

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



By
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Corporate Information Service

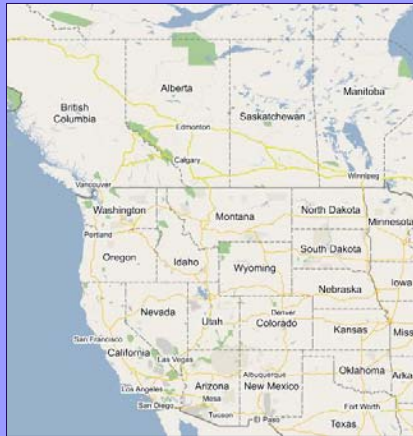
Presentation to ERSI 2005 User Conference



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

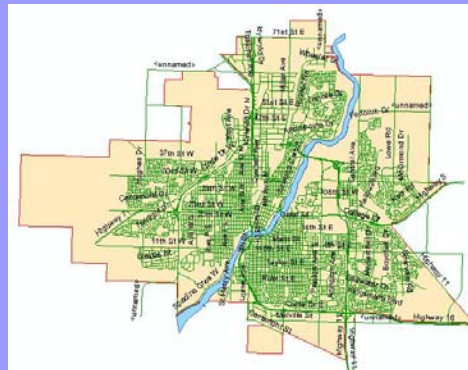


City of Saskatoon



Saskatoon:

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



The presentation:

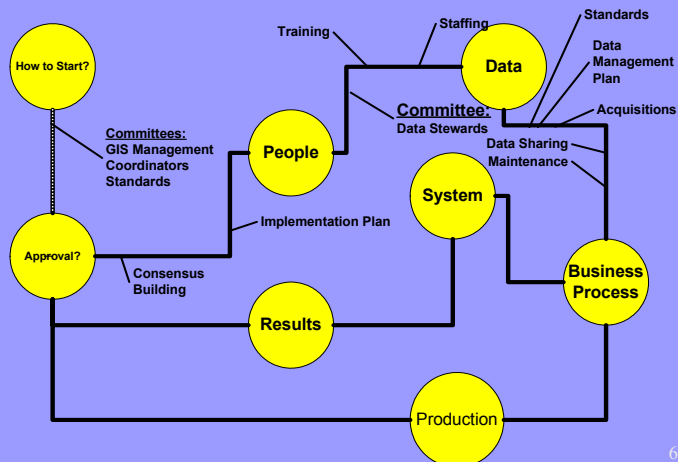
- ◆ Engineering GIS Objectives
 - Strategies
 - Tactics
 - Status today
- ◆ GIS access
- ◆ Data Models
- ◆ Editing & data transfer
- ◆ How is data integrated
- ◆ How is data analyzed
- ◆ Is the Enterprise integrated & Seamless?

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Engineering GIS Objectives

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



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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

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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

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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

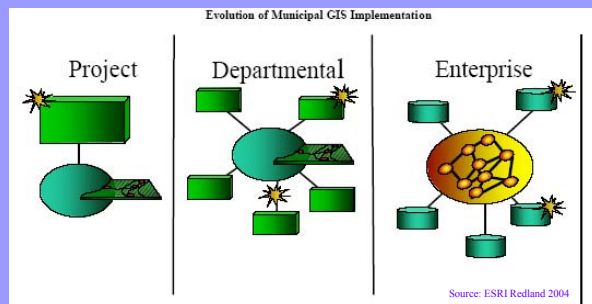
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Background



- 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



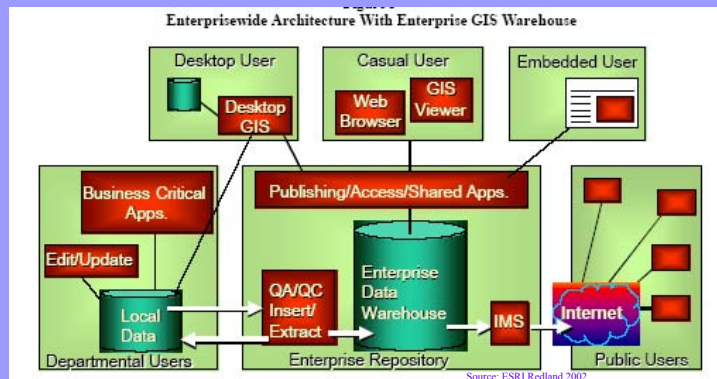
Background (con't)



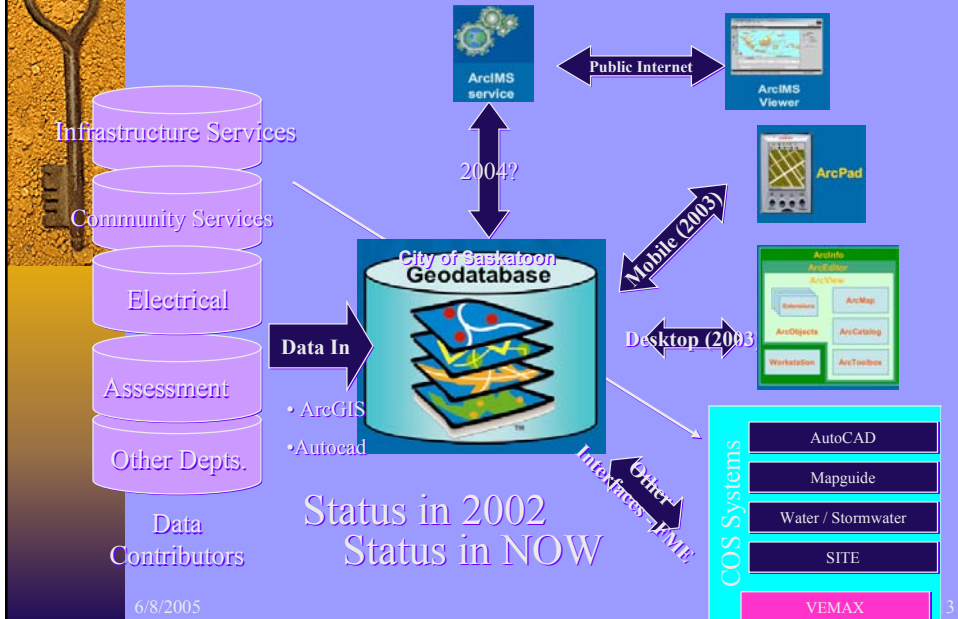
- 1997, Mapguide Enterprise / Intranet applications
- 2000, choose ESRI's SDE data engine and ArcGIS 8 as Enterprise host.

Integration of Data Stores

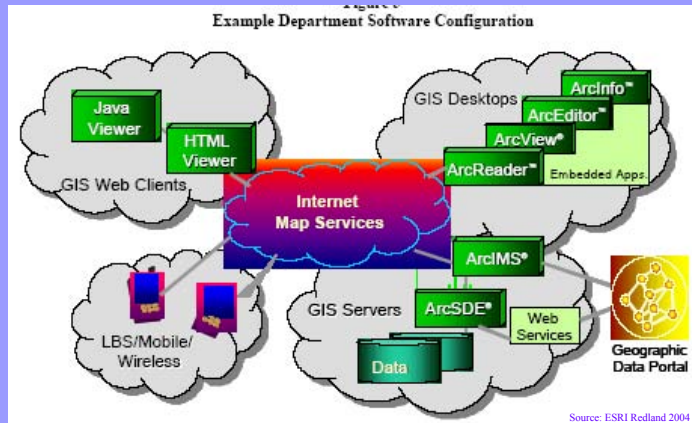
- ◆ Where we are now

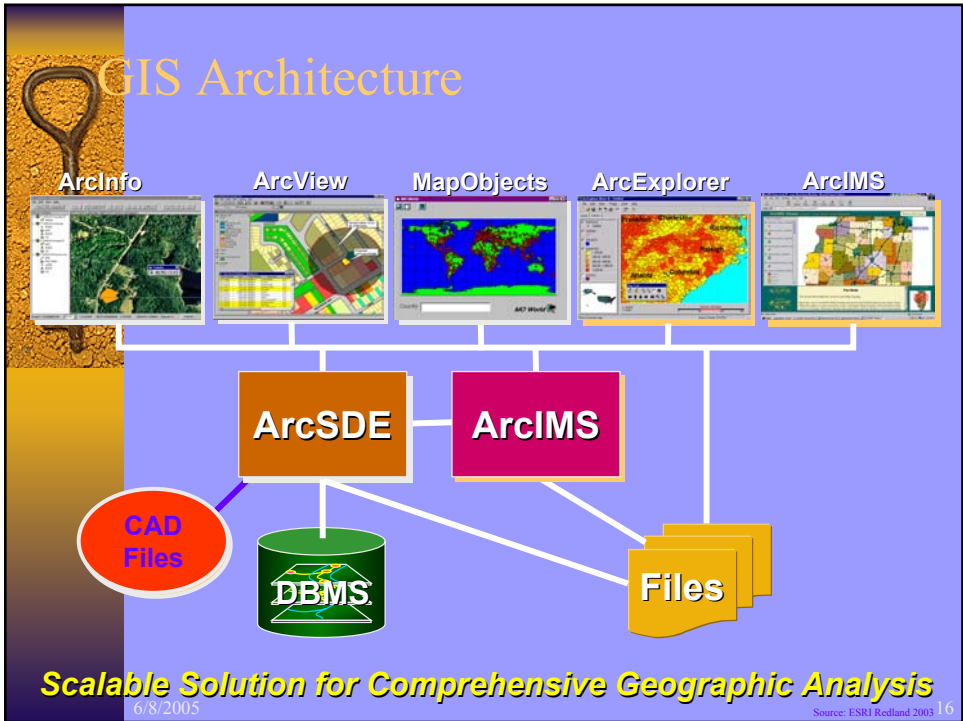


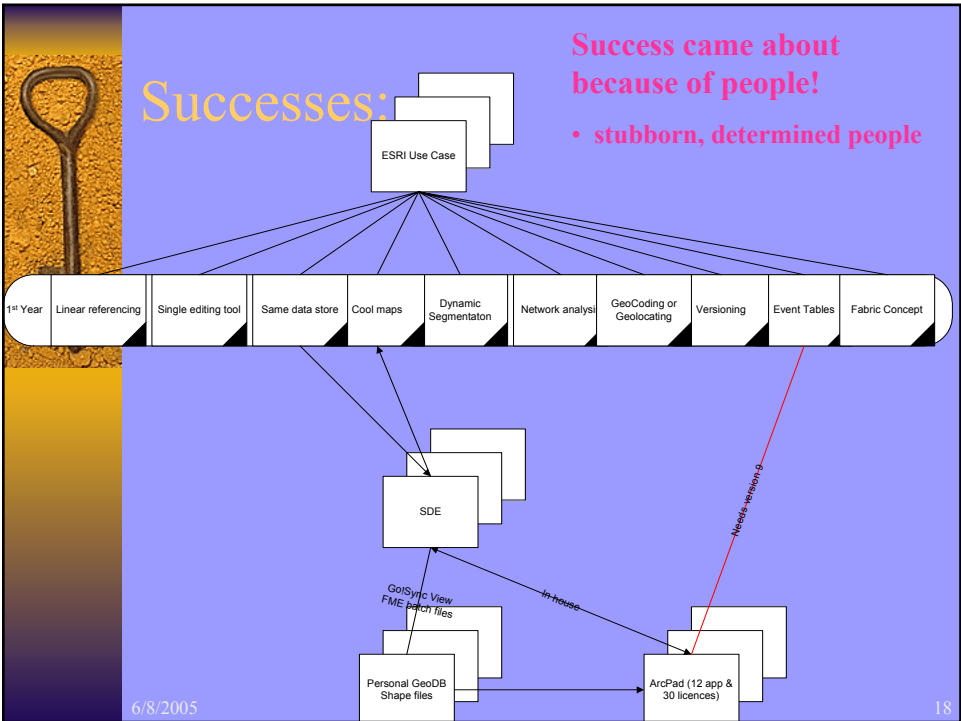
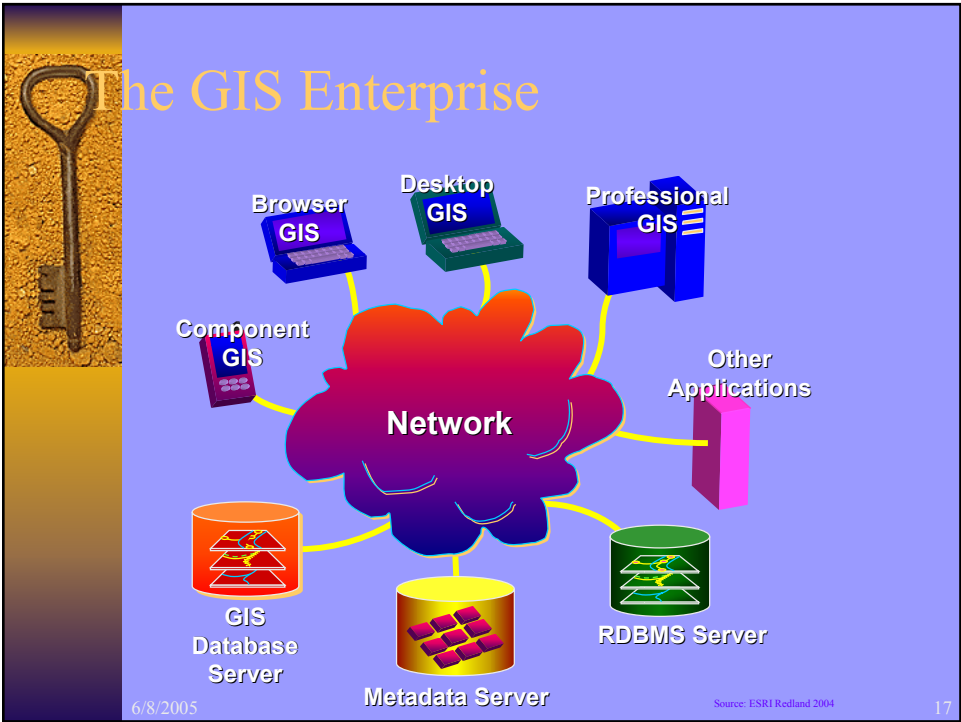
Saskatoon Enterprise

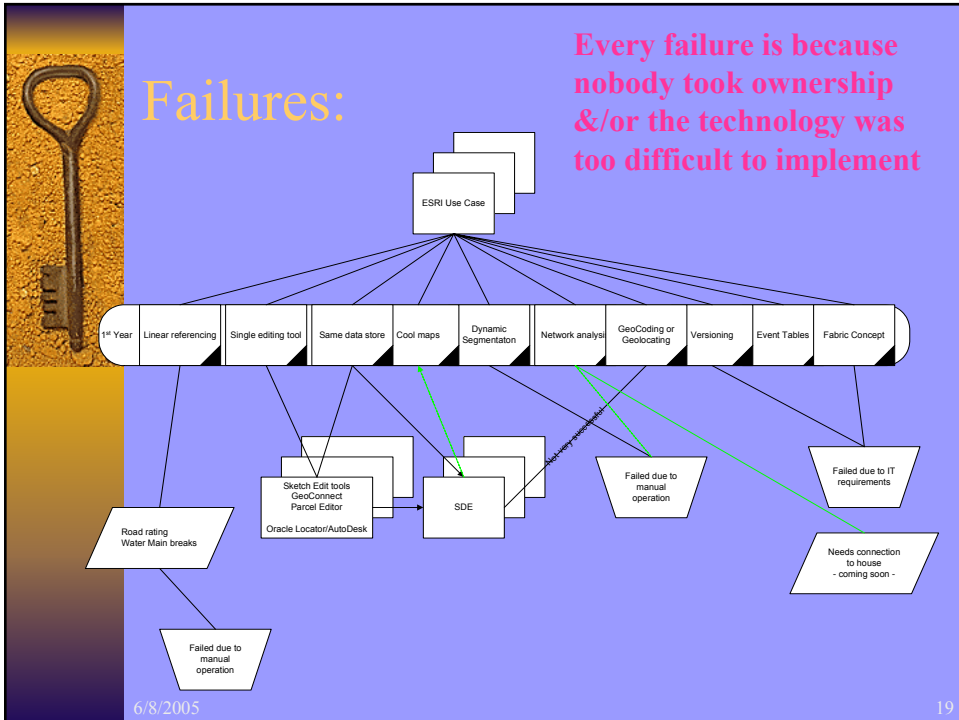


The target – Totally integrated & seamless?









- # The presentation:
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 - ◆ Editing & data transfer
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- 6/8/2005
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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	

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View All Since Tracking Started

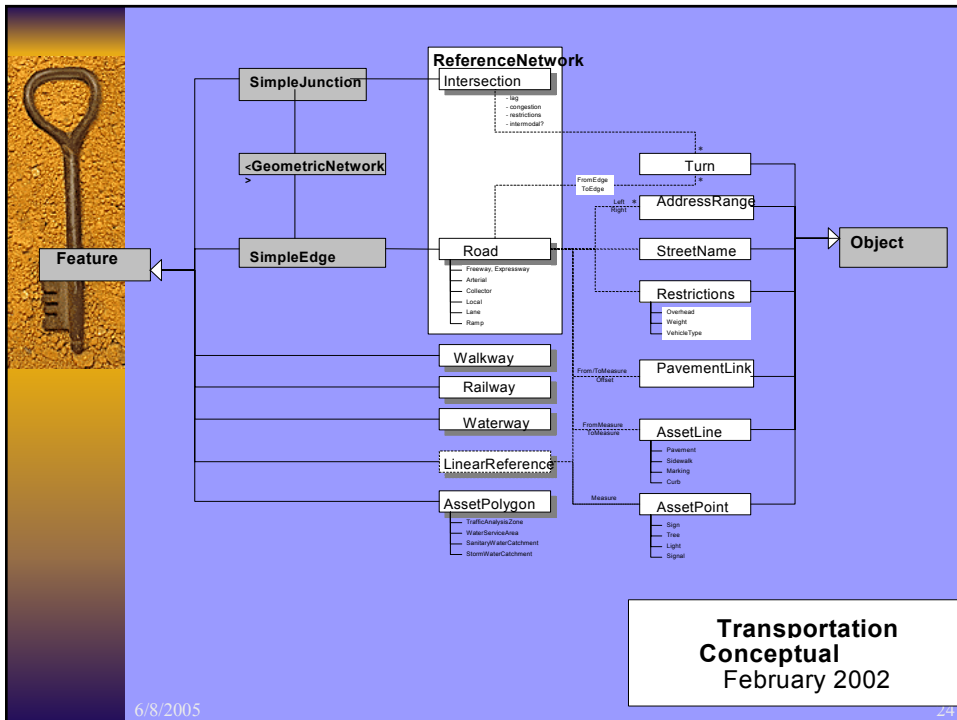
Map Name:	Unique Users: Count:	%	Total Hits: Count:	%
ownerzoning	524	77%	15743	37.50%
IS_Document_Retrieval	221	33%	6334	15.10%
Clearance	168	25%	5817	13.80%
IS_Connection_Cards_Retrieval	155	23%	4633	11.00%
Electrical	90	13%	1858	4.43%
Survey_Benchmarks	91	13%	803	1.92%
Aerial_Photo_Locator	233	34%	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_Modeling	63	9%	321	0.77%
Traffic_Volume	57	8%	309	0.74%
W_S_Data_Retrieval	35	5%	285	0.68%
RdStructureClass	71	10%	285	0.68%
Sewer_Main_Operations	57	8%	258	0.62%
Catchbasin	86	13%	241	0.57%
Sewer_Camera	35	5%	207	0.49%
IS_System_Modeling_Storm	67	10%	195	0.47%
Hydrant_Inspection	47	7%	191	0.46%
IS_System_Modeling_Water_Dist	59	9%	161	0.38%
Stop_Yield_Inspection_Update	2	0%	133	0.32%
IS_System_Modeling_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%
lary	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		41928	

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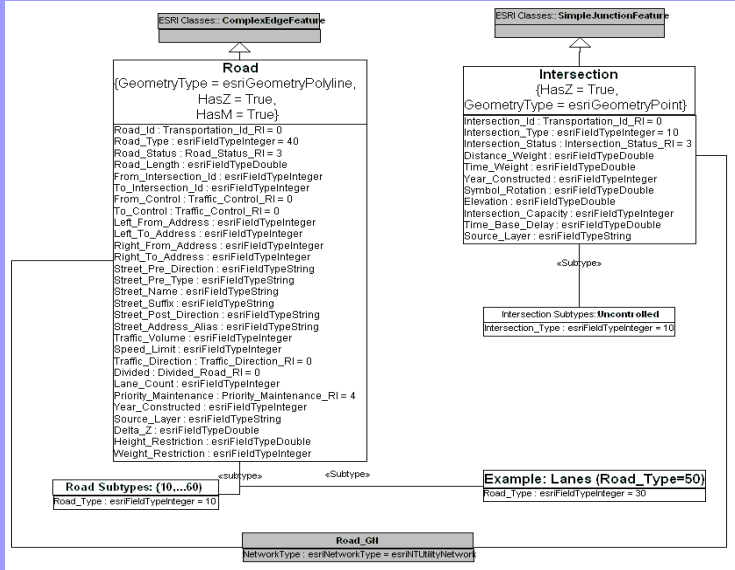
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- ## Transportation Use Cases
- Create New Road
 - Flip Road Links
 - Update Road Status by Graphic Selection
 - Create Pavement Link Feature Class
 - Populate Turn Table
 - Export to TMODEL
 - Create / Update Traffic Analysis Zones
- 6/8/2005 25

Transportation Data Model



Physical Implementation of Road Network in SDE

The screenshot shows the ArcMap interface with a road network displayed in a grid-like pattern. A table window is open, showing the following data:

Field	Value
OBJECTID	706
ENABLED	True
ROAD_ID	4012
ROAD_TYPE	Local
ROAD STATUS	Control
ROAD_LENGTH	61.383
FROM_INTERSECTION_ID TO_INTERSECTION_ID	196
FROM_CONTROL TO_CONTROL	2072
LEFT_FROM_ADDRESS LEFT_TO_ADDRESS	201
RIGHT_FROM_ADDRESS RIGHT_TO_ADDRESS	202
STREET_PRE_DIRECTION STREET_POST_DIRECTION	11th St E
STREET_NAME STREET_SUFFIX	11th St E
ONLINE_STREET_NAME TRAFFIC_VOLUME	11th St E
SPEED_LIMIT	11th St E
TRAFFIC_DIRECTION	Unrestricted
DIVIDED	Undivided
LANE_COUNT	11th St E
PRIORITY_MAINTENANCE	Local
YEAR_CONSTRUCTED	1300
SOURCE_LAYER	ESRI_SDE_LOCAL
DELTA_Z	11th St E
HEIGHT_RESTRICTION	11th St E
WEIGHT_RESTRICTION	11th St E
Municipality Name	11th St E
Road Ownership	11th St E
SHAPE	Polyline
ORIGINAL STATUS	LOCAL
ROAD CLASS	LOCAL
RCSID	11th St E
FLIP_FLAG	11th St E
SHAPE len	61.38366



Implement Enterprise GIS (Water, Sanitary and Storm Sewer)

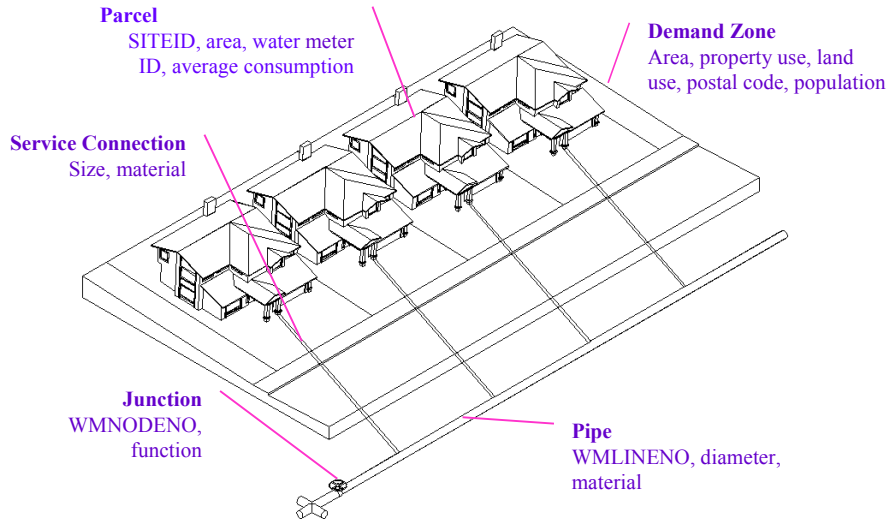
- ◆ Water Distribution System
 - Primary (Trunk) - operational
 - Secondary – operational
 - Every customer's demand is represented
- ◆ Sanitary Sewer Collection System
 - 1 city wide model - end of 2005
- ◆ Storm Water Management System
 - 45 catchment-scale models – operational

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Water Distribution Modeling



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Water Distribution Data Model

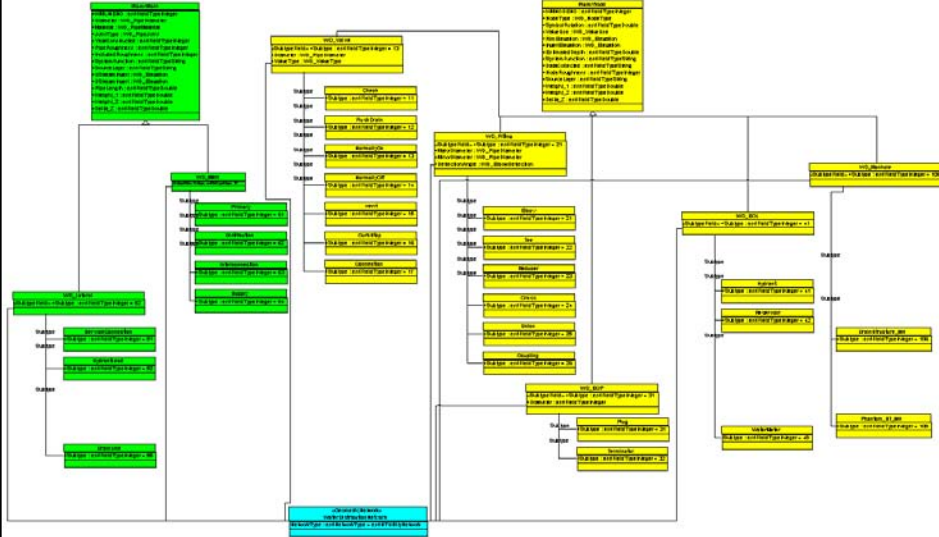
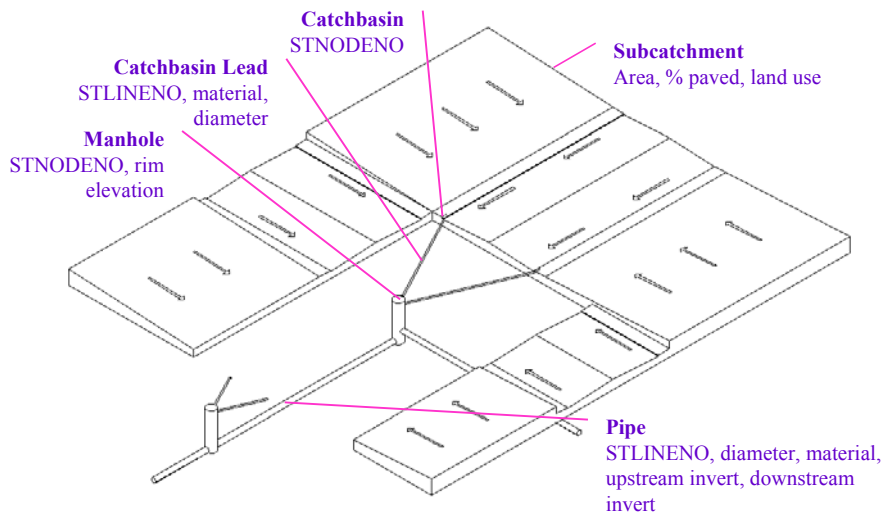


Figure 4.1 City of Saskatoon
First Generation UML - Water Distribution
Author: David W. LeBlond, June 25, 2001

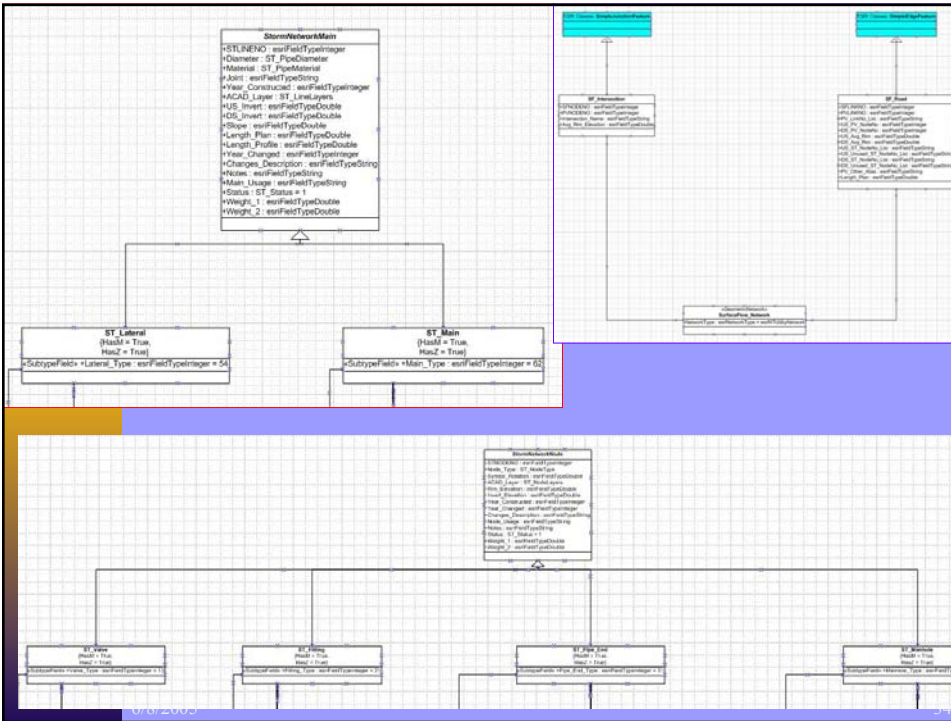
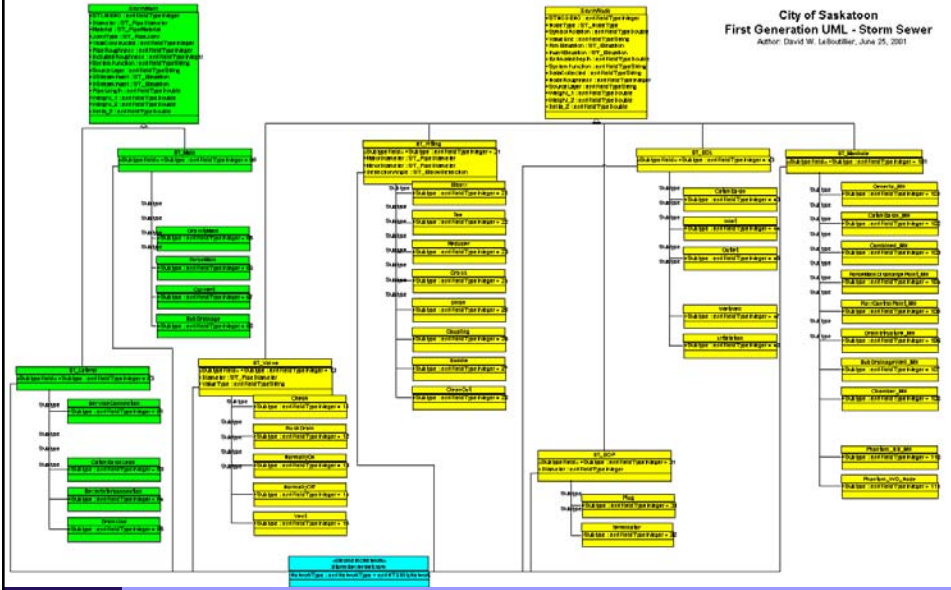
Storm Water Modeling





Storm Sewer Data Model

City of Saskatoon
First Generation UML - Storm Sewer
Author: David W. LeBlond, June 25, 2001



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Parcel Editor (NovaLIS)

Editor ▾ | Task: Create New Feature | Target: Road_Asset_Point : Yield Sign ▾

Parcel Editor ▾ | Create/Update Road Segment | Route Editor ▾

Road Edit Form

Read Only: Road ID: 5124 Length: 188.576

Enter: Road Type: Local Road Status: Current From Control: Uncontrolled To Control: Stop Sign

LEFT Addresses From: 301 To: 324
RIGHT Addresses From: 302 To: 336
Street Name: Hilliard St E
Online Address: Hilliard St E
Traffic Volume: Speed Limit:

Road Edit Form

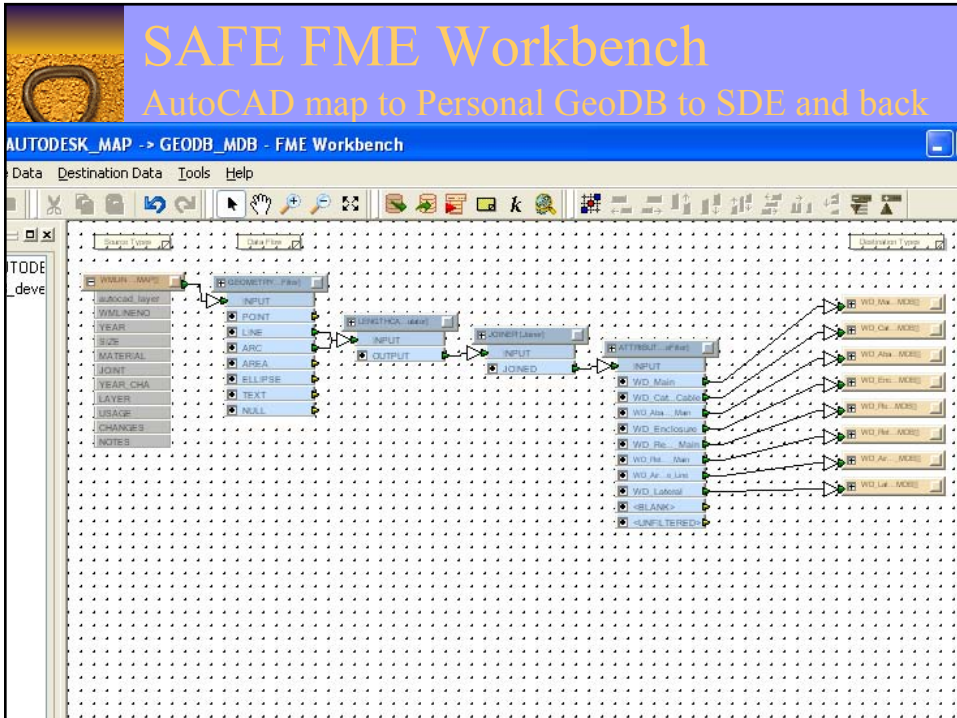
Read Only: Road ID: 18426 Length: 301.197 Intersection ID - From: 24645 To: []

Enter: Road Type: Expressway Traffic Direct: Unrestricted
Road Status: Current Divided: Undivided
From Control: Ramp Merge Lane Count: 2 Year Constr: []
To Control: Ramp Diverge Priority Maint: Last (local)

LEFT Addresses From: To:
RIGHT Addresses From: To:
Street Name: College Dr Info
Online Address: College Dr
Traffic Volume: Speed Limit:

Source Layer: GSLG1AE_4EXPRESSWA
Municip Name: Saskatoon
Road Ownshp: Public Right of Way
RCSSEG Id(s): 8076
PV Link Offset: 0 Road Alias: []

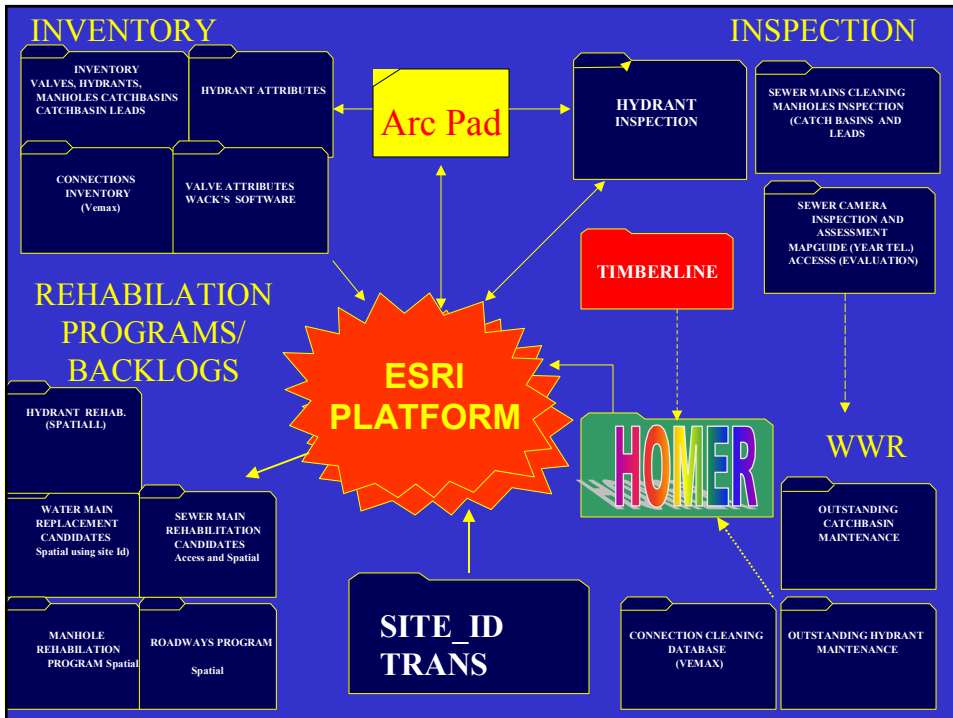
1 of 1



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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)

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Maintenance Memo to Foreman's Report

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Foreman's Report

This form is used when excavation is required

Date	Form Date	File
Work Order No	Job #	
GL No	General Ledger	
Location	Problem	
Foreman	Doing repair	
Backhoe	Doing repair	
Trucks	Doing repair	
Memo Number	Reported problem	
Truck Number	Noted on memo	
Date	Noted on memo	
Date Lost Service		
Time Lost Service		
Date Repair Started		
Time Repair Started		
Date Service Restored		
Time Service Restored		
Date Repair Completed		
Time Repair Completed		
Type of Repair		
Pipe Type	Existing	
Pipe Size	Existing	
Pipe Joint	Existing	
Pipe Depth	Existing	
Clearance Time	When at street (hours)	
Leak Correlation	If done	
Boulevard size (LW)	Damage	
Concrete Size (LW)	Damage	
Pavement Size	Damage	
Valve	In damaged area	
Manhole	In damaged area	
Curb Box	In damaged area	
Priv Prop Damage	Textual	
Backfill	G/F/P/Non-shrink	
Repair Location	Distance from ref point	
Location Description	Of repair	
Material	Used for repair	
Quantity	Used for repair	
Manufacturer	If known	
Type/Description	Used for repair	
Water Mains	Check list of failure	
Water Services	Check list of failure	
Valves	Check list of failure	
Sewer Mains	Check list of failure	
Sewer Services	Check list of failure	
Storm Sewers	Check list of failure	
Remarks	Note utility damage	

Version 1.0.0

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ArcPAD Example

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Storm MH Inspection

GI1 GI2 MinT

856 1304 22nd St W D=8

Cover S S:Solid

Adjustability

Grade

Type C

Size C: Concrete
B: Brick or Brick/Concr
G: Grouted
F: Pre-Cast

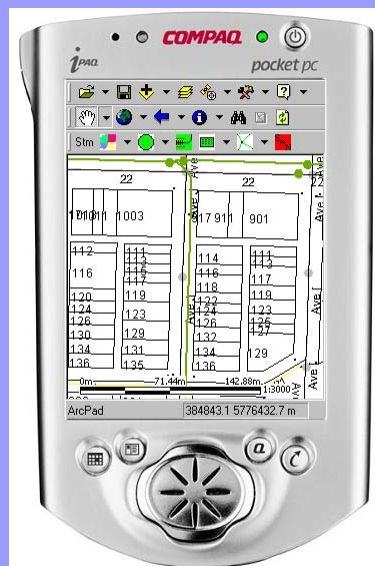
Obstruction

Rungs

Leads

Vertical

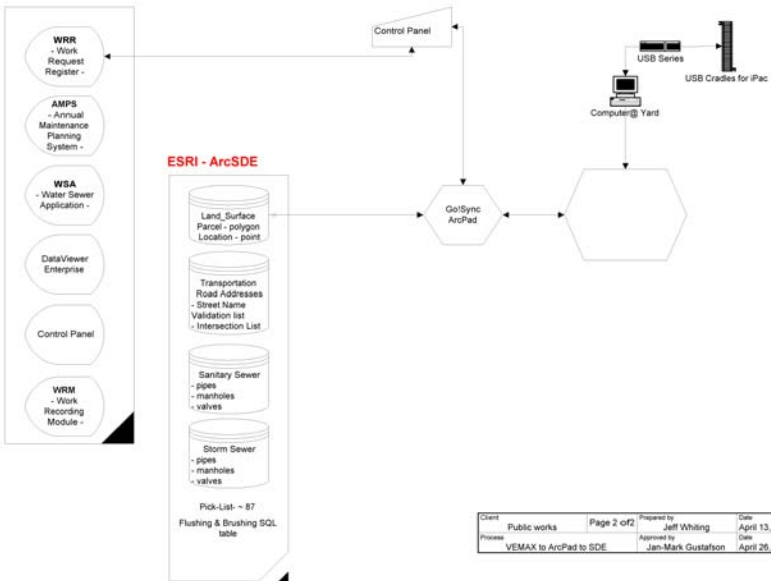
OK Cancel



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Flushing & Brushing example

VEMAX: IBOS



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The presentation:

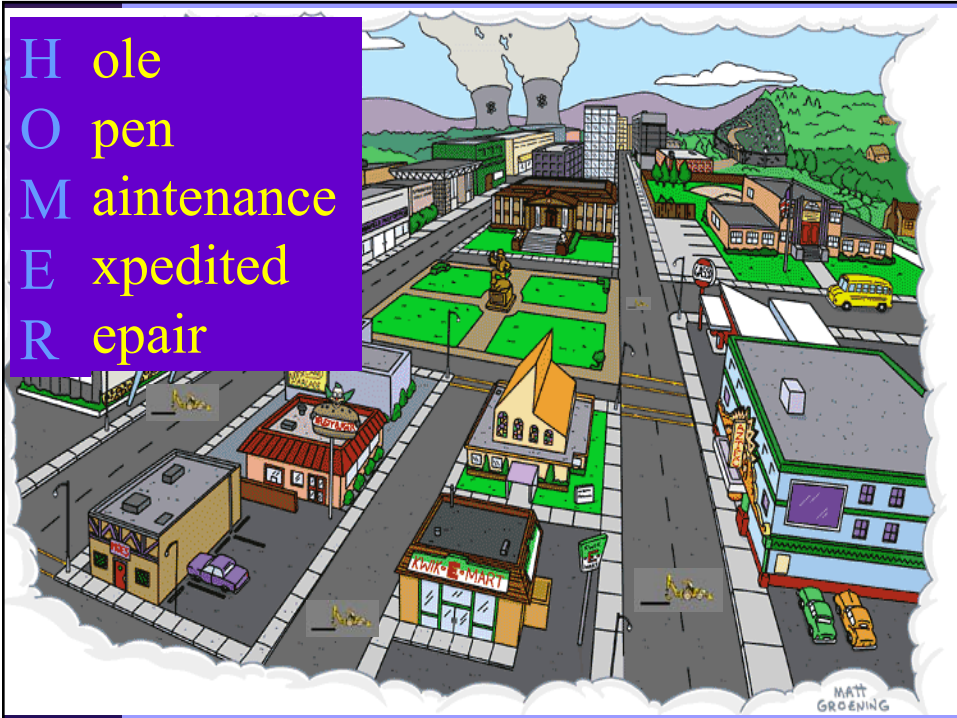
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Hole
Open
Maintenance
Expedited
Repair

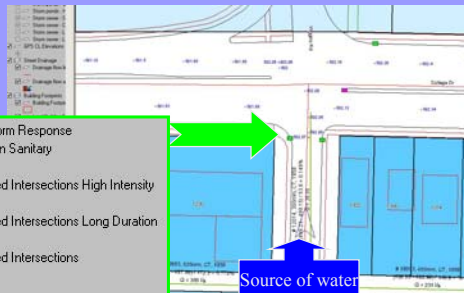


Impervious Area

◆ 2 parcels



- Severe Storm Response
- CB's on Sanitary
- Flooded Intersections High Intensity
- Flooded Intersections Long Duration
- Flooded Intersections



- ◆ Impervious
- ◆ By block
- ◆ By roofline

Water Distribution

- ◆ Hydrant
- ◆ Pressure zone for fire fighting

Individual Hydrant Report

GIS Number:	3399
Works Area:	JB
Works Number:	JB-B23
Location:	1237 BELLIOTT STYWOODS AVE
Make:	MCQUAY
Model:	BE3ADDER
Type:	C
Color:	RED
Height:	23.0
Number of Ports:	3
Stream Port:	1
Valves:	0
Main Size:	6.0
Private:	0
On Dead End:	0
Dead End:	0

Water Consumption

- ◆ Individual house
- ◆ Block
- ◆ Iron pipe connection

Infrastructure Services - Water Consumption Report

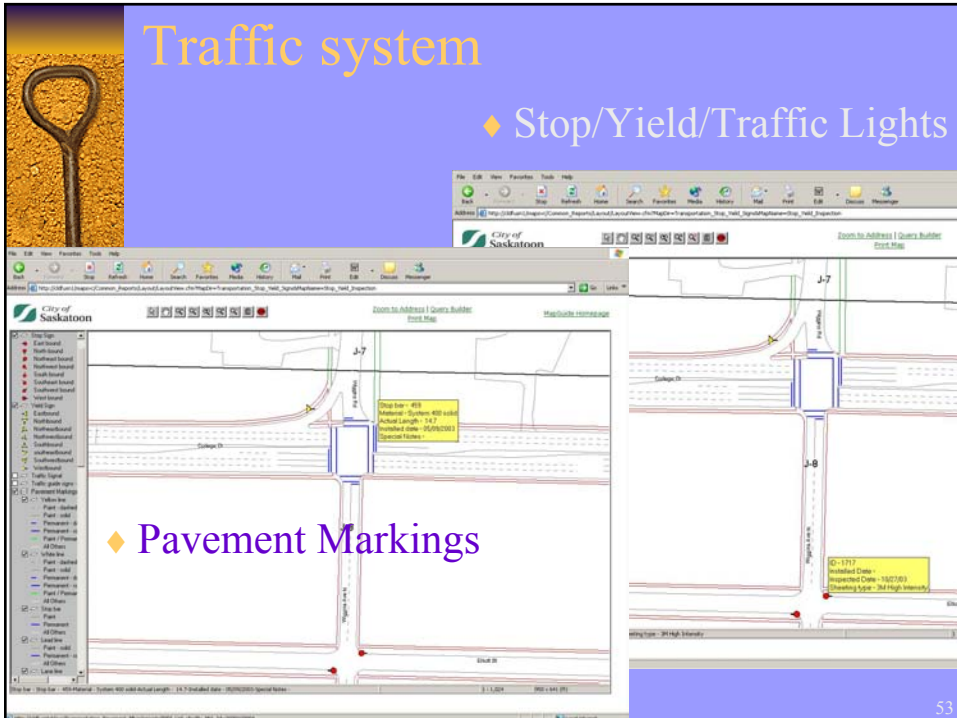
Site ID	Site Address	Type	Status	Year	Consumption Amt/Yr (cu. ft.)	Meter Size
1303841	1236 College Dr, Saskatoon, SK CA	WATER	ON	2001	166,574.61	2"
1303841	1236 College Dr, Saskatoon, SK CA	WATER	ON	2002	189,441.16	2"
1303841	1236 College Dr, Saskatoon, SK CA	WATER	ON	2003	201,091.88	2"
1303841	1236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

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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!**



References:

Dmitruk, Lorne *City of Saskatoon Gap Analysis*, ERSI Canada, Edmonton 2001
Horwood, David. *City of Saskatoon Implementation Strategy*, ERSI Canada Enterprise Solutions Group, Toronto 2001
Infrastructure Service, *Implementation Strategy*, City of Saskatoon Saskatoon 2003
_____. *Transportation Model*, City of Saskatoon Saskatoon 2003

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