

UPDATE ON INFILTRATION / INFLOW (I&I)

For
CITY OF RAPID CITY
(Public Works Committee 11/01/05)

- In April 1994 the Alliance of Architects & Engineers completed a report titled, "Infiltration / Inflow Study for the City of Rapid City, South Dakota". This report compiled three tables of I&I projects illustrated on the attached map and identified as follows:
 - Table 1 – Recommended Areas for Sanitary Sewer Rehabilitation
 - Table 2 – Areas Not Cost Effective for Rehabilitation
 - Table 3 – Areas That No Cost Effective Analysis Could Be Performed
 - Map – I&I Study by Alliance - 1994
- In October 1997 CETEC Engineering Services, Inc. completed a report titled, "Summary Report Southeast Rapid City infiltration / Inflow Study for the City of Rapid City, SD". This report expanded on the 1994 Alliance report and addressed specific I&I and backflow occurrences in the Southeast part of the City. This report recommended a three-phase trunk sewer replacement project.
- In addition, City staff has identified several sanitary sewers which were or are contributors of Infiltration / Inflow to the system. These projects have either been completed or are in the Short or Long Term Capital Improvement Plan. These projects are illustrated on the attached map and identified as follows:
 - Table 4 – Additional I&I Projects Identified and Completed
 - Map - Additional I&I Projects Identified and Completed

IMPORTANT TERMS

Infiltration

Water entering a sewer system and service connections from the ground through such means as defective pipes, pipe joints, connections, or manholes.

Inflow

Water discharged into a sewer system and service connections from such sources as roof drains, yard and area drains, foundation drains, manhole covers, cross connections from storm sewers, surface runoff, or drainages.

Excessive I&I

The quantity of I&I which can be economically eliminated from a sewer system by rehabilitation as determined by a "cost-effective" analysis that compares the cost of rehabilitation to the costs for transportation and treatment of the I&I.

Effectiveness of I&I Removal

The effectiveness of Infiltration/ Inflow removal is elusive because as you remove a source of infiltration, groundwater has the ability to migrate to the next weakest links in the sewer system and begin infiltration there. The CETEC Study for the Southeast area of the City determined that as much as 90% of groundwater infiltration was from private service lines, either from leaking services pipes or basement dewatering systems.

IMPORTANT TERMS

CIP Public Works - Capital Improvement Projects
(as assigned in the 'Plan It' software)

Short Term Plan CIP projects proposed within the budget years
2005 – 2009.

Long Term Plan CIP projects not proposed within the budget
years 2005 – 2009.

INFILTRATION / INFLOW STUDY
for the
CITY OF RAPID CITY, SOUTH DAKOTA
by
the Alliance, April 1994

Alliance Table 1 - Recommended Areas For Sanitary Sewer Rehabilitation

Segment No.:	Status	Notes:
1	Completed	Empey Dr. Sewer
2	Long Term Plan	Project is identified but not scoped. The trunk sewer needs to be assessed as part of the Utility Master Plan regarding future capacity needs. Coordination with Pennington County and Fairgrounds will also be an issue.
3	Long Term Plan	Project 50194 was budgeted for 2006 but because of budget and staffing issues was moved off of the 5-year plan. The project is located along Rapid Creek generally in the area between Canyon lake Dr. and 32nd St. and consists of rehabilitation of sewer manholes and specific sewer pipe segments.
4	Completed	Sewer Rehabilitation east of Dakota Dr.
5	Completed	Hubbard Milling Trunk Sewer Rehabilitation
6	Completed	City has identified project CIP 50338 that will address additional I&I found in this area (project is not currently in 5 year plan).
7	Long Term Plan (RVSD)	Project has been identified and expanded. Because of the City's growth north of Twilight Dr. the capacity of the sewer has to be assessed. This sewer is a RVSD sewer but City has in principal agreed to fund sewer component as their sewer transports sewer for the City service area to the north. Project also needs to be coordinated with Pennington. County's reconstruction of Jolly Lane./Race-Track Rd.
8	Completed	Meadowbrook Sewer Rehabilitation

(Refer to Map - "I and I Study by Alliance - 1994")

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Alliance Table 2 - Areas Not Cost Effective For Rehabilitation

Segment No.:	Status	Notes:
20	Not Completed	The Project identified in Alliance Study has not been scoped nor does it have a CIP Number assigned.
21	Not Completed	A small part of this project will be completed under the SDDOT Mt. View Street Reconstruction Project. The rest of the project identified in the Alliance Study is not scoped and does not have a CIP Number assigned.
22	Not Completed	The Project identified in Alliance Study has not been scoped nor does it have a CIP Number assigned.
119	Completed	W. Main & Platt St. Sewer Rehabilitation
23	Not Completed	The Project identified in Alliance Study has not been scoped nor does it have a CIP Number assigned.
24	Not Completed	The Project identified in Alliance Study has not been scoped nor does it have a CIP Number assigned.
25	Not Completed	The Project identified in Alliance Study has not been scoped nor does it have a CIP Number assigned.
26	Not Completed	The Project identified in Alliance Study has not been scoped nor does it have a CIP Number assigned.
27	Completed	Project was completed as part of a larger trenchless sewer rehabilitation project.
28	Not Completed	The Project identified in Alliance Study has not been scoped nor does it have a CIP Number assigned.
The segments identified on this table are typically addressed through attrition meaning that as other needs present themselves in the area then the sewer is addressed at that time. For example if the street needs to be reconstructed then in conjunction with that project the sewer typically would be reconstructed too.		

(Refer to Map - "I and I Study by Alliance - 1994")

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Alliance Table 3 - Areas That No Cost Effective Analysis Could Be Performed

Segment No.:	Status	Notes:
50	Not Completed	The Project identified in Alliance Study has not been scoped nor does it have a CIP Number assigned.
51	Not Completed	The Project identified in Alliance Study has not been scoped nor does it have a CIP Number assigned.
52	Not Completed	The Project identified in Alliance Study has not been scoped nor does it have a CIP Number assigned.
53	Approx. 50% Complete	Project was completed as part of a larger trenchless sewer rehabilitation project. Balance of segment to be completed with the Kansas City Street Project. (Table 4 Segment 117)
54	Short Term Plan	Included in the Kansas City Street Project
102	Completed	Project was completed as part of a larger trenchless sewer rehabilitation project
55	Not Completed	The Project identified in Alliance Study has not been scoped nor does it have a CIP Number assigned.
118	Completed	Park Dr. Reconstruction Project
111	Phase 1 & 3 of three phases. Phase 1 completed Phase 3 in Short Term Plan	Phase 1 & 3 of three phases completed. The first half of Phase 3 will be completed as part of the Meade/ Elm Reconstruction project. The second half of Phase 3 is not currently scoped nor does it have a CIP Number assigned. (This is tied with Segment 112)
112	Phase 2 of three phases. Phase 2 has been completed	Phases 1 & 2 of three phases completed. The first half of Phase 3 will be completed as part of the Meade/ Elm Reconstruction project. The second half of Phase 3 is not currently scoped nor does it have a CIP Number assigned. This is tied with Segment 111)
57	Short Term Plan and Long Term Plan	Part of this project will be completed under CIP Project No.: 50579. The remainder of the project has not yet been scoped nor does it have a CIP Number assigned.
56	Not Completed	The Project identified in Alliance Study has not been scoped nor does it have a CIP Number assigned.
114	Completed	Brookside Dr. Sewer Rehabilitation

The projects identified on this table are typically addressed through attrition meaning that as other construction needs present themselves in the area then the sewer is addressed at that time. For example if the street needs to be reconstructed then at that time the sewer would be reconstructed as well.

(Refer to Map - "I and I Study by Alliance - 1994")



**ADDITIONAL INFILTRATION / INFLOW PROJECTS IDENTIFIED
AND COMPLETED
for the
CITY OF RAPID CITY, SOUTH DAKOTA**

Table 4 - I&I Projects Identified By Staff

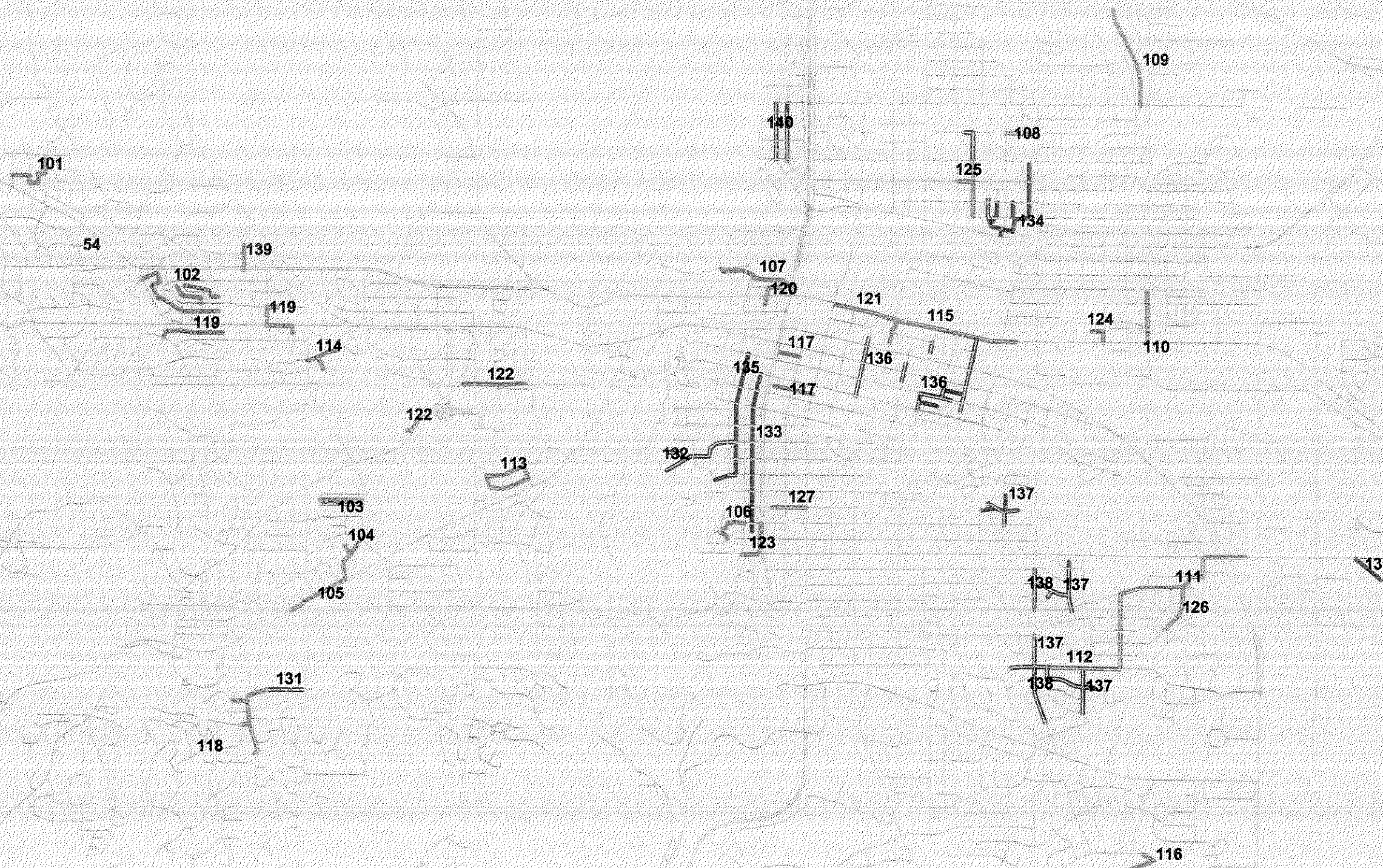
Segment No.:	CIP No.:	Status	Notes:
101		Completed	
102		Completed	
103		Completed	
104		Completed	
105		Completed	
106		Completed	
107		Completed	
108		Completed	
109		Completed	
110		Completed	
111		Completed	
112		Completed	
113		Completed	
114		Completed	
115		Completed	
116		Completed	
117		Completed	
118		Completed	Park Dr. Reconstruction
119		Completed	Part of this project is 119 under Table 2.
120	50567	Completed	11th St. Sanitary Sewer Reconstruction
121		Completed	Omaha Street Reconstruction, I190 to 1st St.
122		Completed	Canyon Lake Dr. Reconstruction

(Refer to Map - "Additional I and I Projects Identified and Completed")

**ADDITIONAL INFILTRATION / INFLOW PROJECTS IDENTIFIED
AND COMPLETED
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Segment No.:	CIP No.:	Status	Notes:
123		Completed	Final Phase of West Blvd. Reconstruction
124		Completed	Waterloo St. and Utility Reconstruction Project
125		Phase 1 & 2 of three phase Completed. Phase 3 scheduled for 2006.	Lemon Avenue Reconstruction
126	50358	Completed	Tallent St. Reconstruction
127	50310	Completed	Franklin St. Reconstruction, Mt. Rushmore Rd. to 11th St.
130	50327	Short Term	42" Trunk Sewer Siphon Rehabilitation
131	50338	Long Term	Meadowbrook Sewer Reconstruction (Need funding for street widening).
132	50377	Long Term	Fulton Street Sewer Reconstruction
133	50422	Long Term	West Blvd. Alley Sewer Reconstruction
134	50420	Long Term	Blaine/ Halley/ Halcomb/ Jackson/ Maple Sewer Reconstruction
135	50414	Long Term	11th/12th St. Alley Sanitary Sewer Reconstruction
136	50019, 50119, 50132, & 50138	Short Term	Sanitary sewer reconstruction around the downtown area in conjunction with the Kansas City Street Reconstruction Project
137	50134, 50389, 50390, 50421, & 50424	Short Term	These projects are anticipated to be completed under the "Robbinsdale Utility and Street Reconstruction Projects" in phases over the next four years and in conjunction with the Elm Ave. Reconstruction Project.
138	50145, 50325, & 50130	Short Term	Elm Avenue Reconstruction Project to be constructed over the next 3 years in three phases.
139	50409	Completed	N. 39th St. and Clover St. Reconstruction
140	50418	Short Term	Silver St. and Gold St. Utilities Reconstruction

(Refer to Map - "Additional I and I Projects Identified and Completed")



ADDITIONAL PROJECTS COMPLETE

ADDITIONAL I & I PROJECTS IDENTIFIED

Legend

- COMPLETED
- NOT COMPLETED

ADDITIONAL I & I PROJECTS IDENTIFIED AND COMPLETED