glen Boos
System Analyst
Infrastructure Services
City of Saskatoon
222-3rd Ave., N.,
Saskatoon, Sk. Canada S7K 0J5
306-975-2253 FAX: 306-975-2971
Glen.Boos@City.Saskatoon.Sk.Ca

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