Harrisonburg Public Utilities (HPU)

Annual Report of Operations

FY 2014 Closure

FY2015 Planning

Sanitary Sewer Management Program Initiative (SSMP)

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I. Introduction:

Harrisonburg Public Utilities (HPU) has crafted a Sanitary Sewer Management Program (SSMP) to guide ownership and operation of the system infrastructure as it increases with age. This document summarizes the SSMP strategy. The strategy underlies the effort to deliver the level of services expected today and to safeguard this level of service into the future.

The SSMP included measures for strategic, tactical, and operational performance. It was organized around a balanced scorecard that emphasized financial and nonfinancial measures with short term and long terms goals that must be part of the information system for all employees at all levels. **Figure 1** shows the SSMP Balance Scorecard.

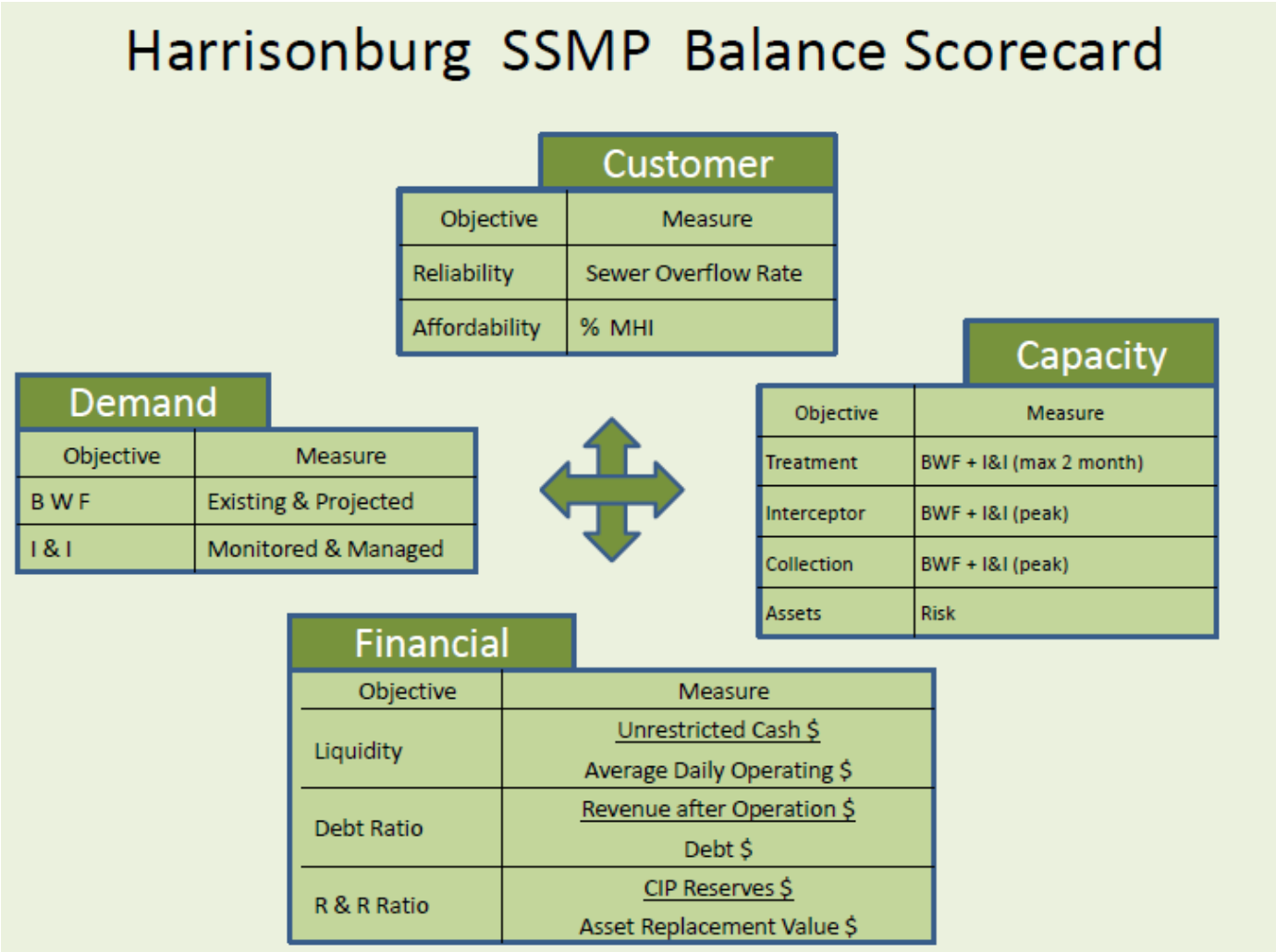


Figure 1

II. Sanitary Sewer Flow

The volumes and rate patterns of the sanitary sewer flow as it enters into the collection system and treatment plant are major topics to the SSMP. Much of the SSMP places attention to changing or accommodating these characteristics. For an understanding, there are three major components (BWF, GWI, and RDII) of wet-weather flow into a sanitary sewer system; they have been illustrated **in Figure 2** below and defined thereafter:

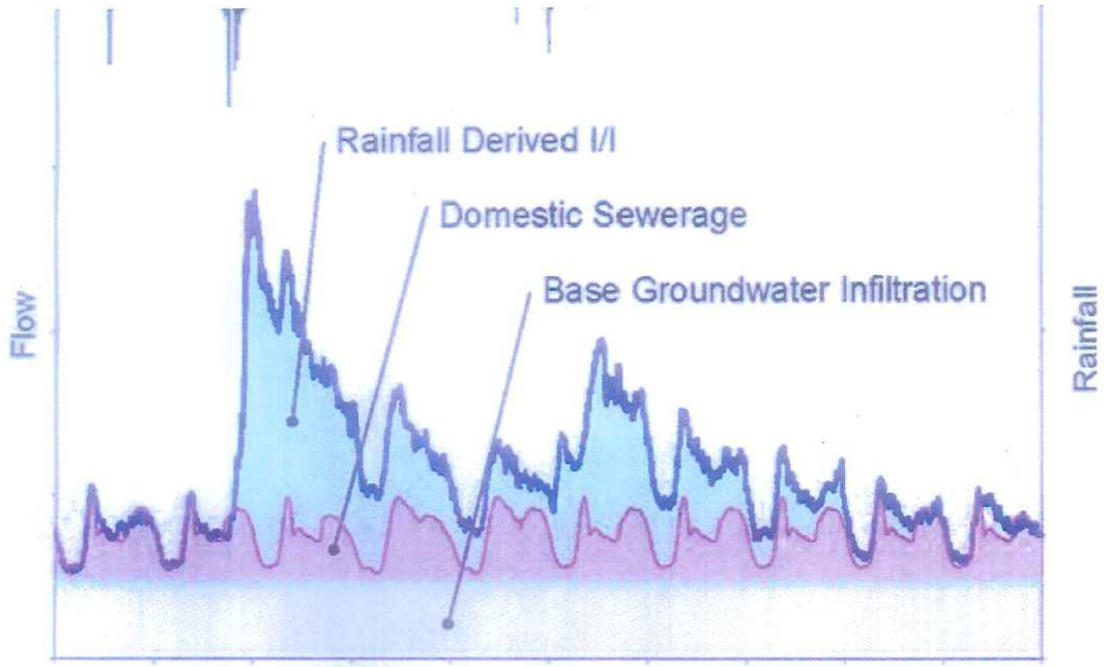


Figure 2

BWF: Base Wastewater Flow is the residential, commercial, institutional, industrial and municipal flow that discharges to a sanitary sewer system for collection and treatment. BWFs are largely a function of population density, water consumption, and land uses. The flow rate varies both diurnally and seasonally. Rates for BWF per unit source have been published under many sanitary sewer design regulations; the City has published our rates in the "Harrisonburg Design and Construction Standards Manual".

GWI: Groundwater Infiltration represents the flow that enters a collection system through leaky pipes, pipe joints, and manhole walls. GWI is generally steady in the short term but varies throughout the year by trending higher when groundwater levels and soil moisture are higher. A design criterion of 1,000 to 2,000 gallons per acre per day is typical for GWI.

DWF is dry-weather flow and is the combination of BWF plus GWI.

RDII is that portion of a sewer flow hydrograph above the normal dry weather base flow pattern. It is a sewer flow response to rainfall or snowmelt in a sewer shed. RDII is typically responsible for capacity related SSO problems and basement backups. Reported design criterion of less than 2,500 gallons per day per inch diameter mile of pipe is typical for RDII.

- Rainfall-derived "Inflow" is the water that enters a sanitary sewer system directly by way of depressed manhole lids and frames, downspouts, sump pumps, foundation drains, areaway drains, and cross connections with storm sewers. Inflow typically occurs shortly after rainfall starts and then stops quickly once it stops. Inflow is typically the major component of RDII peak flow.

- Rainfall-derived "infiltration" refers to rainfall runoff that filters through the soil before entering a sanitary sewer system through damaged pipe sections, leaky joints, or poor manhole connections; duration is generally longer than experienced with inflow.

III. Background:

Regulations: European nations have taken strong enforcement approaches by establishing designated central agencies to police compliance with infrastructure management laws and regulations. In contrast, government efforts to regulate sanitary sewer infrastructure have lagged in the United States. Notable proposed laws have arisen from recognition of the need for a strong infrastructure, but the implementation of the law has most frequently reverted to somewhat of a diluted effort. For example, **GASB 34** was originally issued to require governments to appropriately plan for proper replacement of assets; however, through lobby tactics this effort has been reduced to depreciation accounting. **CMOM** was another attempt to strengthen sanitary sewer management requirements by authorizing EPA to have strong oversight over all owners and operators. CMOM principles were proposed by the United States Environmental Protection Agency (USEPA) as a part of the draft Sanitary Sewer Overflow (SSO) rule that was subsequently withdrawn. Within this withdrawn rule, there were five general principles described that indicate CMOM compliance for a wastewater utility. The following is the text from § 122.42 (e) (1) of the withdrawn SSO Rule reflecting "General Standards" that denoted that the owner or operator must:

- Properly manage, operate, and maintain, at all times, all parts of the collection system;
- Provide adequate capacity to convey base flows and peak flows for all parts of the collection system;
- Take all feasible steps to stop, and mitigate the impact of, sanitary sewer overflows in portions of the collection system;
- Provide notification to parties with a reasonable potential for exposure to pollutants associated with the overflow event; and
- Develop a written summary of your CMOM Program and make it available to any member of the public upon request.

Best Practices: Harrisonburg, like many other owners and operators of sanitary sewer systems, has been built over the past 100 years or more using a variety of design standards, materials, construction practices, and maintenance approaches. The strength in performance can be related to engaging formal or informal best practices**.** A best practice is a method or technique that has consistently shown results superior to those achieved with other means, and thus is used as a benchmark. **Appendix A** includes several SSMP SOPs.

IV. HPU Sanitary Sewer Management Plan (SSMP):

With purpose that HPU plan and execute the SSMP in a consistent and sustained approach, the key element directives of the SSMP are as follows:

- Prior to the beginning of each fiscal year HPU shall establish an "Annual Plan" of activities that will be completed during the fiscal year. The activities shall be in alignment to achieving the goals of the SSMP. The activities shall be compatible with Operating and CIP budgets.

- During the fiscal year, HPU shall implement execution and monitor progress of the "Annual Plan". A "SSMP Chronology Report" shall be published monthly to meet the latter.

- At the end of each fiscal year, HPU shall evaluate and update the SSMP with regard to approach, organization, progress, technology, data, and benchmarks with respect to the SMMP baseline goals.

Figure 3 below shows the HPU SSMP framework including responsible entities and their objectives which are defined in greater detail in this document.

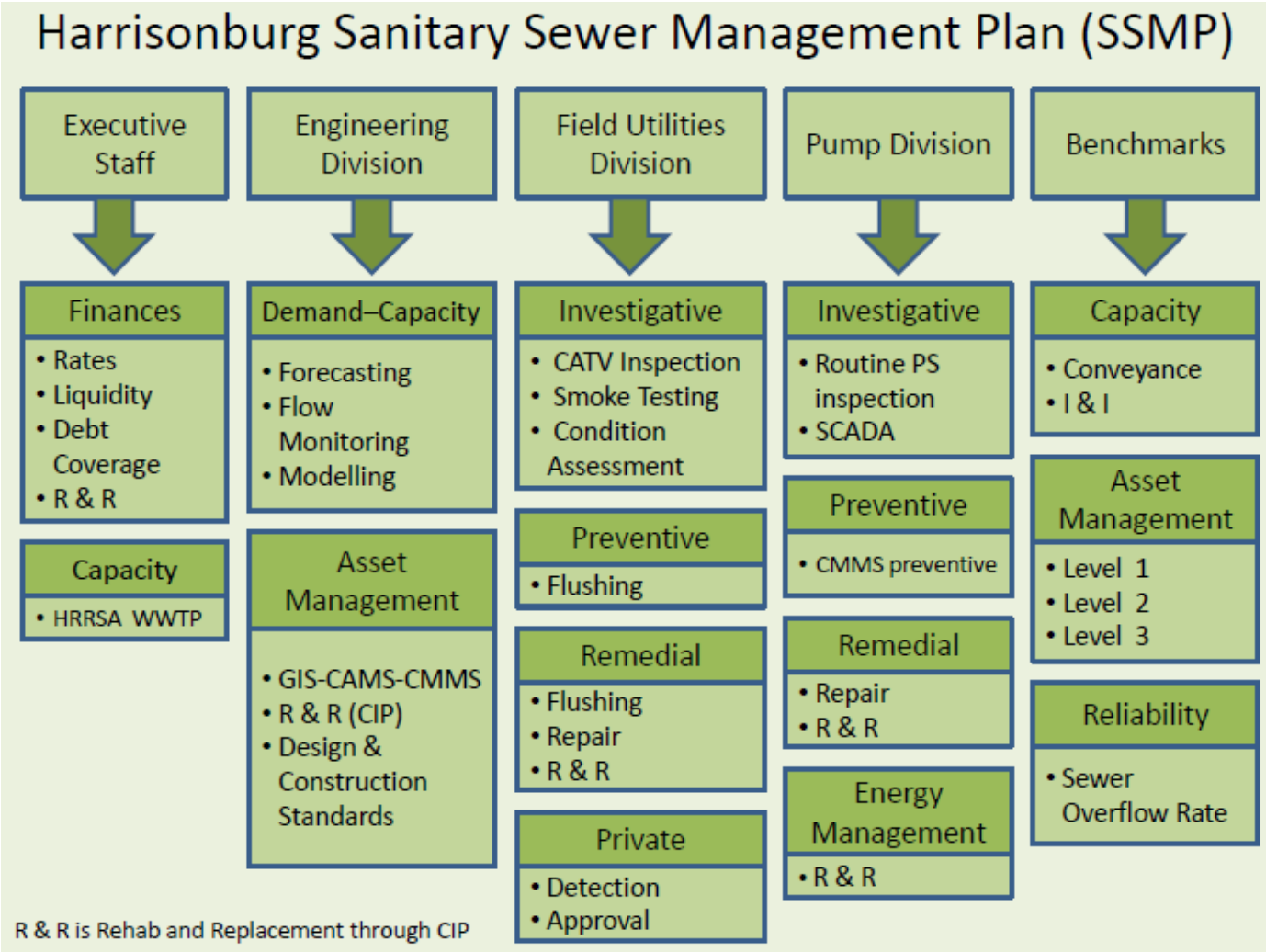


Figure 3

V. SSMP Objective #1: Forecasting Annual Average Daily BWF

Objective: Objective #1 required HPU to monitor existing sanitary sewer flows in terms of annual average daily (AAD) BWF and to then make projections for ultimate build-out conditions to the City system. This effort is with purpose to understand the demands that underlie the capacities needed to treat and to convey the volumes and flow rates of sanitary sewer.

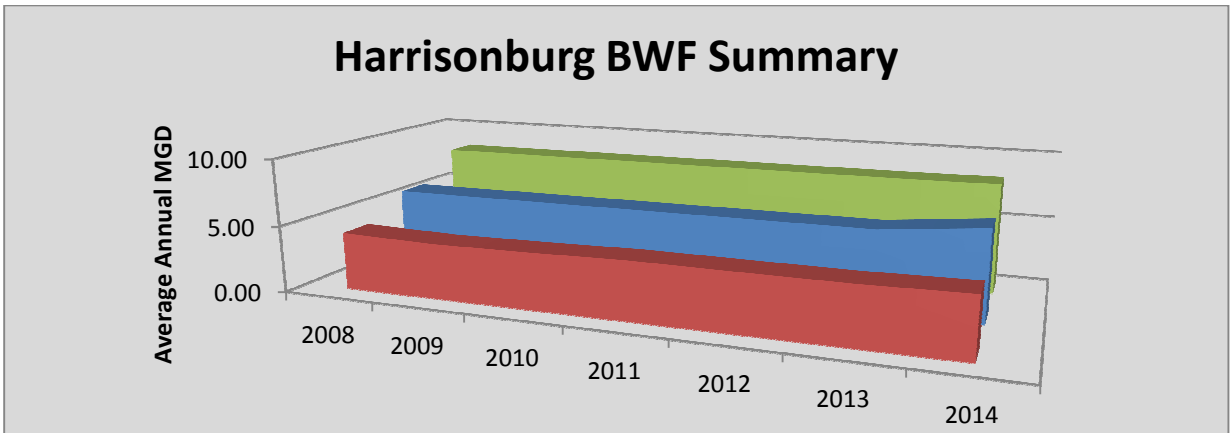
Background: To recognize existing and historic BWFs, the data were obtained from sales records at the HPU Billing Office. The format identified and assigned BWF sources to customer groups listed below.

- City residential
- City commercial
- City institutional
- City apartments
- City municipal
- Rural customer
- Rockingham County as a Contract Customer

Planning: To predict future BWFs, HPU carefully selected a dual approach that delivered both an aggressive forecast and a conservative forecast; thus providing a forecast envelope. The aggressive approach was thereafter used to make evaluations of capacity. The conservative approach has been provided for comparison and understanding of the degree for margin of error (or safety margin) in planning.

- For the aggressive approach, build out BWF was forecasted as existing BWF plus future flow with the latter defined as the product of: 1) the area of undeveloped lands associated with each user group, 2) sewer BWF design criteria per unit area of specific land use type, and 3) an assumed 75% development rate of maximum land use.
- For the conservative approach, future BWF was forecasted as existing BWF plus future flow with the latter defined as the product of: 1) the area of undeveloped lands associated with each user group and 2) historic sewer BWF unit rates as determined from generation of existing flows per unit area of specific developed land use type.

Progress: Each fiscal year from 2008 through 2014, HPU captured the annual BWF data with purpose to compare against, and to revise projection of, the forecasted build out demand. **Figure 4** comparatively displays the annual incurred BWF, the conservatively forecasted BWF at build out conditions and the aggressively forecasted BWF at build out conditions.



	2008	2009	2010	2011	2012	2013	2014
Incurred BWF	4.29	4.12	4.20	4.33	4.29	4.27	4.40
Ultimate BWF Min	5.99	6.00	6.00	6.00	6.00	6.00	6.72
Ultimate BWF Max	8.17	8.18	8.18	8.18	8.18	8.18	8.22

ely

Conclusion:

- The graph shows that aggressively forecasted BWFs at City build-out have been projected to be between 8.17 to 8.22 MGD. For capacity evaluations of the SSMP, this aggressive BWF value has been used.
- In contrast, the graph also shows the same forecasts but using the more conservative technique; these BWFs have been projected to be between 5.99 and 6.72 MGD.
- Inclusive to the graph are records of actual BWFs that were recorded for the respective year; actual BWFs have ranged from 4.12 to 4.40 MGD.
- The envelope approach to forecasting has provided a range differential from 1.50 to 2.18 MGD; thus defining a built in margin of safety within the HPU planning approach.
- Most recent data from FY2014 indicated maturity of BWF was at 71% and 54% of the conservative and aggressive forecasted build out BWF, respectively.

Tabulation of the most recent FY 2014 demand data is provided in **Appendix B;** the results are shown in the table as follows. The data indicated that remaining growth projection are as follows:

Residential	446,000 gpd
Commercial	753,000 gpd
Institutional	38,000 gpd
Apartment's	1,710,000 gpd
Industrial	701,000 gpd
Municipal	0 gpd
Rural	260,000 gpd
Rockingham County	410,000 gpd
Total w/o RoCo	3,908,000 gpd
Total	4,318,000 gpd

Sanitary Sewer Projections for Harrisonburg

		Density Criteria		Historical Criteria	
Description	Existing MGD	Capacity MGD	% Maturity	Capacity MGD	% Maturity
City Residential	1,270,000	1,715,654	74%	1,676,374	76%
City Commercial	1,050,000	1,802,415	58%	1,446,920	73%
City Institutional	710,000	747,479	95%	539,972	131%
City Apartments	490,000	2,199,388	22%	969,603	51%
City Industrial	700,000	1,401,373	50%	1,256,467	56%
City Municipal	20,000	20,000	100%	20,000	100%
Subtotal City	**4,240,000**	**7,886,310**	**54%**	**5,915,798**	**72%**
External	70,000	70,000	100%	70,000.0	100%
Michaels	-	90,000	0%	90,000.0	0%
Daley	-	170,000	0%	170,000.0	0%
Total	**4,310,000**	**8,216,310**	**52%**	**6,245,798**	**69%**

2014 land development: 7,268.3 acres developed; 2,376.7 acres undeveloped; 75.4 % maturity.

Excluded from the data above was 90,000 gallons per day used by Rockingham County with contract agreements extending this use to 500,000 gallons per day. The volume is credited against Rockingham County for capacity at HRRSA and therefore excluded in evaluation of treatment capacity but must be recognized in the evaluation of collection and conveyance system capacities.

VI. SSMP Objective #2: Managing Infiltration & Inflow

Objective: Objective #2 required HPU to monitor existing sanitary sewer infiltration & inflow under current conditions and to then make plans to eliminate or to accommodate the volumes under future conditions.

Background: Infiltration and inflow (I&I) is a significant source of demand that must be separately recognized from the BWF previously discussed. Each and every gallon of I&I competes for equal capacity in the treatment, interceptor, and collector systems. Generally, owners / operators must determine how much I&I its systems will accept and therefore would be added to the previously discussed BWF in order to determine future capacity requirements.

As a benchmark, EPA guidelines suggest that I&I greater than 2,500 gallons per day per inch diameter mile of pipe would be deemed excessive.

Infiltration gallons / per inch mile of pipe= I&I / Total Inch Diameter Miles of System Inventory

Since I&I to a given system varies in definition with differing storm durations and periods of analysis, HPU evaluated its I&I issue in several perspectives as follows.

Average Annual Daily (AAD) I&I: This volume has been determined as the difference between the annual volumes of sewer recorded by HRRSA toward the City's allocation at the WWTP minus the sales volume that the City recorded over the same period of time. The use of this parameter is most applicable to make comparisons with BWFs as defined in Objective #1.

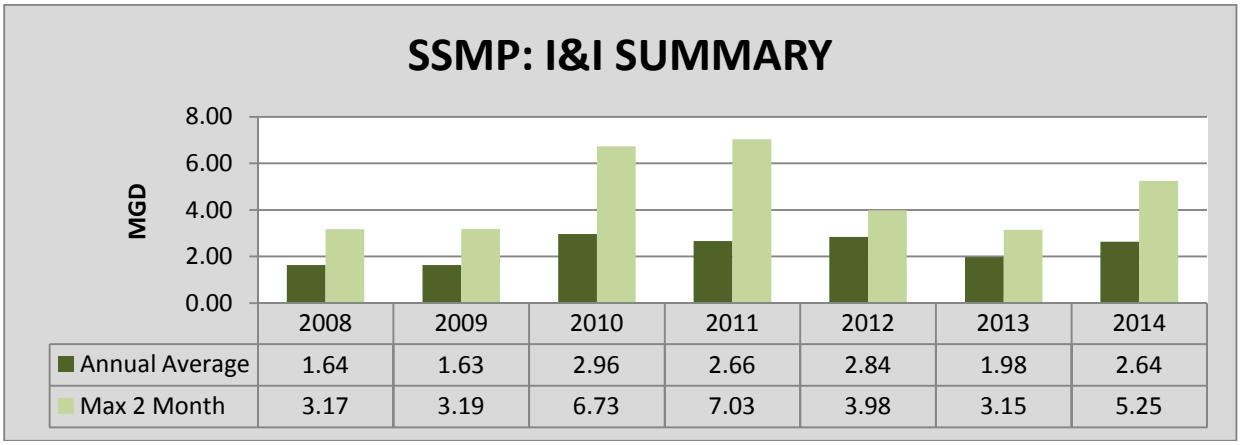
Maximum Two Consecutive Month (M2CM) I&I: This volume has been determined as the difference between the maximum two consecutive month volumes of sewer recorded by HRRSA toward the City's allocation at the WWTP minus the sales volume that the City recorded over the same period of time. The use of this parameter is most applicable to capacity evaluations for wastewater treatment at HRRSA as defined in Objective #3.

Peak I&I: Peak I&I is determined by actual flow monitoring and then quantified to a chosen storm size or duration. Typical examples include the 10 year storm and the peak daily flows. The uses of these parameters are most applicable to capacity evaluations for interceptor and collection systems as defined in Objectives #4 and #5.

Planning

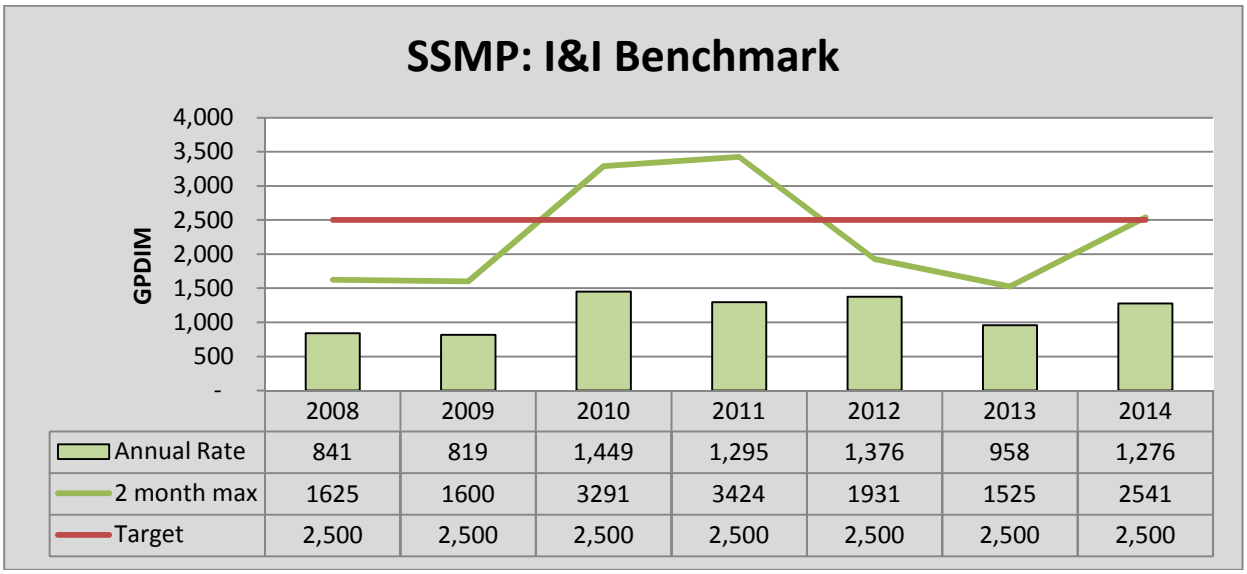
AAD I&I and M2CM I&I were calculated using flow data obtained from HRRSA and flow data obtained from HPU billing records. Peak day I&I may be added in the future pending available data collection equipment and techniques.

Progress: **Figure 5** as follows shows the City's AAD I&I & M2CM I&I. Between 2008 and 2014 the AAD I&I ranged from 1.63 MGD to 2.96 MGD. Prior records indicated a recorded high of 4.21 MGD in 2001. In comparison, the M2CM I&I for the 2008 to 2014 period ranged from 3.17 MGD to 7.03 MGD. The latter two month parameter exhibited a greater value by as much as 264% of the AAD.



	2008	2009	2010	2011	2012	2013	2014
Annual Average	1.64	1.63	2.96	2.66	2.84	1.98	2.64
Max 2 Month	3.17	3.19	6.73	7.03	3.98	3.15	5.25

Conclusions: **Figure 6** as follows shows the City's I&I in terms of the EPA benchmark for gallons per day per inch mile of pipe; both AAD I&I and M2CM I&I presentations have been provided along with the threshold for excessive I&I at 2,500. AAD I&I ranged from 819 to 1,449 and the M2CM I&I ranged from 1,525 to 3,424. AAD I&I flow rates do not indicate concerns but the M2CM I&I flows allowed conclusion that the Harrisonburg system is in need of I&I reductions efforts to reduce the peak.



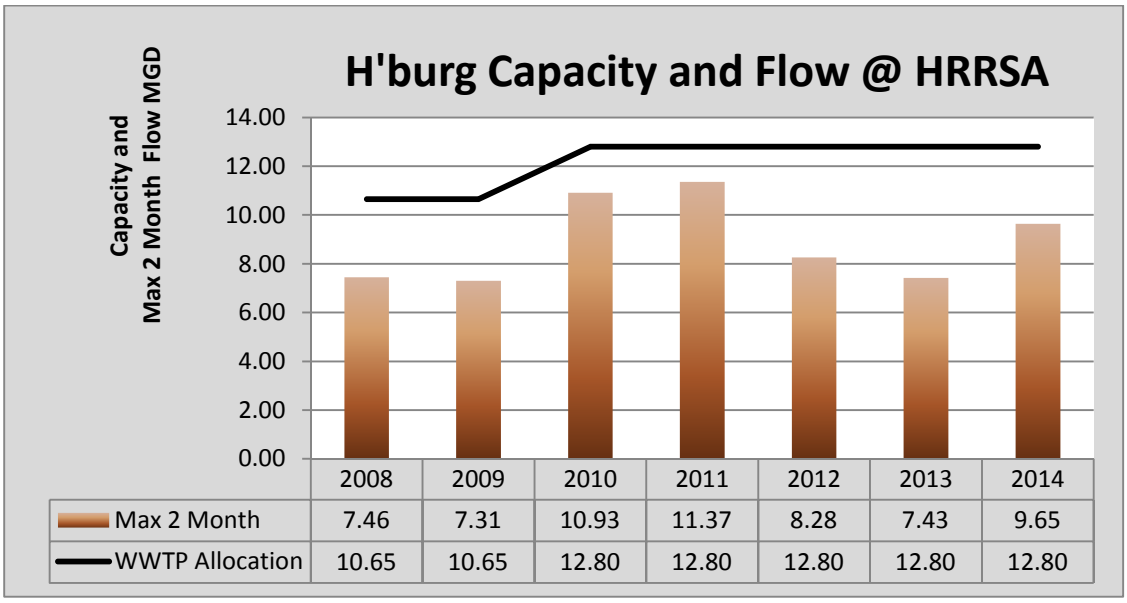
	2008	2009	2010	2011	2012	2013	2014
Annual Rate	841	819	1,449	1,295	1,376	958	1,276
2 month max	1625	1600	3291	3424	1931	1525	2541
Target	2,500	2,500	2,500	2,500	2,500	2,500	2,500

VII. SSMP Objective #3: WWTP Capacity

Objective: The first item in CMOM, **capacity**, directs the owners of sanitary sewer systems to provide adequate capacity to treat and to convey base flows and peak flows for all parts of the sanitary sewer system. Objective #3 placed evaluation upon treatment capacity. Harrisonburg's M2CM daily sewer flows were evaluated against its allocated capacity at Harrisonburg Rockingham Regional Sewer Authority (HRRSA).

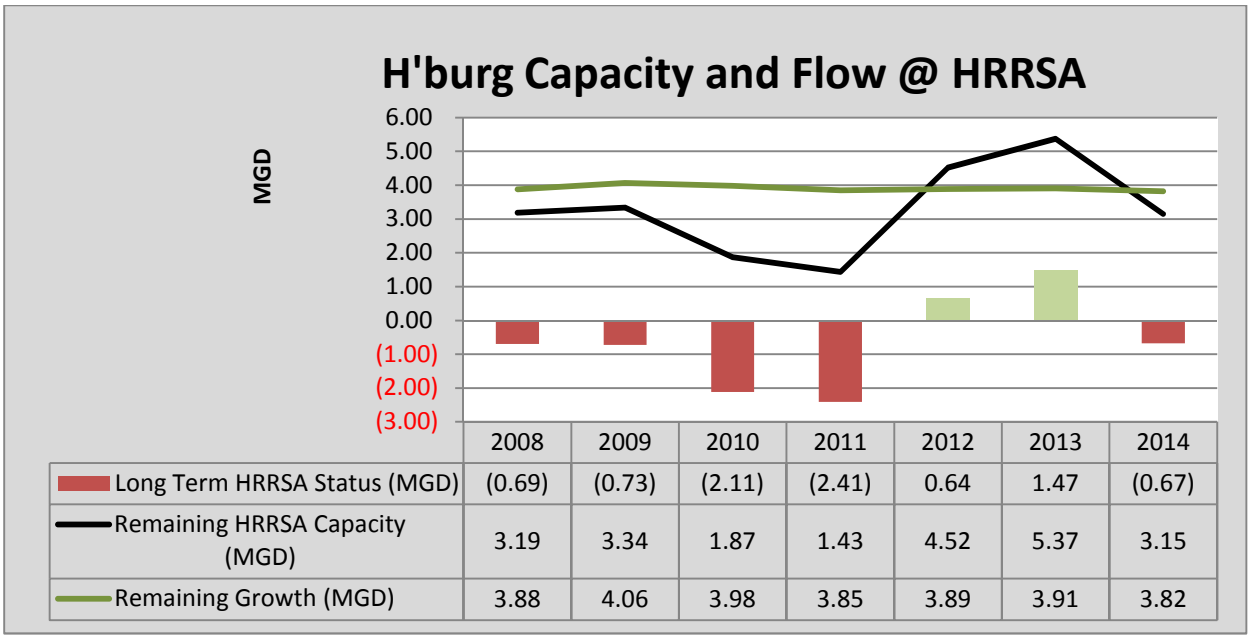
Planning: Section 5.6 of the Service Contract between the City of Harrisonburg and the HRRSA sets forth a limit not to exceed allocated capacity during any two consecutive months. The City desires to avoid any limitations that might be imposed under this scenario.

Progress: The trend line in **Figure 7** shows Harrisonburg's allocated capacity at HRRSA. Fiscal year 2010 denoted an era of increased Harrisonburg capacity from 10.65 MGD to 12.80 MGD at HRRSA. The bar summary shows Harrisonburg's incurred M2CM flow rates from each year beginning 2008 and extending through 2014. The important relationship occurred in 2011 when the M2MD flow reached 11.37 MGD which was just 1.43 MGD less than capacity.



	2008	2009	2010	2011	2012	2013	2014
Max 2 Month	7.46	7.31	10.93	11.37	8.28	7.43	9.65
WWTP Allocation	10.65	10.65	12.80	12.80	12.80	12.80	12.80

Conclusion: To assess Harrisonburg's capacity allocations for future conditions**, Figure 8** imposes BWF growth determined from Objective #1 upon M2CM flows observed from Objective #2. This simulated the effects of the existing system as would be expected when the City nears future build-out conditions. The graph shows that with the addition of expected future flows, Harrisonburg M2CM contribution flows to HRRSA would exceed capacity in five of the seven years observed. The highest flow that exceeded capacity would have occurred in 2011 at 2.41 MGD above allocation. **The *City recognizes the SSMP goal to reduce M2CM RDII (rainfall direct Infiltration & Inflow) by 2.41 MGD***.



	2008	2009	2010	2011	2012	2013	2014
Long Term HRRSA Status (MGD)	(0.69)	(0.73)	(2.11)	(2.41)	0.64	1.47	(0.67)
Remaining HRRSA Capacity (MGD)	3.19	3.34	1.87	1.43	4.52	5.37	3.15
Remaining Growth (MGD)	3.88	4.06	3.98	3.85	3.89	3.91	3.82

VIII. SSMP Objective #4: Interceptor Capacity & RDII Abatement

Objective: As recognized previously, the first item in CMOM, **capacity**, directs the owners of sanitary sewer systems to provide adequate capacity to treat and convey base flows and peak flows for all parts of the sanitary sewer system. Objective #4 places evaluation upon conveyance capacity in the interceptor components.

Background: HPU has chosen its larger interceptor components, shown in **Figure 9**, as first priority. As taken from a 1989 study and listed in the following table, Wiley & Wilson provided peak DWF at ultimate City build out conditions. These DWF projections became the design criteria for an interceptor capacity upgrade program:

INTERCEPTOR SYSTEM	Length	DWF design
Upper HRRSA	3,030	26.65 MGD
Lower West Interceptor	4,832	11.58 MGD
Upper West Interceptor	8,543	2.20 MGD
North Interceptor	14,124	8.36 MGD
West Spur Interceptor	1,975	3.71 MGD
East Interceptor	18,808	12.68 MGD
Blue Ridge Drive Interceptor	3,516	0.88 MGD
Country Club Road Interceptor	3,930	2.06 MGD
Total	58,758	

The Wiley & Wilson study provided a master plan recommending that 68 sections of the interceptor needed capacity enhancements prior to the City reaching its ultimate build out conditions. The study has underlain the HPU Capital Improvement Program (CIP) from which much of the interceptor system has been upgraded. Information pertaining to upgrades that have been completed is included in the table that is embedded into **Figure 9**. At the beginning of FY 2015, the HPU had invested $6.37M since 1989. Because the 1989 study by Wiley & Wilson generally ignored the RDII component of the flow, the HPU implementation approach added new pipes to convey DWF and retained old pipes to convey RDII.

Planning: HPU will engage a key activity to meeting Objective #4 by repeating the Wiley & Wilson Black's Run Interceptor Study, but with integration of RDII as it relates to all objectives of the SSMP. The following activities summarize the plan:

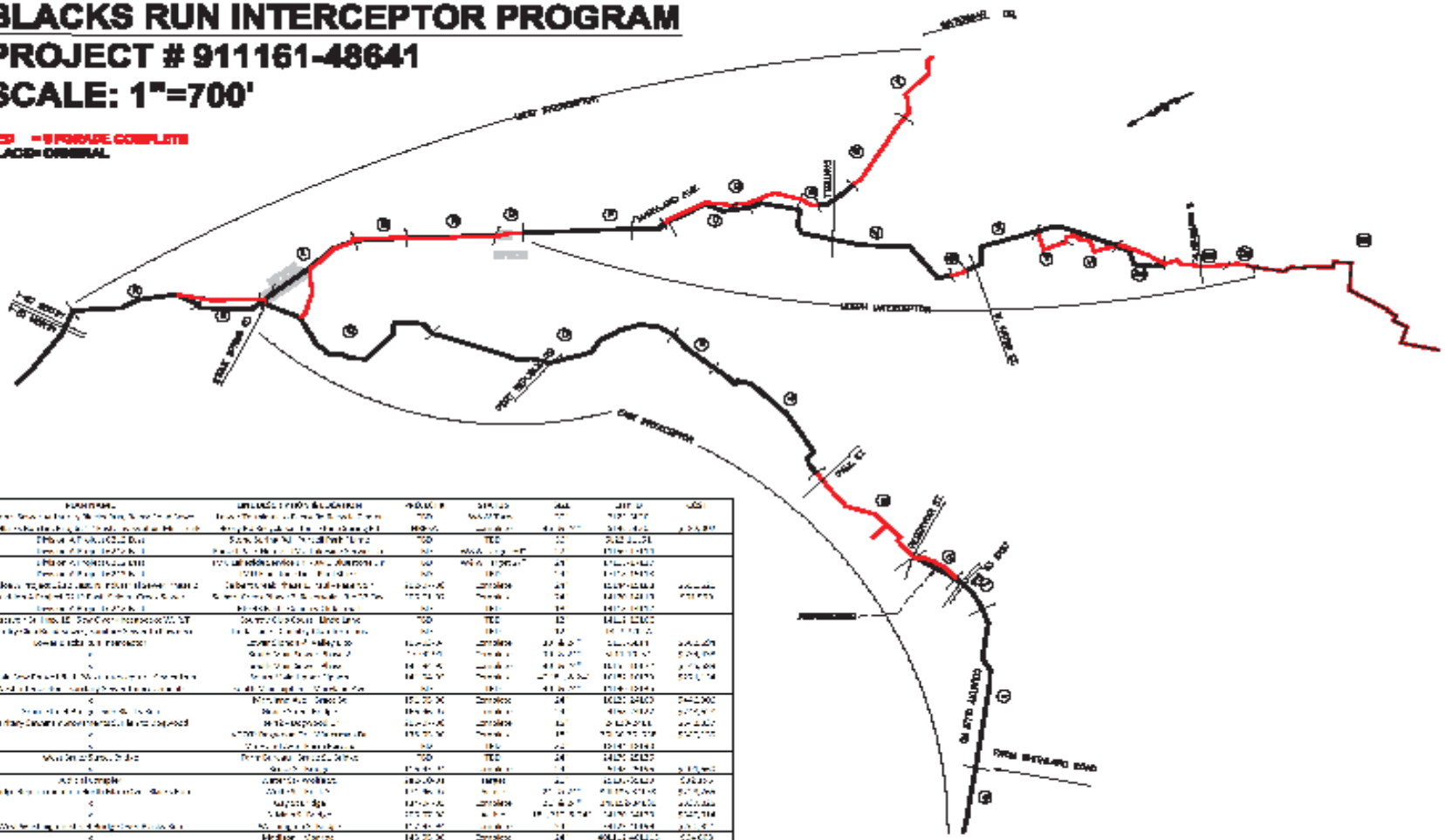
- Flow monitoring will be repeated at the critical terminus locations of each interceptor system.
- New flow data will be collected to identify existing DWF and RDII.
- The interceptor – collector interconnection points will be redefined to match updated GIS records.
- Attributes for each collector sub-system will be identified with purpose to identify future DWF that can be expected at City build-out. This effort will be consistent with the approach used in Objective #1.
- Existing DWF, existing RDII, future DWF and future GWI will be summed to determine future unabated conveyance requirements.
- Capacities of the interceptor system shall be redefined for each asset that was included in the 1989 study; the inventory will be adjusted for additions and removals that have incurred under the HPU upgrade program.
- Comparison of capacities and flows will be made with purpose to identify pipe assets that are, or will be, stressed by hydraulic loading.
- The options for capacity expansion or RDII reduction will be evaluated for "best fit selection" that is both effective and efficient and meets the all goals of the SSMP.

BLACKS RUN INTERCEPTOR PROGRAM

PROJECT # 911161-48641

SCALE: 1"=700'

RED = UPGRADE COMPLETE
BLACK= ORIGINAL



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Progress:

Capacity Expansion:

Since 1989, HPU has made significant progress enhancing its Blacks Run Interceptor capacities. From a qualitative perspective, the frequencies of interceptor overflows are now much less than compared to 1989. In the same qualitative perspective, observations suggested that much larger storm events are now necessary to incur hydraulic stress or overflows in the interceptor system

RDII reduction:

During the most recent years, HPU has attacked RDII reduction through a "Carpet / Sweep"" approach; this approach is defined in more detail under Objective #5. Little quantification of past RDII removal success has been documented.

Conclusion: Re-evaluation of the Blacks Run Interceptor Program will begin with revised flow data when available; flow monitoring will begin FY 2016. The final master plan will be coordinated to include integration with HRRSA treatment capacity (Objective #1) and with the HRRSA downstream interceptor capacities. Quantification of RDII reduction will be made.

IX. SSMP Objective #5: Collection System Capacity & RDII Abatement:

Objective: As recognized twice previously, the first item in CMOM, **capacity**, directs the owners of sanitary sewer systems to provide adequate capacity to treat and convey base flows and peak flows for all parts of the sanitary sewer system. Objective #5 places evaluation upon conveyance capacity in the collection components.

Background: Located as upstream collector components and discharging flow into the interceptor, numerous sub-shed collection systems are comprised of the approximate 190 miles of pipe in the City inventory. HPU has managed these assets with activities previously shown in Figure 3 under the responsibility of the Field Utilities division. Most work that has been performed to date, and applies to Objective #5, can be categorized as investigative, preventive, remedial, and private focus activities.

Some work that has been planned and performed has occurred under the "Carpet / Sweep" approach. Under this approach, activities were scheduled in a progressive format to make a complete sweep of the entire asset inventory over a pre-determined duration. Activities scheduled by "Carpet / Sweep" approach included:

- Smoke-testing was conducted such that all assets were tested once per ten year cycle.
- visual manhole inspections were conducted such that all assets were tested once per ten year cycle

In contrast, some work was planned and performed in response to "priority" events. Activities scheduled by "priority" approach included:

- Investigative Camera Inspection was conducted in response to multiple occurrences of sewer blockages, sewer blockage occurrences causing property damage, or other reported event giving concern for possible repeat of undesired effects.
- Historically, flow monitoring has not been used extensively in this effort.

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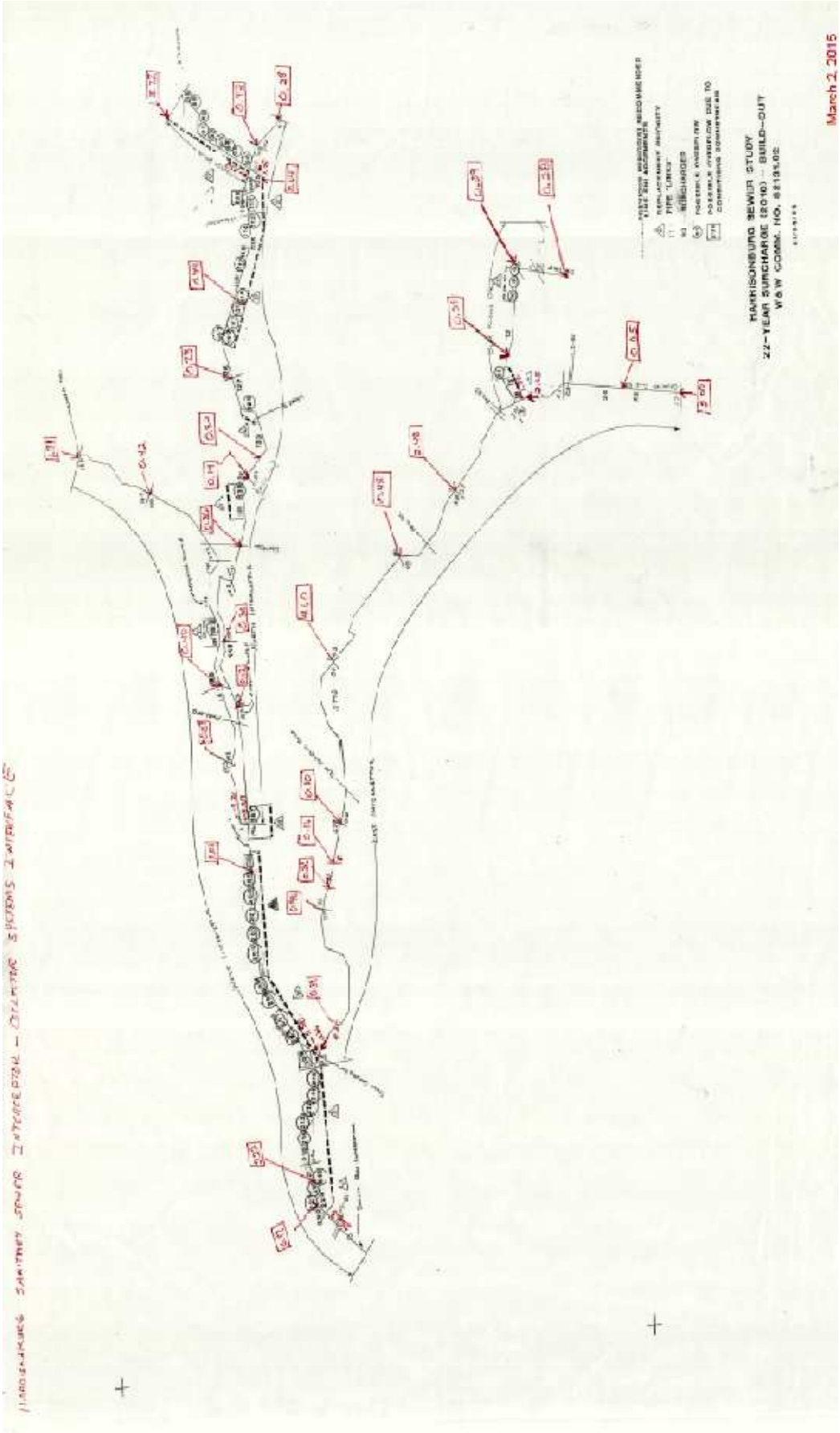
Planning: HPU will continue to use both the same "Carpet /Sweep" and "Priority" approaches in future planning of I&I abatement in the collection system components; however, HPU will enhance its "Priority" approach by adding flow monitoring.

Figure 10 shows a schematic of the interceptor system and the flow contributions as provided in the Wiley and Wilson study. Completing Objective #4 will provide an update of connections and attribute data for each sub-shed collection system. Completing Objective #4 will also allow HPU to prioritize sub-sheds for RDII removal. Within prioritized sub-sections, camera inspection, smoke testing, visual inspections and sub flow monitoring will be used to target RDII reduction projects.

Until the interceptor study can be completed, HPU will randomly prioritize sub-sheds. Generally, sub-sheds located in the upper reaches of the interceptor system have greater potential to address capacity issues for the three objectives of treatment, interceptors, and collectors capacities. However, due to active flow monitoring conducted by HRRSA, Sub-section "BR65" with collector pipes in the area of Mosby Road and Pleasant Valley road will receive attention beginning FY 2015 as an initial test performance model. The sub-section is located in the lower reaches of the City's Blacks Run Interceptor. Additional information was included in the FY2015 SSMP Implementation Section of this document.

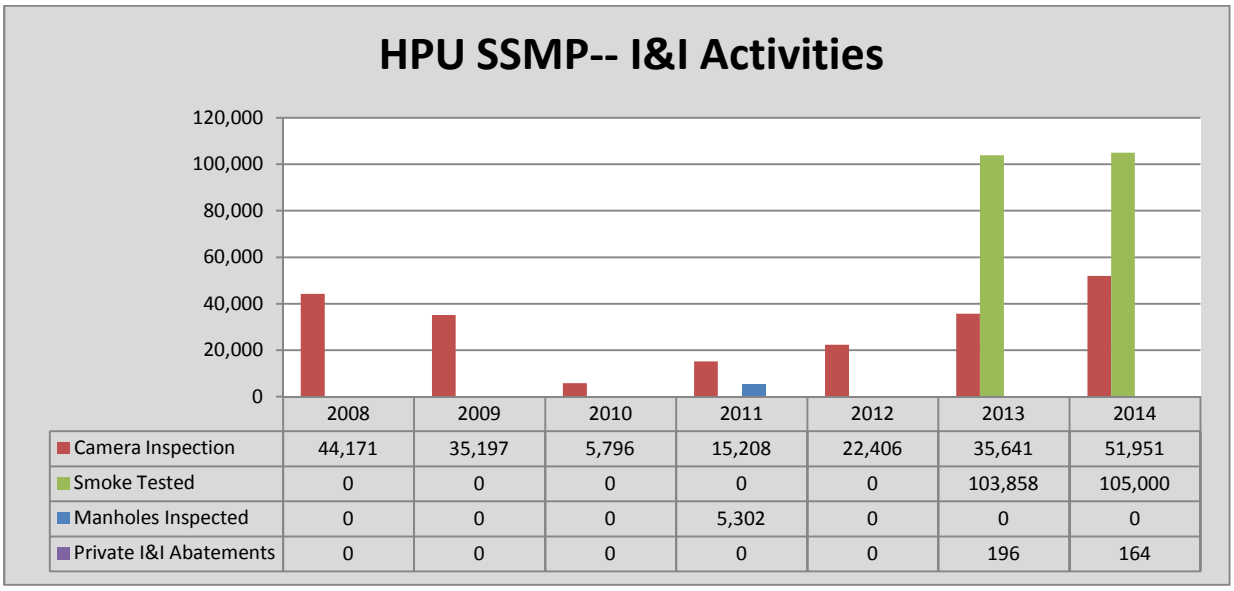


Blacks Run Interceptor Sub-sheds 1

Progress:

Priority Planning: Quantifying past RDII abatement in priority areas is not available at this time but is targeted in FY2015 activities as defined in the Appendix of this document.

Sweep Planning: **Figure 11** shows data from 2008 to 2014 for the feet of sewer main that has be smoke tested and televised, the number of manhole inspections that has been undertaken, and the attention that has been given to private I&I sources. These activities were performed under the general "carpet / sweep" approach.



	2008	2009	2010	2011	2012	2013	2014
Camera Inspection	44,171	35,197	5,796	15,208	22,406	35,641	51,951
Smoke Tested	0	0	0	0	0	103,858	105,000
Manholes Inspected	0	0	0	5,302	0	0	0
Private I&I Abatements	0	0	0	0	0	196	164

Conclusions: During the period 2008 through 2014 HPU has:

- Inspected by camera 210,370 feet of sanitary sewer (19% of inventory);
- visually inspected 5,302 manholes (100% of inventory) over most recent 4 years;
- Smoke tested 208,858 feet of sanitary sewer pipe (19% of inventory) over most recent 2 years;
- Issued abatement notices for 360 private violations; the need for evaluation of an enhanced program to emphasize private I&I abatement through enticements and enforcements has been recognized.

X. SSMP Objective #6: Asset Management Planning:

Objective: Objective #6 has purpose to make inventory of all sanitary sewer assets, assign attributes, and to effectively and efficiently remove Risk from the Sanitary Sewer System.

Background: Under separate formal "Initiative", the HPU Department has committed to a "Total Asset Management Plan" (TAMP). The TAMP has strategic, tactical, and operational components.

- The strategic focus of the TAMP is to systematically preplan projected cash flow schedules that will be needed to replace assets at the end of their useful life. These recommendations are evaluated under the utility rate schedule with purpose to provide adequate funding into the CIP program.
- Upon available funding, tactical projects that are undertaken to efficiently and effectively manipulate infrastructure assets with purpose to minimize the total cost of owning and operating them, while also delivering acceptable service levels to the customer. The methodology requires staff to assign two parameters of definition to all assets; they are "Consequence of Failure" (COF) and the "Probability of Failure" (POF). The product of COF and POF is call "Risk". When the "Risk Rating" of an asset warrants the expenditure of funds to reduce the exposure, a project is considered for charter. To work within limited available funding; the "Risk" methodology is intended to place funds toward greater return of risk reduction.

Planning: Each year HPU will select a certain number of sanitary sewer pipes and manholes to inspect. Assets will then be provided ratings for COF, POF and Risk. Generally, these assets will be selected:

- If they approach recommendation for replacement based on age, or if they have been targeted by flow monitoring, or if they have experienced high frequency of stoppages / overflows
- To coordinate with Harrisonburg Public Works (HPW) paving schedule where each year roads are selected for repaving; HPU cleans and inspects pipeline and manholes such that any defects can be repaired prior to paving.

Progress: FY 2014 initiated the TAMP with goals to 1) inventory all assets, 2) obtain life cycle attribute data for all assets, and 3) establish a Level 1 funding projection based solely on asset age. The following status applied:

FY 2014 Inventory of pipe:	191.2 miles
FY 2014 Inventory of manholes:	5,875 each
FY 2014 Pipe Replacement Value:	167.0 M Dollars
FY 2014 Manholes Replacement Value:	N/A
FY 2014 Pipe Depreciated Value:	109.7 M Dollars
FY 2014 Manholes Depreciated Value:	TBD
Five years Pipe Funding Requirement:	8.2 M Dollars
Five years Manholes Funding Requirement:	TBD
Pipe Replacement Schedule by Age	Yes (data verification to be completed)
Manhole Replacement Schedule by Age	TBD

Conclusion: Validations of pipe and manhole attribute data are priority goals for FY2015. Advancement of condition assessment and Risk assignment are also a priority.

XI. SSMP Objective #7; Sewer Overflow Benchmarking:

Objective: Objective #7 required HPU to progressively monitor the City's sanitary sewer overflow rates in comparisons against AWWA published benchmarks. Trending efforts were for purpose of pursuing progressive improvements.

Background: Benchmarking matured in the 1990's with many corporations investing significant resources in efforts to learn what made leading companies to stand out. Various utility organizations followed the same effort in the early 2000s. AWWA is an example of the latter that has published benchmark data for sanitary sewer system integrity. Overflows that occurred per 100 miles of pipe is the benchmark that has provided utility managers with key information that they needed to understand the health of their sanitary sewer system. This performance indicator became useful when maintained over time to gauge how a utility internally trends through improvement or regression. When used externally, these benchmarks provided indication of performance areas that were out of typical.

AWWA has defined Sewer Overflow Rate = [100 * [(# public sewer stoppages) / Total Miles of Pipe]] and has published the following benchmark data in 2011:

Top quarter percentile	1.30 overflows per 100 miles pipe
Median	8.40 overflows per 100 miles pipe
Bottom Quartile	30.50 overflows per 100 miles pipe

Planning: The activities as listed below were designed and engaged to make continuous improvements upon the City's Sewer Overflow Benchmark. HPU's *Program 912; Sewer System Reliability,* targets the purpose of delivering uninterrupted service to customers and to avoid sewer spills to the environment. Key components included both "carpet / sweep" and "priority" approaches as previously defined. They included:

Carpet / Sweep:

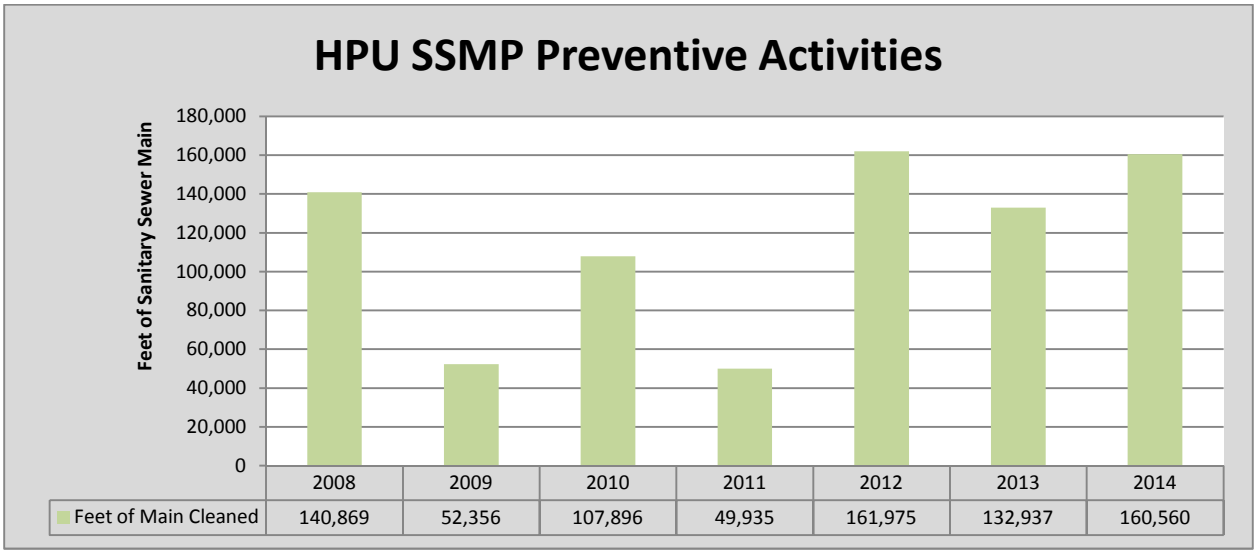
- Preventive Cleaning: Total City sanitary sewer system is prescheduled at 1/10 of inventory to be cleaned each year by jet flushing.

Priority:

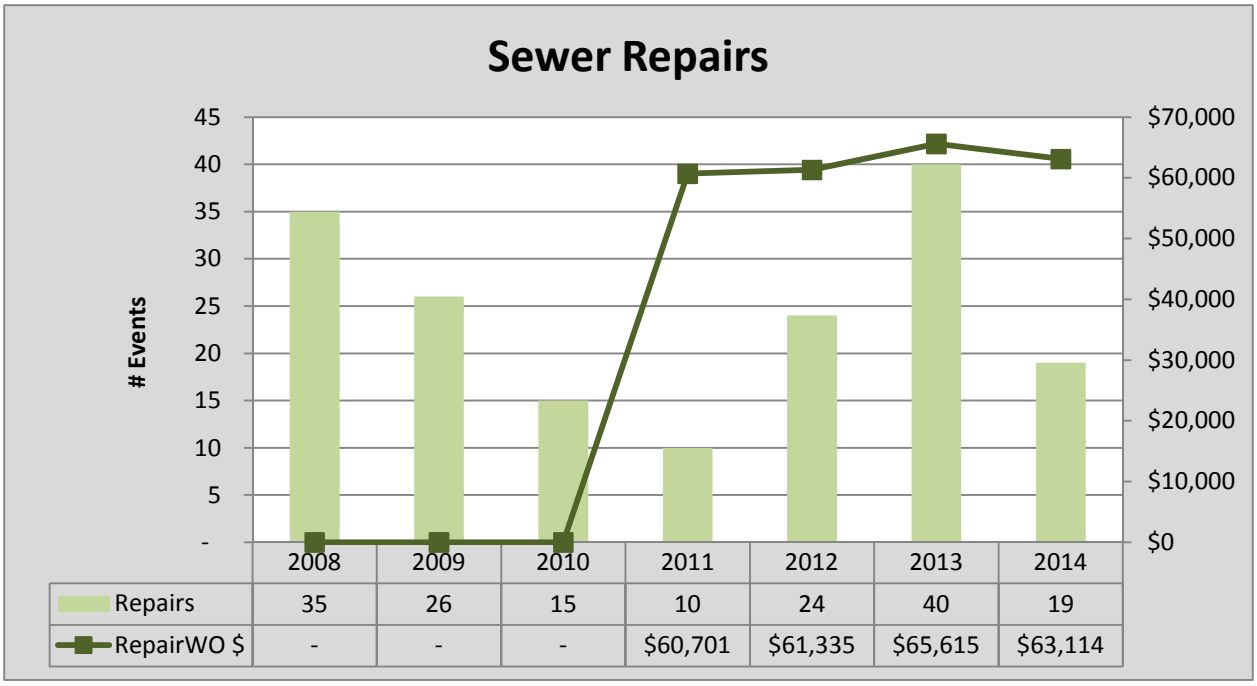
- Investigative Camera Inspection: Multiple occurrences of sewer blockages, or an occurrence causing property damage, initiated the assignment of a camera inspection.
- Remedial Response Cleaning: Sanitary sewer blockages were aggressively remediated by jet flushing response.
- Remedial Sewer Repairs: Under HPU *Program 907, Sewer System Repair,* repair work orders were assigned and tracked, respectively, to prioritize and complete repairs to mains and manholes.
- Remedial Capital Improvements. The occurrences of sewer overflows in specific pipe sections were combined with capacity and Risk assessments to prioritize the upgrade or replacements of sanitary sewer mains and manholes.
- I&I management, as presented in Section 2 above, is also an applicable prevention of sewer overflows.

Progress:

Preventive Maintenance: **Figure 12** as shown below recaptures HPU progress for preventive cleaning that was completed between 2008 and 2014. Since 2008 HPU has cleaned 805,528 feet of sanitary sewer main, or 80 % of system inventory. HPU is on schedule to complete the entire system by closure of the ten year period in 2017.

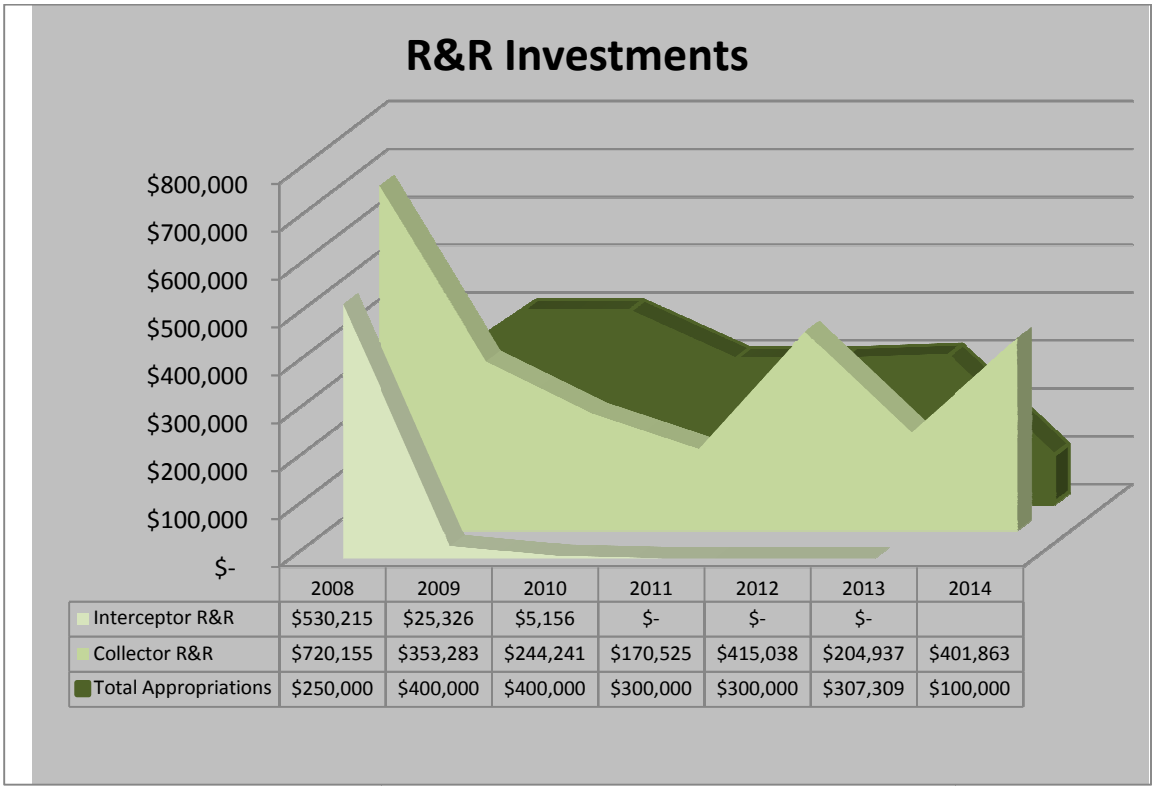


Repair Maintenance: **Figure 13** as shown below recaptures HPU progress for repairs to pipe and manholes that were completed between 2008 and 2014. The recorded annual costs as obtained from work orders have also been provided; this data from 2008 to 2010 was not available.



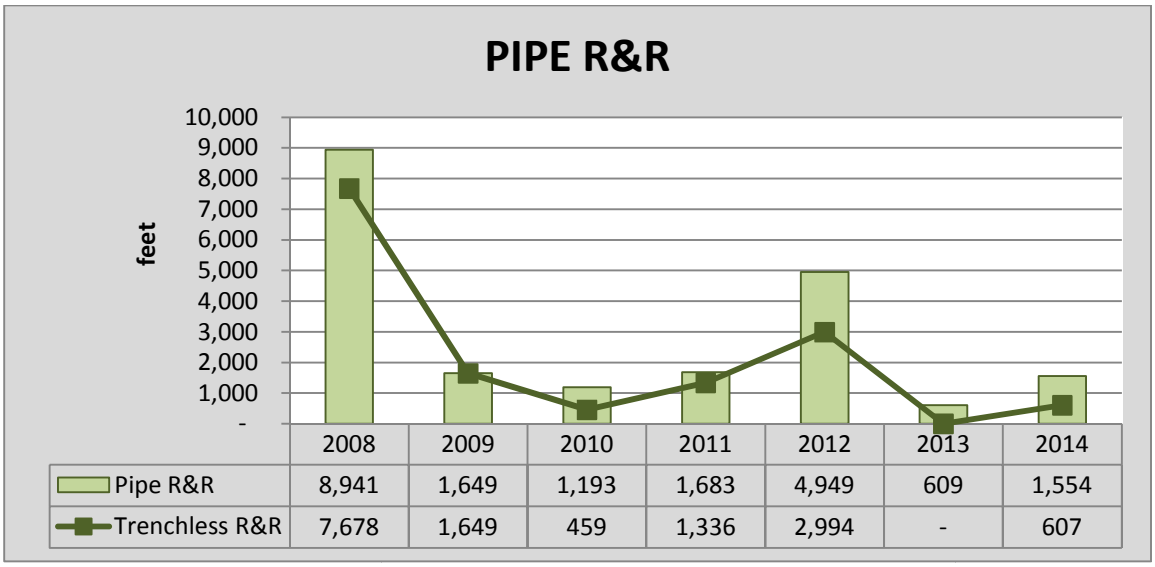
Rehab & Replacement:

Figure 14 shown below recaptures the appropriation and expenditures that the City of Harrisonburg has invested in R&R of its sanitary sewer system between 2008 and 2014. Earlier appropriations and CIP balances have allowed an average investments of $80,000/yr for interceptor R&R and $358,000/yr for collection system R&R. Maintaining appropriations has been a recent challenge in recognition of balancing cost to customers in terms of %HMI and increased funding to accommodate significant increases in HRRSA operating and debt expenses.



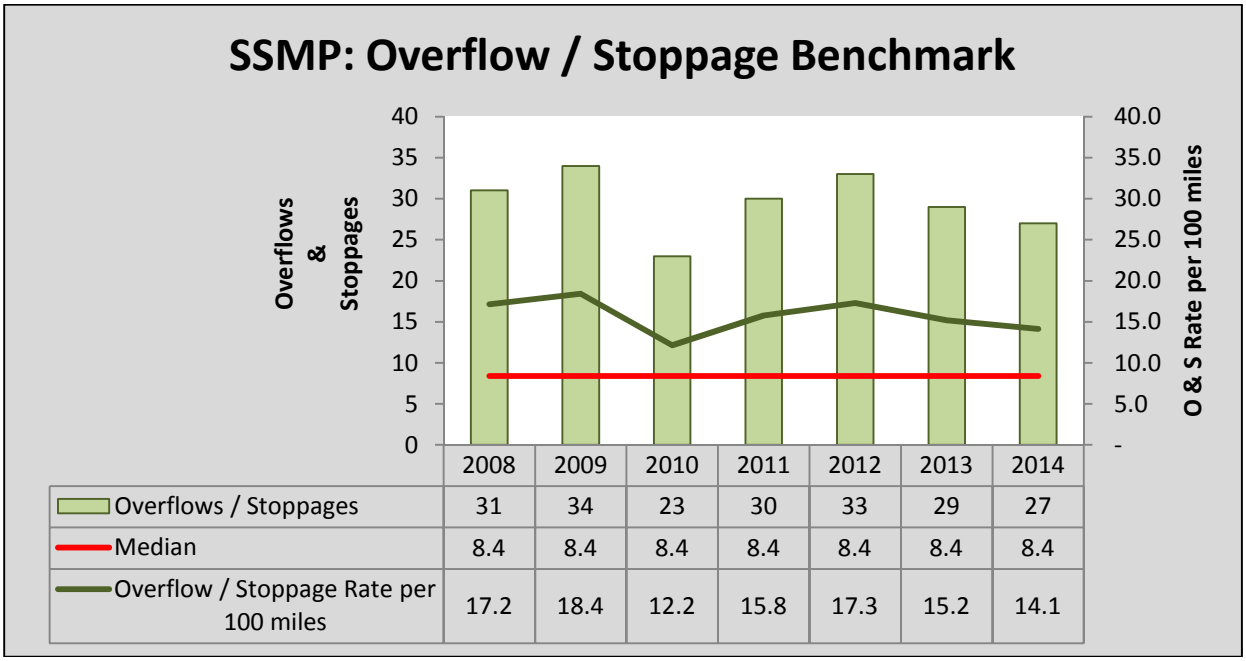
	2008	2009	2010	2011	2012	2013	2014
Interceptor R&R	$530,215	$25,326	$5,156	$-	$-	$-	
Collector R&R	$720,155	$353,283	$244,241	$170,525	$415,038	$204,937	$401,863
Total Appropriations	$250,000	$400,000	$400,000	$300,000	$300,000	$307,309	$100,000

Figure 15 as shown below recaptures HPU progress for pipe rehab and replacement that was completed between 2008 and 2014. Since 2008 HPU has rehabbed or replaced 20,578 feet of pipe; 14,723 feet (72%) has been rehabbed with use of trenchless technology. The remaining pipe was replaced using conventional open cut technology. The total Risk removed from the system has not been quantified.



	2008	2009	2010	2011	2012	2013	2014
Pipe R&R	8,941	1,649	1,193	1,683	4,949	609	1,554
Trenchless R&R	7,678	1,649	459	1,336	2,994	-	607

Conclusion: **Figure 16** uses columns to show sewer overflows / stoppages in the Harrisonburg Sanitary Sewer System from 2008 through 2014. Sewer overflow rates have been shown as the trend line with reported values that had ranges between 12.2 and 18.4 events per 100 miles of pipe. A second trend line shows the same overflow benchmark as reported by EPA to be the median for all surveyed systems. The median of 8.4 overflows per 100 miles of pipe, or lower, has been recognized to be Harrisonburg's goal. The sewer overflow trend places Harrisonburg's performance in the third quartile of the published benchmarks and thereby setting the precedence for improvement.



	2008	2009	2010	2011	2012	2013	2014
Overflows / Stoppages	31	34	23	30	33	29	27
Median	8.4	8.4	8.4	8.4	8.4	8.4	8.4
Overflow / Stoppage Rate per 100 miles	17.2	18.4	12.2	15.8	17.3	15.2	14.1

XII. SSMP Objective #8: Financial Benchmarking

Objective: Objective #8 required HPU to monitor its sewer enterprise fund financial indicators and to strive for "Midrange" or "Stronger" designations.

Background: Fitch Ratings published its evaluation criteria in 2013; this information includes the following financial indicators.

"% Household Median Income"	"Debt Coverage Ratio"
"Liquidity"	"R&R Ratio"

Planning: Financial data has been collected from the official records from the City of Harrisonburg.

Progress: The following indicators and benchmarks for FY2014 have been calculated and then referenced to Fitch's Rating Guide, respectively.

- **Residential Rates = 1.31% HMI;** where annual water plus sewer = $463.56/yr; HMI = $35,489 / yr. (Reported for 2012 as most recent data available for HMI)

Fitch rating "Stronger"	1.2% HMI
Fitch rating "Midrange"	1.5% HMI
Fitch rating "Weaker"	2.0% HMI

- **Liquidity = 148 days;** where Fund Balance = $3,988,263; average daily expenses = $26,997

Fitch rating "Stronger"	365 days
Fitch rating "Midrange"	180 days
Fitch rating "Weaker"	90 days

- **Debt coverage Ratio = 1.75;** where revenue less operating = $4,938,607; debt = $2,814,570

Fitch rating "Stronger"	2.00
Fitch rating "Midrange"	1.50
Fitch rating "Weaker"	1.25

- **R&R Ratio = 0.5%;** where EOY CIP balance = $917,513; asset replacement value = $167,018,200 (Annual CIP distributions at $400,000 per year)

Fitch rating "Stronger"	5.00%
Fitch rating "Midrange"	3.50%
Fitch rating "Weaker"	2.00%

Conclusion: Pursuant to Fitch Ratings: Rates, Liquidity and Debt Coverage are as "Midrange" status while R&R Ratio is designated "Weaker".

XIII. Conclusion:

The SSMP status report card is provided below:

Harrisonburg Public Utilities
SSMP FY 2014-2015 Status Report

Objective 1	Predict BWF at Buildout		8.22	MGD
Objective 2	I & I Benchmark	Goal	< 2,500	GPDIM
		AAD I & I	1,449	GPDIM
		M2M I & I	3,424	GPDIM
		Peak Day	N/A	GPDIM
Objective 3	I & I Reduction Goals / HRRSA-WWTP		(-2.41)	MGD
Objective 4	Re-evaluate Interceptor System Capacity Expansion & Address RDII Reduction Goals	Upper HRRSA Interceptor		FY 2016
		Lower West Interceptor		FY 2016
		Upper West Interceptor		FY 2016
		North Interceptor		FY 2016
		West Spur Interceptor		FY 2016
		East Interceptor		FY 2016
		Blue Ridge Interceptor		FY 2016
		Country Club Interceptor		FY 2016
Objective 5	Collection System Capacity Expansion & RDII Reduction Goals	BR 65	FY 2015 &	FY 2016
Objective 6	Progressively move Asset Management to "Level 3" Status	Level 1 status		85%
		Age Replacement Value		$167.0 M
Objective 7	Monitor Sewer Overflow Rate	Goal	< 8.4 /100 miles pipe	
		H'burg	12.2 - 18.4 /100 miles pipe	
Objective 8	Maintain Midrange & Financial Status	Rate Index		"Midrange"
		Liquidity		"Midrange"
		Debt Coverage Ratio		"Midrange"
		R & R Ratio		"Weaker"

Appendix A: Standard Operating Procedures

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Under Construction

Appendix B: Demand Calculations

Appendix C: FY2015 SSMP Implementation

FY 2015 Sanitary Sewer Priority Planning Project

Project scope of work includes:

Sewer System planned management	input man-hour	**2,882**	
	Output (miles)		n/a
Planned: Root & Grease Runs	input man-hour	150	
	Outputs (miles)		6
Planned: Sewer Main Flushing (miles)	input man-hour	300	
	outputs (miles)		21
Planned: Sewer Smoke Testing (miles)	input man-hour	450	
	Outputs (miles)		30.62
Sweep	input man-hour	300	
	Outputs (miles)		20.00
BR65	input man-hour	150	
	Outputs (miles)		10.62
CATV Work total	input man-hour	1,982	
	Output (miles)		20.22
Age	input man-hour	170	
	Output (miles)		1.10
BR 65	input man-hour	1,416	
	Output (miles)		10.62
Paving	input man-hour	396	
	Output (miles)		8.50

1) Perform field investigation of HRRSA priority (BR65-see below) and correlated to the 1980 PHR&A SSES study. Maps to be provided as follows:
   - A- 100 (Mosby Roads & City Shops Subsection)
   - A-200 (Lower Valley Blox Subsection)
   - A-300 (Pleasant Hill Subsection)
   - A-400 (Dealton Avenue & South Main Subsection)
   - B-200 (South Hampton Subsection)

Work to be performed:

- From previous interceptor flow monitoring, HRRSA has identified a collector sub-system known as BR65 (Mosby Road and Pleasant Hill) that contributes flows to the Upper HRRSA Interceptor. HRRSA has identified this section as having high probability of RDII contributions. HPU will repeat the flow

monitoring of the Upper HRRSA Interceptor and will complete the investigative activities for this sub-section before moving to another priority area.

- Complete a thorough re-smoke test of entire area; repeat as necessary in select locations per flow monitoring and inspections.
- Install flow monitors at Manholes A-2, A-100, B-200; correlate inflow induced peaking events with rainfall as incurred. Plan additional smoke testing, tv inspection, and wet weather investigation as necessary. Relocation of sensors may be required.
- Wet weather visual observations. Assign crews to field investigate the areas during rainfall events (schedule, field records, photographs to be formatted). Start with comprehensive approach and move to suspected high priority areas.

2) Perform field investigation of PHR&A line sections prioritized for Inflow as provided in Table 1-2 page 1-11 PHR&A Volume1. The table has been recreated with original data but also includes current day nomenclature to pipelines and manholes. The investigation should begin with smoke testing and then conclude with Catv inspection or manual inspection and possibly induced I&I.

3) Perform field investigation of all storm devices with possible connections to sanitary sewer per pages 5-18 through 5-23 PHR&A, Volume 1. Field maps are being provided for the following locations:

- West View & South Mason Streets
- South side of Franklin at Main Streets
- 3 inlets at Ash Tree and South Main Streets
- 3 inlets at Campbell and South Main Streets
- Storm lid between #120 and #130 Crescent Drive
- South side of First Street west of Lee Street
- Grate inlet on west side of Lee Street
- Intersection at 2nd and Colicello Streets
- Culvert back of Swift Company Parking Lot
- Behind curb @ 72 Weaver Street
- 12” storm pipe behind Meyers @ Creek Avenue

BR 65 / Old WWTP Site
JOHN WAYLAND HIGHWAY (RT. 42)
SOUTH MAIN ST. (RT. 11)
INTERSTATE 81
PORT REPUBLIC RD.
HB553 FLOW METER
HB1152 FLOW METER
AH3 FLOW METER
HB523 FLOW METER
BR65 FLOW METER
LEGEND
HRRSA SANITARY SEWER SYSTEM
CITY OF HARRISONBURG AND ROCKINGHAM COUNTY SEWER SYSTEM
METERING STATION & FLOW METER LOCATIONS
ROAD CENTERLINE
HARRISONBURG CITY LIMITS
BR65 FLOW METER SEWERSHED
wileywilson.com
Wiley|Wilson
Constant Progress
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