CITY OF KELSO

STORMWATER

MANAGEMENT PLAN

PHASE II

PREPARED BY:

GIBBS & OLSON, INC.
Longview, Washington

Project No. 0427.1015

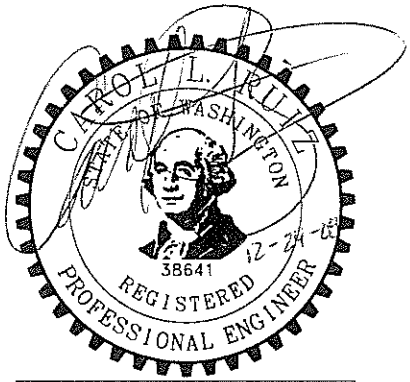
December 2008

CITY OF KELSO

STORMWATER

MANAGEMENT PLAN

PHASE II



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STORMWATER MANAGEMENT PLAN – PHASE II

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EXECUTIVE SUMMARY

In July 2006, Gibbs & Olson, Inc. presented to the City (City) Phase I of the Kelso Stormwater Management Plan (SMP). Phase I included the delineation of the stormwater basins within the city limits and provided a SMP for drainage within Basin 1 of the City. The Phase I SMP included inventory of the existing structures and pipes, evaluation of the materials and function of the system, and recommendations for the improvement to the city's Phase I system. In May of 2007, Gibbs & Olson, in conjunction with the City, began Phase II of the SMP, which includes five basins, Basins 10 through 14. A map of the city basin delineations was included in the Phase I report.

As in Phase I, Phase II of the SMP identifies deficiencies and recommends improvements for the following three elements of the storm drainage system:

- Pipe capacities
- Pipe materials
- Structure access and connections

Development of the SMP included the following steps:

- Preparation of an inventory of the existing stormwater collection system
- Modeling of the existing collection system in Phase II
- Identification of areas of insufficiency
- Preparation of a Capital Improvement Plan (CIP) for recommended improvements

Stormwater Collection System

Phase II includes five Basins, Basins 10, 11, 12, 13 and 14, as shown on Figure A in Appendix A. The City developed a numbering scheme for identifying the existing structures within Phase II, surveyed in the coordinate location (northing and easting), structure rim elevation and documented the structure type, the number of pipes, size and type of pipes, and measure downs within the structure. Gibbs & Olson, Inc. then entered data based on the structure information documented in the field by City personnel. An overall data file has been created based on

compilation of the data. Structure and pipe information was entered into StormCad (Haested Methods) to develop system flows utilizing the Rational Method and develop pipe capacities. Each basin was modeled separately and the overall area for each basin was divided into individual areas corresponding to the number of inlet structures.

System Deficiencies

Modeling for system deficiencies was conducted for each basin in Phase II using a 25-year storm analysis. Individual system flows and capacities for each basin can be found in Appendices B-F. Modeling identified capacities for the corresponding systems, together with individual pipe capacities and identified areas where existing system capacity was insufficient for modeled storm flows. In some locations, pipe material was more of an influence in capacity deficiency than pipe diameter.

A Capital Improvement Plan (CIP) is developed incorporating recommended improvements and associated cost estimates. Summary of the CIP is provided in Chapter 3 and at the end of each basin analysis in Appendices B-F.

CHAPTER 1

INTRODUCTION

1.1 PURPOSE

In response to the 1987 Amendments to the Clean Water Act (CWA), the U.S. Environmental Protection Agency (EPA) developed Phase I of the National Pollutant Discharge Elimination System (NPDES) Stormwater Program in 1990. The Phase I program addressed sources of stormwater runoff that had the greatest potential to negatively impact water quality. Under Phase I, EPA required NPDES permit coverage for stormwater discharges from medium and large municipalities (communities with populations greater than 100,000). Following the Phase I regulations, Phase II of the NPDES Stormwater Program was implemented which required communities with populations greater than 10,000 to comply with the NPDES regulations. With a population of approximately 11,950, the City of Kelso fell within these Phase II parameters and is now covered under the NPDES Western Washington Phase II Municipal Stormwater Permit (Permit). The Permit requires the City to develop a municipal storm sewer map. This report continues to develop this map and the associated Capitol Improvements Program (CIP) for the City.

1.2 SCOPE OF PLAN

This SWP is intended to be the guiding document regarding the management of stormwater, quality and quantity, within the direct control of the City of Kelso. Operation and Maintenance (O&M) outlines will be identified in the SWP as guiding principles for the City's activities in the stormwater arena. A Capital Improvement Plan (CIP) for Phase II has been developed for future City budget planning considerations.

1.3 GOALS AND OBJECTIVES

Goals

The goal of this plan is to:

1) Develop a continuous and comprehensive program for managing surface water and recognizing subsurface drainage contributions in Kelso that prevents property damage and meets or exceeds water quality standards, and;
2) Identify the existing system and its inadequacies and recommend improvements to the system in Basins 10-14. *(Phase I completed July 2006).*
3) Develop a procedure to inventory and analyze the remaining Phases within the City of Kelso city limits.

Objectives

The following objectives are designed to accomplish the above goals:

1) Develop stormwater basin boundaries within the City of Kelso city limits *(completed July 2006)*;
2) Develop a stormwater system inventory that provides a horizontal and vertical relationship together with pipe sizes for all known storm systems within the City;
3) Outline the current existing city conditions with respect to stormwater area characteristics, city policies and regulations, and how the system works;
4) Develop comprehensive maps of the City's drainage system;
5) Analyze the existing drainage system;
6) Develop a Capital Improvements Program;

CHAPTER 2

PHASE II SYSTEM ASSESSMENT

2.1 GENERAL

The current Phase II system is a combination of primarily public with some private systems. The City of Kelso owns and maintains the system in the public right-of-way together with some easements that cross private property.

Private systems were found in several locations within Phase II, consisting of catch basins, manholes and piping. These systems were identified on the individual basin maps, but specific information for some areas of this study was not obtained due to the inability to access the structures on private property.

2.2 HYDROLOGY

A plan of the Phase II system of catch basins and manholes has been mapped and is included in the report in Appendix A. Field data for pipe size, invert elevations (IE), pipe materials, as well as lengths, have been recorded. This Phase includes five basins with basic flow modeling performed using StormCad by Haested Methods to determine where potential flow problems are likely to exist, and to aid in identifying capital improvement projects. StormCad calculates flow (Q) utilizing the Rational Method, Q=CIA. Each catch basin or inlet was assigned an inlet area (in acres) developed by dividing the overall area by the number of inlets. In most instances, the time of concentration for each inlet was entered as five minutes for the Phase II Basin Areas. The rainfall intensity (I) for the modeling was developed based on the 25-year, 24-hour rainfall total as listed in the Stormwater Runoff Control Guidelines for the Longview-Kelso Urban Area. Individual runoff coefficients (C) were selected for each area based on the existing City Zoning Map. The coefficients for the types of drainage area are listed with a range and the median value was used. Phase II basin had a wide range of use from single-family residential to multi-family and commercial. The values for the runoff coefficients used in the runoff calculations are listed in Table 2A.

Land Use	Listed Range for C	Value Used
Single Family Residential	0.3-0.5	0.40
Multi-Family Residential	0.40-0.75	0.60
Commercial: Town Center Special Retail Major Retail	0.70-0.95	 0.80 0.90
Open Space: Rail Yard	0.20-0.35	0.27

Table 2A Runoff Coefficients, C

2.3 SYSTEM ISSUES

As stated previously, a system inventory of Phase II was conducted in a cooperative effort between the City of Kelso and Gibbs & Olson, Inc. The City of Kelso numbered the system structures, surveyed in the coordinate locations using the Washington State Reference Network, and gathered the system information such as pipe sizes and types, along with measure down information for determining invert elevations. A listing of all points gathered for Phase II and a listing of all unused points are provided in Appendix G. Using the structure rim elevation and the measure down data gathered by the City of Kelso, invert elevations were calculated and applied to the pipes entering or exiting a structure. During the analysis of the data for the five basins, several issues became apparent with the City's system. Each of the five basins is discussed in further detail in Appendices B-F.

Several catch basins had pipe leading to a main line pipe with no identified downstream structure connection, and were assumed to be blind connections. Due to the constraints of the modeling program, blind connections cannot be added to the system, and therefore, junctions were added where a blind connection was apparent. For ease of modeling, where two blind connections enter within the same proximity, the blind connections were added at the inserted junction location, using the prefix J in the numbering system for easy identification. In most cases, the City should assume the blind connections occur at 90-degrees to the trunk line pipe. It is recommended that wherever a junction is present, the City perform additional field investigation to determine if a structure exists below the

pavement surface, or if a blind connection actually exists. This investigation would most likely need to occur by television analysis of the system. In addition, some catch basins had smaller diameter pipe entering a basin with no known upstream structure. For the purpose of the model, these pipes were assumed as private roof or yard drains and were not included in the model. (See original field note data for additional information.) However, the area draining the pipe was accounted for in the overall analysis.

Pipe size: The first system issue identified is the presence of small diameter pipe, that is, pipe less than 12-inches in diameter. Approximately 47% of the City's system is comprised of pipe with diameters less than 12-inches. Table 2B shows the pipe compilation by size and material. The small diameter pipe, in conjunction with the relatively flat pipe slopes, severely inhibits the capacity of the piping system due to the reduced flow capacity. A preliminary recommendation is to remove any trunk lines with piping less than 12-inches in diameter and replace with a minimum of 12-inch diameter pipe.

Pipe Size (inches)	Concrete (ft)	CMP (ft)	PVC (ft)	Clay (ft)	HDPE (ft)	Ductile Iron (ft)	Total (ft)	Percentage
4	4	0	147	0	0	0	151	0.32%
6	3,944	0	1,180	197	0	12	5,333	11.35%
8	8,255	0	1,878	1,390	114	0	11,637	24.76%
10	2,830	46	978	1,107	23	0	4,984	10.60%
12	5,313	14	856	0	1,132	235	7,550	16.06%
15	0	161	1,126	0	0	0	1,287	2.74%
16	353	0	0	0	0	0	353	0.75%
18	1,496	0	194	0	0	0	1,690	3.60%
21	0	0	393	0	0	0	393	0.84%
24	4,051	2,043	359	0	0	0	6,453	13.73%
30	0	508	0	0	0	0	508	1.08%
32	144	1,640	0	0	0	0	1,784	3.80%
36	3,517	416	0	0	0	0	3,933	8.37%
48	726	94	0	0	0	0	820	1.74%
60	127	0	0	0	0	0	127	0.27%
Total (ft)	**30,760**	**4,922**	**7,111**	**2,694**	**1,269**	**247**	47,003	100.00%
Percentage	65.44%	10.47%	15.13%	5.73%	2.70%	0.53%	100.00%	

Table 2B Phase II Pipe Totals

Pipe Material: The City's system is comprised of multiple material types, including concrete, polyvinyl chloride (PVC), clay, high density polyethylene (HDPE) and corrugated metal pipe (CMP). The majority of the City's system (65%) consists of concrete pipe. Many issues in the City's system can be attributed to the degradation of concrete pipe. In addition, 10% of the City's system is comprised of CMP, which inhibits the flow of stormwater through the system. The majority of CMP is located in Basins 11 and 12 which drain the area around the Three Rivers Mall.

System Maintenance: The final contributing issue to the City of Kelso's stormwater system is maintenance. During the inventory of structures and pipes, several notes were made in regards to cleaning a structure or pipe connection. Cleaning of a structure took place where needed to obtain existing data, and it is recommended the system continue to be cleaned on a regular basis to maintain the function of the system until recommended improvements can be made. An order of precedence for cleaning and improvements is listed in Chapter 3.

2.4 CONCLUSIONS

Reviewing Basins 10 through 14, the most prominent issue for the functioning of Phase II is the presence of small diameter pipe and the lack of available pipe slope. Providing positive slope for those identified with negative slope is the first issue to be addressed. For those pipes with positive but relatively flat slopes, increasing the pipe size will provide additional capacity for the system. A notable issue to contend with is the lack of ground cover for the piping system. In some cases, providing increased slope and/or larger pipe sizes may not be feasible due to the lack of ground cover over the pipes. In these instances, it may be necessary to utilize a specialized pipe such as an arch pipe, or install two or more pipes of smaller diameter in parallel to provide the capacity required. A detailed engineered design of specific pipe replacements will be required that takes into account ground cover, existing invert elevations of adjacent pipes, other underground utilities and the surrounding environment.

CHAPTER 3

RECOMMENDATIONS

3.1 GENERAL:

With respect to storm water, the City's current system complies with existing local and state requirements, with regular maintenance being the main ongoing expense. It should be noted that storm water is a new evolving field which is in its infancy. Driven by federally mandated changes, that are being governmentally implemented by the State of Washington Department of Ecology (DOE), the existing standards will be evolving and changing over the next decade.

This stormwater plan for Phase II, together with the following recommendations, represents a General Plan which will provide a proactive response for the citizens of Kelso, together with a comprehensive inventory of the City's existing stormwater infrastructure, to aid in a smooth and cost effective transition to the storm water demands of 2013 and beyond.

3.2 SYSTEM UPGRADES

The Phase II inventory for storm water piping and devices represents the best available information at this time. As ongoing piping and devices are expanded or upgraded into the system, the new installations need to be added to the existing inventory. Additionally, should pre-existing conditions be found that are not inventoried, these should be appended into the City's inventory.

Over 47% of the Phase II existing system is comprised of pipes with diameters less than 12-inches (see Chapter 2, Table 2.B). Many of these lines are single pipes connecting into a trunk line, and are not causing a significant problem to the system flow. However, it is recommended that any new pipe installed be a minimum of 12-inches in diameter. Overall, 34,870 linear feet of pipe (74%) were identified as undersized and 21,834 LF (46%) were identified as trunk line pipes to be upgraded. Table 3A shows the breakdown of recommended pipe upgrades per Basin and pipe size.

Pipe Size	10	11	12	13	14	Total
12-inch	0	0	0	0	2,138	**2,138**
18-inch	881	0	0	1,558	1,350	**3,789**
24-inch	1,459	382	0	547	510	**2,898**
30-inch	890	601	0	272	231	**1,994**
36-inch	1,253	707	0	0	0	**1,960**
42-inch	0	751	0	269	0	**1,020**
48-inch	0	1,050	0	300	0	**1,350**
54-inch	319	0	521	513	0	**1,353**
60-inch	1,946	376	1,281	0	0	**3,603**
66-inch	512	0	853	0	0	**1,365**
90-inch	0	0	0	364	0	**364**
Total	**7,260**	**3,867**	**2,655**	**3,823**	**4,229**	**21,834**

Table 3A Pipe Upgrades

The modeling results for the 25-year storm indicate the majority of the system in Phase II is undersized, and should be upsized according to the recommendations in the individual Basin assessments in Appendix B. However, it should be noted much of the system had hydraulic grade lines at or below the existing ground elevation, and while full, may not be creating a major flooding problem.

3.3 CAPITAL IMPROVEMENTS

Appendices B through F contain information on Basins 10 through 14 and recommended improvements. A compilation of the estimated budget for completing all the pipe upgrades and repairing the surface to existing conditions is shown in Table 3B. Since this is a storm water project in the City's street right of way, sales tax is not applied to the estimate. The total Preliminary Opinion of Probable Cost for the identified improvements is $4,715,000. A detailed breakdown of cost is included in the Table 4 for each basin summary. This cost is based on contracting the work to be done by other than City of Kelso forces.

Basin	TOTAL
10	$1,598,345
11	$915,995
12	$938,050
13	$766,500
14	$494,620
Total Phase II	**$4,713,510**

Table 3B Preliminary Opinion of Probable Cost, Phase II

It is unlikely the City of Kelso will have the estimated budget to complete all the recommended upgrades to the system at the same time, as listed in this report. Therefore, a guideline for order of precedence for the CIP has been developed and is suggested as follows:

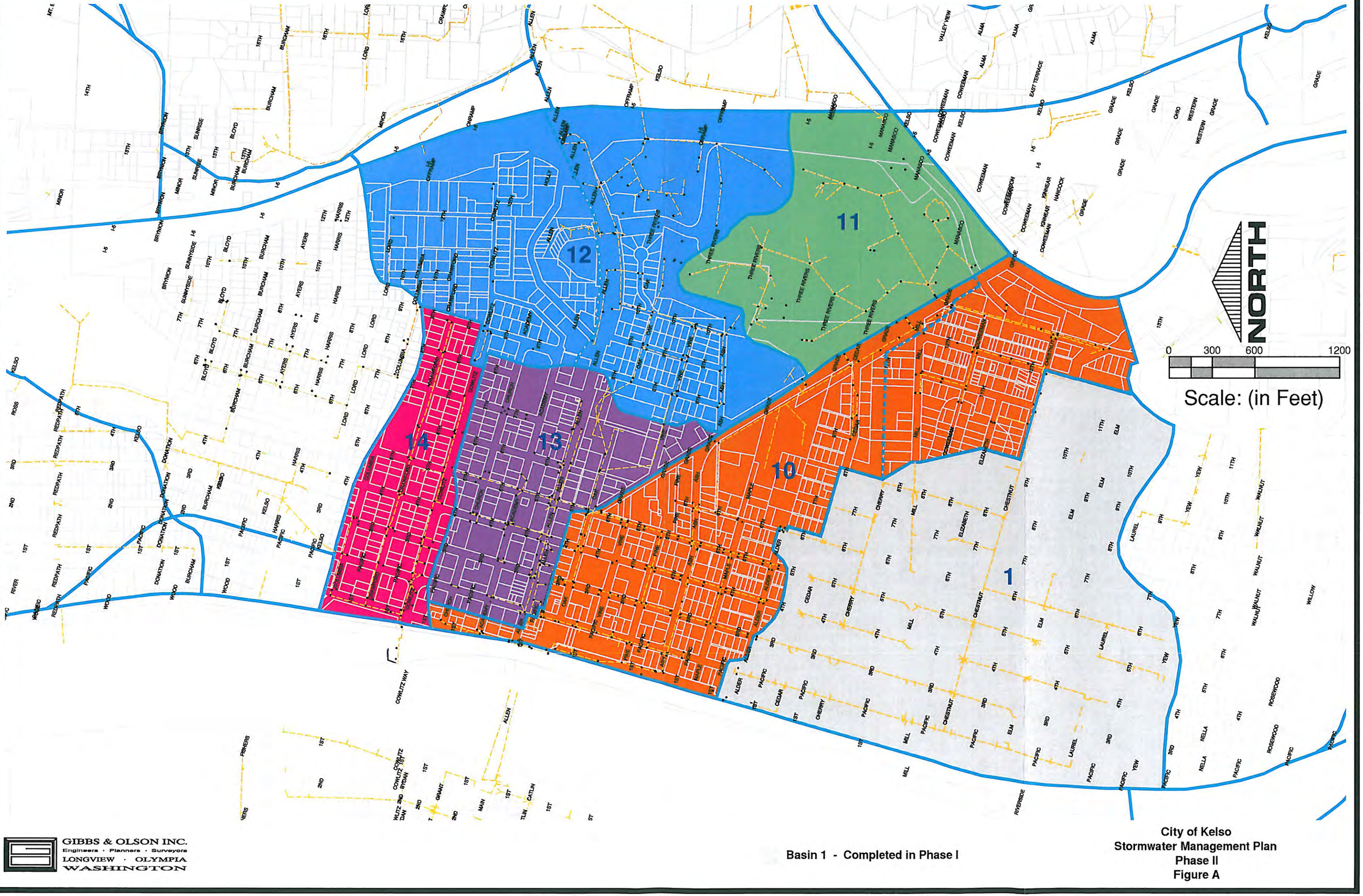
1. Clean catch basins and storm drain manholes to verify pipe inverts;
2. Clean and television storm drain pipes to determine if blockages are encountered;
3. Replace corrugated metal and clay/terracotta pipes with HDPE pipe such as ADS N-12 or similar;
4. Upgrade storm drain pipes on trunk lines to sizes recommended to handle flow from side systems and to provide additional storage during larger storm events;
5. Upgrade storm drain pipes on side streets to sizes recommended.

These recommendations are based on a planning level assessment only. There may be physical constraints that make it impossible to install the large pipes recommended for upgrading the system. A detailed engineered design of the proposed system will be required, which takes into account the existing surrounding environment. The individual and overall system budget estimates have been developed based on the cost to remove and replace the pipes with the sizes as shown, and to repair the existing surface to its current condition. Consideration should be

given to the shallow cover and other utilities within the City's right of way which may require additional engineering solutions and add unknown costs to those provided in this report.

Appendix A

Phase II Basin Mapping



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Basin 1 - Completed in Phase I

City of Kelso
Stormwater Management Plan
Phase II
Figure A

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NORTH

0 500 1000 2000

Scale (in Feet)

NOT INCLUDED

NOT INCLUDED

City of Kelso
Stormwater Management Plan
Phase II
Figure B
Overall City Basin Mapping

Appendix B

Basin 10

BASIN 10

SYSTEM ASSESSMENT

Basin Description: Basin 10 consists of the structures along Grade Street, 1st Avenue and the north boundary of Basin 1, from Church Street south to Chestnut Street. It drains an area between the bank of the Cowlitz River dike on the west and the bank of the Coweeman River to the east, from Church Street to the north boundary of Basin 1. Figure 10.1 shows an aerial photograph of Basin 10. It contains 217 structures (148 catch basin, 8 curb inlets, 61 manholes and 38 assumed connections), the majority of which are between 1st and 5th Avenues and Oak and Alder Streets. The outlet for the Basin 10 model is at node 4138 in Grade Street. The runoff from Basin 10 flows from 4138 into a 36-inch pipe that crosses Grade Street and continues south along 13th Avenue, eventually discharging to the Coweeman slough. Due to high water elevations and confined entry restrictions, field data was not obtained for this run. It is recommended further field investigation take place so the remainder of the system be modeled.

The total drainage area for Basin 10 is 108.9 acres. However, approximately 31% of the basin area, 33.5 acres, was eliminated from this phase due to insufficient data to complete the modeling of the existing system. The land use for the 74.5 acres included in the model is approximately 8% single family residential, 37% multi-family residential, 18% special retail, 6% major retail, 29% town center and 2% open space. See Figure 10.2 for the land use areas in Basin 10.

System Modeling: Table 10.1, System Summary, lists the structure information and connections, along with total flows and capacities. Figures 10.3-1 and 10.3-2 show a schematic of the structure locations and piping layout. As stated in Chapter 2, junctions were entered into the model where blind connections were assumed to occur, using the prefix J in the numbering system for easy identification.

Other assumptions were made in the modeling, such as interpolating an invert or rim elevation when junctions were added to the system. The field data for points 4067,

4068 and 1216 indicate each had pipes to the east, toward the City parking lot, matching the City's schematic. However, no structures were field located to complete the connection between 4067 and 4068. Therefore, junctions J-10-34 and J-10-35 were inserted, matching the City's schematic, and pipes inserted connecting 4067 and 4068, with slopes assumed based on the invert out of 4067 and the invert in at 4068. For modeling purposes, point 1216 was assumed to connect at J-10-35, matching the field data for the pipe exiting this structure. It is recommended that additional investigation be performed to determine if structures exist at J-10-34 and J-10-35.

There are several locations where field data indicates the system flow (based on pipe inverts) is heading in a particular direction, but the system could not be connected due to a missing structure, such as at 5th Avenue and Oak Street. For modeling purposes, a junction was inserted to complete the system. It is recommended that additional field investigation be performed to determine if a structure exists at the intersection of 5th Avenue and Oak Street, identified in Basin 10 as J-10-17.

As seen in Table 10.1, the majority of pipes with insufficient capacity (50%) are less than 12-inch in diameter. Utilizing the current slopes, the majority of pipes less than 12-inch in diameter will gain capacity by upsizing to 12-inch HDPE pipe. The majority of pipes along Grade Street, Ash Street and Pacific Avenue (P-10-100 through P-10-127, considered the trunk line) have slopes less than 0.005 ft/ft, severely inhibiting the capacity of the system. Increasing these pipes from the existing to HDPE in the diameter listed in Table 10.3, keeping the same slope, will provide increased capacity in the system.

SYSTEM ISSUES

Pipe size: The first system issue identified for Basin 10 is the presence of small diameter pipe, that is, pipe less than 12-inches in diameter. Approximately 50% of the system is comprised of pipe with a diameter less than 12-inches. Table 10.2 shows the pipe compilation by size and material. The small diameter pipe severely inhibits the capacity of the piping system due to the reduced flow capacity. A preliminary recommendation is

to remove any trunk lines with piping less than 12-inches in diameter and replace with a minimum of 18-inch diameter pipe.

Pipe Material: Basin 10 is comprised of five modeled material types: concrete, CMP, PVC, clay and HDPE. The majority of the system, (90%) consists of concrete and clay, with the remaining 10% comprised of PVC, HDPE and CMP. Both concrete and clay pipe are similar in properties, with a relatively low Manning's coefficient. However, both concrete and clay piping are rigid materials that provide movement only at the joints, and are susceptible to separation, fracture or breakage in the pipe if ground movement occurs. Typically, the most common failure in older concrete pipe occurs at the joints as the rubber gaskets become brittle and disintegrate, providing an opportunity for the pipe to separate. Overtime, this can lead to deposit of unwanted material in the pipe and degradation or failure of the pipe. Material in the pipe opening blocks the path of flow for storm water, making it less effective. In addition, the life expectancy of concrete pipe is approximately 40-years versus HDPE which has a projected life span in excess of 100 years. Material such as HDPE is more flexible and less likely to degrade overtime, and for this reason it is recommended replacement of any concrete or clay pipe be completed with HDPE.

System Maintenance: The final contributing issue to the City of Kelso Basin 10 storm water system is maintenance. During the inventory of structures and pipes, several notes were made in regards to cleaning a structure or pipe connection. The inability to obtain specific inventory data for the pipes and structures along 13th Avenue resulted in the need to truncate the modeling at structure 4138, the last structure with sufficient data for running the model. Cleaning of many structures took place to obtain existing data, and it is recommended the system continue to be cleaned on an annual or semi-annual basis to maintain the function of the system until recommended improvements can be made.

RECOMMENDATIONS

System Replacements: It is recommended at a minimum that the main pipes down 1st, Pacific, and 5th Avenue, and Ash and Grade Streets (considered trunk line pipes) be replaced with HDPE pipe in the diameter size listed in Table 10.3. This would allow for increased pipe capacity and act as storage for the system should downstream tail-water conditions occur. Many of the smaller lines in the system are connecting into the trunk line and do not appear to be causing a significant problem to the system. However, it is recommended that any new or replaced pipe be composed of HDPE at a minimum diameter of 18-inches. A total of 7,260 LF of trunk line pipes are recommended for upsizing.

Capital Improvements: The estimated budget to upgrade from the existing pipe sizes to the pipe sizes listed is approximately $1,600,000, as shown in Table 10.4. This cost is based on contracting the work to be done by other than City of Kelso forces, and includes the cost for repairing the surface to the existing conditions.

Operation and Maintenance: A guideline for order of precedence for the CIP has been developed such that budget consideration can be included and is suggested as follows:

1. Clean catch basins and storm drain manholes;
2. Clean and television storm drain pipes to determine if blockages are encountered;
3. Replace concrete and clay pipes with HDPE pipe such as ADS N-12 or similar;
4. Upgrade storm drain pipes on trunk lines to sizes recommended to handle flow from side systems and to provide additional storage during larger storm events;
5. Upgrade storm drain pipes on side streets to sizes recommended, and eliminate as many blind connections as possible during the improvement process.

These recommendations are based on a planning level assessment only. There may be physical constraints that make it impossible to install the large pipes recommended for upgrading the system. A detailed engineered design of the proposed system will be required, which takes into account the existing surrounding environment. The individual and overall system budget estimates have been developed based on the cost to remove

and replace the pipes with the sizes as shown, and to repair the existing surface to its current condition. Consideration should be given to the shallow cover and other utilities within the City's right of way which may require additional engineering solutions and add unknown costs to those provided in this report.

NORTH

0 200 400 800

Scale (in Feet)

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WASHINGTON

City of Kelso
Stormwater Management Plan
Phase II - Aerial Photo of Basin 10
Figure 10.1

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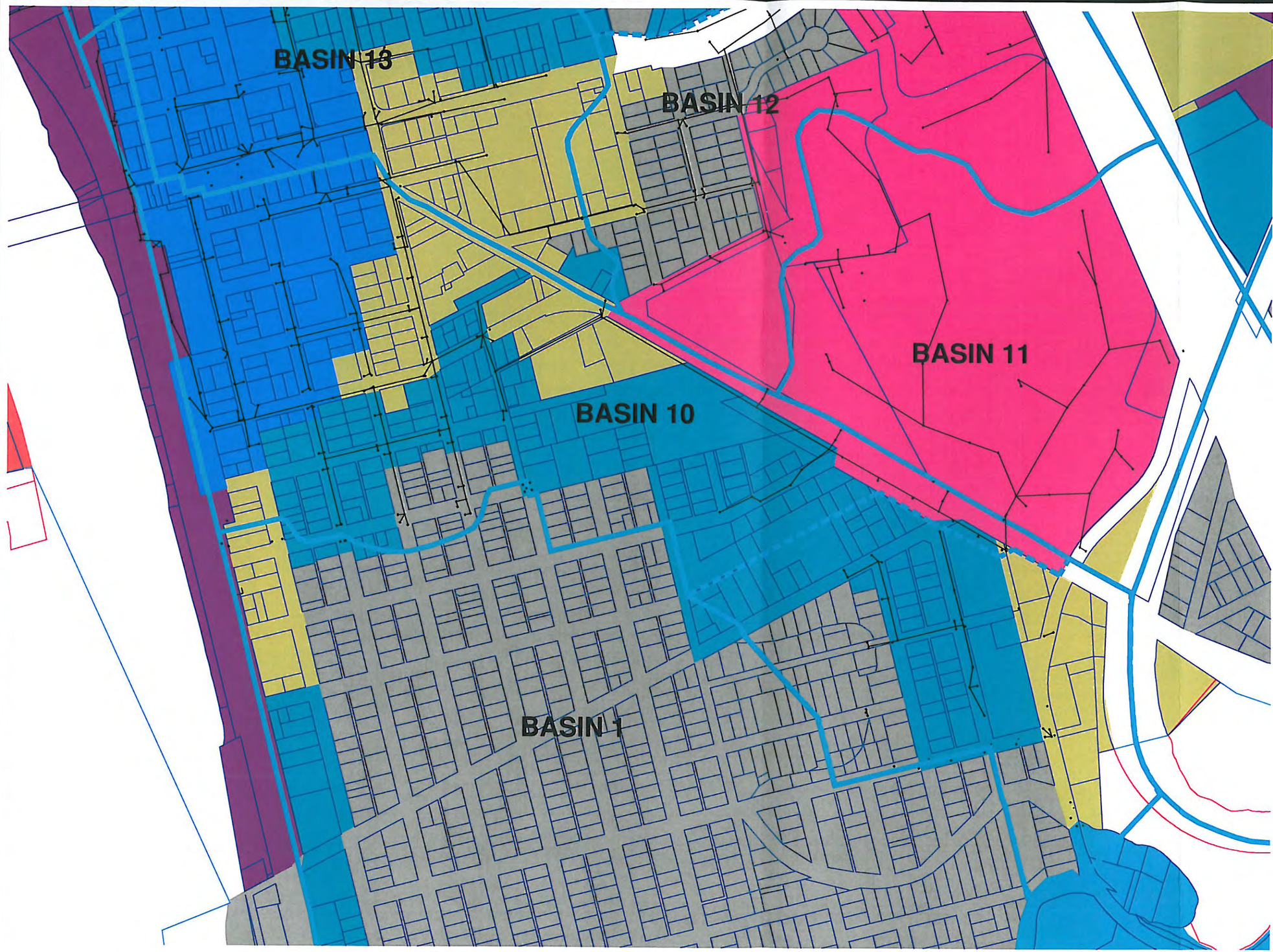

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WASHINGTON

City of Kelso
Stormwater Management Plan
Phase II - Basin 10 with Zoning
Figure 10.2

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MATCHLINE - SEE DWG 2 OF 2

13

14

10

1

COWLITZ
CHURCH
ACADEMY
ALLEN
VINE
OAK
GRADE
PINE
ASH
MAPLE
ALDER
CEDAR
CHERRY
PACIFIC
1ST
3RD
4TH
5TH
6TH
7TH
8TH

0 100 200 400

Scale: (in Feet)

NORTH

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City of Kelso
Stormwater Management Plan
Phase II
Basins 10 - 1 of 2

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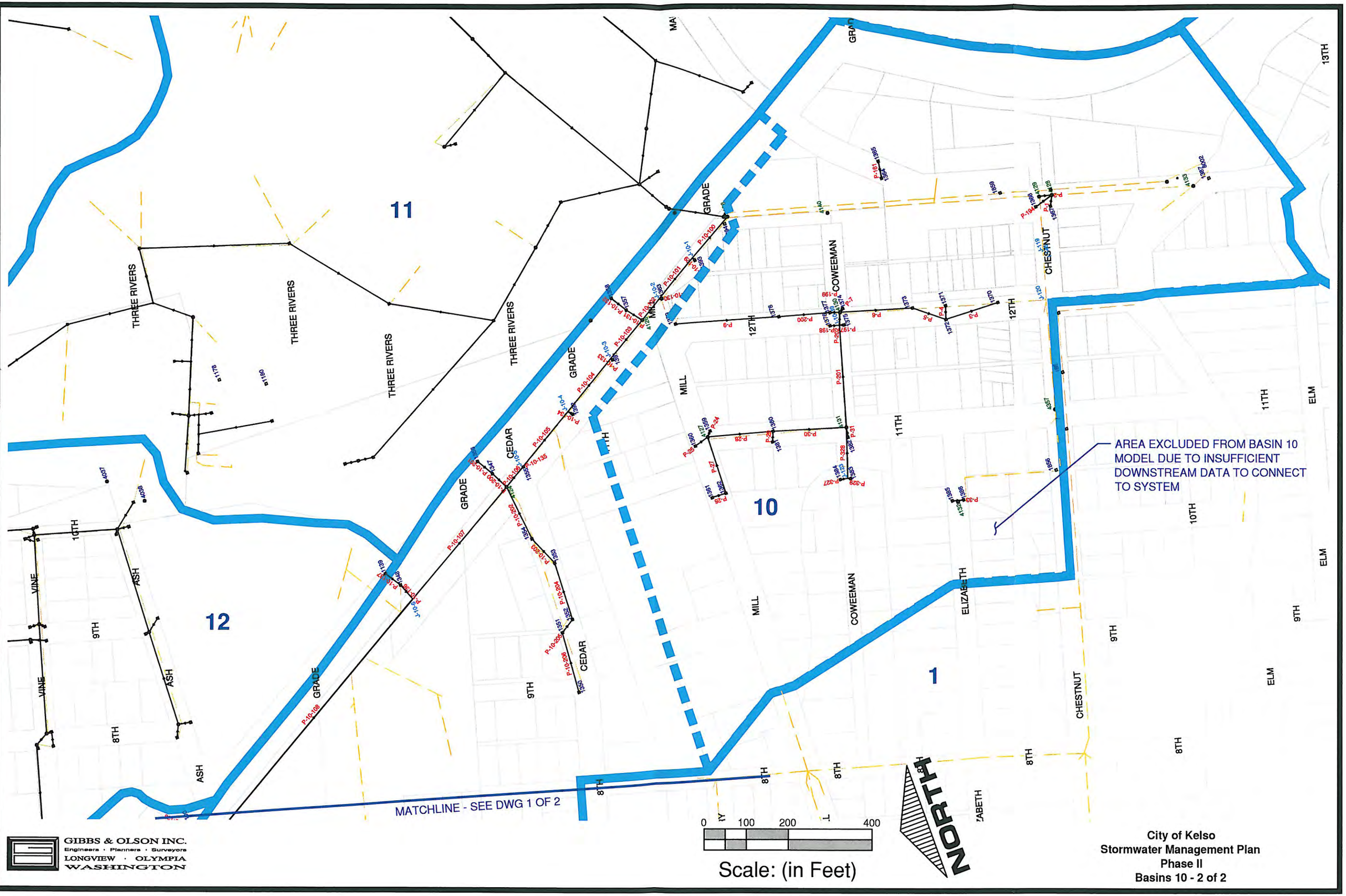

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City of Kelso
Stormwater Management Plan
Phase II
Basins 10 - 2 of 2

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Kelso Stormwater Management Plan
Phase II
Summary Legend

Legend

	System Flow > Pipe Capacity
	Ground elevation interpolated from nearest structure
	Invert elevation interpolated from upstream and downstream nodes
-0.02	Negative slope based on data provided
J	Junction
O	Outlet
Conc.	Concrete
T-cotta	Terracotta
DI	Ductile Iron
PVC	Polyvinyl Chloride
HDPE	High Density Polyethylene
CMP	Corrugated Metal Pipe
1000's	Catch Basins
4000's	Manholes or Curb Inlets
NDA	No Data Available

Kelso Stormwater Management Plan
Phase II
Basin 10

Table 10.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-10-100	4138	J-10-1	N/A	N/A	N/A	50.87	13.24	2.31	118.31	128	0.0043	36	Concrete	0.013	43.72	4.09	4.64	12.23	11.22	5.14	3.58	11.10	7.04	
P-10-101	J-10-1	J-10-2	N/A	N/A	N/A	50.34	13.11	2.32	117.60	127	0.0043	36	Concrete	0.013	43.89	4.64	5.19	11.22	19.54	3.58	11.35	15.05	11.10	
P-10-102	J-10-2	4126	N/A	N/A	N/A	49.82	13.05	2.32	116.63	64	0.0044	36	Concrete	0.013	44.11	5.19	5.47	19.54	13.31	11.35	4.84	17.00	15.05	
P-10-103	4126	J-10-3	N/A	N/A	N/A	48.78	12.93	2.33	114.65	118	0.0014	36	Concrete	0.013	25.31	5.47	5.64	13.31	10.42	4.84	1.78	16.80	13.31	
P-10-104	J-10-3	J-10-4	N/A	N/A	N/A	48.26	12.76	2.34	114.06	163	0.0015	36	Concrete	0.013	25.59	5.64	5.88	10.42	9.70	1.78	0.82	15.19	10.42	
P-10-105	J-10-4	J-10-5	N/A	N/A	N/A	47.73	12.58	2.36	113.50	172	0.0015	36	Concrete	0.013	25.43	5.88	6.13	9.70	17.99	0.82	8.86	14.68	9.70	
P-10-106	J-10-5	4124	N/A	N/A	N/A	47.21	12.52	2.36	112.49	59	0.0015	36	Concrete	0.013	26.05	6.13	6.22	17.99	13.74	8.86	4.52	16.36	14.68	
P-10-107	4124	J-10-6	N/A	N/A	N/A	44.43	12.14	2.39	107.18	346	0.0018	36	Concrete	0.013	28.23	7.30	7.92	13.74	21.60	3.44	10.68	22.68	13.74	
P-10-108	J-10-6	4123	N/A	N/A	N/A	43.38	11.33	2.46	107.40	731	0.0018	36	Concrete	0.013	28.13	7.92	9.22	21.6	24.14	10.68	11.92	40.56	21.6	
P-10-109	4123	4121	N/A	N/A	N/A	42.46	10.81	2.5	106.86	479	0.0027	36	Concrete	0.013	34.34	9.14	10.41	24.14	19.12	12	5.71	36.44	24.14	
P-10-110	4121	4120	0	0	0	42.46	10.8	2.5	106.89	6	0.0033	36	Concrete	0.013	38.51	10.41	10.43	19.12	19.12	5.71	5.69	19.27	19.12	
P-10-111	4120	4116	N/A	N/A	N/A	41.76	10.63	2.51	105.70	155	0.0012	36	Concrete	0.013	23.35	10.52	10.71	19.12	18.45	5.60	4.74	17.39	13.44	
P-10-112	4116	4111	0	0.00	0	40.02	10.37	2.53	102.13	229	0.0016	36	Concrete	0.013	26.81	10.71	11.08	18.45	18.92	4.74	4.84	22.76	17.39	
P-10-113	4111	4109	N/A	N/A	N/A	12.87	10.24	2.54	32.97	70	0.0213	16	Concrete	0.013	11.19	12.08	13.57	18.92	19.22	5.51	4.32	26.34	13.41	Assumed pipe connection 4109 to 4111 per Kelso schematic and direction of pipes in field data notes
P-10-114	4109	4142	N/A	N/A	N/A	12.40	9.89	2.58	32.22	381	0.0050	18	Concrete	0.013	7.42	13.87	15.77	19.22	21.47	3.85	4.2	55.07	19.22	
P-10-115	4142	J-10-7	N/A	N/A	N/A	12.40	9.59	2.62	32.78	330	0.0050	18	Concrete	0.013	7.45	15.79	17.45	21.47	24.25	4.18	5.3	53.6	21.47	
P-10-116	J-10-7	4074	0	0	0	11.94	9.55	2.63	31.62	44	0.0050	18	Concrete	0.013	7.43	17.45	17.67	24.25	24.52	5.3	5.35	28.24	24.25	
P-10-117	4074	4075	N/A	N/A	N/A	6.03	6.57	3.07	18.69	5	0.0020	12	Concrete	0.013	1.59	17.6	17.61	24.52	24.58	5.92	5.97	25.9	24.52	
P-10-118	4075	J-10-8	N/A	N/A	N/A	5.10	6.45	3.09	15.91	145	0.0010	12	Concrete	0.013	1.15	17.66	17.81	24.58	23.57	5.92	4.76	53.5	24.58	
P-10-119	J-10-8	4076	N/A	N/A	N/A	4.18	6.32	3.11	13.10	133	0.0011	12	Concrete	0.013	1.16	17.81	17.95	23.57	25.16	4.76	6.21	41.56	23.57	
P-10-120	4076	J-10-9	N/A	N/A	N/A	3.25	6.2	3.13	10.25	128	0.0011	10	Concrete	0.013	0.72	17.96	18.1	25.16	23.96	6.37	5.03	53.15	25.16	Structure 4078 lists 10" out to south; structure 4077 lists 12" in from north; 10" entered.
P-10-121	J-10-9	4077	N/A	N/A	N/A	2.32	6	3.16	7.39	115	0.0011	12	Concrete	0.013	1.2	18.1	18.23	23.96	24.75	4.86	5.52	28.91	23.96	
P-10-122	4077	J-10-10	N/A	N/A	N/A	2.32	5.74	3.2	7.48	147	0.0018	12	PVC	0.01	1.95	18.27	18.53	24.75	23.93	5.48	4.4	28.58	24.75	
P-10-123	J-10-10	4078	N/A	N/A	N/A	1.39	5.69	3.21	4.50	28	0.0018	10	PVC	0.01	1.2	18.53	18.58	23.93	24.6	4.57	5.19	24.63	23.93	
P-10-124	4078	4079	N/A	N/A	N/A	1.39	5.48	3.24	4.54	102	0.0028	10	PVC	0.01	1.52	18.53	18.82	24.6	25.12	5.24	5.47	27.19	24.6	
P-10-125	4079	J-10-11	N/A	N/A	N/A	1.39	5.44	3.24	4.55	21	0.0048	10	PVC	0.01	1.97	18.91	19.01	25.12	24.4	5.38	4.56	25.66	25.12	
P-10-126	J-10-11	4080	N/A	N/A	N/A	0.93	5.18	3.28	3.07	89	0.0048	10	PVC	0.01	1.98	19.01	19.44	24.4	24.63	4.56	4.36	25.43	24.4	
P-10-127	4080	J-10-12	N/A	N/A	N/A	0.93	5.12	3.29	3.08	18	0.0050	10	Clay	0.011	1.83	19.41	19.5	24.63	24	4.39	3.67	24.88	24.63	Slope assumed at 0.5% to match down stream slope. No field data to verify, but 1232 and 1242 field notes state blind connection.
P-10-128	J-10-12	1242	0.58	0.8	0.46	0.46	5	3.31	1.55	33	0.0285	8	Concrete	0.013	2.04	19.5	20.44	24	23.76	3.83	2.65	24.54	24	
P-10-129	J-10-1	1393	0.58	0.90	0.52	0.52	0.00	3.31	1.74	8	0.1225	12	CMP	0.024	6.75	4.64	5.62	11.22	11.22	5.58	4.60	11.16	11.10	
P-10-130	J-10-2	1363	0.58	0.90	0.52	0.52	5.00	3.31	1.74	8	1.6200	8	Concrete	0.013	15.38	5.19	18.15	19.54	19.54	13.68	0.72	18.75	15.05	
P-10-131	4126	1357	0.58	0.90	0.52	1.04	5.12	3.29	3.46	44	0.1507	8	Concrete	0.013	4.69	10.54	17.17	13.31	20.07	2.10	2.23	17.83	13.31	
P-10-132	1357	1358	0.58	0.90	0.52	0.52	5.00	3.31	1.74	46	0.0283	8	Concrete	0.013	2.03	17.27	18.57	20.07	19.92	2.13	0.68	19.17	17.75	
P-10-133	J-10-3	1391	0.58	0.90	0.52	0.52	5.00	3.31	1.74	6	0.2050	12	CMP	0.024	8.74	5.94	7.17	10.42	10.42	3.48	2.25	10.47	10.42	
P-10-134	J-10-4	1392	0.58	0.90	0.52	0.52	5.00	3.31	1.74	14	0.0514	12	PVC	0.01	10.5	6.59	7.31	9.70	9.71	2.11	1.40	9.72	9.70	

Kelso Stormwater Management Plan
Phase II
Basin 10

Table 10.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-10-135	J-10-5	1355	0.58	0.90	0.52	0.52	5.00	3.31	1.74	4	2.7150	8	Concrete	0.013	19.91	7.28	18.14	17.99	17.99	10.04	-0.82	18.74	14.68	
P-10-136	J-10-6	1348	0.58	0.9	0.52	1.04	5.15	3.29	3.46	44	0.2480	8	Concrete	0.013	6.02	7.92	18.83	21.6	21.63	13.01	2.13	25.21	21.6	
P-10-137	1348	1139	0.58	0.90	0.52	0.52	5.00	3.31	1.74	45	-0.0222	8	PVC	0.01	-2.34	18.88	17.88	21.63	21.62	2.08	3.07	22.18	21.63	
P-10-138	4123	1100	0.58	0.80	0.46	0.46	5.00	3.31	1.55	68	0.0740	6	Concrete	0.013	1.53	14.67	19.70	24.14	22.19	8.97	1.99	29.32	24.14	
P-10-139	4123	1349	0.58	0.80	0.46	0.46	5.00	3.31	1.55	30	0.0543	8	Concrete	0.013	2.82	18.16	19.79	24.14	22.34	5.31	1.88	24.63	24.14	
P-10-140	4120	4122	N/A	N/A	N/A	0.70	5.23	3.28	2.30	167	0.0293	12	Concrete	0.013	6.1	10.52	15.42	19.12	19.02	7.6	2.6	19.82	19.12	
P-10-141	4122	1341	0.58	0.60	0.35	0.70	5.19	3.28	2.30	14	0.0486	8	PVC	0.01	3.46	16.01	16.69	19.02	18.86	2.34	1.50	19.32	19.02	
P-10-142	1341	1342	0.58	0.60	0.35	0.35	5.00	3.31	1.16	38	-0.0032	8	PVC	0.01	-0.88	16.69	16.57	18.86	18.52	1.50	1.28	19.07	18.86	
P-10-143	4116	4118	0.58	0.60	0.35	0.35	5.00	3.31	1.16	48	0.0167	8	PVC	0.01	2.03	13.83	14.63	18.45	18.68	3.95	3.38	17.65	17.39	
P-10-144	4116	4119	0.58	0.60	0.35	0.35	5.00	3.31	1.16	49	0.0043	8	PVC	0.01	1.03	14.85	15.06	18.45	18.36	2.93	2.63	17.65	17.39	
P-10-145	4116	4117	0.58	0.60	0.35	0.35	5.00	3.31	1.16	23	0.0987	8	PVC	0.01	4.93	13.71	15.98	18.45	18.98	4.07	2.33	17.51	17.39	
P-10-146	4116	1340	0.58	0.60	0.35	0.35	5.00	3.31	1.16	138	0.0302	8	Concrete	0.013	2.1	12.33	16.50	18.45	18.40	5.45	1.23	18.66	17.39	
P-10-147	4116	4115	0.58	0.6	0.35	0.35	5.00	3.31	1.16	24	0.0113	8	PVC	0.01	1.67	14.97	15.24	18.45	18.84	2.81	2.93	17.52	17.39	
P-10-148	4111	J-10-13	N/A	N/A	N/A	0.93	5.05	3.30	3.09	26	0.0419	8	PVC	0.01	3.22	15.89	16.98	18.92	19.38	2.36	1.73	19.93	18.92	
P-10-149	J-10-13	4110	0.58	0.80	0.46	0.46	5.00	3.31	1.55	12	0.0417	8	PVC	0.01	3.21	16.98	17.48	19.38	19.38	1.73	1.23	19.50	19.38	
P-10-150	J-10-13	1328	0.58	0.80	0.46	0.46	5.00	3.31	1.55	18	0.0178	6	PVC	0.01	0.97	16.98	17.30	19.38	18.43	1.90	0.63	20.19	19.38	
P-10-151	4109	4108	0.58	0.8	0.46	0.46	5	3.31	1.55	7	0.0243	8	PVC	0.01	2.45	14.67	14.84	19.22	19.59	3.88	4.08	19.29	19.22	
P-10-152	J-10-7	4084	0.58	0.8	0.46	0.46	5	3.31	1.55	52	0.1012	6	PVC	0.01	2.32	17.45	22.71	24.25	24.39	6.3	1.18	26.59	24.25	
P-10-153	4074	1223	0.58	0.8	0.46	0.93	5.09	3.3	3.08	108	0.0215	8	Concrete	0.013	1.77	18.72	21.04	24.52	23.7	5.13	1.99	31.55	24.52	No connection data provided; pipe connection assumed
P-10-154	1223	1246	0.58	0.8	0.46	0.46	5	3.31	1.55	42	0.0226	6	Concrete	0.013	0.84	21.04	21.99	23.7	23.82	2.16	1.33	26.9	23.7	No connection data; pipe connection assumed
P-10-155	4075	1224	0.58	0.8	0.46	0.93	5.15	3.29	3.08	20	0.0745	8	PVC	0.01	4.29	20.18	21.67	24.58	23.55	3.73	1.21	25.35	24.58	
P-10-156	1224	1226	0.58	0.8	0.46	0.46	5	3.31	1.55	39	-0.0023	8	PVC	0.01	-0.75	21.67	21.58	23.55	23.93	1.21	1.68	23.93	23.55	
P-10-157	J-10-8	1245	0.58	0.8	0.46	0.46	5	3.31	1.55	36	0.1017	6	Concrete	0.013	1.79	17.81	21.47	23.57	23.89	5.26	1.92	26.31	23.57	
P-10-158	J-10-8	1225	0.58	0.8	0.46	0.46	5	3.31	1.55	4	0.9425	8	PVC	0.01	15.25	17.81	21.58	23.57	23.57	5.09	1.32	23.61	23.57	
P-10-159	4076	1227	0.58	0.8	0.46	0.46	5	3.31	1.55	21	0.0124	6	Concrete	0.013	0.62	20.25	20.51	25.16	23.86	4.41	2.85	26.76	25.16	
P-10-160	4076	1228	0.58	0.8	0.46	0.46	5	3.31	1.55	21	0.0248	6	Concrete	0.013	0.88	20.14	20.66	25.16	24.06	4.52	2.9	26.76	25.16	
P-10-161	J-10-9	1244	0.58	0.8	0.46	0.46	5	3.31	1.55	37	0.0541	6	Concrete	0.013	1.3	18.1	20.1	23.96	23.9	5.36	3.3	26.78	23.96	
P-10-162	J-10-9	1229	0.58	0.8	0.46	0.46	5	3.31	1.55	4	1.0275	12	PVC	0.01	46.95	18.1	22.21	23.96	23.96	4.86	0.75	23.96	23.96	
P-10-163	J-10-10	1243	0.58	0.8	0.46	0.46	5	3.31	1.55	36	0.0644	6	Concrete	0.013	1.42	18.1	20.42	23.93	23.77	5.33	2.85	26.67	23.93	
P-10-164	J-10-10	1230	0.58	0.8	0.46	0.46	5	3.31	1.55	4	0.8575	6	Concrete	0.013	5.2	18.1	21.53	23.93	23.93	5.33	1.9	24.23	23.93	
P-10-165	J-10-11	1231	0.58	0.8	0.46	0.46	5	3.31	1.55	5	0.9040	6	Concrete	0.013	5.33	19.01	23.53	24.4	24.4	4.89	0.37	24.78	24.4	
P-10-166	J-10-12	1232	0.58	0.8	0.46	0.46	5	3.31	1.55	6	0.4717	6	Concrete	0.013	3.85	19.5	22.33	24	24.28	4	1.45	24.46	24	
P-10-200	4124	1347	0.58	0.90	0.52	1.04	5.15	3.29	3.46	46	0.1689	8	Concrete	0.013	4.97	9.94	17.71	13.74	20.26	3.13	1.88	18.37	13.74	
P-10-201	1347	1356	0.58	0.90	0.52	0.52	5.00	3.31	1.74	46	0.0083	8	PVC	0.01	1.43	17.76	18.14	20.26	20.14	1.83	1.33	18.96	18.37	
P-10-202	4124	1354	0.58	0.60	0.35	1.74	5.66	3.21	5.63	138	0.0175	8	Concrete	0.013	1.6	6.71	9.13	13.74	11.23	6.36	1.43	43.71	13.74	
P-10-203	1354	1353	0.58	0.6	0.35	1.39	5.6	3.22	4.52	78	-0.0055	6	Concrete	0.013	-0.42	8.93	8.5	11.23	9.9	1.8	0.9	61.79	11.23	
P-10-204	1353	1352	0.58	0.6	0.35	1.04	5.47	3.24	3.41	140	0.0019	6	Concrete	0.013	0.24	8.93	9.19	9.9	10.69	0.47	1	61.58	9.9	
P-10-205	1352	1351	0.58	0.6	0.35	0.70	5.41	3.25	2.28	39	0.0072	6	Concrete	0.013	0.48	8.64	8.92	10.69	10.42	1.55	1	17.12	10.69	
P-10-206	1351	1350	0.58	0.6	0.35	0.35	5	3.31	1.16	147	0.0007	6	Concrete	0.013	0.15	8.92	9.03	10.42	11.21	1	1.68	16.72	10.42	
P-10-300	4111	J-10-14	N/A	N/A	N/A	15.78	10.24	2.54	40.41	95	0.0034	24	Concrete	0.013	13.13	11.22	11.54	18.92	18.41	5.70	4.87	21.95	18.92	
P-10-301	J-10-14	4356	0	0.00	0	14.85	10.07	2.55	38.24	129	0.0033	24	Concrete	0.013	12.91	11.54	11.96	18.41	18.71	4.87	4.75	22.10	18.41	
P-10-302	4356	J-10-15	N/A	N/A	N/A	5.57	9.64	2.61	14.67	119	0.0055	24	Concrete	0.013	16.85	12.01	12.67	18.71	18.94	4.70	4.27	19.21	18.71	

Kelso Stormwater Management Plan
Phase II
Basin 10

Table 10.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-10-303	J-10-15	4113	N/A	N/A	N/A	4.64	9.09	2.70	12.62	134	0.0056	24	Concrete	0.013	16.92	12.67	13.42	18.94	19.31	4.27	3.89	19.36	18.94	
P-10-304	4113	J-10-16	N/A	N/A	N/A	3.25	6.45	3.09	10.12	36	0.0069	18	Concrete	0.013	8.75	13.33	13.58	19.31	18.92	4.48	3.84	19.64	19.31	
P-10-305	J-10-16	J-10-17	N/A	N/A	N/A	2.32	5.60	3.22	7.53	218	0.0070	18	Concrete	0.013	8.77	13.58	15.10	18.92	20.40	3.84	3.80	20.04	18.92	
P-10-306	J-10-17	4095	N/A	N/A	N/A	1.86	5.12	3.29	6.16	506	0.0070	8	Clay	0.011	1.19	15.10	18.63	20.40	22.08	4.63	2.78	114.15	20.04	Pipe slope and connection point assumed; no field data for down stream structure.
P-10-307	4095	J-10-18	N/A	N/A	N/A	0.93	5.07	3.30	3.09	48	0.0188	6	Concrete	0.013	0.77	18.65	19.55	22.08	22.00	2.93	1.95	36.61	22.08	
P-10-308	J-10-18	1269	0.58	0.80	0.46	0.46	5.00	3.31	1.55	24	-0.0150	6	Concrete	0.013	-0.69	19.55	19.19	22.00	21.95	1.95	2.26	23.83	22.00	
P-10-309	J-10-15	1334	0.58	0.80	0.46	0.93	5.04	3.30	3.09	8	0.4275	6	Concrete	0.013	3.67	12.67	16.09	18.94	18.94	5.77	2.35	21.37	18.94	
P-10-310	1334	1333	0.58	0.80	0.46	0.46	5.00	3.31	1.55	21	0.0143	6	Concrete	0.013	0.67	16.49	16.79	18.94	18.69	1.95	1.40	20.54	18.94	
P-10-311	4113	1335	0.58	0.80	0.46	0.93	5.05	3.30	3.09	42	0.0214	8	Concrete	0.013	1.77	15.39	16.29	19.31	19.16	3.25	2.20	22.06	19.31	
P-10-312	1335	1336	0.58	0.80	0.46	0.46	5.00	3.31	1.55	22	0.0205	6	Concrete	0.013	0.8	16.58	17.03	19.16	18.90	2.08	1.37	20.83	19.16	
P-10-313	4113	4112	N/A	N/A	N/A	0.46	8.81	2.74	1.28	12	0.0217	18	Concrete	0.013	15.46	13.66	13.92	19.31	19.57	4.15	4.15	19.31	19.31	
P-10-314	4112	4114	N/A	N/A	N/A	0.46	5.05	3.30	1.54	197	0.0002	18	Concrete	0.013	1.5	13.94	13.98	19.57	20.85	4.13	5.37	19.35	19.31	
P-10-315	4114	1339	0.58	0.80	0.46	0.46	5.00	3.31	1.55	14	0.0214	8	Concrete	0.013	1.77	17.32	17.62	20.85	20.30	2.86	2.01	19.58	19.35	
P-10-316	J-10-16	1338	0.58	0.80	0.46	0.93	5.05	3.30	3.09	10	0.2430	6	Concrete	0.013	2.77	13.58	16.01	18.92	18.91	4.84	2.40	21.95	18.92	
P-10-317	1338	1337	0.58	0.80	0.46	0.46	5.00	3.31	1.55	22	0.0209	6	Concrete	0.013	0.81	16.46	16.92	18.91	18.95	1.95	1.53	20.58	18.91	
P-10-318	J-10-17	1294	0.58	0.80	0.46	0.46	5.00	3.31	1.55	52	0.0550	8	Concrete	0.013	2.83	15.10	17.96	20.40	20.56	4.63	1.93	20.89	20.04	Assumed connection for 1294 into assumed structure; no field data for down stream structure.
P-10-319	4095	1266	0.58	0.80	0.46	0.93	5.07	3.30	3.09	13	0.0308	6	Clay	0.011	1.16	18.63	19.03	22.08	21.63	2.95	2.10	24.90	22.08	
P-10-320	1266	1267	0.58	0.80	0.46	0.46	5.00	3.31	1.55	34	0.0294	6	Clay	0.011	1.14	19.23	20.23	21.63	22.00	1.90	1.27	23.48	21.63	
P-10-321	J-10-18	1268	0.58	0.80	0.46	0.46	5.00	3.31	1.55	33	0.0039	6	PVC	0.01	0.46	19.55	19.68	22.00	22.08	1.95	1.90	23.49	22.00	
P-10-322	J-10-14	1330	0.58	0.80	0.46	0.93	5.05	3.30	3.09	7	0.5929	6	Concrete	0.013	4.32	11.54	15.69	18.41	18.41	6.37	2.22	20.53	18.41	
P-10-323	1330	1329	0.58	0.80	0.46	0.46	5.00	3.31	1.55	22	0.0259	6	Concrete	0.013	0.9	16.09	16.66	18.41	18.40	1.82	1.24	20.08	18.41	
P-10-400	4356	4100	N/A	N/A	N/A	8.35	5.53	3.23	27.19	259	0.0115	10	Concrete	0.013	2.35	12.04	15.01	18.71	20.68	5.84	4.84	411.99	12.87	Structure 4100 lists 12" out to east; structure 4356 lists 10" in from west; 10" entered
P-10-401	4100	4092	N/A	N/A	N/A	4.64	5.44	3.24	15.18	256	0.0000	8	Concrete	0.013	0	15.01	15.01	20.68	22.74	5	7.06	424.53	20.68	Structure 4092 lists 8" conc to east; 4100 lists 12" orange in from west; 8" conc entered
P-10-402	4092	J-10-19	N/A	N/A	N/A	2.78	5.39	3.25	9.12	40	-0.0053	8	Clay	0.011	-1.03	15.96	15.75	22.74	21.92	6.11	5.50	39.07	22.74	
P-10-403	J-10-19	4093	N/A	N/A	N/A	1.86	5.26	3.27	6.12	135	-0.0054	8	Clay	0.011	-1.05	15.75	15.02	21.92	22.72	5.50	7.03	46.70	21.92	
P-10-404	4093	J-10-20	N/A	N/A	N/A	1.86	5.21	3.28	6.13	57	0.0032	8	PVC	0.01	0.88	15.94	16.12	22.72	22.16	6.11	5.37	31.41	22.72	
P-10-405	J-10-20	4094	N/A	N/A	N/A	0.93	5.09	3.30	3.08	66	0.0032	8	Clay	0.011	0.81	16.12	16.33	22.16	22.75	5.37	5.75	25.24	22.16	
P-10-406	4094	1264	0.58	0.80	0.46	0.93	5.07	3.30	3.09	13	0.0454	6	Concrete	0.013	1.2	18.95	19.54	22.75	22.20	3.30	2.16	26.68	22.75	
P-10-407	1264	1265	0.58	0.80	0.46	0.46	5.00	3.31	1.55	34	0.0221	6	Concrete	0.013	0.83	19.54	20.29	22.20	22.15	2.16	1.36	24.79	22.20	
P-10-408	4356	1331	0.58	0.80	0.46	0.93	5.08	3.30	3.08	42	0.0143	6	Concrete	0.013	0.67	15.46	16.06	18.71	18.96	2.75	2.40	28.65	15.96	
P-10-409	1331	1332	0.58	0.80	0.46	0.46	5.00	3.31	1.55	22	0.0214	8	Concrete	0.013	1.77	16.58	17.05	18.96	18.90	1.71	1.18	19.32	18.96	
P-10-410	4100	1300	0.58	0.80	0.46	1.86	5.48	3.24	6.06	39	0.0338	6	Concrete	0.013	1.03	15.77	17.09	20.68	19.77	4.41	2.18	66.17	20.68	
P-10-411	1300	1298	0.58	0.80	0.46	0.93	5.07	3.30	3.09	214	0.0055	8	Clay	0.011	1.06	17.18	18.35	19.77	20.95	1.92	1.93	29.76	19.77	
P-10-412	1298	1297	0.58	0.80	0.46	0.46	5.00	3.31	1.55	34	0.0294	6	Concrete	0.013	0.96	18.55	19.55	20.95	21.10	1.90	1.05	23.54	20.95	
P-10-413	1300	1299	0.58	0.80	0.46	0.46	5.00	3.31	1.55	26	0.0246	6	Concrete	0.013	0.88	17.61	18.25	19.77	20.05	1.66	1.30	21.75	19.77	
P-10-414	4100	J-10-21	N/A	N/A	N/A	1.86	5.41	3.25	6.08	25	0.0076	6	Clay	0.011	0.58	15.71	15.90	20.68	20.68	4.47	4.28	41.68	20.68	

Kelso Stormwater Management Plan
Phase II
Basin 10

Table 10.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-10-415	J-10-21	4101	N/A	N/A	N/A	0.93	5.06	3.30	3.09	188	0.0076	8	Concrete	0.013	1.05	15.90	17.32	20.68	20.44	4.11	2.45	32.96	20.68	
P-10-416	4101	1304	0.58	0.80	0.46	0.46	5.00	3.31	1.55	27	0.0426	6	Concrete	0.013	1.16	17.69	18.84	20.44	20.26	2.25	0.92	22.50	20.44	Assumed connection to 4101 per Kelso Schematic;
P-10-417	1301	1302	0.58	0.80	0.46	0.46	5.00	3.31	1.55	26	0.0223	6	Concrete	0.013	0.84	17.67	18.25	19.79	20.10	1.62	1.35	21.77	19.79	
P-10-418	J-10-21	1301	0.58	0.80	0.46	0.93	5.05	3.30	3.09	4	0.3050	6	PVC	0.01	4.03	15.90	17.12	20.68	19.79	4.28	2.17	21.40	20.68	
P-10-419	4101	1303	0.58	0.80	0.46	0.46	5.00	3.31	1.55	10	0.0050	6	PVC	0.01	0.52	18.02	18.07	20.44	19.98	1.92	1.41	20.89	20.44	
P-10-420	4092	J-10-22	N/A	N/A	N/A	1.86	5.41	3.25	6.08	30	0.0053	8	PVC	0.01	1.15	15.04	15.20	22.74	22.02	7.03	6.15	27.23	22.74	
P-10-421	J-10-22	4091	N/A	N/A	N/A	0.93	5.07	3.30	3.09	181	0.0052	8	PVC	0.01	1.14	15.20	16.15	22.02	22.20	6.15	5.38	29.01	22.02	
P-10-422	4091	1256	0.58	0.8	0.46	0.46	5.00	3.31	1.55	31	0.0387	6	Clay	0.011	1.3	19.00	20.20	22.20	21.75	2.70	1.05	23.89	22.20	Field notes list blind connect to south of 4091; pipe entered into 4091 to eliminate extra junction; invert matched to pipe in from SE
P-10-423	4091	1257	0.58	0.80	0.46	0.46	5.00	3.31	1.55	8	0.0563	6	Clay	0.011	1.57	19.00	19.45	22.20	21.80	2.70	1.85	22.64	22.20	
P-10-424	J-10-22	1259	0.58	0.80	0.46	0.46	5.00	3.31	1.55	29	0.3014	6	Concrete	0.013	3.08	15.20	23.94	22.02	25.89	6.32	1.45	24.44	22.02	
P-10-425	J-10-22	1258	0.58	0.80	0.46	0.46	5.00	3.31	1.55	5	0.8440	6	Clay	0.011	6.09	15.20	19.42	22.02	22.02	6.32	2.10	22.29	22.02	
P-10-426	J-10-19	1260	0.58	0.80	0.46	0.46	5.00	3.31	1.55	29	0.1541	6	Concrete	0.013	2.2	15.75	20.22	21.92	22.12	5.67	1.40	24.13	21.92	
P-10-427	J-10-19	1261	0.58	0.80	0.46	0.46	5.00	3.31	1.55	4	0.8925	6	Concrete	0.013	5.3	15.75	19.32	21.92	21.92	5.67	2.10	22.22	21.92	
P-10-428	J-10-20	1263	0.58	0.8	0.46	0.46	5	3.31	1.55	30	0.1367	6	Concrete	0.013	2.07	16.12	20.22	22.16	22.12	5.54	1.4	24.44	22.16	
P-10-429	J-10-20	1262	0.58	0.8	0.46	0.46	5	3.31	1.55	5	0.6060	8	Concrete	0.013	9.41	16.12	19.15	22.16	22.16	5.37	2.34	22.24	22.16	
P-10-500	4111	J-10-23	0	0.00	0	10.45	6.23	3.13	32.92	54	0.0054	16	Concrete	0.013	5.62	12.08	12.37	18.92	18.60	5.51	4.90	28.86	18.92	
P-10-501	J-10-23	J-10-24	N/A	N/A	N/A	9.75	6.11	3.14	30.90	164	0.0053	16	Concrete	0.013	5.59	12.37	13.24	18.6	19.2	4.9	4.63	40.33	13.7	
P-10-502	J-10-24	4107	N/A	N/A	N/A	9.06	6.05	3.15	28.77	65	0.0054	16	Concrete	0.013	5.63	13.24	13.59	19.2	19.54	4.63	4.62	28.35	19.2	
P-10-503	4107	J-10-25	N/A	N/A	N/A	6.97	6.04	3.15	22.16	32	0.0028	12	Concrete	0.013	1.89	13.57	13.66	19.54	19.38	4.97	4.72	31.93	19.54	
P-10-504	J-10-25	4104	0	0	0	6.27	5.89	3.18	20.08	226	0.0028	12	Concrete	0.013	1.9	13.66	14.3	19.38	20.76	4.72	5.46	91.25	19.38	
P-10-505	4104	J-10-26	N/A	N/A	N/A	3.72	5.82	3.19	11.94	44	0.0114	10	Clay	0.011	2.76	14.35	14.85	20.76	20.5	5.58	4.82	24.54	15.18	Structure 4087 lists 12" orange out to east; 4101 lists 10" in from west; 10" entered
P-10-506	J-10-26	4087	N/A	N/A	N/A	3.02	5.69	3.21	9.76	219	0.0114	8	Concrete	0.013	1.29	14.85	17.34	20.5	22.53	4.98	4.52	163.46	20.5	
P-10-507	4087	J-10-27	N/A	N/A	N/A	1.39	5.64	3.21	4.51	41	0.0029	8	Concrete	0.013	0.65	17.29	17.41	22.53	21.64	4.57	3.56	28.24	22.53	
P-10-508	J-10-27	4086	N/A	N/A	N/A	0.70	5.05	3.3	2.32	233	0.0028	8	Concrete	0.013	0.64	17.41	18.07	21.64	22.01	3.56	3.27	30.21	21.64	
P-10-509	4086	1251	0.58	0.6	0.35	0.35	5	3.31	1.16	18	0.0028	6	PVC	0.01	0.38	19.41	19.46	22.01	21.31	2.1	1.35	22.47	22.01	
P-10-510	4086	1250	0.58	0.6	0.35	0.35	5	3.31	1.16	3	-0.0700	6	PVC	0.01	-1.93	19.74	19.53	22.01	21.39	1.77	1.36	22.09	22.01	
P-10-511	J-10-24	1325	0.58	0.6	0.35	0.70	5.06	3.3	2.32	15	0.1913	6	Concrete	0.013	2.45	13.24	16.11	19.2	19.17	5.46	2.56	21.76	19.2	
P-10-512	1325	1324	0.58	0.6	0.35	0.35	5	3.31	1.16	22	0.0241	6	Concrete	0.013	0.87	16.63	17.16	19.17	19.2	2.04	1.54	20.11	19.17	
P-10-513	4107	J-10-28	N/A	N/A	N/A	2.09	5.67	3.21	6.76	50	0.0062	8	Concrete	0.013	0.95	13.45	13.76	19.54	19.13	5.42	4.7	35.18	19.54	
P-10-514	J-10-28	J-10-29	N/A	N/A	N/A	1.39	5.43	3.25	4.55	191	0.0062	8	Concrete	0.013	0.95	13.76	14.95	19.13	19.71	4.7	4.09	46.27	19.13	
P-10-515	J-10-29	4106	N/A	N/A	N/A	0.93	5.32	3.26	3.05	54	0.0063	8	Concrete	0.013	0.96	14.95	15.29	19.71	20.01	4.09	4.05	23.15	19.71	
P-10-516	4106	1316	0.58	0.4	0.23	0.46	5.09	3.3	1.54	61	0.0089	8	Concrete	0.013	1.14	16.08	16.62	20.01	19.66	3.26	2.37	21	20.01	
P-10-517	1316	1315	0.58	0.4	0.23	0.23	5	3.31	0.77	22	0.0332	6	Concrete	0.013	1.02	16.67	17.4	19.66	19.75	2.49	1.85	20.08	19.66	
P-10-518	J-10-28	1321	0.58	0.6	0.35	0.70	5.06	3.3	2.32	8	0.3300	6	Concrete	0.013	3.22	13.76	16.4	19.13	19.13	4.87	2.23	20.49	19.13	
P-10-519	1321	1320	0.58	0.6	0.35	0.35	5	3.31	1.16	22	0.0273	6	Concrete	0.013	0.93	16.67	17.27	19.13	19.32	1.96	1.55	20.07	19.13	
P-10-520	J-10-29	1318	0.58	0.4	0.23	0.23	5	3.31	0.77	3	0.7700	6	Concrete	0.013	4.92	14.95	17.26	19.71	19.71	4.26	1.95	19.77	19.71	
P-10-521	J-10-29	1319	0.58	0.4	0.23	0.23	5	3.31	0.77	19	0.1416	6	Concrete	0.013	2.11	14.95	17.64	19.71	19.74	4.26	1.6	20.07	19.71	

Kelso Stormwater Management Plan
Phase II
Basin 10

Table 10.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-10-522	4106	1317	0.58	0.4	0.23	0.46	5.09	3.3	1.54	41	0.0202	8	Concrete	0.013	1.72	16.46	17.29	20.01	19.89	2.88	1.93	20.68	20.01	
P-10-523	1317	1314	0.58	0.4	0.23	0.23	5	3.31	0.77	22	0.0255	6	Concrete	0.013	0.9	17.39	17.95	19.89	19.95	2	1.5	20.31	19.89	
P-10-524	J-10-25	1323	0.58	0.6	0.35	0.70	5.06	3.3	2.32	11	0.2282	12	PVC	0.01	22.12	13.66	16.17	19.38	19.38	4.72	2.21	19.41	19.38	
P-10-525	1323	1322	0.58	0.6	0.35	0.35	5	3.31	1.16	22	0.0268	6	Concrete	0.013	0.92	16.86	17.45	19.38	19.4	2.02	1.45	20.32	19.38	
P-10-526	4104	J-10-30	N/A	N/A	N/A	1.16	5.53	3.23	3.78	122	0.0122	8	Concrete	0.013	1.34	14.43	15.92	20.76	20.14	5.66	3.55	32.69	20.76	
P-10-527	J-10-30	4102	N/A	N/A	N/A	0.46	5.09	3.3	1.54	116	0.0122	8	Concrete	0.013	1.33	15.92	17.33	20.14	20.49	3.55	2.49	22.03	20.14	
P-10-528	4102	4103	0.58	0.8	0.46	0.46	5	3.31	1.55	42	0.0074	6	Concrete	0.013	0.48	17.72	18.03	20.49	21.31	2.27	2.78	23.69	20.49	
P-10-529	J-10-30	1306	0.58	0.6	0.35	0.35	5	3.31	1.16	21	0.1205	6	Concrete	0.013	1.95	15.92	18.45	20.14	20.31	3.72	1.36	21.04	20.14	
P-10-530	J-10-30	1305	0.58	0.6	0.35	0.35	5	3.31	1.16	4	0.3825	6	Concrete	0.013	3.47	15.92	17.45	20.14	20.14	3.72	2.19	20.31	20.14	
P-10-531	4104	J-10-31	N/A	N/A	N/A	1.39	5.83	3.18	4.47	42	0.0060	8	Concrete	0.013	0.93	16.06	16.31	20.76	20.61	4.03	3.63	26.51	20.76	
P-10-532	J-10-31	4105	N/A	N/A	N/A	0.70	5.19	3.28	2.30	253	0.0059	8	Concrete	0.013	0.93	16.31	17.8	20.61	21.42	3.63	2.95	29.79	20.61	
P-10-533	4105	1313	0.58	0.4	0.23	0.23	5	3.31	0.77	46	0.0098	6	Concrete	0.013	0.55	18.09	18.54	21.42	21	2.83	1.96	22.3	21.42	
P-10-534	4105	1312	0.58	0.4	0.23	0.23	5	3.31	0.77	37	0.0351	6	Concrete	0.013	1.05	18.29	19.59	21.42	21.14	2.63	1.05	22.12	21.42	
P-10-535	4105	1311	0.58	0.4	0.23	0.23	5	3.31	0.77	27	0.0363	6	Concrete	0.013	1.07	18.23	19.21	21.42	21.11	2.69	1.4	21.93	21.42	
P-10-536	J-10-31	1310	0.58	0.6	0.35	0.35	5	3.31	1.16	4	0.4575	6	Concrete	0.013	3.8	16.31	18.14	20.61	20.61	3.8	1.97	20.78	20.61	
P-10-537	J-10-31	1309	0.58	0.6	0.35	0.35	5	3.31	1.16	22	0.0986	8	Concrete	0.013	3.79	16.31	18.48	20.61	20.49	3.63	1.34	20.81	20.61	
P-10-538	J-10-26	1308	0.58	0.6	0.35	0.35	5	3.31	1.16	18	0.2111	6	Concrete	0.013	2.58	14.85	18.65	20.5	20.55	5.15	1.4	21.27	20.5	
P-10-539	J-10-26	1307	0.58	0.6	0.35	0.35	5	3.31	1.16	4	0.7750	6	Concrete	0.013	4.94	14.85	17.95	20.5	20.5	5.15	2.05	20.67	20.5	
P-10-540	4087	J-10-32	N/A	N/A	N/A	1.63	5.62	3.22	5.28	26	0.0096	10	Clay	0.011	2.54	17.27	17.52	22.53	21.64	4.43	3.29	23.61	22.53	4088 does not have pipe size out to south, but PVC listed as material; 4087 lists 10" orange in from north; 10" VCP entered.
P-10-541	J-10-32	4088	N/A	N/A	N/A	0.93	5.04	3.3	3.10	197	0.0097	10	Clay	0.011	2.56	17.52	19.44	21.64	21.93	3.29	1.66	24.47	21.64	4088 does not have pipe size out to south, but PVC listed as material; 4087 lists 10" orange in from north; 10" VCP entered.
P-10-542	4088	4090	0.58	0.8	0.46	0.46	5	3.31	1.55	21	0.0576	6	PVC	0.01	1.75	19.26	20.47	21.93	22.47	2.17	1.5	22.88	21.93	
P-10-543	4088	4089	0.58	0.8	0.47	0.47	5	3.31	1.56	9	0.2300	6	PVC	0.01	3.5	18.57	20.64	21.93	22.31	2.86	1.17	22.34	21.93	
P-10-544	J-10-32	1254	0.58	0.6	0.35	0.35	5	3.31	1.16	4	0.5025	6	Concrete	0.013	3.98	17.52	19.53	21.64	21.64	3.62	1.61	21.81	21.64	
P-10-545	J-10-32	1255	0.58	0.6	0.35	0.35	5	3.31	1.16	18	0.1211	6	Clay	0.011	2.31	17.52	19.7	21.64	21.65	3.62	1.45	22.19	21.64	
P-10-546	J-10-27	1252	0.58	0.6	0.35	0.35	5	3.31	1.16	4	0.4400	6	Concrete	0.013	3.72	17.41	19.17	21.64	21.64	3.73	1.97	21.81	21.64	
P-10-547	J-10-27	1253	0.58	0.6	0.35	0.35	5	3.31	1.16	18	0.1189	6	Concrete	0.013	1.93	17.41	19.55	21.64	21.65	3.73	1.6	22.41	21.64	
P-10-548	J-10-23	1326	0.58	0.6	0.35	0.70	5.06	3.3	2.32	11	0.2773	6	Concrete	0.013	2.95	12.37	15.42	18.6	18.68	5.73	2.76	15.92	12.74	
P-10-549	1326	1327	0.58	0.6	0.35	0.35	5	3.31	1.16	22	0.0195	6	Concrete	0.013	0.78	16.17	16.6	18.68	18.55	2.01	1.45	17.61	16.65	
P-10-600	4074	4072	N/A	N/A	N/A	4.98	9.42	2.65	13.28	133	0.0040	12	Concrete	0.013	2.25	17.67	18.2	24.52	25.16	5.85	5.96	37.16	18.67	
P-10-601	4072	4070	N/A	N/A	N/A	4.47	9.37	2.65	11.95	48	0.0073	12	Concrete	0.013	3.04	18.33	18.68	25.16	24.89	5.83	5.21	30.56	25.16	
P-10-602	4070	J-10-33	N/A	N/A	N/A	3.44	9.22	2.68	9.29	106	0.0050	12	Concrete	0.013	2.52	18.69	19.22	24.89	24.65	5.2	4.43	32.1	24.89	
P-10-603	J-10-33	4071	N/A	N/A	N/A	2.93	8.98	2.71	8.01	145	0.0050	12	Concrete	0.013	2.51	19.22	19.94	24.65	25.63	4.43	4.69	31.99	24.65	
P-10-604	4071	4069	N/A	N/A	N/A	2.93	8.72	2.75	8.13	166	0.0032	12	Concrete	0.013	2.01	20.01	20.54	25.63	24.83	4.62	3.29	34.28	25.63	
P-10-605	4069	4068	N/A	N/A	N/A	2.76	8.38	2.8	7.79	198	0.0009	12	Concrete	0.013	1.07	20.59	20.77	24.83	25.58	3.24	3.81	34.3	24.83	
P-10-606	4068	J-10-34	N/A	N/A	N/A	2.76	8.32	2.81	7.82	35	0.0029	12	Concrete	0.013	1.9	20.79	20.89	25.58	25.5	3.79	3.61	27.27	25.58	
P-10-607	J-10-34	J-10-35	N/A	N/A	N/A	2.76	8.11	2.84	7.91	132	0.0030	12	Concrete	0.013	1.94	20.89	21.28	25.5	25	3.61	2.72	32	25.5	
P-10-608	J-10-35	4067	N/A	N/A	N/A	2.59	8.04	2.85	7.44	79	0.0029	8	Concrete	0.013	0.65	21.28	21.51	25	25.72	3.05	3.54	54.93	25	

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Phase II
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Table 10.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-10-609	4067	J-10-36	N/A	N/A	N/A	2.41	8.02	2.86	6.95	21	0.0048	10	Concrete	0.013	1.51	21.42	21.52	25.72	25.6	3.47	3.25	27.83	25.72	Structure 4067 lists concrete in from north; structure 1213 lists PVC out to south; concrete entered as pipe matl
P-10-610	J-10-36	1213	0.64	0.27	0.17	2.24	7.87	2.88	6.50	102	0.0004	10	Concrete	0.013	0.43	21.52	21.56	25.6	26.19	3.25	3.8	34.58	25.6	
P-10-611	1213	1212	0.64	0.27	0.17	2.07	7.83	2.89	6.01	19	0.0005	12	HDPE	0.012	0.89	21.65	21.66	26.19	26.25	3.54	3.59	26.65	26.19	
P-10-612	1212	1211	0.64	0.27	0.17	1.89	7.7	2.9	5.55	54	-0.0011	12	HDPE	0.012	-1.29	21.73	21.67	26.25	26.33	3.52	3.66	27.37	26.25	
P-10-613	1211	1210	0.64	0.27	0.17	1.72	7.64	2.91	5.06	24	-0.0004	12	HDPE	0.012	-0.79	21.71	21.7	26.33	26.34	3.62	3.64	26.74	26.33	
P-10-614	1210	4066	N/A	N/A	N/A	0.86	7.28	2.97	2.59	72	0.0031	12	Concrete	0.013	1.97	21.77	21.99	26.34	26.1	3.57	3.11	26.72	26.34	
P-10-615	4066	J-10-37	N/A	N/A	N/A	0.69	6.16	3.14	2.18	186	0.0015	12	Concrete	0.013	1.38	22.12	22.4	26.1	24.9	2.98	1.5	26.8	26.1	
P-10-616	J-10-37	4065	N/A	N/A	N/A	0.52	5.97	3.16	1.65	24	0.0013	12	Concrete	0.013	1.26	22.4	22.43	24.9	25.99	1.5	2.56	24.95	24.9	
P-10-617	4065	4063	N/A	N/A	N/A	0.17	5.12	3.29	0.57	252	0.0302	12	Concrete	0.013	6.19	22.47	30.08	25.99	35.04	2.52	3.96	30.39	24.95	
P-10-618	4063	1203	0.64	0.27	0.17	0.17	5	3.31	0.58	43	0.0430	6	Concrete	0.013	1.16	32.34	34.19	35.04	35.42	2.2	0.73	34.58	32.59	
P-10-619	4072	1221	0.64	0.8	0.51	0.51	5	3.31	1.71	17	0.0359	6	PVC	0.01	1.38	22.43	23.04	25.16	24.64	2.23	1.1	26.09	25.16	6" leaving 1221 to NW; 8" entering 4072 from SW; 6" entered.
P-10-620	4070	1220	0.64	0.8	0.51	0.51	5	3.31	1.71	11	0.0427	6	PVC	0.01	1.51	23.09	23.56	24.89	24.66	1.3	0.6	25.49	24.89	
P-10-621	4070	1218	0.64	0.8	0.51	0.51	5	3.31	1.71	104	0.0192	8	PVC	0.01	2.18	20.03	22.03	24.89	25.76	4.19	3.06	26.12	24.89	
P-10-622	J-10-33	1219	0.64	0.8	0.51	0.51	5	3.31	1.71	6	0.5733	6	Concrete	0.013	4.25	19.22	22.66	24.65	24.65	4.93	1.49	25.21	24.65	
P-10-623	4069	1217	0.64	0.27	0.17	0.17	5	3.31	0.58	4	0.2525	4	Concrete	0.013	0.96	20.77	21.78	24.83	24.88	3.73	2.77	25.2	24.83	
P-10-624	J-10-35	1216	0.64	0.27	0.17	0.17	5	3.31	0.58	37	0.0473	8	Concrete	0.013	2.63	21.28	23.03	25	25.46	3.05	1.76	25.08	25	
P-10-625	4067	1215	0.64	0.27	0.17	0.17	5	3.31	0.58	4	0.0525	12	HDPE	0.012	8.84	22.42	22.63	25.72	25.55	2.3	1.92	25.72	25.72	
P-10-626	J-10-36	1214	0.64	0.27	0.17	0.17	5	3.31	0.58	18	0.0744	6	Concrete	0.013	1.53	21.52	22.86	25.6	25.59	3.58	2.23	25.79	25.6	
P-10-627	1210	1209	0.64	0.8	0.51	0.68	5.98	3.16	2.18	29	0.0172	12	HDPE	0.012	5.07	21.7	22.2	26.34	25.07	3.64	1.87	26.43	26.34	
P-10-628	1209	1208	0.64	0.27	0.17	0.17	5	3.31	0.58	43	0.0209	12	HDPE	0.012	5.58	22.27	23.17	25.07	25.41	1.8	1.24	25.08	25.07	
P-10-629	4066	1207	0.64	0.27	0.17	0.17	5	3.31	0.58	9	0.0467	6	Concrete	0.013	1.21	23.3	23.72	26.1	25.77	2.3	1.55	26.2	26.1	
P-10-630	J-10-37	1206	0.64	0.27	0.17	0.17	5	3.31	0.58	10	0.0960	6	Concrete	0.013	1.74	22.4	23.36	24.9	24.91	2	1.05	25.01	24.9	
P-10-631	4065	J-10-38	N/A	N/A	N/A	0.35	5.18	3.28	1.14	11	0.0273	6	Concrete	0.013	0.93	22.35	22.65	25.99	25.2	3.14	2.05	25.41	24.95	
P-10-632	J-10-38	1205	0.64	0.27	0.17	0.17	5	3.31	0.58	11	0.0264	6	Concrete	0.013	0.91	22.65	22.94	25.2	25.01	2.05	1.57	25.32	25.2	
P-10-633	J-10-38	1204	0.64	0.27	0.17	0.17	5	3.31	0.58	31	-0.0061	6	Concrete	0.013	-0.44	22.65	22.46	25.2	24.89	2.05	1.93	25.53	25.2	
										15137														

System Flow > Pipe Capacity
Ground elevation interpolated from nearest structure
Invert elevation interpolated from upstream and downstream nodes

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Table 10.2 - Existing Pipe Totals

Pipe Size	Concrete	CMP	PVC	Clay	HDPE	Total	Percentage
4-inch	4	0	0	0	0	**4**	**0.03%**
6-inch	1,753	0	196	134	0	**2083**	**13.76%**
8-inch	2,779	0	767	961	0	**4507**	**29.77%**
10-inch	510	0	240	285	0	**1035**	**6.84%**
12-inch	2,320	14	176	0	173	**2683**	**17.72%**
16-inch	353	0	0	0	0	**353**	**2.33%**
18-inch	1,218	0	0	0	0	**1218**	**8.05%**
24-inch	477	0	0	0	0	**477**	**3.15%**
36-inch	2,777	0	0	0	0	**2777**	**18.35%**
Total	**12,191**	**14**	**1,379**	**1380**	**173**	**15,137**	**100.00%**
Percentage	**80.54%**	**0.09%**	**9.11%**	**9.12%**	**1.14%**	**100.00%**	

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Table 10.3 - Recommended Trunk Line Improvements

Pipe	Exist. Size	Prop. Size	Length (ft)
P-10-100	36-inch	54-inch	128
P-10-101	36-inch	54-inch	127
P-10-102	36-inch	54-inch	64
P-10-103	36-inch	66-inch	118
P-10-104	36-inch	66-inch	163
P-10-105	36-inch	66-inch	172
P-10-106	36-inch	66-inch	59
P-10-107	36-inch	60-inch	346
P-10-108	36-inch	60-inch	731
P-10-109	36-inch	60-inch	479
P-10-110	36-inch	60-inch	6
P-10-111	36-inch	60-inch	155
P-10-112	36-inch	60-inch	229
P-10-113	16-inch	36-inch	70
P-10-114	18-inch	36-inch	381
P-10-115	18-inch	36-inch	330
P-10-116	18-inch	36-inch	44
P-10-117	12-inch	36-inch	5
P-10-118	12-inch	36-inch	145
P-10-119	12-inch	30-inch	133
P-10-120	10-inch	30-inch	128
P-10-121	12-inch	24-inch	115
P-10-122	12-inch	24-inch	147
P-10-123	10-inch	18-inch	28
P-10-124	10-inch	18-inch	102
P-10-125	10-inch	18-inch	21
P-10-126	10-inch	18-inch	89
P-10-127	10-inch	18-inch	18
P-10-300	24-inch	36-inch	95
P-10-301	24-inch	36-inch	129
P-10-302	24-inch	24-inch	119
P-10-304	18-inch	24-inch	36
P-10-500	16-inch	36-inch	54
P-10-501	16-inch	30-inch	164
P-10-502	16-inch	30-inch	65
P-10-503	12-inch	30-inch	32
P-10-504	12-inch	30-inch	226
P-10-505	10-inch	18-inch	44
P-10-506	8-inch	18-inch	219
P-10-600	12-inch	24-inch	133
P-10-601	12-inch	24-inch	48
P-10-602	12-inch	24-inch	106
P-10-603	12-inch	24-inch	145
P-10-604	12-inch	24-inch	166
P-10-605	12-inch	24-inch	198

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Table 10.3 - Recommended Trunk Line Improvements

Pipe	Exist. Size	Prop. Size	Length (ft)
P-10-606	12-inch	24-inch	35
P-10-607	12-inch	24-inch	132
P-10-608	8-inch	24-inch	79
P-10-609	10-inch	30-inch	21
P-10-610	10-inch	30-inch	102
P-10-611	12-inch	30-inch	19
P-10-612	12-inch	18-inch	54
P-10-613	12-inch	18-inch	24
P-10-614	12-inch	18-inch	72
P-10-615	12-inch	18-inch	186
P-10-616	12-inch	18-inch	24
Total			**7,260**

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Phase II
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Table 10.4 - Preliminary Opinion of Probable Cost

Item	Description	QTY	Unit	Price	Total
1	Mobilization	1	LS	$ 87,200	$ 87,200
2	Traffic Control	1	LS	$ 10,000	$ 10,000
3	Clearing and Grubbing	1	LS	$ 5,000	$ 5,000
4	Removal of Structures and Obstructions	1	LS	$ 7,500	$ 7,500
5	Removal of Existing Asphalt	5920	SY	$ 10	$ 59,200
6	Construction Fabric	4305	SY	$ 2	$ 8,610
7	CSBC	1995	Tons	$ 20	$ 39,900
8	CSTC	700	Tons	$ 22	$ 15,400
9	HMA	1065	Tons	$ 150	$ 159,750
10	18-inch HDPE	881	LF	$ 50	$ 44,050
11	24-inch HDPE	1459	LF	$ 65	$ 94,835
12	30-inch HDPE	890	LF	$ 80	$ 71,200
13	36-inch HDPE	1253	LF	$ 100	$ 125,300
14	54-inch HDPE	319	LF	$ 180	$ 57,420
15	60-inch HDPE	1946	LF	$ 190	$ 369,740
16	66-inch HDPE	512	LF	$ 200	$ 102,400
17	Catch Basins	15	EA	$ 1,200	$ 18,000
18	Manholes	8	EA	$ 1,500	$ 12,000
19	Import Trench Backfill (assume 3' avg)	4305	CY	$ 8	$ 34,440
20	Trench Safety Systems	1	LS	$ 10,000	$ 10,000
	Subtotal				$ 1,331,945
	Contingency @	20%			$ 266,400
	Total Opinion of Probable Cost				**$ 1,598,345**

Kelso Stormwater Management Plan
Phase II
Basin 10
Table 10.5 - All Undersized Pipes

Pipe	Exist. Size	Prop. Size	Length (ft)
P-10-100	36-inch	54-inch	128
P-10-101	36-inch	54-inch	127
P-10-102	36-inch	54-inch	64
P-10-103	36-inch	66-inch	118
P-10-104	36-inch	66-inch	163
P-10-105	36-inch	66-inch	172
P-10-106	36-inch	66-inch	59
P-10-107	36-inch	60-inch	346
P-10-108	36-inch	60-inch	731
P-10-109	36-inch	54-inch	479
P-10-110	36-inch	54-inch	6
P-10-111	36-inch	66-inch	155
P-10-112	36-inch	60-inch	229
P-10-113	16-inch	24-inch	70
P-10-114	18-inch	36-inch	381
P-10-115	18-inch	36-inch	330
P-10-116	18-inch	36-inch	44
P-10-117	12-inch	30-inch	5
P-10-118	12-inch	36-inch	145
P-10-119	12-inch	30-inch	133
P-10-120	10-inch	30-inch	128
P-10-121	12-inch	24-inch	115
P-10-122	12-inch	24-inch	147
P-10-123	10-inch	18-inch	28
P-10-124	10-inch	18-inch	102
P-10-125	10-inch	18-inch	21
P-10-126	10-inch	18-inch	89
P-10-127	10-inch	18-inch	18
P-10-137	8-inch	12-inch	45
P-10-138	6-inch	6-inch	68
P-10-142	8-inch	12-inch	38
P-10-144	8-inch	12-inch	49
P-10-150	6-inch	12-inch	18
P-10-153	8-inch	12-inch	108
P-10-154	6-inch	12-inch	42
P-10-156	8-inch	12-inch	39
P-10-159	6-inch	12-inch	21
P-10-160	6-inch	12-inch	21
P-10-161	6-inch	12-inch	37
P-10-163	6-inch	12-inch	36
P-10-201	8-inch	12-inch	46
P-10-202	8-inch	18-inch	138
P-10-203	6-inch	18-inch	78
P-10-204	6-inch	18-inch	140
P-10-205	6-inch	12-inch	39
P-10-206	6-inch	18-inch	147
P-10-300	24-inch	36-inch	95
P-10-301	24-inch	36-inch	129
P-10-304	18-inch	24-inch	36

Kelso Stormwater Management Plan
Phase II
Basin 10
Table 10.5 - All Undersized Pipes

Pipe	Exist. Size	Prop. Size	Length (ft)
P-10-306	8-inch	18-inch	506
P-10-307	6-inch	12-inch	48
P-10-308	6-inch	12-inch	24
P-10-310	6-inch	12-inch	21
P-10-311	8-inch	12-inch	42
P-10-312	6-inch	12-inch	22
P-10-314	18-inch	18-inch	197
P-10-316	6-inch	12-inch	10
P-10-317	6-inch	12-inch	22
P-10-319	6-inch	12-inch	13
P-10-320	6-inch	12-inch	34
P-10-321	6-inch	12-inch	33
P-10-323	6-inch	12-inch	22
P-10-400	10-inch	30-inch	259
P-10-401	8-inch	24-inch	256
P-10-402	8-inch	24-inch	40
P-10-403	8-inch	18-inch	135
P-10-404	8-inch	18-inch	57
P-10-405	8-inch	18-inch	66
P-10-406	6-inch	12-inch	13
P-10-407	6-inch	12-inch	34
P-10-408	6-inch	12-inch	42
P-10-410	6-inch	12-inch	39
P-10-411	8-inch	18-inch	214
P-10-412	6-inch	12-inch	34
P-10-413	6-inch	12-inch	26
P-10-414	6-inch	18-inch	25
P-10-415	8-inch	12-inch	188
P-10-416	6-inch	12-inch	27
P-10-417	6-inch	12-inch	26
P-10-419	6-inch	12-inch	10
P-10-420	8-inch	18-inch	30
P-10-421	8-inch	18-inch	181
P-10-422	6-inch	12-inch	31
P-10-500	16-inch	36-inch	54
P-10-501	16-inch	30-inch	164
P-10-502	16-inch	30-inch	65
P-10-503	12-inch	30-inch	32
P-10-504	12-inch	30-inch	226
P-10-505	10-inch	18-inch	44
P-10-506	8-inch	18-inch	219
P-10-507	8-inch	18-inch	41
P-10-508	8-inch	18-inch	233
P-10-509	6-inch	12-inch	18
P-10-510	6-inch	12-inch	3
P-10-512	6-inch	12-inch	22
P-10-513	8-inch	18-inch	50
P-10-514	8-inch	18-inch	191
P-10-515	8-inch	12-inch	54

Kelso Stormwater Management Plan
Phase II
Basin 10
Table 10.5 - All Undersized Pipes

Pipe	Exist. Size	Prop. Size	Length (ft)
P-10-516	8-inch	12-inch	61
P-10-519	6-inch	12-inch	22
P-10-525	6-inch	12-inch	22
P-10-526	8-inch	12-inch	122
P-10-527	8-inch	12-inch	116
P-10-528	6-inch	12-inch	42
P-10-531	8-inch	18-inch	42
P-10-532	8-inch	12-inch	253
P-10-533	6-inch	12-inch	46
P-10-540	10-inch	18-inch	26
P-10-541	10-inch	12-inch	197
P-10-549	6-inch	12-inch	22
P-10-600	12-inch	24-inch	133
P-10-601	12-inch	24-inch	48
P-10-602	12-inch	24-inch	106
P-10-603	12-inch	18-inch	145
P-10-604	12-inch	24-inch	166
P-10-605	12-inch	30-inch	198
P-10-606	12-inch	24-inch	35
P-10-607	12-inch	24-inch	132
P-10-608	8-inch	24-inch	79
P-10-609	10-inch	18-inch	21
P-10-610	10-inch	30-inch	102
P-10-611	12-inch	30-inch	19
P-10-612	12-inch	18-inch	54
P-10-613	12-inch	18-inch	24
P-10-614	12-inch	18-inch	72
P-10-615	12-inch	18-inch	186
P-10-616	12-inch	18-inch	24
P-10-619	6-inch	12-inch	17
P-10-620	6-inch	12-inch	11
P-10-631	6-inch	12-inch	11
P-10-633	6-inch	12-inch	31
Total			12,600

City of Kelso Stormwater Management Plan
Phase II
Basin 10

Table 10.6 - Basin 10 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1100	303,993.125	1,030,546.056	22.186	ex cb type 1	10	
1139	303,352.469	1,030,946.661	21.623	ex cb type 1	10	
1203	305,899.492	1,029,258.614	35.418	ex cb type 1	10	
1204	305,643.764	1,029,189.341	24.89	ex cb type 2	10	
1205	305,611.044	1,029,180.164	25.009	ex cb type 2	10	
1206	305,601.518	1,029,166.168	24.912	ex cb type 2	10	
1207	305,419.766	1,029,114.080	25.773	ex cb type 2	10	
1208	305,397.073	1,029,115.259	25.408	ex cb type 1	10	
1209	305,354.451	1,029,115.918	25.069	ex cb type 1	10	
1210	305,352.915	1,029,086.723	26.335	ex cb type 1	10	
1211	305,328.700	1,029,084.973	26.329	ex cb type 1	10	
1212	305,276.686	1,029,071.044	22.39	ex cb type 1	10	
1213	305,260.516	1,029,060.853	26.188	ex cb type 1	10	
1214	305,157.716	1,029,050.390	25.592	ex cb type 1	10	
1215	305,143.273	1,029,023.490	25.55	ex cb type 1	10	
1216	305,093.373	1,029,057.606	25.459	ex cb type 1	10	
1217	304,794.447	1,028,972.058	24.876	ex cb type 1	10	
1218	304,485.976	1,028,879.118	25.761	ex cb type 1	10	
1219	304,483.812	1,028,929.091	24.645	ex cb type 1	10	
1220	304,391.544	1,028,902.640	24.662	ex cb type 1	10	
1221	304,328.883	1,028,884.866	24.644	ex cb type 1	10	
1223	304,196.784	1,028,992.873	23.701	ex cb type 1	10	
1224	304,307.465	1,029,008.566	23.548	ex cb type 1	10	
1225	304,446.833	1,029,066.130	23.568	ex cb type 2	10	
1226	304,343.354	1,029,022.643	23.933	ex cb type 1	10	
1227	304,557.670	1,029,087.138	23.858	ex cb type 2	10	
1228	304,590.557	1,029,095.787	24.062	ex cb type 2	10	
1229	304,697.315	1,029,138.034	23.962	ex cb type 2	10	
1230	304,948.968	1,029,210.023	23.927	ex cb type 2	10	
1231	305,094.460	1,029,252.587	24.398	ex cb type 1	10	
1232	305,194.265	1,029,280.315	24.277	ex cb type 1	10	
1237	305,825.261	1,029,502.814	47.944	ex cb type 1	10	Deleted - Bubblers, insufficient data to connect to system
1238	305,776.794	1,029,486.546	45.342	ex cb type 2	10	Deleted - Bubblers, insufficient data to connect to system
1242	305,183.522	1,029,316.955	23.762	ex cb type 2	10	
1243	304,937.830	1,029,246.715	23.767	ex cb type 2	10	
1244	304,685.824	1,029,174.592	23.896	ex cb type 2	10	
1245	304,435.480	1,029,102.976	23.892	ex cb type 2	10	
1246	304,185.004	1,029,032.963	23.819	ex cb type 1	10	
1250	303,734.506	1,029,164.070	21.39	ex cb type 2	10	
1251	303,740.403	1,029,144.260	21.307	ex cb type 2	10	
1252	303,959.033	1,029,228.563	21.637	ex cb type 2	10	

Table 10.6 - Basin 10 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1253	303,964.770	1,029,207.377	21.651	ex cb type 2	10	
1254	304,023.563	1,029,247.090	21.635	ex cb type 2	10	
1255	304,030.217	1,029,225.923	21.649	ex cb type 2	10	
1256	304,281.735	1,029,291.855	21.75	ex cb type 2	10	
1257	304,273.505	1,029,324.673	21.797	ex cb type 2	10	
1258	304,454.206	1,029,376.463	22.017	ex cb type 2	10	
1259	304,466.131	1,029,345.357	25.891	ex cb type 2	10	
1260	304,531.174	1,029,363.188	22.124	ex cb type 2	10	
1261	304,522.088	1,029,395.785	21.92	ex cb type 2	10	
1262	304,707.728	1,029,448.961	22.161	ex cb type 2	10	
1263	304,717.502	1,029,416.295	22.12	ex cb type 2	10	
1264	304,781.777	1,029,470.276	22.204	ex cb type 2	10	
1265	304,791.423	1,029,437.723	22.146	ex cb type 2	10	
1266	304,960.166	1,029,521.462	21.627	ex cb type 2	10	
1267	304,969.012	1,029,488.448	21.995	ex cb type 2	10	
1268	305,027.702	1,029,505.555	22.076	ex cb type 1	10	
1269	305,040.820	1,029,541.650	21.938	ex cb type 1	10	
1294	304,878.578	1,029,995.611	20.563	ex cb type 1	10	
1297	304,693.474	1,029,659.777	21.1	ex cb type 2	10	
1298	304,662.075	1,029,672.363	20.947	ex cb type 2	10	
1299	304,459.634	1,029,617.215	20.054	ex cb type 2	10	
1300	304,450.140	1,029,641.539	19.765	ex cb type 2	10	
1301	304,387.951	1,029,623.584	19.792	ex cb type 2	10	
1302	304,395.442	1,029,598.850	20.102	ex cb type 2	10	
1303	304,199.346	1,029,570.621	19.979	ex cb type 1	10	
1304	304,211.762	1,029,541.191	20.26	ex cb type 1	10	
1305	304,043.551	1,029,525.029	20.141	ex cb type 2	10	
1306	304,050.572	1,029,500.528	20.311	ex cb type 2	10	
1307	303,942.691	1,029,447.708	20.495	ex cb type 2	10	
1308	303,921.791	1,029,441.673	20.552	ex cb type 2	10	
1309	303,894.994	1,029,455.739	20.486	ex cb type 2	10	
1310	303,887.581	1,029,480.376	20.611	ex cb type 2	10	
1311	303,654.607	1,029,383.396	21.106	ex cb type 1	10	
1312	303,623.752	1,029,375.548	21.135	ex cb type 2	10	
1313	303,598.918	1,029,397.794	21.005	ex cb type 2	10	
1314	303,562.674	1,029,610.056	19.949	ex cb type 2	10	
1315	303,519.116	1,029,620.558	19.745	ex cb type 2	10	
1316	303,513.175	1,029,641.600	19.662	ex cb type 2	10	
1317	303,583.734	1,029,616.025	19.885	ex cb type 2	10	
1318	303,624.377	1,029,673.403	19.713	ex cb type 2	10	
1319	303,630.768	1,029,652.476	19.742	ex cb type 2	10	
1320	303,806.516	1,029,702.848	19.315	ex cb type 2	10	

Table 10.6 - Basin 10 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1321	303,799.918	1,029,723.712	19.126	ex cb type 2	10	
1322	303,850.486	1,029,691.247	19.399	ex cb type 2	10	
1323	303,871.179	1,029,697.650	19.382	ex cb type 2	10	
1324	303,910.437	1,029,732.637	19.2	ex cb type 2	10	
1325	303,904.121	1,029,753.481	19.174	ex cb type 2	10	
1326	304,064.824	1,029,799.528	18.675	ex cb type 2	10	
1327	304,070.592	1,029,778.493	18.55	ex cb type 2	10	
1328	304,144.383	1,029,799.722	18.427	ex cb type 1	10	
1329	304,230.376	1,029,824.294	18.396	ex cb type 1	10	
1330	304,224.189	1,029,845.006	18.413	ex cb type 1	10	
1331	304,350.492	1,029,834.342	18.958	ex cb type 2	10	
1332	304,371.305	1,029,840.528	18.903	ex cb type 2	10	
1333	304,468.737	1,029,892.776	18.687	ex cb type 2	10	
1334	304,463.838	1,029,913.541	18.94	ex cb type 2	10	
1335	304,600.371	1,029,906.239	19.164	ex cb type 2	10	
1336	304,621.262	1,029,912.243	18.904	ex cb type 2	10	
1337	304,634.603	1,029,940.147	18.946	ex cb type 2	10	
1338	304,629.198	1,029,961.137	18.91	ex cb type 2	10	
1339	304,772.186	1,030,024.317	20.299	ex cb type 1	10	
1340	304,246.530	1,030,093.585	18.395	ex cb type ?	10	
1341	303,810.947	1,029,962.666	18.857	ex cb type 1	10	
1342	303,776.053	1,029,947.182	18.517	ex cb type 1	10	
1347	303,033.541	1,031,083.162	20.262	ex cb type 1	10	
1348	303,327.824	1,030,908.939	21.629	ex cb type 1	10	
1349	303,971.181	1,030,510.930	22.343	ex cb type 1	10	
1350	303,015.258	1,030,526.383	11.213	ex cb type 2	10	
1351	303,004.635	1,030,672.663	10.424	ex cb type 2	10	
1352	302,971.555	1,030,693.824	10.69	ex cb type 2	10	
1353	302,965.628	1,030,834.184	9.898	ex cb type 1	10	
1354	302,997.302	1,030,905.926	11.232	ex cb type 1	10	
1355	302,958.575	1,031,073.390	17.99	ex cb type 1	10	
1356	303,056.817	1,031,122.516	20.143	ex cb type 1	10	
1357	302,601.400	1,031,339.650	20.065	ex cb type 1	10	
1358	302,625.768	1,031,378.094	19.92	ex cb type 1	10	
1359	302,509.465	1,031,001.359	11.342	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1360	302,554.532	1,030,979.547	11.505	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1361	302,558.630	1,030,850.988	11.055	ex cb type 1	10	
1362	302,524.465	1,030,849.988	10.957	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.

Table 10.6 - Basin 10 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1363	302,510.277	1,031,337.255	19.544	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1364	301,921.084	1,031,428.540	11.868	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1365	301,914.755	1,031,469.170	11.95	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1366	301,597.944	1,031,238.789	10.121	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1367	301,564.431	1,031,228.500	9.83	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1370	301,761.735	1,031,055.896	8.457	ex cb type ?	10	Excluded from model due to insuffient downstream data to connect to system.
1371	301,881.150	1,031,090.923	8.374	ex cb type ?	10	Excluded from model due to insuffient downstream data to connect to system.
1372	301,891.602	1,031,059.917	8.678	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1373	301,956.505	1,031,112.490	8.121	ex cb type ?	10	Excluded from model due to insuffient downstream data to connect to system.
1374	302,113.891	1,031,167.915	10.098	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1375	302,123.611	1,031,129.943	9.519	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1376	302,156.502	1,031,139.623	10.292	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1377	302,145.799	1,031,169.022	10.613	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1378	302,263.825	1,031,200.893	10.737	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1379	302,499.965	1,031,268.214	15.597	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1380	302,369.302	1,030,949.966	10.508	ex cb type ?	10	Excluded from model due to insuffient downstream data to connect to system.

Table 10.6 - Basin 10 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1381	302,378.901	1,030,926.999	9.801	ex cb type ?	10	Excluded from model due to insuffient downstream data to connect to system.
1382	302,206.236	1,030,875.665	11.368	ex cb type 2	10	Excluded from model due to insuffient downstream data to connect to system.
1383	302,233.670	1,030,782.075	10.545	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1384	302,257.262	1,030,787.882	10.688	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1385	302,023.574	1,030,649.481	10.653	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1386	301,997.992	1,030,642.368	10.714	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1387	301,187.088	1,031,160.908	11.357	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1391	302,672.087	1,031,240.063	10.421	ex cb type 1	10	
1392	302,805.464	1,031,151.119	9.71	ex cb type 1	10	
1393	302,405.404	1,031,394.280	11.221	ex cb type 1	10	
1394	302,309.597	1,031,451.849	10.786	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1856	301,766.038	1,030,633.714	11.281	ex cb type 2	10	Excluded from model due to insuffient downstream data to connect to system.
4063	305,866.546	1,029,231.177	35.042	ex mh type ?	10	
4065	305,624.234	1,029,162.724	25.993	ex mh type ?	10	
4066	305,422.251	1,029,105.592	26.098	ex mh type ?	10	
4067	305,142.142	1,029,027.740	25.718	ex mh type ?	10	
4068	304,981.635	1,029,024.860	25.577	ex mh type ?	10	
4069	304,790.898	1,028,970.138	24.829	ex mh type ?	10	
4070	304,383.500	1,028,894.893	24.885	ex mh type ?	10	
4071	304,625.039	1,028,962.971	25.628	ex mh type ?	10	
4072	304,335.561	1,028,900.400	25.163	ex mh type ?	10	
4073	303,979.520	1,028,765.232	24.771	ex mh type ?	10	
4074	304,298.545	1,029,028.302	24.523	ex mh type ?	10	
4075	304,303.887	1,029,028.058	24.583	ex mh type ?	10	
4076	304,570.676	1,029,103.913	25.159	ex mh type ?	10	
4077	304,804.189	1,029,170.564	24.747	ex mh type ?	10	
4078	304,971.670	1,029,219.782	24.603	ex mh type ?	10	
4079	305,069.639	1,029,246.703	25.119	ex mh type ?	10	

Table 10.6 - Basin 10 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
4084	304,323.552	1,029,107.153	24.389	ex mh type ?	10	
4086	303,735.380	1,029,161.093	22.007	ex mh type ?	10	
4087	303,998.679	1,029,236.345	22.531	ex mh type ?	10	
4088	304,212.959	1,029,297.217	21.934	ex mh type ?	10	
4089	304,205.589	1,029,301.629	22.313	ex mh type ?	10	
4090	304,212.815	1,029,275.822	22.472	ex mh type ?	10	
4091	304,281.218	1,029,322.607	22.195	ex mh type ?	10	
4092	304,484.242	1,029,380.798	22.744	ex mh type ?	10	
4093	304,652.402	1,029,428.151	22.719	ex mh type ?	10	
4094	304,771.284	1,029,463.330	22.755	ex mh type ?	10	
4095	304,970.098	1,029,529.524	22.08	ex mh type ?	10	
4100	304,413.741	1,029,626.893	20.685	ex mh type ?	10	
4101	304,209.014	1,029,568.226	20.44	ex mh type ?	10	
4102	304,156.271	1,029,553.990	20.489	ex mh type ?	10	
4103	304,159.077	1,029,511.805	21.306	ex mh type ?	10	
4104	303,927.002	1,029,488.634	20.764	ex mh type ?	10	
4105	303,643.443	1,029,407.440	21.419	ex mh type ?	10	
4106	303,572.260	1,029,655.479	20.014	ex mh type ?	10	
4107	303,855.909	1,029,736.684	19.542	ex mh type ?	10	
4108	304,088.584	1,029,759.245	19.59	ex mh type ?	10	
4109	304,093.005	1,029,753.723	19.222	ex mh type ?	10	
4110	304,132.323	1,029,776.742	19.381	ex mh type ?	10	
4111	304,128.317	1,029,814.337	18.918	ex mh type ?	10	
4112	304,582.159	1,029,956.928	19.566	ex mh type ?	10	
4113	304,586.012	1,029,945.750	19.306	ex mh type ?	10	
4114	304,771.777	1,030,010.462	20.853	ex mh type ?	10	
4115	304,126.197	1,030,020.901	18.836	ex mh type ?	10	
4116	304,118.407	1,030,043.077	18.447	ex mh type ?	10	
4117	304,124.103	1,030,080.462	18.978	ex mh type ?	10	
4118	304,077.838	1,030,068.497	18.681	ex mh type ?	10	
4119	304,079.533	1,030,013.806	18.355	ex mh type ?	10	
4120	303,965.471	1,030,015.532	19.123	ex mh type ?	10	
4121	303,965.270	1,030,021.440	19.12	ex mh type ?	10	
4122	303,803.719	1,029,974.378	19.017	ex mh type ?	10	
4123	303,943.147	1,030,500.043	24.14	ex mh type ?	10	
4125	302,689.976	1,031,346.067	21.064	ex mh type ?	10	Deleted - SS per City
4126	302,573.596	1,031,305.131	13.312	ex mh type ?	10	
4127	302,519.875	1,030,990.129	11.999	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4128	301,552.387	1,031,252.855	10.5	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.

Table 10.6 - Basin 10 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
4129	301,582.306	1,031,259.304	10.424	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4130	302,123.119	1,031,162.038	10.866	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4131	302,201.445	1,030,899.640	11.361	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4132	302,012.155	1,030,642.719	11.385	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4133	301,228.149	1,031,156.516	11.809	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4138	302,297.873	1,031,466.187	12.229	ex mh type ?	10	Outfall for Basin 10
4140	302,070.711	1,031,393.831	11.812	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4141	303,490.134	1,029,889.275	17.918	ex mh type ?	10	
4142	304,198.326	1,029,387.948	21.471	ex mh type ?	10	
4350	304,625.832	1,031,956.426	11.101	ex mh type ?	10	Deleted - Assumed SS
4356	304,342.651	1,029,875.989	18.71	ex mh type ?	10	
4357	301,719.339	1,030,770.289	10.548	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
8002	301,176.663	1,031,183.950	7.838	OUTFALL	10	Excluded from model due to insuffient downstream data to connect to system.

Appendix C

Basin 11

BASIN 11

SYSTEM ASSESSMENT

Basin Description: Basin 11 consists of the structures in the area of the Three Rivers Mall. It drains an area bound between Grade Street along the southwest edge, Manasco Drive and Interstate 5 (1-5) along the southeast edge, and Basin 12 to the north. Figure 11.1 shows an aerial photograph of Basin 11. The majority of structures within this basin are located outside City right-of-way and are privately maintained. The outlet for the Basin 11 model is at node 4358 in Grade Street. The runoff from Basin 11 flows from 4358 into a 36-inch pipe that crosses Grade Street and continues south along 13th Avenue, eventually discharging to the Coweeman slough. Due to high water elevations and confined entry restrictions field data was not obtained for this run. It is recommended that further field investigation take place so the remainder of the system be modeled. The total drainage area for Basin 11 is 40.64 acres, and the land use is 100% Major Retail. See Figure 11.2 for the land use areas in Basin 11.

System Modeling: Table 11.1 lists the structure information and connections, along with total flows and capacities. Figure 11.3 shows a schematic of the structure locations and piping layout. As stated in Chapter 2, junctions were entered into the model where blind connections were assumed to occur using the prefix J in the numbering system for easy identification. Insufficient field data was able to be obtained for catch basins 1142, 1176, 1177 & 1179 and manholes 4049 and 4050. Therefore, As-Built Construction drawings for Top Foods were used to input pipe data to connect these structures to the system.

Other assumptions were made in the modeling, such as interpolating an invert or rim elevation when junctions were added to the system. The field data for catch basin 1193 indicates an additional pipe was entering this structure. However, catch basin 1395 had four unaccounted for pipes, none of which could be connected to 1193. It was assumed that catch basin 1395 connects to the system in Manasco Drive to the east. It is recommended that additional investigation be performed to determine how this catch basin connects to the system.

As seen in Table 11.1, a significant number of pipes with insufficient capacity (19%) are less than 12-inch in diameter. Utilizing the current slopes, the majority of these pipes will gain capacity by upsizing to 12- or 18-inch HDPE pipe. Pipes P-11-100 to P-11-108 are 32-inch to 48-inch in diameter, but have insufficient slope, and are undersized based on the modeled amount of flow in the system. Increasing these pipes from the existing to HDPE in the diameter listed in Table 11.3, keeping the same slope, will provide increased capacity in the system.

System Issues

Pipe size: The presence of small diameter pipe, that is, pipe less than 12-inches in diameter, in Basin 11 is relatively low (19%). Table 11.2 shows the pipe compilation by size and material. The majority of the system is 24-inch or greater but is limited in capacity due to insufficient slopes. A preliminary recommendation is to remove any trunk lines with piping less than 12-inches in diameter and replace with a minimum of 18-inch diameter pipe, to provide additional capacity of the system.

Pipe Material: Basin 11 is comprised of five modeled material types: concrete, CMP, PVC, HDPE and ductile iron. The majority of the system (91%) consists of CMP and PVC, and the remaining 9% comprised of concrete, HDPE and ductile iron. PVC has a relatively low Manning's coefficient (0.011). In contrast, CMP pipe has a high Manning's Coefficient (0.024) which reduces the flow capacity to half that of PVC or HDPE, for the same slope. Material such as HDPE, smooth wall interior, is flexible and has a Manning's value similar to PVC (0.012). However, in contrast to PVC, HDPE has corrugated outer walls which allow it to lock into position in the ground and become less susceptible to movement and separation. In addition, the projected life expectancy of HDPE is in excess of 100 years. Material such as HDPE is more flexible and less likely to degrade overtime, and for this reason it is recommended replacement of CMP pipe be completed with HDPE.

System Maintenance: The final contributing issue to the City of Kelso Basin 11 storm water system is maintenance. During the inventory of structures and pipes, several notes were made in regards to cleaning a structure or pipe connection. Cleaning of a structure took place where needed to obtain existing data, and it is recommended the system continue to be cleaned on an annual or semi-annual basis to maintain the function of the system until recommended improvements can be made.

RECOMMENDATIONS

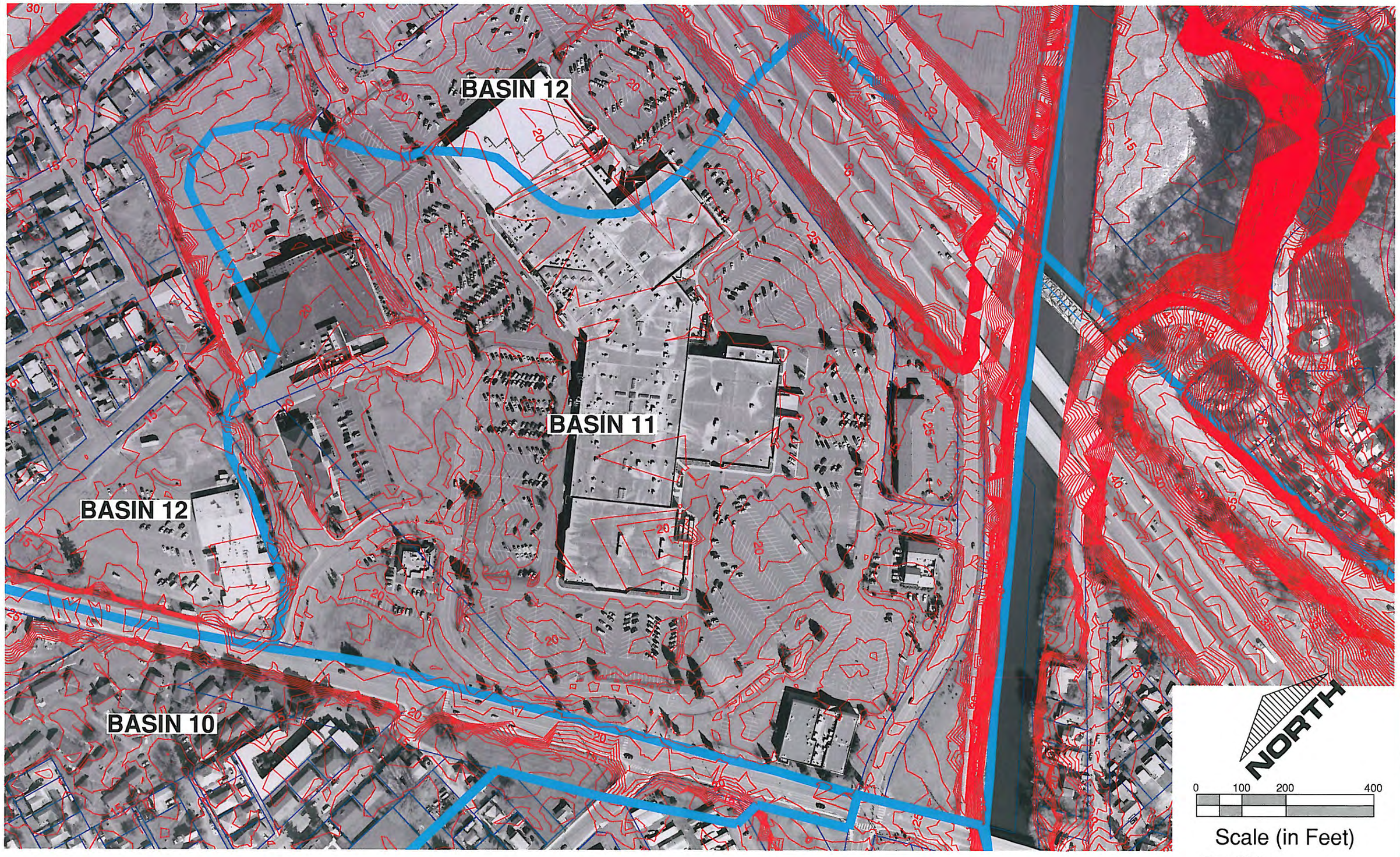
System Replacements: It is recommended at a minimum that the main pipes down Three Rivers Mall Drive (considered trunk line pipes) be replaced with HDPE pipe in the diameter size listed in Table 11.3. This would allow for increased pipe capacity and act as storage for the system should downstream tail-water conditions occur. Many of the smaller lines in the system are connecting into the trunk line and do not appear to be causing a significant problem to the system. However, it is recommended that any new or replaced pipe be composed of HDPE at a minimum diameter of 12-inches.

Capital Improvements: The estimated budget to upgrade from the existing pipe sizes to the pipe sizes listed is approximately $916,000, as shown in Table 11.4. This cost is based on contracting the work to be done by other than City of Kelso forces.

Operation and Maintenance: A guideline for order of precedence for the CIP has been developed such that budget consideration can be included and is suggested as follows:

1. Clean catch basins and storm drain manholes;
2. Clean and television storm drain pipes to determine if blockages are encountered;
3. Replace concrete and clay pipes with HDPE pipe such as ADS N-12 or similar;
4. Upgrade storm drain pipes on trunk lines to sizes recommended to handle flow from side systems and to provide additional storage during larger storm events;
5. Upgrade storm drain pipes on side streets to sizes recommended, and eliminate as many blind connections as possible during the improvement process.

These recommendations are based on a planning level assessment only. There may be physical constraints that make it impossible to install the large pipes recommended for upgrading the system. A detailed engineered design of the proposed system will be required, which takes into account the existing surrounding environment. The individual and overall system budget estimates have been developed based on the cost to remove and replace the pipes with the sizes as shown, and to repair the existing surface to its current condition. Consideration should be given to the shallow cover and other utilities within the City's right of way which may require additional engineering solutions and add unknown costs to those provided in this report.



NORTH

0 100 200 400

Scale (in Feet)

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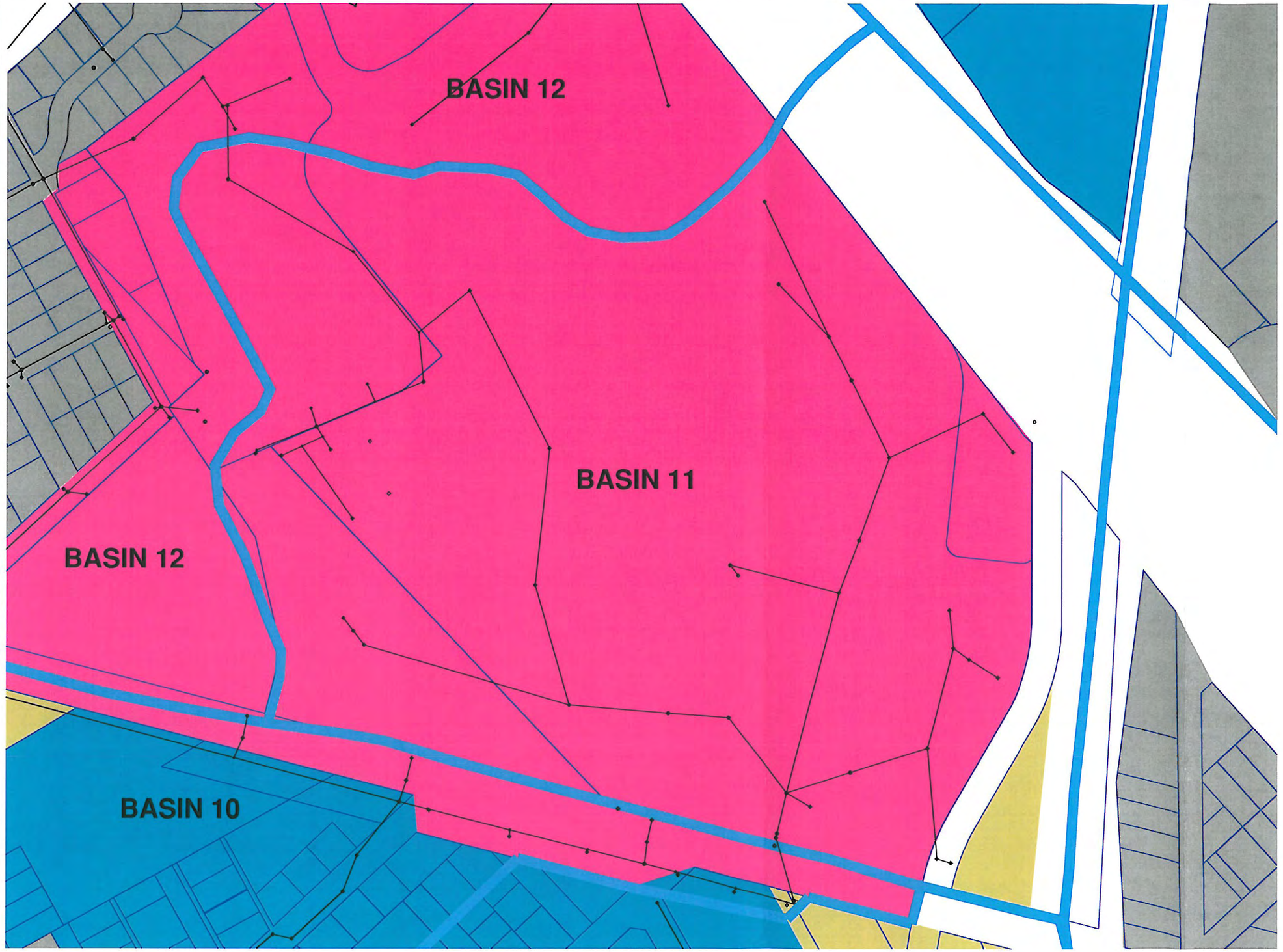
City of Kelso
Stormwater Management Plan
Phase II - Aerial Photo of Basin 11
Figure 11.1

T:\Projects\04271015.act\Basins\Kelso zoning.dwg, Fig 11.1, 12/29/2008 7:22:18 AM, DFrye, DWF6 ePlot.pc3, Gibbs & Olson - Report B Size (17.00 x 11.00 Inches), 1:1, Gibbs & Olson, Inc.



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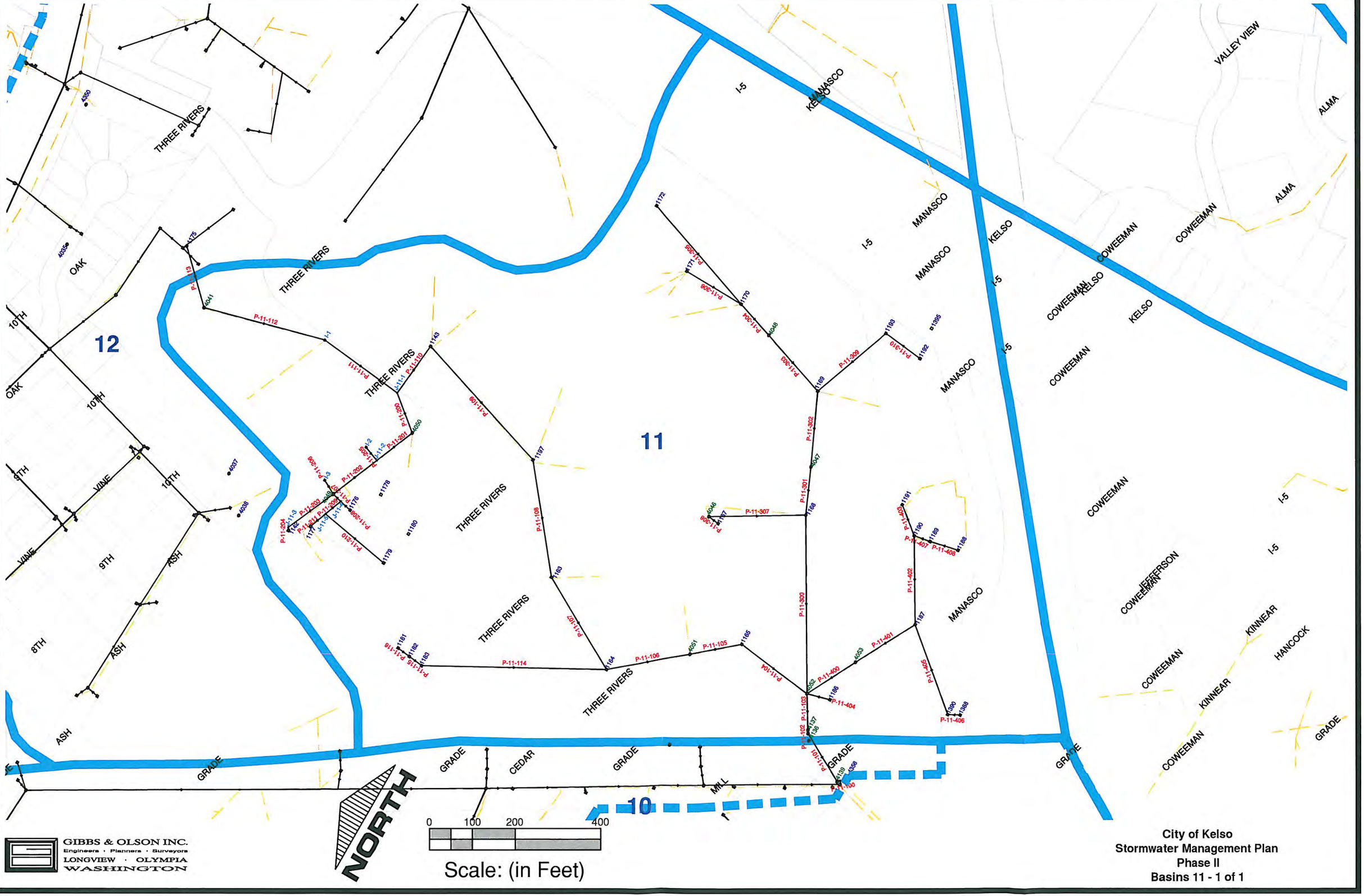
City of Kelso
Stormwater Management Plan
Phase II - Basin 11 with Zoning
Figure 11.2

T:\Projects\04271015.act\Basins\Kelso zoning.dwg, Fig 11.2, 12/29/2008 7:23:16 AM, DFrye, DWF6 ePlot.pc3, Gibbs & Olson - Report B Size (17.00 x 11.00 Inches), 1:1, Gibbs & Olson, Inc.



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City of Kelso
Stormwater Management Plan
Phase II
Basins 11 - 1 of 1

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Kelso Stormwater Management Plan
Phase II
Summary Legend

Legend

	System Flow > Pipe Capacity
	Ground elevation interpolated from nearest structure
	Invert elevation interpolated from upstream and downstream nodes
-0.02	Negative slope based on data provided
J	Junction
O	Outlet
Conc.	Concrete
T-cotta	Terracotta
DI	Ductile Iron
PVC	Polyvinyl Chloride
HDPE	High Density Polyethylene
CMP	Corrugated Metal Pipe
1000's	Catch Basins
4000's	Manholes or Curb Inlets
NDA	No Data Available

Kelso Stormwater Management Plan
Phase II
Basin 11

Table 11.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-11-100	O-4358	4139	N/A	N/A	N/A	48.12	10.53	2.52	122.18	16	0.0019	36-inch	Concrete	0.013	28.88	3.68	3.71	13.53	14.67	6.85	7.96	7.20	6.63	
P-11-101	4139	4136	N/A	N/A	N/A	48.12	10.40	2.53	122.65	131	0.0340	36-inch	Concrete	0.013	122.92	3.75	8.20	14.67	22.66	7.92	11.46	11.64	7.20	
P-11-102	4136	4137	N/A	N/A	N/A	48.12	10.39	2.53	122.71	9	-0.0078	48-inch	CMP	0.024	-68.62	12.50	12.43	22.66	23.16	6.16	6.73	16.42	15.83	
P-11-103	4137	4052	0	0.00	0	48.12	10.24	2.54	123.26	85	0.0027	48-inch	CMP	0.024	40.47	12.43	12.66	23.16	22.06	6.73	5.40	18.56	16.42	
P-11-104	4052	1165	1.62	0.9	1.46	24.79	9.21	2.68	66.92	193	0.0041	32-inch	CMP	0.024	16.88	12.69	13.48	22.06	18.43	6.7	2.28	27.72	15.22	
P-11-105	1165	4051	N/A	N/A	N/A	23.33	9.03	2.71	63.62	123	0.0080	32-inch	CMP	0.024	23.55	13.51	14.49	18.43	20.61	2.25	3.45	25.58	18.43	
P-11-106	4051	1164	1.62	0.9	1.46	23.33	8.74	2.75	64.64	201	-0.0045	32-inch	CMP	0.024	-17.76	14.51	13.6	20.61	19.15	3.43	2.88	32.67	20.61	
P-11-107	1164	1163	1.62	0.9	1.46	17.50	8.27	2.82	49.73	251	0.0015	32-inch	CMP	0.024	10.27	13.58	13.96	19.15	19.18	2.9	2.55	28.06	19.15	
P-11-108	1163	1197	1.62	0.90	1.46	16.04	7.72	2.90	46.91	277	0.0013	32-inch	CMP	0.024	9.64	13.97	14.34	19.18	19.04	2.54	2.03	27.93	19.18	
P-11-109	1197	1143	1.62	0.9	1.46	14.58	7.29	2.97	43.59	357	0.0009	24-inch	CMP	0.024	3.67	14.35	14.67	19.04	18.23	2.69	1.56	64.23	19.04	field data showed a 32" cmp at 1197 and a 24" cmp at 1143. Assumed to be 24" cmp.
P-11-110	1143	J-11-1	N/A	N/A	N/A	13.12	7.11	2.99	39.59	134	0.0016	24-inch	PVC	0.01	11.92	14.67	14.89	18.23	17.76	1.56	0.87	20.66	18.23	
P-11-111	J-11-1	I-1	1.62	0.90	1.46	4.37	6.31	3.11	13.73	210	0.0010	24-inch	PVC	0.01	9.3	14.89	15.10	17.76	24.74	0.87	7.64	18.22	17.76	
P-11-112	I-1	4041	1.62	0.90	1.46	2.92	5.10	3.29	9.68	293	0.0010	21-inch	PVC	0.01	6.48	15.37	15.66	24.74	18.96	7.62	1.55	18.87	18.22	
P-11-113	4041	1175	1.62	0.90	1.46	1.46	5.00	3.31	4.86	149	-0.0051	6-inch	PVC	0.01	-0.52	15.66	14.90	18.96	17.09	2.80	1.69	85.14	18.87	
P-11-114	1164	1183	1.62	0.90	1.46	4.37	5.14	3.29	14.50	432	0.0021	15-inch	PVC	0.01	3.85	13.56	14.47	19.15	19.57	4.34	3.85	32.04	19.15	
P-11-115	1183	1182	1.62	0.90	1.46	2.92	5.09	3.30	9.69	36	0.0328	12-inch	PVC	0.01	8.38	14.50	15.68	19.57	19.83	4.07	3.15	21.15	19.57	
P-11-116	1182	1181	1.62	0.9	1.46	1.46	5	3.31	4.86	33	0.0555	12-inch	PVC	0.01	10.91	15.75	17.58	19.83	20.55	3.08	1.97	20.19	19.83	
P-11-200	J-11-1	4050	N/A	N/A	N/A	8.75	5.48	3.24	28.56	100	0.0012	21-inch	PVC	0.01	7.14	15.03	15.15	17.76	19.78	0.98	2.88	19.68	17.76	
P-11-201	4050	J-11-2	N/A	N/A	N/A	8.75	5.43	3.25	28.62	106	0.0011	12-inch	Ductile Iron	0.012	1.3	15.38	15.50	19.78	20.50	3.40	4.00	77.97	19.68	
P-11-202	J-11-2	4049	N/A	N/A	N/A	7.29	5.36	3.26	23.93	129	0.0012	12-inch	Ductile Iron	0.012	1.32	15.50	15.65	20.50	21.19	4.00	4.54	70.09	20.50	
P-11-203	4049	J-11-3	N/A	N/A	N/A	1.46	5.01	3.31	4.86	131	0.0171	12-inch	PVC	0.01	6.06	15.79	18.03	21.19	19.40	4.40	0.37	22.63	21.19	
P-11-204	J-11-3	1142	1.62	0.90	1.46	1.46	5.00	3.31	4.86	8	0.0175	6-inch	PVC	0.01	0.96	18.03	18.17	19.40	19.22	0.87	0.55	22.96	19.40	
P-11-205	J-11-2	I-2	1.62	0.90	1.46	1.46	5.00	3.31	4.86	39	0.0190	6-inch	PVC	0.01	1	15.50	16.24	20.50	18.24	4.50	1.50	37.85	20.50	
P-11-206	4049	I-3	1.62	0.90	1.46	1.46	5.00	3.31	4.86	38	0.0100	6-inch	PVC	0.01	0.73	16.11	16.49	21.19	18.24	4.58	1.25	38.09	21.19	
P-11-207	4049	J-11-4	N/A	N/A	N/A	4.37	5.23	3.28	14.44	24	0.0375	8-inch	PVC	0.01	3.04	15.83	16.73	21.19	20.63	4.69	3.23	41.48	21.19	
P-11-208	J-11-4	1176	1.62	0.90	1.46	1.46	5.00	3.31	4.86	30	0.0380	8-inch	PVC	0.01	3.06	16.73	17.87	20.63	19.94	3.23	1.40	23.51	20.63	
P-11-209	J-11-4	J-11-5	N/A	N/A	N/A	2.92	5.21	3.28	9.64	46	0.0309	6-inch	PVC	0.01	1.28	16.74	18.16	20.63	20.24	3.39	1.58	100.90	20.63	
P-11-210	J-11-5	1179	1.62	0.90	1.46	1.46	5.00	3.31	4.86	178	0.0051	8-inch	PVC	0.01	1.12	17.45	18.35	20.24	20.55	2.12	1.53	37.31	20.24	
P-11-211	J-11-5	1177	1.62	0.90	1.46	1.46	5.00	3.31	4.86	46	0.0309	6-inch	PVC	0.01	1.28	16.74	18.16	20.24	19.84	3.00	1.18	40.70	20.24	
P-11-300	4052	1168	1.62	0.90	1.46	11.66	8.73	2.75	32.34	416	0.0030	36-inch	CMP	0.024	19.64	12.73	13.96	22.06	18.53	6.33	1.57	21.90	18.56	Field data showed a 45" cmp at 4052 and a 36" cmp at 1168. Assumed to be 36" cmp.
P-11-301	1168	4047	N/A	N/A	N/A	8.75	8.3	2.81	24.82	113	0.0029	32-inch	CMP	0.024	14.26	13.93	14.26	18.53	20.45	1.93	3.52	19.53	18.53	
P-11-302	4047	1169	1.62	0.9	1.46	8.75	7.66	2.91	25.67	178	0.0029	32-inch	CMP	0.024	14.13	14.26	14.77	20.45	19.31	3.52	1.87	21.21	19.53	
P-11-303	1169	4048	N/A	N/A	N/A	4.37	6.97	3.01	13.29	174	0.0032	24-inch	CMP	0.024	6.89	14.76	15.31	19.31	20.96	2.55	3.65	21.36	19.31	Field data showed a 32" cmp at 1169 and a 24" cmp at 4043. Assumed to be 24" cmp.
P-11-304	4048	1170	1.62	0.90	1.46	4.37	6.59	3.07	13.54	98	0.0013	24-inch	CMP	0.024	4.46	15.28	15.41	20.96	18.91	3.68	1.50	22.16	20.96	
P-11-305	1170	1172	1.62	0.9	1.46	1.46	5	3.31	4.86	304	0.0038	15-inch	PVC	0.01	5.19	15.44	16.6	18.91	20.39	2.22	2.54	19.93	18.91	
P-11-306	1170	1171	1.62	0.9	1.46	1.46	5	3.31	4.86	148	0.0066	24-inch	CMP	0.024	9.97	15.42	16.4	18.91	20.8	1.49	2.4	19.14	18.91	
P-11-307	1168	4046	N/A	N/A	N/A	1.46	5.02	3.31	4.86	228	0.0057	12-inch	PVC	0.01	3.5	14.13	15.43	18.53	21.68	3.4	5.25	21.04	18.53	
P-11-308	4046	1167	1.62	0.90	1.46	1.46	5.00	3.31	4.86	27	0.1211	6-inch	PVC	0.01	2.54	15.38	18.65	21.68	20.52	5.80	1.37	33.05	21.04	
P-11-309	1169	1193	1.62	0.90	1.46	2.92	5.18	3.28	9.65	209	0.0285	10-inch	PVC	0.01	4.81	14.77	20.73	19.31	24.17	3.71	2.61	43.29	19.31	Field notes show a 15" cmp at 1169 and a 10" pvc at 1193. Assume 10" pvc.

Kelso Stormwater Management Plan
Phase II
Basin 11

Table 11.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-11-310	1193	1192	1.62	0.90	1.46	1.46	5.00	3.31	4.86	98	0.0013	10-inch	PVC	0.01	1.04	20.65	20.78	24.17	22.73	2.69	1.12	27.03	24.17	
P-11-400	4052	4053	N/A	N/A	N/A	10.21	5.81	3.19	32.80	135	0.0002	24-inch	CMP	0.024	1.83	12.81	12.84	22.06	22.31	7.25	7.47	28.23	18.56	
P-11-401	4053	1187	1.62	0.90	1.46	10.21	5.55	3.23	33.20	165	0.0009	24-inch	CMP	0.024	3.69	12.99	13.14	22.31	19.78	7.32	4.64	34.42	22.31	
P-11-402	1187	1190	1.62	0.90	1.46	5.83	5.11	3.29	19.36	208	0.0180	12-inch	HDPE	0.012	5.18	14.18	17.93	19.78	21.13	4.60	2.20	72.14	19.78	
P-11-403	1190	1191	1.62	0.90	1.46	1.46	5.00	3.31	4.86	77	0.0049	8-inch	PVC	0.01	1.1	18.16	18.54	21.13	20.90	2.30	1.69	28.51	21.13	
P-11-404	4052	1186	1.62	0.90	1.46	1.46	5.00	3.31	4.86	55	0.0460	8-inch	PVC	0.01	3.37	15.72	18.25	22.06	20.41	5.67	1.49	23.83	18.56	
P-11-405	1187	1390	1.62	0.90	1.46	2.92	5.08	3.30	9.69	223	0.0213	15-inch	PVC	0.01	12.26	13.24	17.99	19.78	22.04	5.29	2.80	22.75	19.78	
P-11-406	1390	1388	1.62	0.90	1.46	1.46	5.00	3.31	4.86	30	0.0140	12-inch	Concrete	0.013	4.22	17.99	18.41	22.04	21.99	3.05	2.58	22.60	22.04	
P-11-407	1190	1189	1.62	0.90	1.46	2.92	5.08	3.30	9.69	39	0.0292	8-inch	PVC	0.01	2.69	17.95	19.09	21.13	21.87	2.51	2.11	35.98	21.13	
P-11-408	1189	1188	1.62	0.90	1.46	1.46	5.00	3.31	4.86	69	0.0070	8-inch	PVC	0.01	1.31	19.12	19.60	21.87	21.64	2.08	1.37	28.49	21.87	

System Flow > Pipe Capacity
Ground elevation interpolated from nearest structure
Invert elevation interpolated from upstream and downstream nodes

Kelso Stormwater Management Plan
Phase II
Basin 11

Table 11.2 - Existing Pipe Totals

Pipe Size	Concrete	CMP	PVC	Clay	HDPE	Ductile Iron	Cast Iron	Total	Percentage
6-inch	0	0	353	0	0	0	0	353	5.19%
8-inch	0	0	472	0	0	0	0	472	6.94%
10-inch	0	0	307	0	0	0	0	307	4.52%
12-inch	30	0	428	0	208	235	0	901	13.25%
15-inch	0	0	959	0	0	0	0	959	14.11%
21-inch	0	0	393	0	0	0	0	393	5.78%
24-inch	0	1,077	344	0	0	0	0	1421	20.90%
32-inch	0	1,336	0	0	0	0	0	1336	19.65%
36-inch	147	416	0	0	0	0	0	563	8.28%
48-inch	0	94	0	0	0	0	0	94	1.38%
Total	**177**	**2,923**	**3,256**	**0**	**208**	**235**	**0**	**6,799**	**100.00%**
Percentage	**2.60%**	**42.99%**	**47.89%**	**0.00%**	**3.06%**	**3.46%**	**0.00%**	**100.00%**	

Table 11.3 - Recommended Trunk Line Improvements

Pipe	Exist. Size	Prop. Size	Length (ft)
P-11-100	36-inch	60-inch	16
P-11-101	36-inch	60-inch	131
P-11-102	48-inch	60-inch	9
P-11-103	48-inch	60-inch	85
P-11-104	32-inch	42-inch	193
P-11-105	32-inch	42-inch	123
P-11-106	32-inch	42-inch	201
P-11-107	32-inch	48-inch	251
P-11-108	32-inch	48-inch	277
P-11-109	24-inch	48-inch	357
P-11-110	24-inch	42-inch	134
P-11-111	24-inch	30-inch	210
P-11-112	21-inch	30-inch	293
P-11-200	21-inch	42-inch	100
P-11-300	36-inch	36-inch	416
P-11-301	32-inch	36-inch	113
P-11-302	32-inch	36-inch	178
P-11-303	24-inch	24-inch	174
P-11-304	24-inch	30-inch	98
P-11-400	24-inch	60-inch	135
P-11-401	24-inch	48-inch	165
P-11-402	12-inch	24-inch	208
Total			**3,867**

Kelso Stormwater Management Plan
Phase II
Basin 11

Table 11.4 - Preliminary Opinion of Probable Cost

Item	Description	QTY	Unit	Price	Total
1	Mobilization	1	LS	$ 50,000	$ 50,000
2	Traffic Control	1	LS	$ 10,000	$ 10,000
3	Clearing and Grubbing	1	LS	$ 5,000	$ 5,000
4	Removal of Structures and Obstructions	1	LS	$ 7,500	$ 7,500
5	Removal of Existing Asphalt	3,175	SY	$ 10	$ 31,750
6	Construction Fabric	2,315	SY	$ 2	$ 4,630
7	CSBC	1,075	Tons	$ 20	$ 21,500
8	CSTC	380	Tons	$ 22	$ 8,360
9	HMA	570	Tons	$ 150	$ 85,500
12	24-inch HDPE	382	LF	$ 65	$ 24,830
13	30-inch HDPE	601	LF	$ 80	$ 48,080
15	42-inch HDPE	751	LF	$ 135	$ 101,385
16	48-inch HDPE	1,050	LF	$ 170	$ 178,500
17	54-inch HDPE	0	LF	$ 180	$ -
18	60-inch HDPE	376	LF	$ 190	$ 71,440
19	66-inch HDPE	0	LF	$ 200	$ -
22	Catch Basins	8	EA	$ 1,200	$ 9,600
23	Manholes	4	EA	$ 1,500	$ 6,000
24	Import Trench Backfill (assume 3' avg)	2,315	CY	$ 8	$ 18,520
25	Trench Safety Systems	1	LS	$ 10,000	$ 10,000
	Subtotal				$ 763,295
	Contingency @	20%			$ 152,700
	Total Opinion of Probable Cost				**$ 915,995**

Kelso Stormwater Management Plan
Phase II
Basin 11

Table 11.5 - All Undersized Pipes

Pipe	Exist. Size	Prop. Size	Length (ft)
P-11-100	36-inch	60-inch	16
P-11-102	48-inch	54-inch	9
P-11-103	48-inch	60-inch	85
P-11-104	32-inch	42-inch	193
P-11-105	32-inch	36-inch	123
P-11-106	32-inch	42-inch	201
P-11-107	32-inch	48-inch	251
P-11-108	32-inch	48-inch	277
P-11-109	24-inch	48-inch	357
P-11-110	24-inch	42-inch	134
P-11-111	24-inch	30-inch	210
P-11-112	21-inch	30-inch	293
P-11-113	6-inch	18-inch	149
P-11-114	15-inch	30-inch	432
P-11-115	12-inch	18-inch	36
P-11-200	21-inch	42-inch	100
P-11-201	12-inch	42-inch	106
P-11-202	12-inch	36-inch	129
P-11-204	6-inch	12-inch	8
P-11-205	6-inch	12-inch	39
P-11-206	6-inch	18-inch	38
P-11-207	8-inch	18-inch	24
P-11-208	8-inch	12-inch	30
P-11-209	6-inch	18-inch	46
P-11-210	8-inch	18-inch	178
P-11-211	6-inch	12-inch	46
P-11-300	36-inch	36-inch	416
P-11-301	32-inch	36-inch	113
P-11-302	32-inch	36-inch	178
P-11-303	24-inch	24-inch	174
P-11-304	24-inch	30-inch	98
P-11-307	12-inch	18-inch	228
P-11-308	6-inch	12-inch	27
P-11-309	10-inch	18-inch	209
P-11-310	10-inch	24-inch	98
P-11-400	24-inch	60-inch	135
P-11-401	24-inch	48-inch	165
P-11-402	12-inch	24-inch	208
P-11-403	8-inch	18-inch	77
P-11-404	8-inch	12-inch	55
P-11-406	12-inch	18-inch	30
P-11-407	8-inch	18-inch	39
Total			**5,760**

Table 11.6 - Basin 11 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1142	303,715.011	1,031,331.599	19.219	ex cb type ?	11	
1143	303,641.229	1,031,871.062	18.227	ex cb type ?	11	
1163	303,126.752	1,031,545.723	19.181	ex cb type ?	11	
1164	302,907.526	1,031,423.818	19.154	ex cb type ?	11	
1165	302,661.340	1,031,634.245	18.425	ex cb type ?	11	
1166	302,680.615	1,031,970.538	18.555	CB	11	Deleted - Duplicate of 1168
1167	302,849.663	1,031,850.362	20.515	ex cb type 1	11	
1168	302,680.619	1,031,970.470	18.527	ex cb type ?	11	
1169	302,801.052	1,032,235.174	19.31	ex cb type ?	11	
1170	303,059.618	1,032,320.927	18.909	ex cb type ?	11	
1171	303,207.425	1,032,323.983	20.797	ex cb type ?	11	
1172	303,346.455	1,032,421.679	20.394	ex cb type ?	11	
1175	304,253.672	1,031,787.359	17.094	ex cb type 1	11	
1176	303,612.970	1,031,445.456	19.936	ex cb type 1	11	
1177	303,674.838	1,031,365.932	19.836	ex cb type 1	11	
1178	303,568.657	1,031,513.177	20.585	ex cb type 1	11	Deleted - per City of Kelso
1179	303,483.460	1,031,378.404	20.551	ex cb type 1	11	
1180	303,466.743	1,031,466.121	21.532	ex cb type 1	11	Deleted - per City of Kelso
1181	303,354.372	1,031,223.789	20.545	ex cb type 1	11	
1182	303,321.824	1,031,219.852	19.834	ex cb type 1	11	
1183	303,286.250	1,031,215.566	19.571	ex cb type ?	11	
1186	302,416.582	1,031,625.778	20.406	ex cb type 1	11	
1187	302,331.737	1,031,876.987	19.777	ex cb type ?	11	
1188	302,331.380	1,032,077.494	21.637	ex cb type 1	11	
1189	302,398.781	1,032,062.022	21.869	ex cb type 1	11	
1190	302,437.473	1,032,055.550	21.127	ex cb type 1	11	
1191	302,497.357	1,032,104.231	20.902	ex cb type 1	11	
1192	302,632.156	1,032,420.419	22.735	ex cb type 1	11	
1193	302,729.944	1,032,432.171	24.17	ex cb type 1	11	
1197	303,301.422	1,031,761.086	19.036	ex cb type ?	11	
1368	301,550.380	1,031,265.126	10.087	ex cb type 1	11	
1388	302,135.394	1,031,746.722	21.986	ex cb type 1	11	
1390	302,161.653	1,031,732.921	22.043	ex cb type 1	11	
1395	302,644.058	1,032,494.715	16.581	ex cb type ?	11	Deleted - Connection unknown, assumed to drain to future basin
1859	301,667.996	1,031,298.937	9.888	ex cb type ?	11	Excluded from model due to insuffient downstream data to connect to system.
4041	304,146.724	1,031,683.372	18.956	ex mh type ?	11	
4046	302,876.577	1,031,853.101	21.678	ex mh type ?	11	
4047	302,726.411	1,032,073.901	20.453	ex mh type ?	11	
4048	302,966.182	1,032,290.781	20.96	ex mh type ?	11	
4049	303,666.243	1,031,457.935	21.193	ex mh type ?	11	
4050	303,577.103	1,031,674.602	19.784	ex mh type ?	11	

Table 11.6 - Basin 11 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
4051	302,754.423	1,031,553.441	20.606	ex mh type ?	11	
4052	302,470.108	1,031,611.248	22.063	ex mh type ?	11	
4053	302,408.903	1,031,731.121	22.311	ex mh type ?	11	
4124	303,012.879	1,031,042.598	13.737	ex mh type ?	11	
4134	301,283.417	1,031,187.062	11.364	ex mh type ?	11	Excluded from model due to insuffient downstream data to connect to system.
4135	302,411.978	1,031,518.288	21.887	ex mh type ?	11	Deleted - Assumed SS
4136	302,421.108	1,031,531.841	22.665	ex mh type ?	11	
4137	302,425.965	1,031,538.903	23.162	ex mh type ?	11	
4139	302,306.523	1,031,468.774	14.668	ex mh type ?	11	
4358	302,294.475	1,031,479.765	13.534	ex mh type ?	11	Outfall for Basin 11

Appendix D

Basin 12

BASIN 12

SYSTEM ASSESSMENT

Basin Description: Basin 12 drains an area between Interstate 5 (I-5) to the east and Basin 13 to the west, from Lord Street to the north and Basin 11 to the south. It includes a portion of the Three Rivers Mall. Figure 12.1 shows an aerial photograph of Basin 12. Basin 12 outlets into a 60-inch pipe at node 4355 located along the eastern edge of the Three Rivers Mall property. The total drainage area for Basin 12 is approximately 90 acres. However, the area can be divided into two major sub-basins; the area north of Allen Street is approximately 40 acres and the area south of Allen Street is approximately 50 acres. The area to the north of Allen Street had insufficient field data to connect the existing pipes and structures to the system to the south. The topography suggests that the area to the north drain towards Allen Street either by overland flow or a combination of closed system piping and open channel flow. Therefore, this area was distributed equally to catch basins located along Allen Street (1104 through 1116) for the model. The land use for Basin 12 is approximately 48% single-family residential, 38% major retail, 8% special retail, 5% multi-family residential, and 1% open space. See Figure 12.2 for the land use area map of Basin 12.

System Modeling: Table 12.1 lists the structure information and connections, along with total flows and capacities. Figure 12.3 shows a schematic of the structure locations and piping layout. As stated in Chapter 2, junctions were entered into the model where blind connections were assumed to occur using the prefix J in the numbering system for easy identification. Field data for catch basins 1001-1004, 1196, 1198-1202 and manhole 4002 located in the area north of Allen Street had insufficient data to include in the model, as described above, and are not included in the system results. The runoff for this area of Basin 12 was divided equally into catch basins 1104 through 1116 using an area of 0.87 acres, a C value of 0.45 and a time of concentration of 15 minutes to distribute the flow from the north half of Basin 12 into the remainder of the basin.

Other assumptions were made in the modeling, such as interpolating an invert or rim elevation when junctions were added to the system using the prefix J in the numbering system for easy identification. In addition, the runoff from Basin 13 outfalls into Basin 12 at node 4029 and was accounted for in the model. This flow was entered into Basin 12 by entering the system CA and time of concentration at the outlet from Basin 13.

As seen in Table 12.1, 35% of pipes with insufficient capacity are less than 12-inch in diameter. Utilizing the current slopes, the majority of these pipes will gain capacity by upsizing to 12-inch HDPE pipe. Pipes P-12-100 and P-12-101 are 60-inch diameter and pipes P-12-102 through P-12-105 are 48-inch diameter, but have insufficient slope, and are undersized based on the modeled amount of flow in the system. Increasing these pipes from the existing to HDPE in the diameter listed in Table 12.3, keeping the same slope, will provide increased capacity in the system.

System Issues

Pipe size: The first system issue identified for Basin 12 is the presence of small diameter pipe, that is, pipe less than 12-inches in diameter. Approximately 30% of the system is comprised of pipe with a diameter less than 12-inches. Table 12.2 shows the pipe compilation by size and material. The small diameter pipe severely inhibits the capacity of the piping system due to the reduced flow capacity. A preliminary recommendation is to remove any trunk lines with piping less than 12-inches in diameter and replace with a minimum of 24-inch diameter pipe.

Pipe Material: Basin 12 is comprised of five modeled material types: concrete, CMP, PVC, HDPE and ductile iron, with only one 12-foot section of pipe consisting of ductile iron. The majority of the system (60%) consists of concrete, with 20% CMP and 20% PVC. Concrete and PVC have a relatively low Manning's coefficient (0.012 and 0.011, respectively). However, concrete piping is rigid material that provides movement only at the joints, and is susceptible to separation, fracture or breakage in the pipe if ground movement occurs. Typically, the most common failure in older concrete pipe occurs at the joints as the rubber gaskets become brittle and disintegrate, providing an opportunity

for the pipe to separate. Overtime, this can lead to deposit of unwanted material in the pipe and degradation or failure of the pipe. Material in the pipe opening blocks the path of flow for storm water, making it less effective. In contrast, CMP pipe has a high Manning's Coefficient which reduces the flow capacity to half of that of PVC or HDPE, for the same slope. Material such as HDPE, smooth wall interior, is flexible and has a Manning's value similar to PVC. However, in contrast to PVC, HDPE has corrugated outer walls which allow it to lock into position in the ground and become less susceptible to movement and separation. In addition, the life expectancy of concrete pipe is approximately 40-years versus HDPE which has a projected life span in excess of 100 years. Material such HDPE is more flexible and less likely to degrade overtime, and for this reason it is recommended that replacement of any concrete or CMP pipe be completed with HDPE.

System Maintenance: The final contributing issue to the City of Kelso Basin 12 storm water system is maintenance. During the inventory of structures and pipes, several notes were made in regards to cleaning a structure or pipe connection. Cleaning of a structure took place where needed to obtain existing data, and it is recommended the system continue to be cleaned on an annual or semi-annual basis to maintain the function of the system until recommended improvements can be made.

RECOMMENDATIONS

System Replacements: It is recommended at a minimum that the main pipes down Allen Street, 10th Avenue and Vine Street (considered trunk line pipes) be replaced with HDPE pipe in the diameter size listed in Table 12.3. This would allow for increased pipe capacity and act as storage for the system should downstream tail-water conditions occur. Many of the smaller lines in the system are connecting into the trunk line and do not appear to be causing a significant problem to the system. However, it is recommended that any new or replaced pipe be composed of HDPE at a minimum diameter of 12-inches.

Capital Improvements: The estimated budget to upgrade from the existing pipe sizes to the pipe sizes listed is approximately $1,000,000, as shown in Table 12.4. This cost is based on contracting the work to be done by other than City of Kelso forces.

Operation and Maintenance: A guideline for order of precedence for the CIP has been developed such that budget consideration can be included and is suggested as follows:

1. Clean catch basins and storm drain manholes;
2. Clean and television storm drain pipes to determine if blockages are encountered;
3. Replace concrete and clay pipes with HDPE pipe such as ADS N-12 or similar;
4. Upgrade storm drain pipes on trunk lines to sizes recommended to handle flow from side systems and to provide additional storage during larger storm events;
5. Upgrade storm drain pipes on side streets to sizes recommended, and eliminate as many blind connections as possible during the improvement process.

These recommendations are based on a planning level assessment only. There may be physical constraints that make it impossible to install the large pipes recommended for upgrading the system. A detailed engineered design of the proposed system will be required, which takes into account the existing surrounding environment. The individual and overall system budget estimates have been developed based on the cost to remove and replace the pipes with the sizes as shown, and to repair the existing surface to its current condition. Consideration should be given to the shallow cover and other utilities within the City's right of way which may require additional engineering solutions and add unknown costs to those provided in this report.

GIBBS & OLSON INC.
Engineers · Planners · Surveyors
LONGVIEW · OLYMPIA
WASHINGTON

City of Kelso
Stormwater Management Plan
Phase II - Aerial Photo of Basin 12
Figure 12.1

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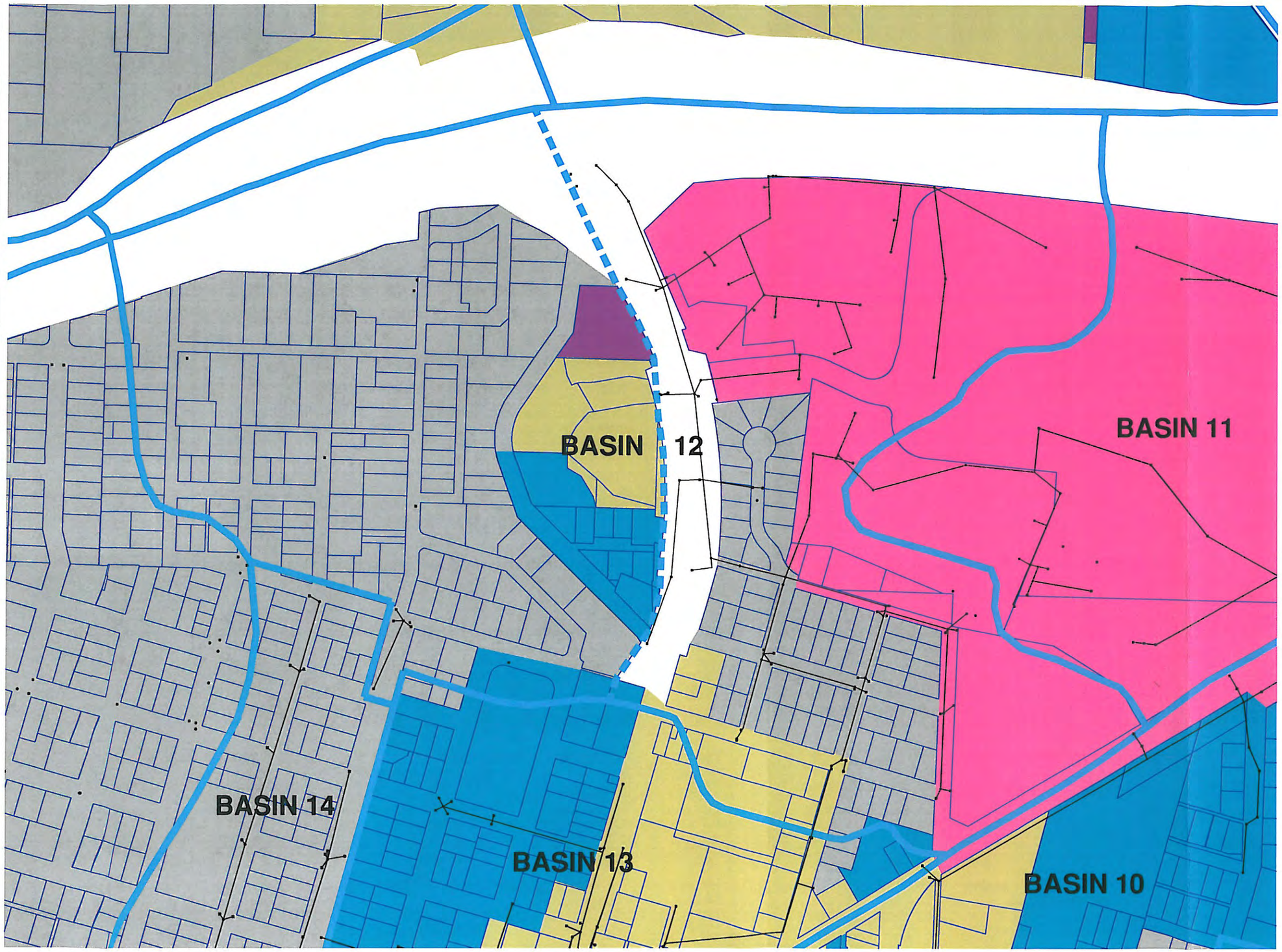

LEGEND

- KELSO CITY LIMITS
- MAJOR RETAIL AREA
- OPEN SPACE
- RESIDENTIAL MULTI-FAMILY
- RESIDENTIAL SINGLE FAMILY
- SPECIAL RETAIL DISTRICT

NORTH

0 150 300 600

Scale (in Feet)

GIBBS & OLSON INC.
Engineers · Planners · Surveyors
LONGVIEW · OLYMPIA
WASHINGTON

City of Kelso
Stormwater Management Plan
Phase II - Basin 12 with Zoning
Figure 12.2

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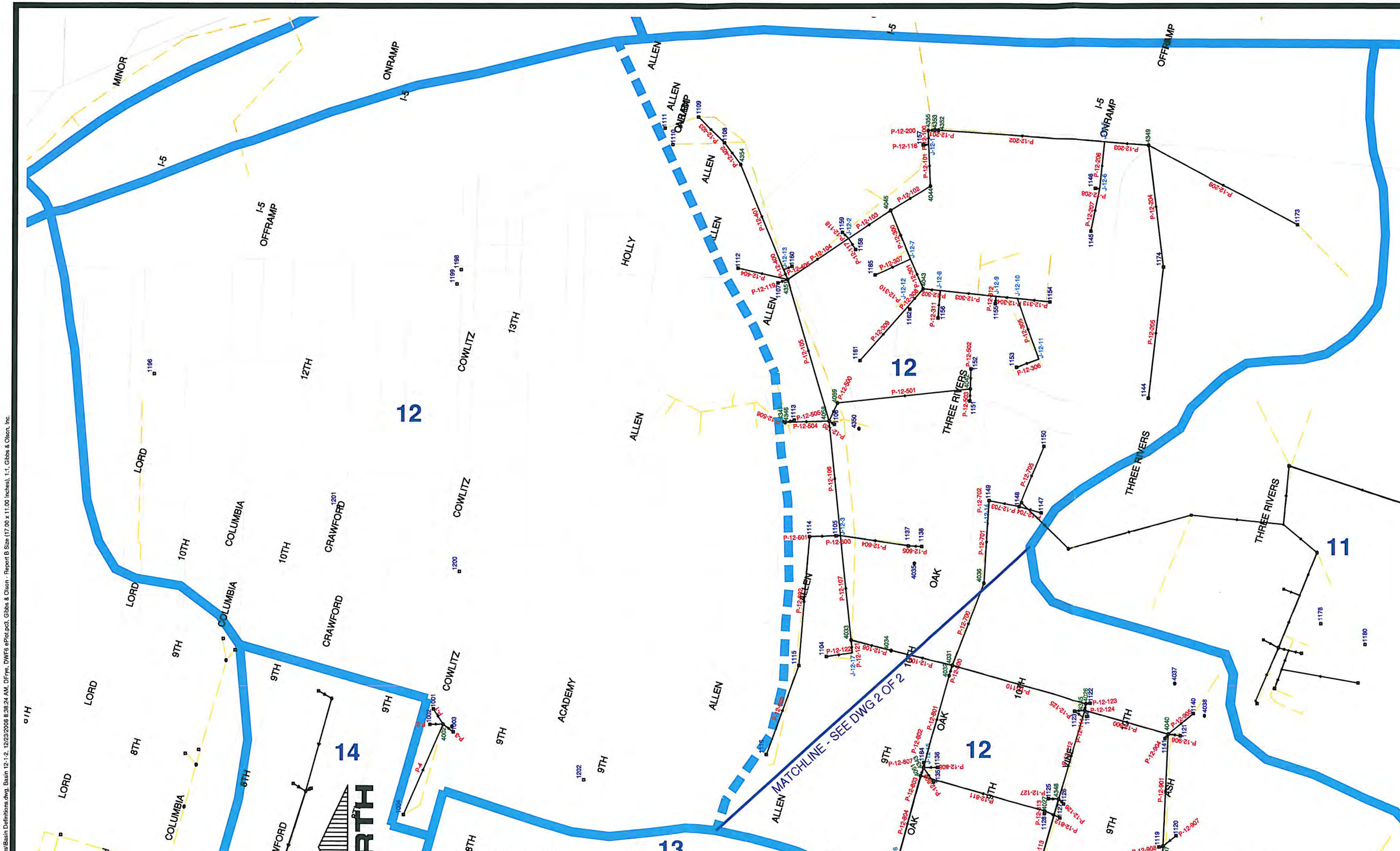

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City of Kelso
Stormwater Management Plan
Phase II
Basins 12 - 1 of 2

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MATCHLINE - SEE DWG 1 OF 2

12 13 14 11 10

COLUMBIA CRAWFORD COWLITZ ALLEN THREE RIVERS ACADEMY CHURCH OAK VINE ASH GRADE CEDAR

6TH 7TH 8TH 9TH 10TH 11TH 12TH 13TH

NORTH

0 100 200 400

Scale: (in Feet)

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City of Kelso
Stormwater Management Plan
Phase II
Basins 12 - 2 of 2

Kelso Stormwater Management Plan
Phase II
Summary Legend

Legend

	System Flow > Pipe Capacity
	Ground elevation interpolated from nearest structure
	Invert elevation interpolated from upstream and downstream nodes
-0.02	Negative slope based on data provided
J	Junction
O	Outlet
Conc.	Concrete
T-cotta	Terracotta
DI	Ductile Iron
PVC	Polyvinyl Chloride
HDPE	High Density Polyethylene
CMP	Corrugated Metal Pipe
1000's	Catch Basins
4000's	Manholes or Curb Inlets
NDA	No Data Available

Kelso Stormwater Management Plan
Phase II
Basin 12

Table 12.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-12-100	4355	J-12-1	N/A	N/A	N/A	86.82	17.49	2.06	180.15	33	0.0024	60-inch	Conc.	0.013	128.23	1.29	1.37	23.42	18.00	17.13	11.63	5.62	5.13	No field data provided; assumed invert elevation based on 0.5% slope from 4044.
P-12-101	J-12-1	4044	N/A	N/A	N/A	86.03	17.32	2.07	179.19	94	0.0026	60-inch	Conc.	0.013	131.59	1.37	1.61	18	19.61	11.63	13	6.19	5.62	
P-12-102	4044	4045	N/A	N/A	N/A	86.03	17.20	2.07	179.67	107	0.0006	48-inch	Conc.	0.013	34.01	1.61	1.67	19.61	20.07	14.00	14.40	7.87	6.19	
P-12-103	4045	J-12-2	N/A	N/A	N/A	80.55	17.05	2.08	168.75	115	0.0081	48-inch	Conc.	0.013	129.17	2.07	3	20.07	19.43	14	12.43	9.45	7.87	
P-12-104	J-12-2	4351	0	0	0	78.99	16.84	2.09	166.22	168	0.0081	48-inch	Conc.	0.013	129.23	3	4.36	19.43	17.25	12.43	8.9	11.7	9.45	
P-12-105	4351	4058	N/A	N/A	N/A	68.74	16.27	2.11	146.43	336	0.0016	48-inch	Conc.	0.013	57.05	4.36	4.89	17.25	21.17	8.90	12.28	11.67	7.93	
P-12-106	4058	J-12-3	N/A	N/A	N/A	62.44	16.04	2.12	133.66	261	0.0022	36-inch	Conc.	0.013	31.44	5.15	5.73	21.17	26.81	13.02	18.08	22.15	11.67	
P-12-107	J-12-3	4033	N/A	N/A	N/A	52.28	15.12	2.16	114.07	239	0.0023	36-inch	Conc.	0.013	31.7	5.73	6.27	26.81	15.36	18.08	6.09	29.14	22.15	
P-12-108	4033	4034	N/A	N/A	N/A	49.91	7.90	2.87	144.63	93	0.0060	36-inch	Conc.	0.013	51.75	6.44	7.00	15.36	15.96	5.92	5.96	19.73	15.36	
P-12-109	4034	4031	0	0.00	0	49.91	7.81	2.89	145.33	144	0.0042	32-inch	Conc.	0.013	31.45	7.02	7.62	15.96	14.99	6.27	4.70	28.77	15.96	
P-12-110	4031	4026	N/A	N/A	N/A	43.65	7.68	2.91	127.96	318	0.0014	24-inch	Conc.	0.013	8.32	8.00	8.43	14.99	13.79	4.99	3.36	111.79	10.00	
P-12-111	4026	4345	N/A	N/A	N/A	42.87	7.67	2.91	125.71	15	0.0087	24-inch	PVC	0.01	27.38	8.4	8.53	13.79	13.95	3.39	3.42	16.53	13.79	
P-12-112	4345	4348	N/A	N/A	N/A	35.82	7.57	2.92	105.61	211	0.0023	24-inch	Conc.	0.013	10.79	8.54	9.02	13.95	14.52	3.41	3.50	59.95	13.95	
P-12-113	4348	4344	N/A	N/A	N/A	35.13	7.44	2.94	104.25	260	0.0027	24-inch	Conc.	0.013	11.74	9.12	9.82	14.52	15.76	3.40	3.94	69.74	14.52	
P-12-114	4344	4028	N/A	N/A	N/A	33.74	7.42	2.95	100.22	36	0.0075	24-inch	Conc.	0.013	19.59	9.96	10.23	15.76	15.45	3.80	3.22	22.83	15.76	
P-12-115	4028	4029	0	0.00	0	33.04	7.30	2.96	98.75	225	0.0022	24-inch	Conc.	0.013	10.56	10.25	10.74	15.45	15.87	3.20	3.13	58.32	15.45	
P-12-116	J-12-1	1157	0.87	0.9	0.78	0.78	5.00	3.31	2.61	14	0.7350	6-inch	PVC	0.01	6.25	4.50	14.79	18.00	17.29	13.00	2.00	15.29	5.62	Down stream invert assumed, not field data provided;
P-12-117	J-12-2	1158	0.87	0.9	0.78	0.78	5	3.31	2.61	30	0.5247	4-inch	PVC	0.01	1.79	3	18.74	19.43	19.66	16.1	0.59	42.91	9.45	
P-12-118	J-12-2	1159	0.87	0.9	0.78	0.78	5	3.31	2.61	19	0.8153	6-inch	PVC	0.01	6.59	3	18.49	19.43	19.29	15.93	0.3	18.99	9.45	
P-12-119	4351	1107	0.87	0.80	0.7	2.37	15.00	2.17	5.18	24	0.2021	10-inch	CMP	0.024	5.33	9.76	14.61	17.25	16.74	6.66	1.30	16.27	11.70	
P-12-120	4058	1106	0.87	0.80	0.7	2.37	15.00	2.17	5.18	14	0.0457	10-inch	Conc.	0.013	4.68	18.25	18.89	21.17	20.79	2.09	1.07	19.86	19.07	
P-12-121	4033	J-12-17	N/A	N/A	N/A	2.37	15.05	2.17	5.17	29	0.0052	12-inch	Conc.	0.013	2.56	11.17	11.32	15.36	15.00	3.19	2.68	15.97	15.36	No info. on connection; interpolation from 1104 and 4033 places pipe invert higher than nearby ground elevation; upstream invert calc'd based on 0.5% slope from 4033.
P-12-122	J-12-17	1104	0.87	0.80	0.7	2.37	15.00	2.17	5.18	60	0.3248	10-inch	Conc.	0.013	12.49	11.32	30.81	15.00	32.96	2.85	1.32	31.63	15.00	Assume this structure connects to system via a blind connection 90-degrees to 4033.
P-12-123	4026	1122	0.87	0.9	0.78	0.78	5.00	3.31	2.61	10	-0.0880	6-inch	PVC	0.01	-2.16	13.15	12.27	13.79	13.66	0.14	0.89	15.07	13.79	
P-12-124	4345	1123	0.87	0.9	0.78	1.57	5.03	3.31	5.22	24	0.0092	8-inch	Conc.	0.013	1.16	10.75	10.97	13.95	12.76	2.53	1.12	18.43	13.95	
P-12-125	1123	1124	0.87	0.9	0.78	0.78	5	3.31	2.61	22	0.0373	6-inch	Conc.	0.013	1.08	11.11	11.93	12.76	12.9	1.15	0.47	17.53	12.76	
P-12-126	4348	1126	0.87	0.4	0.35	0.35	5	3.31	1.16	15	0.1393	8-inch	Conc.	0.013	4.51	9.54	11.63	14.52	13.28	4.31	0.98	14.66	14.52	
P-12-127	4348	1125	0.87	0.4	0.35	0.35	5	3.31	1.16	23	0.1004	10-inch	HDPE	0.012	7.52	9.67	11.98	14.52	13.44	4.02	0.63	14.58	14.52	
P-12-128	4344	1129	0.87	0.80	0.7	1.39	5.05	3.30	4.63	13	0.1623	8-inch	Conc.	0.013	4.87	10.86	12.97	15.76	14.59	4.23	0.95	17.67	15.76	
P-12-129	1129	1130	0.87	0.80	0.7	0.70	5.00	3.31	2.32	34	-0.0100	6-inch	Conc.	0.013	-0.56	12.97	12.63	14.59	14.79	1.12	1.66	20.41	14.59	
P-12-130	4028	1131	0.87	0.80	0.7	0.70	5.00	3.31	2.32	9	0.0356	8-inch	Conc.	0.013	2.28	11.96	12.28	15.45	14.85	2.82	1.90	15.78	15.45	
P-12-200	4355	4353	N/A	N/A	N/A	3.92	13.56	2.28	9.01	15	0.0013	30-inch	CMP	0.024	8.11	13.42	13.44	23.42	21.94	7.50	6.00	14.75	14.42	
P-12-201	4353	4352	N/A	N/A	N/A	3.92	13.51	2.29	9.02	9	0.0033	30-inch	CMP	0.024	12.83	13.44	13.47	21.94	21.97	6.00	5.99	14.81	14.75	
P-12-202	4352	J-12-5	N/A	N/A	N/A	3.92	10.38	2.53	9.99	382	0.0017	30-inch	CMP	0.024	9.09	13.47	14.11	21.97	23.00	5.99	6.39	16.09	14.81	

Table 12.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-12-203	J-12-5	4349	N/A	N/A	N/A	2.35	9.52	2.63	6.23	102	0.0017	30-inch	CMP	0.024	9.07	14.11	14.28	23.00	25.58	6.39	8.80	16.18	16.09	32" CMP listed on field notes; 30" CMP listed on Target construction drawings; 30" CMP entered into model.
P-12-204	4349	1174	0.87	0.90	0.78	1.57	7.61	2.92	4.61	280	0.0035	24-inch	CMP	0.024	7.21	14.38	15.35	25.58	18.95	9.20	1.60	16.64	16.18	Inverts based on slopes on Target construction drawings.
P-12-205	1174	1144	0.87	0.90	0.78	0.78	5.00	3.31	2.61	301	0.0027	24-inch	CMP	0.024	6.36	15.35	16.16	18.95	19.34	1.60	1.18	17.09	16.64	
P-12-206	J-12-5	J-12-6	N/A	N/A	N/A	1.57	5.12	3.29	5.20	109	0.0265	8-inch	PVC	0.01	2.56	15.02	17.91	23.00	21.40	7.31	2.82	28.02	16.09	
P-12-207	J-12-6	1145	0.87	0.90	0.78	0.78	5.00	3.31	2.61	98	0.0100	6-inch	PVC	0.01	0.73	17.91	18.89	21.40	21.39	2.99	2.00	33.97	21.40	
P-12-208	J-12-6	1146	0.87	0.90	0.78	0.78	5.00	3.31	2.61	10	0.2760	6-inch	DI	0.012	3.19	17.91	20.67	21.40	21.45	2.99	0.28	23.25	21.40	
P-12-209	4349	1173	0.87	0.90	0.78	0.78	5.00	3.31	2.61	385	0.0032	24-inch	CMP	0.024	6.98	14.34	15.59	25.58	18.69	9.24	1.10	16.52	16.18	
P-12-300	4045	J-12-7	N/A	N/A	N/A	5.48	5.92	3.17	17.53	120	0.0250	18-inch	PVC	0.01	21.59	8.42	11.42	20.07	20.18	10.15	7.26	12.87	9.49	inverts based on slopes from Target construction plans
P-12-301	J-12-7	4043	N/A	N/A	N/A	4.70	5.82	3.19	15.09	74	0.0250	18-inch	PVC	0.01	21.59	11.42	13.27	20.18	20.25	7.26	5.48	14.68	12.87	
P-12-302	4043	J-12-8	N/A	N/A	N/A	3.13	5.76	3.2	10.09	39	0.0177	15-inch	PVC	0.01	11.17	13.52	14.21	20.25	20	5.48	4.54	15.4	14.52	
P-12-303	J-12-8	J-12-9	N/A	N/A	N/A	2.35	5.54	3.23	7.64	128	0.0177	15-inch	PVC	0.01	11.18	14.21	16.48	20.00	19.80	4.54	2.07	17.58	15.40	Pipe slope and size assumed per Target construction plans.
P-12-304	J-12-9	J-12-10	N/A	N/A	N/A	1.57	5.45	3.24	5.12	50	0.0178	12-inch	PVC	0.01	6.18	16.48	17.37	19.80	20.00	2.32	1.63	18.29	17.58	Pipe slope and size assumed per Target construction plans.
P-12-305	J-12-10	J-12-11	N/A	N/A	N/A	0.78	5.12	3.29	2.60	147	0.0034	8-inch	PVC	0.01	0.92	17.37	17.87	20	20.57	1.96	2.03	22.31	18.29	Pipe slope and size assumed per Target construction plans.
P-12-306	J-12-11	1153	0.87	0.9	0.78	0.78	5	3.31	2.61	54	0.0100	8-inch	PVC	0.01	1.57	17.87	18.41	20.57	20.57	2.03	1.49	22.06	20.57	Assume 8" PVC as per Target construction plans; inverts calculated based on Target construction plans
P-12-307	J-12-7	1185	0.87	0.90	0.78	0.78	5.00	3.31	2.61	88	0.0745	8-inch	PVC	0.01	4.29	11.42	17.98	20.18	19.16	8.09	0.51	18.63	12.87	
P-12-308	4043	J-12-12	N/A	N/A	N/A	1.57	5.56	3.23	5.09	55	0.0100	10-inch	PVC	0.01	2.85	16.32	16.87	20.25	19.50	3.10	1.80	18.91	17.14	
P-12-309	J-12-12	1161	0.87	0.90	0.78	0.78	5.00	3.31	2.61	162	0.0100	10-inch	PVC	0.01	2.85	16.87	18.49	19.50	19.88	1.80	0.56	20.27	18.91	
P-12-310	J-12-12	1162	0.87	0.90	0.78	0.78	5.00	3.31	2.61	8	0.0200	6-inch	PVC	0.01	1.03	16.87	17.03	19.50	19.53	2.13	2.00	19.93	18.91	
P-12-311	J-12-8	1156	0.87	0.90	0.78	0.78	5.00	3.31	2.61	63	0.0483	12-inch	PVC	0.01	10.17	14.21	17.25	20.00	19.75	4.79	1.50	17.94	15.40	
P-12-312	J-12-9	1155	0.87	0.90	0.78	0.78	5.00	3.31	2.61	17	0.0518	8-inch	PVC	0.01	3.57	16.48	17.36	19.80	19.86	2.65	1.83	18.05	17.58	Pipe slope and size assumed per Target construction plans.
P-12-313	J-12-10	1154	0.87	0.90	0.78	0.78	5.00	3.31	2.61	75	0.0177	12-inch	PVC	0.01	6.17	17.37	18.70	20.00	19.91	1.63	0.21	19.39	18.29	12" PVC assumed per Target construction plans
P-12-400	4351	J-12-13	N/A	N/A	N/A	5.52	16.74	2.09	11.63	24	0.0096	24-inch	Conc.	0.013	22.14	4.56	4.79	17.25	18.00	10.70	11.21	11.77	11.70	
P-12-401	J-12-13	4354	N/A	N/A	N/A	4.73	15.41	2.15	10.26	259	0.0097	24-inch	Conc.	0.013	22.22	4.79	7.29	18.00	12.92	11.21	3.63	12.30	11.77	
P-12-402	4354	1108	0.87	0.80	0.7	4.73	15.09	2.17	10.33	63	0.0108	24-inch	Conc.	0.013	23.5	7.37	8.05	12.92	13.80	3.55	3.75	12.43	12.30	
P-12-403	1108	1109	0.87	0.80	0.7	2.37	15.00	2.17	5.18	84	0.0400	8-inch	HDPE	0.012	2.62	8.94	12.30	13.80	14.30	4.19	1.33	25.56	12.43	Field data unclear; assumed connection to 1108 per Kelso Stormwater Schematic;
P-12-404	4351	1112	0.87	0.8	0.7	2.37	15	2.17	5.18	116	0.0343	15-inch	CMP	0.024	6.48	5.86	9.84	17.25	16.39	10.15	5.3	14.24	11.7	1112 lists 15" cmp out; 4351 in from NE lists 32" conc; 15" CMP assumed for modeling

Table 12.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-12-405	J-12-13	1160	0.87	0.90	0.78	0.78	5.00	3.31	2.61	21	0.5548	6-inch	PVC	0.01	5.43	4.79	16.44	18.00	18.72	12.71	1.78	16.94	11.77	Blind connection per Target plans; slope calculated from interpolated invert on pipe between 4351 and 4354.
P-12-500	4058	4059	N/A	N/A	N/A	1.57	6.99	3.01	4.75	45	0.1422	15-inch	CMP	0.024	13.2	5.00	11.40	21.17	20.40	14.92	7.75	12.43	11.67	Assumed connection; insufficient field data to confirm system connection and layout.
P-12-501	4059	4042	N/A	N/A	N/A	1.57	5.06	3.30	5.21	304	0.0039	32-inch	CMP	0.024	16.58	11.40	12.60	20.40	18.80	6.33	3.53	13.63	12.43	Field notes state can't see; 32" CMP assumed
P-12-502	4042	1152	0.87	0.90	0.78	0.78	5.00	3.31	2.61	45	0.0729	12-inch	PVC	0.01	12.5	12.77	16.05	18.80	18.50	5.03	1.45	16.74	13.63	
P-12-503	4042	1151	0.87	0.90	0.78	0.78	5.00	3.31	2.61	28	0.1200	10-inch	PVC	0.01	9.87	12.71	16.07	18.80	18.32	5.26	1.42	16.78	13.63	
P-12-504	4058	4346	N/A	N/A	N/A	2.37	15.02	2.17	5.17	101	0.0089	24-inch	Conc.	0.013	21.35	5.10	6.00	21.17	15.08	14.07	7.08	11.72	11.67	pipe out 4346 is 24" conc; pipe in 4058 is 32" CMP; assume 24" conc for modeling
P-12-505	4346	1113	0.87	0.80	0.7	2.37	15.00	2.17	5.18	22	0.4195	10-inch	CMP	0.024	7.69	9.34	18.57	15.08	20.97	4.91	1.57	19.39	11.72	1113 out is 10" CMP; 4346 in is 10" conc; assume CMP
P-12-506	4346	4347	N/A	N/A	N/A	0.00	0.00	0.00	0.00	6	0.0767	12-inch	Conc.	0.013	9.86	6.18	6.64	15.08	15.23	7.90	7.59	11.72	11.72	Assume this pipe is pipe 2 on 4346 field note schematic; 12" conc entering 4346, 24" conc leaving 4347; 12" assumed
P-12-600	J-12-3	1105	0.87	0.80	0.7	9.46	16.03	2.12	20.26	10	1.2820	10-inch	Conc.	0.013	24.81	5.73	18.55	26.81	26.81	20.25	7.43	30.70	22.15	Assumed blind connection to 36" pipe in Allen Street. No info for connecting to system.
P-12-601	1105	1114	0.87	0.80	0.7	7.10	15.92	2.13	15.23	60	0.0108	18-inch	Conc.	0.013	10.93	18.71	19.36	26.81	26.72	6.60	5.86	28.07	26.81	
P-12-602	1114	1115	0.87	0.80	0.7	4.73	15.54	2.15	10.23	293	0.0362	12-inch	Conc.	0.013	6.78	19.50	30.10	26.72	33.40	6.22	2.30	50.90	26.72	
P-12-603	1115	1116	0.87	0.80	0.7	2.37	15.00	2.17	5.18	215	0.0139	12-inch	Conc.	0.013	4.2	30.15	33.14	33.40	35.97	2.25	1.83	37.94	33.40	
P-12-604	J-12-3	1137	0.87	0.40	0.35	0.70	5.15	3.29	2.31	156	0.0263	12-inch	Conc.	0.013	5.78	5.73	9.84	26.81	11.62	20.08	0.78	22.80	22.15	
P-12-605	1137	1138	0.87	0.40	0.35	0.35	5.00	3.31	1.16	30	0.0183	8-inch	HDPE	0.012	1.77	9.81	10.36	11.62	11.60	1.14	0.57	11.86	11.62	Assumed 8" plastic (HDPE) with conc. or grout build-up.
P-12-700	4031	4036	N/A	N/A	N/A	3.13	5.40	3.25	10.26	200	0.0028	12-inch	Conc.	0.013	1.87	8.49	9.04	14.99	15.93	5.50	5.89	31.57	14.99	15" conc out 4036; 12" in 4031; assume smaller, 12" entered.
P-12-701	4036	J-12-14	N/A	N/A	N/A	3.13	5.24	3.27	10.34	186	0.0222	10-inch	PVC	0.01	4.24	9.43	13.55	15.93	14.33	5.67	-0.05	40.43	15.93	
P-12-702	J-12-14	1149	0.87	0.90	0.78	3.13	5.24	3.27	10.34	2	0.0000	6-inch	DI	0.012	0	13.55	13.55	14.33	14.33	0.28	0.28	20.11	14.33	
P-12-703	1149	1148	0.87	0.90	0.78	2.35	5.19	3.28	7.77	71	0.0277	8-inch	PVC	0.01	2.62	11.93	13.90	14.33	16.40	1.73	1.83	31.71	14.33	
P-12-704	1148	1147	0.87	0.90	0.78	0.78	5.00	3.31	2.61	53	0.0147	8-inch	PVC	0.01	1.91	13.92	14.70	16.40	17.70	1.81	2.33	17.87	16.40	
P-12-705	1148	1150	0.87	0.90	0.78	0.78	5.00	3.31	2.61	148	0.0138	6-inch	PVC	0.01	0.86	14.05	16.09	16.40	18.22	1.85	1.63	35.39	16.40	
P-12-800	4031	4032	N/A	N/A	N/A	3.13	6.54	3.08	9.72	24	0.0142	24-inch	Conc.	0.013	26.92	8.42	8.76	14.99	14.41	4.57	3.65	15.03	14.99	
P-12-801	4032	J-12-15	N/A	N/A	N/A	3.13	5.93	3.17	10.01	205	0.0036	18-inch	Conc.	0.013	6.27	8.83	9.56	14.41	13.60	4.08	2.54	16.27	14.41	
P-12-802	J-12-15	4343	N/A	N/A	N/A	2.78	5.89	3.18	8.91	13	0.0038	18-inch	Conc.	0.013	6.51	9.56	9.61	13.60	13.66	2.54	2.55	13.69	13.60	
P-12-803	4343	4061	N/A	N/A	N/A	2.09	5.85	3.18	6.70	19	0.0242	12-inch	PVC	0.01	7.21	9.71	10.17	13.66	13.91	2.95	2.74	14.06	13.66	
P-12-804	4061	J-12-16	N/A	N/A	N/A	1.39	5.17	3.28	4.61	223	0.0027	12-inch	Conc.	0.013	1.85	10.11	10.71	13.91	13.75	2.80	2.04	17.64	13.91	Bend added to pipe to follow schematic and to allow blind connection for 1133 to the south, as per field notes.

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Table 12.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-12-805	J-12-16	4030	N/A	N/A	N/A	0.70	5.01	3.31	2.32	29	0.0028	12-inch	Conc.	0.013	1.87	10.71	10.79	13.75	14.67	2.04	2.88	13.87	13.75	Bend added to pipe to follow schematic and to allow blind connection for 1133 to the south, as per field notes.
P-12-806	4030	1134	0.87	0.80	0.7	0.70	5.00	3.31	2.32	4	0.1025	6-inch	Conc.	0.013	1.8	11.27	11.68	14.67	14.24	2.90	2.06	14.56	13.87	
P-12-807	J-12-15	1184	0.87	0.40	0.35	0.35	5.00	3.31	1.16	3	0.8500	8-inch	Conc.	0.013	11.14	9.56	12.11	13.60	13.60	3.37	0.82	13.63	13.60	
P-12-808	4343	1136	0.87	0.40	0.35	0.35	5.00	3.31	1.16	32	0.0722	8-inch	Conc.	0.013	3.25	9.71	12.02	13.66	13.56	3.28	0.87	13.95	13.66	No pipes in from SE at 4343, but field notes for 1136 states to MH E of 4061. Invert into 4343 assumed as invert in from pipe from 4061.
P-12-809	4343	1135	0.87	0.40	0.35	0.35	5.00	3.31	1.16	40	0.0318	8-inch	Conc.	0.013	2.15	9.71	10.98	13.66	13.30	3.28	1.65	14.03	13.66	No pipes in from SE at 4343, but field notes for 1135 states to MH E of 4061. Invert into 4343 assumed as invert in from pipe from 4061.
P-12-810	J-12-16	1133	0.87	0.80	0.7	0.70	5.00	3.31	2.32	3	0.0300	8-inch	Conc.	0.013	2.09	10.71	10.80	13.75	13.75	2.37	2.28	13.86	13.75	
P-12-811	4061	4027	N/A	N/A	N/A	0.70	5.11	3.29	2.31	295	0.0039	8-inch	Conc.	0.013	0.76	10.46	11.62	13.91	14.08	2.78	1.79	24.70	13.91	
P-12-812	4027	1127	0.87	0.40	0.35	0.35	5.00	3.31	1.16	39	0.0154	6-inch	Conc.	0.013	0.7	11.81	12.41	14.08	13.44	1.77	0.53	15.75	14.08	
P-12-813	4027	1128	0.87	0.40	0.35	0.35	5.00	3.31	1.16	6	0.0433	6-inch	Conc.	0.013	1.17	12.09	12.35	14.08	13.41	1.49	0.56	14.34	14.08	
P-12-900	4345	4040	N/A	N/A	N/A	5.48	5.7	3.21	17.71	199	0.0035	10-inch	Conc.	0.013	1.29	9.13	9.82	13.95	14.4	3.99	3.75	144.04	13.95	
P-12-901	4040	4097	N/A	N/A	N/A	3.13	5.47	3.24	10.23	255	0.0042	10-inch	Conc.	0.013	1.41	9.84	10.9	14.4	14.83	3.73	3.1	69.97	14.4	
P-12-902	4097	4025	N/A	N/A	N/A	1.57	5.07	3.30	5.21	229	0.0022	10-inch	Conc.	0.013	1.03	10.95	11.46	14.83	15.76	3.05	3.47	27.77	14.83	
P-12-903	4025	1117	0.87	0.90	0.78	0.78	5.00	3.31	2.61	32	0.0556	8-inch	Conc.	0.013	2.85	11.48	13.26	15.76	14.97	3.61	1.04	17.26	15.76	
P-12-904	4040	1141	0.87	0.9	0.78	0.78	5	3.31	2.61	13	0.1515	8-inch	Conc.	0.013	4.7	9.82	11.79	14.4	13.56	3.91	1.1	15.01	14.4	
P-12-905	4040	1140	0.87	0.9	0.78	0.78	0	3.31	2.61	74	0.0330	6-inch	PVC	0.01	1.32	10.47	12.91	14.4	15.41	3.43	2	23.89	14.4	Assume to connect to MH 4040 as per Target construction plans. Downstream invert calculated from slope shown on Target plans and field measured upstream invert.
P-12-906	4040	1121	0.87	0.9	0.78	0.78	5	3.31	2.61	28	0.0696	8-inch	Conc.	0.013	3.19	9.83	11.78	14.4	14.22	3.9	1.77	15.71	14.4	
P-12-907	4097	1120	0.87	0.90	0.78	0.78	5.00	3.31	2.61	38	0.0289	8-inch	Conc.	0.013	2.06	11.07	12.17	14.83	14.47	3.09	1.63	16.61	14.83	
P-12-908	4097	1119	0.87	0.90	0.78	0.78	5.00	3.31	2.61	10	0.1400	8-inch	Conc.	0.013	4.52	11.09	12.49	14.83	13.85	3.07	0.69	15.30	14.83	
P-12-909	4025	1118	0.87	0.90	0.78	0.78	5.00	3.31	2.61	30	0.0407	8-inch	Conc.	0.013	2.44	11.48	12.70	15.76	15.00	3.61	1.63	17.16	15.76	

System Flow > Pipe Capacity
Ground elevation interpolated from nearest structure
Invert elevation interpolated from upstream and downstream nodes

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Table 12.2 - Existing Pipe Totals

Pipe Size	Conc.	CMP	PVC	HDPE	DI	Total	Percentage
4-inch	0	0	30	0	0	30	0.30%
6-inch	105	0	392	0	12	509	5.01%
8-inch	585	0	539	114	0	1238	12.20%
10-inch	767	46	431	23	0	1267	12.48%
12-inch	1,151	0	252	0	0	1403	13.82%
15-inch	0	161	167	0	0	328	3.23%
18-inch	278	0	194	0	0	472	4.65%
24-inch	1,521	966	15	0	0	2502	24.65%
30-inch	0	508	0	0	0	508	5.00%
32-inch	144	304	0	0	0	448	4.41%
36-inch	593	0	0	0	0	593	5.84%
48-inch	726	0	0	0	0	726	7.15%
60-inch	127	0	0	0	0	127	1.25%
Total	**5,997**	**1,985**	**2,020**	**137**	**12**	**10,151**	**100.00%**
Percentage	**59.08%**	**19.55%**	**19.90%**	**1.35%**	**0.12%**	**100.00%**	

Table 12.3 Recommended Trunk Line Improvements

Pipe	Exist. Size	Prop. Size	Length
P-12-100	60-inch	66-inch	33
P-12-101	60-inch	66-inch	94
P-12-102	48-inch	66-inch	107
P-12-103	48-inch	66-inch	115
P-12-104	48-inch	66-inch	168
P-12-105	48-inch	66-inch	336
P-12-106	36-inch	60-inch	261
P-12-107	36-inch	60-inch	239
P-12-108	36-inch	60-inch	93
P-12-109	32-inch	60-inch	144
P-12-110	24-inch	60-inch	318
P-12-111	24-inch	60-inch	15
P-12-112	24-inch	60-inch	211
P-12-113	24-inch	54-inch	260
P-12-114	24-inch	54-inch	36
P-12-115	24-inch	54-inch	225
Total			**2,655**

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Table 12.4 - Preliminary Opinion of Probable Cost

Item	Description	QTY	Unit	Price	Total
1	Mobilization	1	LS	$ 51,200	$ 51,200
2	Traffic Control	1	LS	$ 10,000	$ 10,000
3	Clearing and Grubbing	1	LS	$ 5,000	$ 5,000
4	Removal of Structures and Obstructions	1	LS	$ 7,500	$ 7,500
5	Removal of Existing Asphalt	2825	SY	$ 10	$ 28,250
6	Construction Fabric	2235	SY	$ 2	$ 4,470
7	CSBC	1035	Tons	$ 20	$ 20,700
8	CSTC	365	Tons	$ 22	$ 8,030
9	HMA	510	Tons	$ 150	$ 76,500
10	60-inch HDPE	521	LF	$ 190	$ 98,990
11	66-inch HDPE	1281	LF	$ 200	$ 256,200
12	72-inch HDPE	853	LF	$ 210	$ 179,130
13	Catch Basins	4	EA	$ 1,200	$ 4,800
14	Manholes	2	EA	$ 1,500	$ 3,000
15	Import Trench Backfill (assume 3' avg)	2235	CY	$ 8	$ 17,880
16	Trench Safety Systems	1	LS	$ 10,000	$ 10,000
	Subtotal				$ 781,650
	Contingency @	20%			$ 156,400
	Total Opinion of Probable Cost				**$ 938,050**

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Table 12.5 - All Undersized Pipes

Pipe	Exist. Size	Prop. Size	Length (ft)
P-12-100	60-inch	66-inch	33
P-12-101	60-inch	66-inch	94
P-12-102	48-inch	90-inch	107
P-12-103	48-inch	54-inch	115
P-12-104	48-inch	54-inch	168
P-12-105	48-inch	72-inch	336
P-12-106	36-inch	60-inch	261
P-12-107	36-inch	60-inch	239
P-12-108	36-inch	54-inch	93
P-12-109	32-inch	60-inch	144
P-12-110	24-inch	66-inch	318
P-12-111	24-inch	48-inch	15
P-12-112	24-inch	60-inch	211
P-12-113	24-inch	54-inch	260
P-12-114	24-inch	48-inch	36
P-12-115	24-inch	54-inch	225
P-12-117	4-inch	6-inch	30
P-12-120	10-inch	12-inch	14
P-12-121	12-inch	18-inch	29
P-12-123	6-inch	12-inch	10
P-12-124	8-inch	18-inch	24
P-12-125	6-inch	12-inch	22
P-12-129	6-inch	12-inch	34
P-12-130	8-inch	12-inch	9
P-12-200	30-inch	24-inch	15
P-12-202	30-inch	24-inch	382
P-12-206	8-inch	12-inch	109
P-12-207	6-inch	12-inch	98
P-12-305	8-inch	18-inch	147
P-12-306	8-inch	12-inch	54
P-12-308	10-inch	18-inch	55
P-12-310	6-inch	12-inch	8
P-12-403	8-inch	12-inch	84
P-12-601	18-inch	24-inch	60
P-12-602	12-inch	18-inch	293
P-12-603	12-inch	18-inch	215
P-12-700	12-inch	24-inch	200
P-12-701	10-inch	18-inch	186
P-12-702	6-inch	24-inch	2
P-12-703	8-inch	18-inch	71
P-12-704	8-inch	12-inch	53

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Table 12.5 - All Undersized Pipes

Pipe	Exist. Size	Prop. Size	Length (ft)
P-12-705	6-inch	12-inch	148
P-12-801	18-inch	24-inch	205
P-12-802	18-inch	24-inch	13
P-12-804	12-inch	18-inch	223
P-12-805	12-inch	18-inch	29
P-12-806	6-inch	12-inch	4
P-12-810	8-inch	12-inch	3
P-12-811	8-inch	12-inch	295
P-12-812	6-inch	12-inch	39
P-12-900	10-inch	30-inch	199
P-12-901	10-inch	24-inch	255
P-12-902	10-inch	18-inch	229
P-12-905	6-inch	12-inch	74
P-12-907	8-inch	12-inch	38
P-12-909	8-inch	12-inch	30
Total			**6,643**

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Table 12.6 - Basin 12 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1001	305,597.643	1,031,319.697	121.829	ex cb type 1	12	
1002	305,605.792	1,031,284.815	121.622	ex cb type 1	12	
1003	305,552.539	1,031,267.332	121.812	ex cb type 1	12	
1004	305,665.549	1,031,079.502	122.576	ex cb type 1	12	
1104	304,699.259	1,031,438.806	32.964	ex cb type 1	12	
1105	304,677.102	1,031,713.098	26.813	ex cb type 1	12	
1106	304,681.068	1,031,966.363	20.787	ex cb type 1	12	
1107	304,811.207	1,032,287.992	16.742	ex cb type 1	12	
1108	304,933.817	1,032,607.962	13.804	ex cb type 1	12	
1109	304,993.570	1,032,667.036	14.303	ex cb type 1	12	
1110	305,052.707	1,032,603.285	14.148	ex cb type 1	12	Deleted - Heads to WSDOT grate
1111	305,070.778	1,032,640.499	14.398	ex cb type 1	12	Deleted - Heads to WSDOT grate
1112	304,902.396	1,032,321.270	16.393	ex cb type 1	12	
1113	304,773.191	1,031,976.122	20.97	ex cb type 1	12	
1114	304,737.546	1,031,711.025	26.715	ex cb type 1	12	
1115	304,762.381	1,031,418.738	33.404	ex cb type 1	12	
1116	304,836.742	1,031,216.596	35.974	ex cb type 2	12	
1117	303,951.438	1,030,750.424	14.965	ex cb type 1	12	
1118	303,908.782	1,030,772.935	14.996	ex cb type 1	12	
1119	303,938.106	1,031,006.162	13.851	ex cb type 2	12	
1120	303,898.690	1,031,031.688	14.47	ex cb type 1	12	
1121	303,889.325	1,031,258.809	14.22	ex cb type 1	12	
1122	304,096.144	1,031,332.454	13.665	ex cb type 1	12	
1123	304,132.112	1,031,315.286	12.76	ex cb type 1	12	
1124	304,104.174	1,031,302.776	12.904	ex cb type 2	12	
1125	304,192.485	1,031,114.980	13.442	ex cb type 2	12	
1126	304,158.316	1,031,104.079	13.284	ex cb type 2	12	
1127	304,166.570	1,031,071.429	13.437	ex cb type 2	12	
1128	304,202.297	1,031,080.592	13.413	ex cb type 2	12	
1129	304,228.399	1,030,864.282	14.593	ex cb type 2	12	
1130	304,235.821	1,030,831.188	14.786	ex cb type 1	12	
1131	304,271.982	1,030,838.198	14.85	ex cb type 1	12	
1133	304,548.920	1,030,956.345	13.751	ex cb type 2	12	
1134	304,562.769	1,030,924.963	14.235	ex cb type 2	12	
1135	304,454.533	1,031,154.039	13.299	ex cb type 2	12	
1136	304,446.208	1,031,187.236	13.559	ex cb type 2	12	
1137	304,512.901	1,031,689.849	11.615	ex cb type 1	12	
1138	304,482.674	1,031,688.293	11.601	ex cb type 1	12	
1140	303,859.434	1,031,309.261	15.408	ex cb type ?	12	
1141	303,923.548	1,031,251.886	13.563	ex cb type 1	12	
1144	303,961.568	1,032,025.178	19.339	ex cb type ?	12	
1145	304,094.008	1,032,405.501	21.394	ex cb type ?	12	
1146	304,084.327	1,032,503.013	21.445	ex cb type ?	12	

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Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1147	304,209.184	1,031,764.636	17.702	ex cb type 1	12	
1148	304,259.697	1,031,779.127	16.395	ex cb type 1	12	
1149	304,329.136	1,031,792.411	14.333	ex cb type ?	12	
1150	304,202.488	1,031,916.006	18.215	ex cb type ?	12	
1151	304,372.749	1,032,018.931	18.32	ex cb type ?	12	
1152	304,370.111	1,032,091.946	18.495	ex cb type 1	12	
1153	304,265.696	1,032,095.798	20.572	ex cb type 1	12	
1154	304,188.585	1,032,244.782	19.908	ex cb type ?	12	
1155	304,314.654	1,032,240.425	19.864	ex cb type ?	12	
1156	304,445.232	1,032,207.635	19.749	ex cb type ?	12	
1157	304,479.893	1,032,602.693	17.291	ex cb type ?	12	
1158	304,633.036	1,032,364.071	19.656	ex cb type 1	12	
1159	304,662.833	1,032,403.046	19.285	ex cb type ?	12	
1160	304,778.649	1,032,326.041	18.717	ex cb type ?	12	
1161	304,623.106	1,032,111.243	19.884	ex cb type ?	12	
1162	304,509.712	1,032,228.053	19.529	ex cb type ?	12	
1173	303,621.938	1,032,419.982	18.687	ex cb type ?	12	
1174	303,927.099	1,032,323.972	18.951	ex cb type ?	12	
1184	304,477.696	1,031,198.108	13.6	ex cb type 2	12	
1185	304,588.600	1,032,306.000	19.16	ex cb type 1	12	
1196	306,237.306	1,032,079.695	114.722	ex cb type 1	12	
1198	305,536.614	1,032,317.838	99.717	ex cb type 1	12	
1199	305,546.220	1,032,285.342	102.806	ex cb type 2	12	
1200	305,539.105	1,031,631.949	94.622	ex cb type 1	12	
1201	305,815.693	1,031,779.154	113.671	ex cb type 1	12	
1202	305,254.778	1,031,159.210	120.966	ex cb type 2	12	
4002	305,575.514	1,031,285.118	122.465	ex mh type ?	12	
4025	303,937.789	1,030,778.862	15.757	ex mh type ?	12	
4026	304,106.267	1,031,331.564	13.792	ex mh type ?	12	
4027	304,201.951	1,031,086.930	14.076	ex mh type ?	12	
4028	304,272.253	1,030,847.461	15.446	ex mh type ?	12	
4029	304,333.311	1,030,631.261	15.871	ex mh type ?	13/12	
4030	304,562.382	1,030,929.429	14.674	ex mh type ?	12	
4031	304,412.124	1,031,418.385	14.994	ex mh type ?	12	
4032	304,419.562	1,031,395.558	14.411	ex mh type ?	12	
4033	304,643.005	1,031,475.867	15.358	ex mh type ?	12	
4034	304,552.424	1,031,452.688	15.962	ex mh type ?	12	
4035	304,499.210	1,031,650.191	12.374	ex mh type ?	12	Deleted - Insufficient data to connect to system
4036	304,340.817	1,031,604.950	15.934	ex mh type ?	12	
4037	303,901.844	1,031,377.414	17.677	ex mh type ?	12	Deleted - Assumed SS
4038	303,833.029	1,031,304.124	15.84	ex mh type ?	12	Deleted - Assumed SS
4040	303,916.889	1,031,262.695	14.404	ex mh type ?	12	
4042	304,371.584	1,032,046.576	18.797	ex mh type ?	12	

Kelso Stormwater Management Plan
Phase II
Basin 12

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
4043	304,479.570	1,032,274.297	20.255	ex mh type ?	12	
4044	304,462.123	1,032,508.952	19.605	ex mh type ?	12	
4045	304,553.734	1,032,453.284	20.071	ex mh type ?	12	
4058	304,693.428	1,031,973.796	21.167	ex mh type ?	12	
4059	304,674.096	1,032,014.973	20.403	ex mh type ?	12	
4061	304,485.036	1,031,168.144	13.913	ex mh type ?	12	
4097	303,928.659	1,031,008.064	14.831	ex mh type ?	12	
4343	304,478.485	1,031,186.439	13.659	ex mh type ?	12	
4344	304,241.039	1,030,864.952	15.759	ex mh type ?	12	
4345	304,108.642	1,031,316.787	13.952	ex mh type ?	12	
4346	304,794.157	1,031,970.671	15.084	ex mh type ?	12	
4347	304,799.967	1,031,972.984	15.23	ex mh type ?	12	
4348	304,169.569	1,031,114.484	14.524	ex mh type ?	12	
4349	303,961.398	1,032,601.532	25.583	ex mh type ?	12	
4351	304,788.784	1,032,295.944	17.255	ex mh type ?	12	
4352	304,444.092	1,032,636.027	21.965	ex mh type ?	12	
4353	304,452.761	1,032,636.725	21.938	ex mh type ?	12	
4354	304,896.251	1,032,557.944	12.922	ex mh type ?	12	
4355	304,467.413	1,032,635.757	23.42	ex mh type ?	12	

Appendix E

Basin 13

BASIN 13

SYSTEM ASSESSMENT

Basin Description: Basin 13 drains an area primarily from Pacific Avenue along the west boundary to 8th Avenue along the east and from Church Street along the north boundary to Vine Street along the south. Figure 13.1 shows an aerial photograph of Basin 13. The discharge from Basin 13 outlets to Basin 12 at node 4029 and was added to the model of Basin 12. The total drainage area for Basin 13 is 44 acres and the land use is approximately 37% multi-family residential, 31% special retail, 31% town center, and 1% single-family residential.

System Modeling: Table 13.1, system summary, lists the structure information and connections, along with total flows and capacities. Figure 13.3 shows a schematic of the structure locations and piping layout. As stated in Chapter 2, junctions were entered into the model where blind connections were assumed to occur using the prefix J in the numbering system for easy identification. Field data for catch basins 1058-1059 and manhole 4016 located along 7th Avenue between Church and Academy Street indicates these catch basins are connected into the system through 8-inch pipe running south in 7th Avenue. Since there was no other field data, it was assumed that this pipe connects to the system at a blind connection in Allen Street. There is a significant change in elevation between Church Street and Allen Street, creating some steep slopes as indicated in the modeling results. It is possible there is an existing drop structure in this area that was unable to be field located and further field investigation is required if a more accurate model in this area is desired.

Other assumptions were made in the modeling, such as interpolating an invert or rim elevation when junctions were added to the system. The field data for manhole 4022 located in Oak Street indicates there is a 24-inch pipe entering to the east that is unaccounted for. The upstream system is located on private property and was therefore

unable to be surveyed. It is recommended additional field investigation be performed to determine what additional structures are connected to the City's system at this location.

As seen in Table 13.1, 58% of the pipes have insufficient capacity, the majority of those pipes being concrete. Replacing these pipes from the existing material to HDPE in the diameter listed in Table 13.3, keeping the same slope, will provide the required capacity in the system.

SYSTEM ISSUES

Pipe size: One of the system issues identified for Basin 13 is the presence of smaller diameter pipes, i.e., pipe with a diameter less than 12-inches. Approximately 63% of the system is comprised of 4, 6, 8, or 10-inch pipe. Table 13.2 shows the pipe compilation by size and material. The small diameter pipe severely inhibits the capacity of the piping system due to the reduced flow capacity. For this reason it is recommended replacement of any trunk lines with piping less than 12-inches in diameter be replaced with a minimum of 12-inch diameter pipe.

Pipe Material: The primary system issue identified for Basin 13 is the amount of concrete pipe existing in the system. Basin 13 contains four modeled material types: concrete, PVC, HDPE and clay. The majority of the system (81%) consists of concrete and the remaining (19%) of HDPE, PVC, or clay. All of these types of pipe are similar in properties, with a relatively low Manning's coefficient ranging from 0.010 to 0.013. However, both concrete and clay piping are rigid materials that provide movement only at the joints, and are susceptible to separation, fracture or breakage in the pipe if ground movement occurs. Typically, the most common failure in older concrete pipe occurs at the joints as the rubber gaskets become brittle and disintegrate, providing an opportunity for the pipe to separate. Overtime, this can lead to deposit of unwanted material in the pipe and degradation or failure of the pipe. Material in the pipe opening blocks the path of flow for storm water, making it less effective. In addition, the life expectancy of concrete pipe is approximately 40-years versus HDPE which has a projected life span in excess of 100 years. Material such HDPE is more flexible and less likely to degrade

overtime; HDPE has a life expectancy of over 100 years. A preliminary recommendation is to replace any concrete or clay pipe with HDPE.

System Maintenance: The final contributing issue to the City of Kelso Basin 13 storm water system is maintenance. During the inventory of structures and pipes, several notes were made in regards to cleaning a structure or pipe connection. Where ever possible, the cleaning of a structure took place to obtain existing data, and it is recommended the system continue to be cleaned on an annual or semi-annual basis to maintain the function of the system until recommended upgrades can be completed.

RECOMMENDATIONS

System Replacements: It is recommended at a minimum the main pipes down 4th, 5th and 7th Avenues as well as Allen, Oak and Vine Streets (considered the main trunk line pipes) be replaced with HDPE pipe in the diameter size listed in Table 13.3. This would allow for increased pipe capacity and act as storage for the system should tail-water conditions occur downstream in Basin 12. Many of the smaller pipes that are connecting into the trunk line from side connections do not appear to be causing a significant problem to the system. However, it is recommended that any new or replaced pipe be composed of HDPE at a minimum diameter of 12-inches.

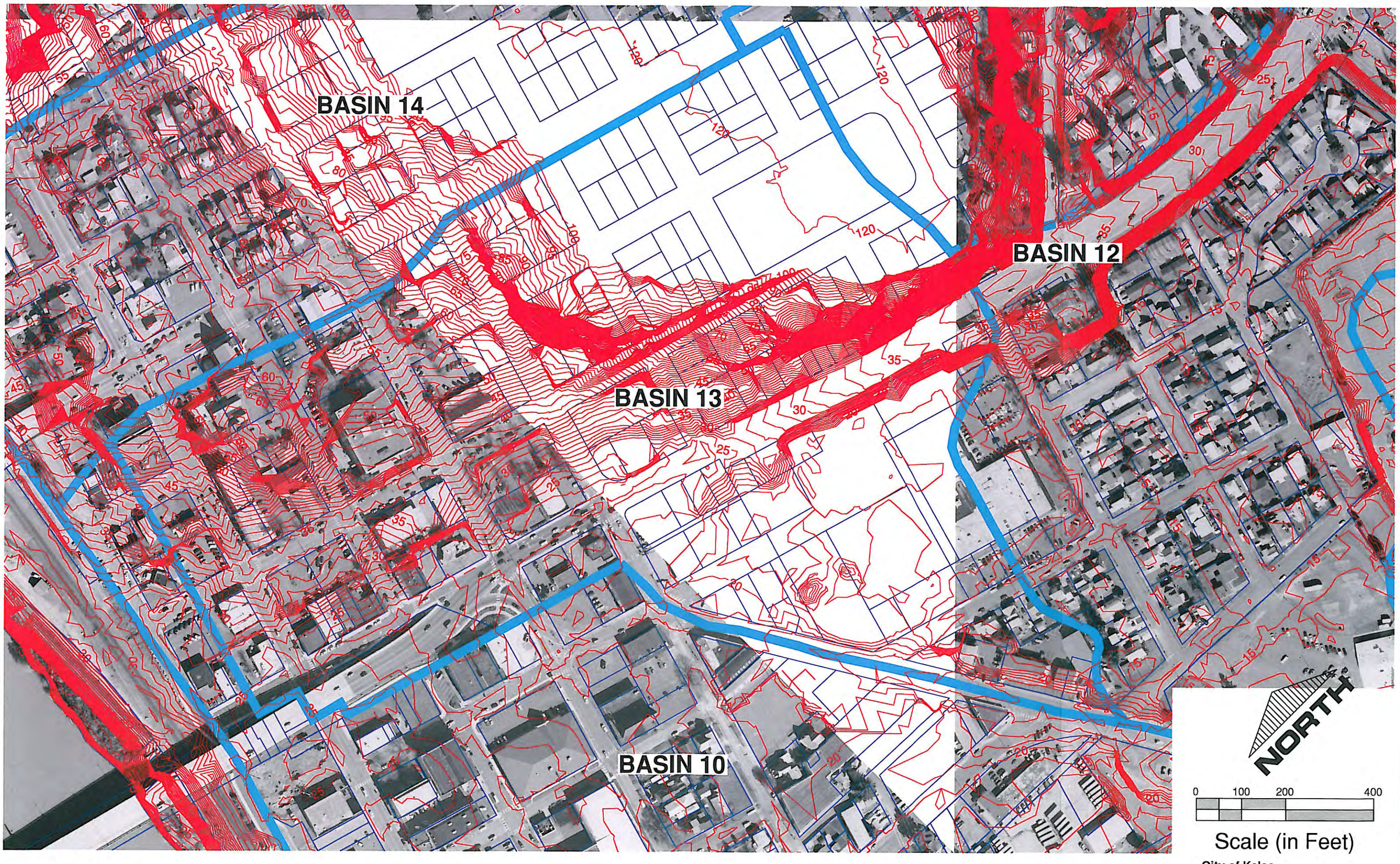
Capital Improvements: The estimated budget to upgrade from the existing pipe sizes to the pipe sizes listed is approximately $766,500, as shown in Table 13.4. This cost is based on contracting the work to be done by other than City of Kelso forces and includes the cost to repair the street surface to existing conditions.

Operation and Maintenance: A guideline for order of precedence for the CIP has been developed such that budget consideration can be included and is suggested as follows:

1. Clean catch basins and storm drain manholes;
2. Clean and television storm drain pipes to determine if blockages are encountered;
3. Replace concrete and clay pipes with HDPE pipe such as ADS N-12 or similar;

4. Upgrade storm drain pipes on trunk lines to sizes recommended to handle flow from side systems and to provide additional storage during larger storm events;
5. Upgrade storm drain pipes on side streets to sizes recommended, and eliminate as many blind connections as possible during the improvement process.

These recommendations are based on a planning level assessment only. There may be physical constraints that make it impossible to install the large pipes recommended for upgrading the system. A detailed engineered design of the proposed system will be required, which takes into account the existing surrounding environment. The individual and overall system budget estimates have been developed based on the cost to remove and replace the pipes with the sizes as shown, and to repair the existing surface to its current condition. Consideration should be given to the shallow cover and other utilities within the City's right of way which may require additional engineering solutions and add unknown costs to those provided in this report.



NORTH

0 100 200 400

Scale (in Feet)

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City of Kelso
Stormwater Management Plan
Phase II - Aerial Photo of Basin 13
Figure 13.1

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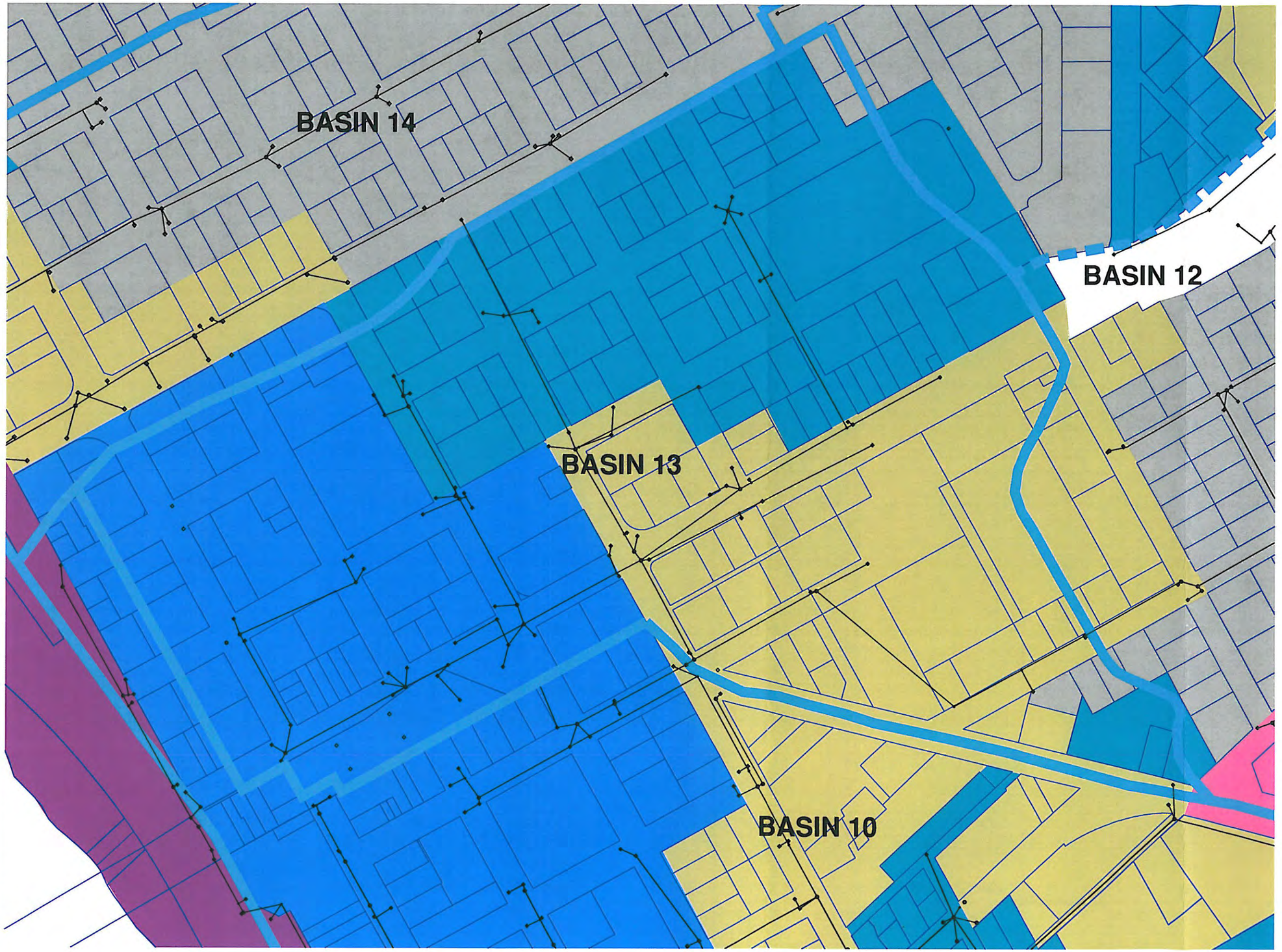

LEGEND

- KELSO CITY LIMITS
- MAJOR RETAIL AREA
- OPEN SPACE
- RESIDENTIAL MULTI-FAMILY
- RESIDENTIAL SINGLE FAMILY
- SPECIAL RETAIL DISTRICT
- TOWN CENTER COMMUNITY

NORTH

0 100 200 400

Scale (in Feet)

City of Kelso
Stormwater Management Plan
Phase II - Basin 13 with Zoning
Figure 13.2

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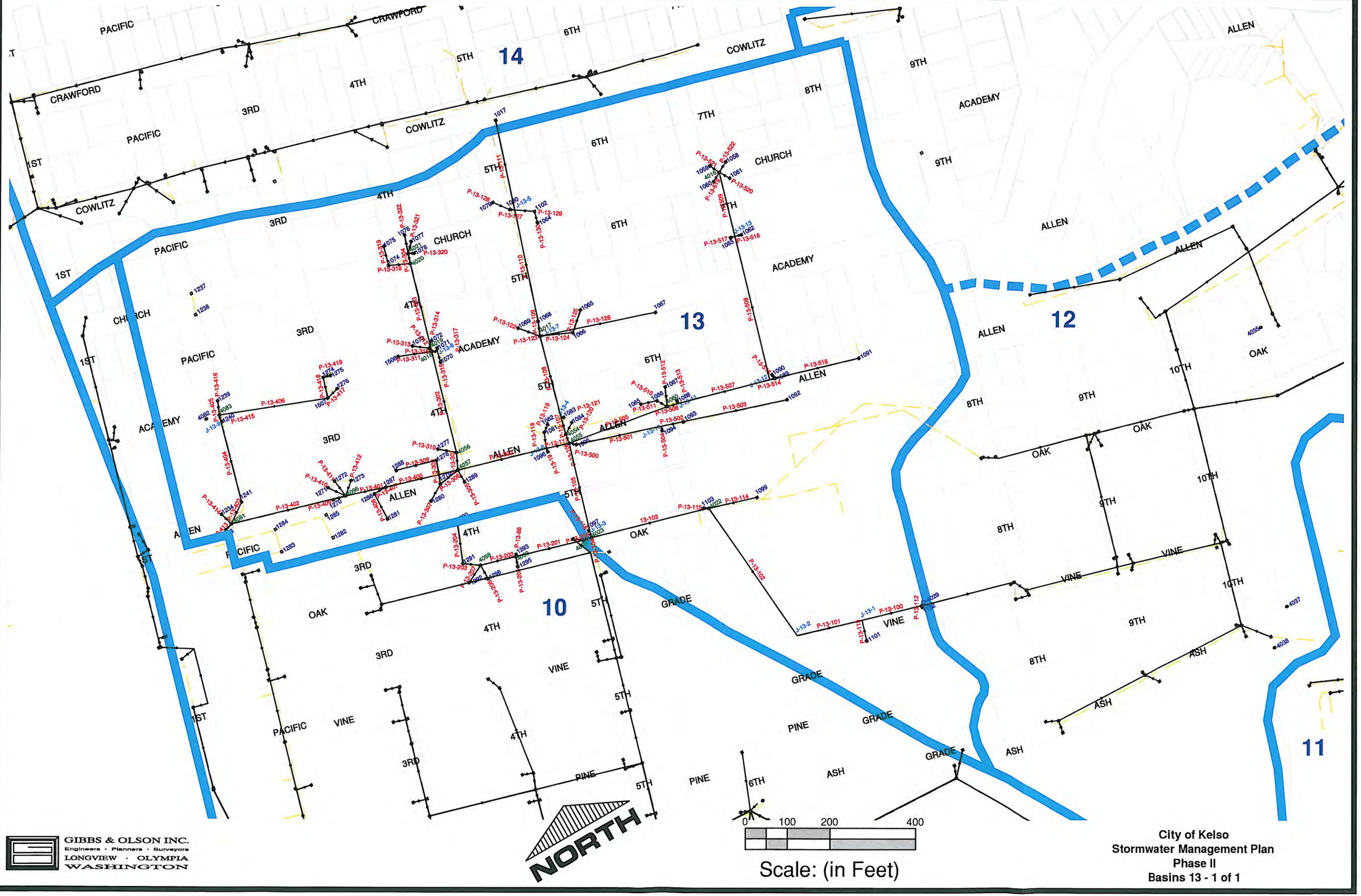

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City of Kelso
Stormwater Management Plan
Phase II
Basins 13 - 1 of 1

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Kelso Stormwater Management Plan
Phase II
Summary Legend

Legend

	System Flow > Pipe Capacity
	Ground elevation interpolated from nearest structure
	Invert elevation interpolated from upstream and downstream nodes
-0.02	Negative slope based on data provided
J	Junction
O	Outlet
Conc.	Concrete
T-cotta	Terracotta
DI	Ductile Iron
PVC	Polyvinyl Chloride
HDPE	High Density Polyethylene
CMP	Corrugated Metal Pipe
1000's	Catch Basins
4000's	Manholes or Curb Inlets
NDA	No Data Available

Kelso Stormwater Management Plan
Phase II
Basin 13

Table 13.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-13-100	4029	J-13-1	N/A	N/A	N/A	32.57	7.22	2.98	97.72	144	0.0043	24-inch	Concrete	0.013	14.84	10.76	11.38	15.87	16.00	3.11	2.62	39.65	12.76	
P-13-101	J-13-1	J-13-2	N/A	N/A	N/A	32.10	7.14	2.99	96.71	156	0.0050	24-inch	Concrete	0.013	16	11.38	12.16	16.00	16.00	2.62	1.84	44.53	16.00	
P-13-102	J-13-2	4022	N/A	N/A	N/A	32.10	6.95	3.02	97.66	364	0.0002	24-inch	Concrete	0.013	3.14	12.17	12.24	16.00	17.58	1.83	3.34	83.86	16.00	
P-13-103	4022	4023	0	0.00	0	31.16	6.79	3.04	95.53	286	0.0044	24-inch	Concrete	0.013	15.07	12.25	13.52	17.58	20.66	3.33	5.14	68.58	17.58	
P-13-104	4023	J-13-3	N/A	N/A	N/A	28.33	6.78	3.04	86.88	13	0.0023	24-inch	Concrete	0.013	10.87	14.10	14.13	20.66	20.70	4.56	4.57	22.58	20.66	
P-13-105	J-13-3	4055	0	0.00	0	27.85	6.65	3.06	85.98	214	0.0026	24-inch	Concrete	0.013	11.47	14.13	14.68	20.70	21.89	4.57	5.21	51.62	20.70	
P-13-106	4055	4054	N/A	N/A	N/A	4.84	5.98	3.16	15.42	23	-0.0022	10-inch	Concrete	0.013	-1.02	17.68	17.63	21.89	22.12	3.38	3.66	33.30	21.89	
P-13-107	4054	J-13-4	N/A	N/A	N/A	4.37	5.96	3.17	13.93	40	0.0703	10-inch	Concrete	0.013	5.81	17.62	20.43	22.12	22.35	3.67	1.09	38.32	22.12	
P-13-108	J-13-4	4017	N/A	N/A	N/A	3.89	5.81	3.19	12.51	198	0.0703	10-inch	Concrete	0.013	5.81	20.43	34.35	22.35	39.48	1.09	4.30	86.98	22.35	
P-13-109	4017	1068	0.59	0.80	0.47	2.12	5.78	3.19	6.83	36	0.1069	8-inch	Concrete	0.013	3.95	34.90	38.75	39.48	41.28	3.91	1.86	51.01	39.48	
P-13-110	1068	J-13-5	N/A	N/A	N/A	1.65	5.50	3.24	5.39	267	0.0879	8-inch	Concrete	0.013	3.58	38.78	62.25	41.28	66.96	1.83	4.04	94.37	41.28	
P-13-111	J-13-5	1017	0.59	0.40	0.24	0.24	5.00	3.31	0.79	216	0.0879	8-inch	Concrete	0.013	3.58	62.25	81.24	66.96	82.83	4.04	0.92	81.66	66.96	
P-13-112	4029	1132	0.59	0.80	0.47	0.47	5.00	3.31	1.57	3	0.4433	6-inch	Concrete	0.013	3.74	12.89	14.22	15.87	15.47	2.48	0.75	14.72	13.21	
P-13-113	J-13-1	1101	0.59	0.80	0.47	0.47	5.00	3.31	1.57	50	0.0534	6-inch	PVC	0.01	1.69	11.38	14.05	16.00	16.51	4.12	1.96	18.33	16.00	
P-13-114	4022	1099	0.59	0.80	0.47	0.47	5.00	3.31	1.57	117	0.0191	4-inch	PVC	0.01	0.34	13.76	16.00	17.58	18.03	3.49	1.70	64.99	17.58	Pipe and invert information at 1099 unavailable; Pipe invert at 1099 assumed as 16.00.
P-13-115	4022	1103	0.59	0.80	0.47	0.47	5.00	3.31	1.57	12	0.1333	8-inch	Concrete	0.013	4.41	12.96	14.56	17.58	16.92	3.95	1.69	17.78	17.58	
P-13-116	J-13-3	1097	0.59	0.80	0.47	0.47	5.00	3.31	1.57	5	0.7720	8-inch	Concrete	0.013	10.62	14.13	17.99	20.70	20.73	5.90	2.07	20.78	20.70	
P-13-117	4055	J-13-6	0	0.00	0	15.70	6.59	3.07	48.60	56	0.0020	24-inch	Concrete	0.013	10.03	15.26	15.37	21.89	21.63	4.63	4.26	24.47	21.89	
P-13-118	J-13-6	1081	0.59	0.80	0.47	0.94	5.07	3.30	3.14	39	0.0954	12-inch	HDPE	0.012	11.92	15.38	19.10	21.63	21.93	5.25	1.83	21.89	21.63	
P-13-119	1081	1082	0.59	0.80	0.47	0.47	5.00	3.31	1.57	20	0.0390	8-inch	PVC	0.01	3.1	19.60	20.38	21.93	22.54	1.66	1.49	22.09	21.89	
P-13-120	4054	1084	0.59	0.8	0.47	0.47	5.00	3.31	1.57	31	0.0290	6-inch	Concrete	0.013	0.96	17.94	18.84	22.12	21.15	3.68	1.81	24.56	22.12	
P-13-121	J-13-4	1083	0.59	0.80	0.47	0.47	5.00	3.31	1.57	6	-0.0717	12-inch	Concrete	0.013	-9.54	20.43	20.00	22.35	22.35	0.92	1.35	22.36	22.35	
P-13-122	4017	1069	0.59	0.80	0.47	0.47	5.00	3.31	1.57	55	0.0535	6-inch	Concrete	0.013	1.3	34.63	37.57	39.48	39.91	4.35	1.84	43.81	39.48	
P-13-123	4017	J-13-7	N/A	N/A	N/A	1.30	5.46	3.24	4.24	8	0.0763	8-inch	Concrete	0.013	3.34	34.78	35.39	39.48	40.00	4.03	3.94	40.47	39.48	
P-13-124	J-13-7	1066	0.59	0.80	0.47	0.94	5.09	3.30	3.14	70	0.0806	8-inch	Clay	0.011	4.05	35.39	41.03	40.00	40.41	3.94	-1.29	43.38	40.00	
P-13-125	1066	1065	0.59	0.80	0.47	0.47	5.00	3.31	1.57	56	0.0730	8-inch	Clay	0.011	3.86	41.03	45.12	40.41	48.45	-1.29	2.66	45.70	41.33	
P-13-126	J-13-7	1067	0.59	0.60	0.35	0.35	5.00	3.31	1.18	271	0.0762	8-inch	Clay	0.011	3.94	35.39	56.03	40.00	58.53	3.94	1.83	56.55	40.00	
P-13-127	J-13-5	1080	0.59	0.60	0.35	0.71	5.47	3.24	2.31	12	0.1858	8-inch	Concrete	0.013	5.21	62.25	64.48	66.96	66.96	4.04	1.81	67.40	66.96	
P-13-128	1080	1079	0.59	0.60	0.35	0.35	5.00	3.31	1.18	42	0.0160	12-inch	Concrete	0.013	4.5	64.54	65.21	66.96	68.46	1.42	2.25	67.01	66.96	
P-13-129	J-13-5	1102	0.59	0.60	0.35	0.71	5.07	3.30	2.35	47	0.4704	8-inch	Concrete	0.013	8.29	62.25	84.36	66.96	87.04	4.04	2.01	85.00	66.96	
P-13-130	1102	1064	0.59	0.60	0.35	0.35	5.00	3.31	1.18	27	0.0278	6-inch	Concrete	0.013	0.94	84.36	85.11	87.04	86.51	2.18	0.90	86.20	85.00	
P-13-131	J-13-6	1096	0.59	0.80	0.47	0.47	5.00	3.31	1.57	8	0.4863	8-inch	PVC	0.01	10.95	15.38	19.27	21.63	21.63	5.58	1.69	21.71	21.63	
P-13-200	4023	4024	N/A	N/A	N/A	2.83	6.37	3.10	8.86	19	-0.0205	12-inch	Concrete	0.013	-5.1	14.67	14.28	20.66	20.91	4.99	5.63	16.84	15.66	
P-13-201	4024	4099	N/A	N/A	N/A	2.83	6.13	3.14	8.97	164	0.0038	12-inch	Concrete	0.013	2.21	14.54	15.17	20.91	20.25	5.37	4.08	27.23	16.84	No field data for inverts on 4099; upstream elevation assumed by interpolating between 4098 and 4024.
P-13-202	4099	4098	N/A	N/A	N/A	1.89	5.94	3.17	6.03	86	0.0038	12-inch	Concrete	0.013	2.21	15.17	15.50	20.25	21.85	4.08	5.35	22.71	20.25	No field data for inverts on 4099; downstream elevation assumed by interpolating between 4098 and 4024.
P-13-203	4098	1291	0.59	0.80	0.47	0.94	5.76	3.20	3.04	41	0.0083	12-inch	HDPE	0.012	3.51	15.50	15.84	21.85	20.49	5.35	3.65	22.10	21.85	
P-13-204	1291	1290	0.59	0.80	0.47	0.47	5.00	3.31	1.57	92	0.0220	12-inch	HDPE	0.012	5.72	15.89	17.91	20.49	21.75	3.60	2.84	20.64	20.49	
P-13-205	4099	1295	0.59	0.80	0.47	0.47	5.00	3.31	1.57	24	0.0850	6-inch	Concrete	0.013	1.64	15.17	17.21	20.25	20.01	4.58	2.30	22.14	20.25	No field data for inverts on 4099; downstream elevation assumed by interpolating between 4098 and 4024.

Kelso Stormwater Management Plan
Phase II
Basin 13

Table 13.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-13-206	4099	1293	0.59	0.80	0.47	0.47	5.00	3.31	1.57	6	0.4067	8-inch	Concrete	0.013	7.71	15.17	17.61	20.25	20.11	4.41	1.83	20.35	20.25	No field data for inverts on 4099; downstream elevation assumed by interpolating between 4098 and 4024.
P-13-207	4098	1296	0.59	0.80	0.47	0.47	5.00	3.31	1.57	37	0.0627	8-inch	Concrete	0.013	3.03	15.45	17.77	21.85	20.21	5.73	1.77	22.48	21.85	
P-13-208	4098	1292	0.59	0.80	0.47	0.47	5.00	3.31	1.57	49	0.0478	10-inch	Concrete	0.013	4.79	15.34	17.68	21.85	20.60	5.68	2.09	22.10	21.85	
P-13-300	J-13-6	4057	0	0.00	0	14.28	6.34	3.11	44.74	213	0.0021	24-inch	Concrete	0.013	10.28	15.37	15.81	21.63	23.20	4.26	5.39	25.69	17.34	
P-13-301	4057	4056	N/A	N/A	N/A	4.37	5.63	3.22	14.15	41	0.0159	8-inch	Concrete	0.013	1.52	18.86	19.51	23.20	23.04	3.67	2.86	79.48	23.20	
P-13-302	4056	4018	N/A	N/A	N/A	3.89	5.52	3.23	12.69	244	0.0535	8-inch	Concrete	0.013	2.8	20.35	33.41	23.04	37.81	2.02	3.73	292.18	23.04	
P-13-303	4018	4020	N/A	N/A	N/A	1.77	5.30	3.26	5.82	213	0.0615	8-inch	Concrete	0.013	3	33.55	46.66	37.81	51.51	3.59	4.18	87.30	37.81	
P-13-304	4020	4021	N/A	N/A	N/A	1.06	5.12	3.29	3.52	24	0.0525	8-inch	Concrete	0.013	2.77	46.89	48.15	51.51	52.61	3.95	3.79	53.55	51.51	
P-13-305	4057	1289	0.59	0.80	0.47	0.47	5.00	3.31	1.57	32	0.0547	12-inch	HDPE	0.012	9.03	17.35	19.10	23.20	23.00	4.85	2.90	23.25	23.20	
P-13-306	4057	1279	0.59	0.80	0.47	1.89	5.44	3.24	6.17	53	0.0111	12-inch	HDPE	0.012	4.07	15.64	16.23	23.20	22.83	6.56	5.60	24.56	23.20	
P-13-307	1279	1280	0.59	0.80	0.47	0.47	5.00	3.31	1.57	45	0.0227	12-inch	HDPE	0.012	5.81	17.53	18.55	22.83	23.05	4.30	3.50	22.90	22.83	
P-13-308	1279	1278	0.59	0.80	0.47	0.94	5.20	3.28	3.12	56	0.0625	12-inch	HDPE	0.012	9.65	16.23	19.73	22.83	22.08	5.60	1.35	23.20	22.83	
P-13-309	1278	1288	0.59	0.80	0.47	0.47	5.00	3.31	1.57	98	0.0044	6-inch	PVC	0.01	0.48	20.70	21.13	22.08	22.96	0.88	1.33	26.65	22.08	
P-13-310	4056	1277	0.59	0.80	0.47	0.47	5.00	3.31	1.57	45	0.0458	12-inch	Concrete	0.013	7.62	19.53	21.59	23.04	23.69	2.51	1.10	23.13	23.04	
P-13-311	4018	1508	0.59	0.80	0.47	0.47	5.00	3.31	1.57	81	0.0091	6-inch	Concrete	0.013	0.54	33.95	34.69	37.81	36.52	3.36	1.33	44.19	37.81	
P-13-312	4018	4019	N/A	N/A	N/A	0.71	5.11	3.29	2.35	10	0.0310	8-inch	Concrete	0.013	2.13	33.69	34.00	37.81	38.14	3.45	3.47	38.19	37.81	
P-13-313	4019	1073	0.59	0.60	0.35	0.35	5.00	3.31	1.18	40	0.0535	6-inch	Concrete	0.013	1.3	34.14	36.28	38.14	38.28	3.50	1.50	39.91	38.14	
P-13-314	4019	1072	0.59	0.60	0.35	0.35	5.00	3.31	1.18	17	0.0735	6-inch	Concrete	0.013	1.52	34.97	36.22	38.14	38.47	2.67	1.75	38.89	38.14	
P-13-315	4018	J-13-8	N/A	N/A	N/A	0.94	5.05	3.30	3.14	13	0.0054	6-inch	Concrete	0.013	0.41	34.16	34.23	37.81	37.00	3.15	2.27	41.89	37.81	
P-13-316	J-13-8	1070	0.59	0.8	0.47	0.47	5.00	3.31	1.57	26	-0.0081	6-inch	Concrete	0.013	-0.5	34.23	34.02	37.00	36.45	2.27	1.93	39.05	37.00	
P-13-317	J-13-8	1071	0.59	0.80	0.47	0.47	5.00	3.31	1.57	9	0.0789	6-inch	Concrete	0.013	1.58	34.23	34.94	37.00	37.44	2.27	2.00	37.71	37.00	
P-13-318	4020	1074	0.59	0.60	0.35	0.71	5.23	3.28	2.34	51	0.0190	6-inch	Concrete	0.013	0.77	48.36	49.33	51.51	51.95	2.65	2.12	60.36	51.51	
P-13-319	1074	1075	0.59	0.60	0.35	0.35	5.00	3.31	1.18	47	0.0291	8-inch	Concrete	0.013	2.06	49.56	50.93	51.95	53.73	1.72	2.13	52.40	51.95	
P-13-320	4021	1078	0.59	0.60	0.35	0.35	5.00	3.31	1.18	14	0.0693	6-inch	Concrete	0.013	1.48	48.68	49.65	52.61	51.93	3.43	1.78	53.23	52.61	
P-13-321	4021	1077	0.59	0.60	0.35	0.35	5.00	3.31	1.18	29	0.0686	6-inch	Concrete	0.013	1.47	48.35	50.34	52.61	53.21	3.76	2.37	53.90	52.61	
P-13-322	4021	1076	0.59	0.60	0.35	0.35	5.00	3.31	1.18	44	0.0868	6-inch	Concrete	0.013	1.65	48.35	52.17	52.61	54.17	3.76	1.50	54.56	52.61	
P-13-400	4057	1287	0.59	0.80	0.47	7.55	5.96	3.17	24.10	175	-0.0005	24-inch	Concrete	0.013	-5.13	15.80	15.71	23.20	24.61	5.40	6.90	19.67	17.54	Structure 1287 lists 24" ADS to east and west, but 4057 lists 24" concrete to east, and all other structures between 4057 and 4022 list 24" concrete; 24" concrete entered as material type.
P-13-401	1287	4096	N/A	N/A	N/A	6.14	5.71	3.20	19.82	97	0.0038	24-inch	Concrete	0.013	13.97	15.61	15.98	24.61	22.89	7.00	4.91	20.42	19.67	
P-13-402	4096	4081	N/A	N/A	N/A	4.25	5.44	3.24	13.89	277	0.0060	12-inch	HDPE	0.012	2.98	16.21	17.86	22.89	24.35	5.68	5.49	56.28	20.42	
P-13-403	4081	1241	0.59	0.80	0.47	3.30	5.43	3.25	10.81	57	0.0130	6-inch	PVC	0.01	0.83	20.73	21.47	24.35	23.79	3.12	1.82	149.55	24.35	
P-13-404	1241	J-13-9	N/A	N/A	N/A	2.83	5.31	3.26	9.32	194	0.0455	8-inch	Concrete	0.013	2.58	20.99	29.82	23.79	32.86	2.13	2.37	139.15	23.79	
P-13-405	J-13-9	4083	N/A	N/A	N/A	2.36	5.29	3.27	7.77	16	0.0488	8-inch	Concrete	0.013	2.67	29.82	30.60	32.86	34.28	2.37	3.01	39.47	32.86	
P-13-406	4083	1507	0.59	0.80	0.47	1.89	5.16	3.29	6.25	258	0.0089	6-inch	Concrete	0.013	0.53	30.74	33.04	34.28	34.21	3.04	0.67	354.81	34.28	No pipe listed on fields notes out of 1507, but 4083 lists pipe in from east; assumed connection made to connect 1274, 1275, 1276 and 1507 to system.
P-13-407	1287	1286	0.59	0.80	0.47	0.94	5.20	3.28	3.12	30	0.0330	12-inch	HDPE	0.012	7.01	21.01	22.00	24.61	26.10	2.60	3.10	22.76	21.50	
P-13-408	1286	1281	0.59	0.80	0.47	0.47	5.00	3.31	1.57	67	0.0158	12-inch	HDPE	0.012	4.85	22.00	23.06	26.10	26.36	3.10	2.30	23.59	22.76	
P-13-409	4096	1270	0.59	0.80	0.47	0.47	5.00	3.31	1.57	31	0.0519	6-inch	PVC	0.01	1.66	18.84	20.45	22.89	22.66	3.55	1.71	21.86	20.42	

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Table 13.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Notes
P-13-410	4096	1271	0.59	0.80	0.47	0.47	5.00	3.31	1.57	46	0.0267	6-inch	Concrete	0.013	0.92	18.94	20.17	22.89	22.32	3.45	1.65	24.04	20.42	
P-13-411	4096	1272	0.59	0.80	0.47	0.47	5.00	3.31	1.57	44	0.0311	8-inch	Concrete	0.013	2.13	18.91	20.28	22.89	22.27	3.31	1.32	21.16	20.42	
P-13-412	4096	1273	0.59	0.80	0.47	0.47	5.00	3.31	1.57	38	0.0324	8-inch	Concrete	0.013	2.17	18.80	20.03	22.89	22.15	3.42	1.45	21.06	20.42	
P-13-413	4081	1233	0.59	0.80	0.47	0.47	5.00	3.31	1.57	19	-0.0042	12-inch	HDPE	0.012	-2.5	19.48	19.40	24.35	23.91	3.87	3.51	24.38	24.35	
P-13-414	4081	1234	0.59	0.80	0.47	0.47	5.00	3.31	1.57	33	0.0279	6-inch	Concrete	0.013	0.94	20.91	21.83	24.35	23.71	2.94	1.38	26.95	24.35	
P-13-415	J-13-9	1240	0.59	0.80	0.47	0.47	5.00	3.31	1.57	3	0.5867	6-inch	PVC	0.01	5.59	29.82	31.58	32.86	32.86	2.54	0.78	33.00	32.86	
P-13-416	4083	1239	0.59	0.80	0.47	0.47	5.00	3.31	1.57	34	0.0465	6-inch	Concrete	0.013	1.21	30.64	32.22	34.28	34.36	3.14	1.64	36.96	34.28	
P-13-417	1507	1276	0.59	0.80	0.47	0.47	5.00	3.31	1.57	32	0.0181	8-inch	PVC	0.01	2.11	33.16	33.74	34.21	35.24	0.38	0.83	34.53	34.21	
P-13-418	1507	1274	0.59	0.80	0.47	0.94	5.07	3.30	3.14	50	0.0264	8-inch	Concrete	0.013	1.96	33.04	34.36	34.21	36.32	0.50	1.29	37.59	34.21	
P-13-419	1274	1275	0.59	0.80	0.47	0.47	5.00	3.31	1.57	18	-0.0011	8-inch	Concrete	0.013	-0.4	34.42	34.40	36.32	35.80	1.23	0.73	36.63	36.32	
P-13-500	4055	1095	0.59	0.8	0.47	1.89	6.36	3.11	5.91	17	0.0088	10-inch	Concrete	0.013	2.06	19.18	19.33	21.89	21.67	1.88	1.51	21.25	20.01	
P-13-501	1095	J-13-10	N/A	N/A	N/A	1.42	5.95	3.17	4.52	206	0.0046	10-inch	Concrete	0.013	1.49	19.29	20.24	21.67	23.17	1.55	2.1	30.02	21.25	
P-13-502	J-13-10	1093	0.59	0.8	0.47	0.94	5.72	3.2	3.05	53	0.0045	12-inch	Concrete	0.013	2.4	20.24	20.48	23.17	23.8	1.93	2.32	23.56	23.17	
P-13-503	1093	1092	0.59	0.8	0.47	0.47	5	3.31	1.57	251	0.0215	12-inch	Concrete	0.013	5.23	20.5	25.9	23.8	30.35	2.3	3.45	26.43	23.56	
P-13-504	J-13-10	1094	0.59	0.8	0.47	0.47	5	3.31	1.57	11	0.1709	8-inch	Concrete	0.013	5	20.24	22.12	23.17	23.17	2.26	0.38	23.36	23.17	
P-13-505	4055	4060	N/A	N/A	N/A	5.43	5.89	3.18	17.38	247	0.0100	10-inch	Concrete	0.013	2.19	15.88	18.35	21.89	23.77	5.18	4.59	172.17	16.71	
P-13-506	4060	J-13-11	N/A	N/A	N/A	4.01	5.88	3.18	12.85	26	0.0250	8-inch	Concrete	0.013	1.91	18.99	19.64	23.77	23.77	4.11	3.46	53.19	23.77	
P-13-507	J-13-11	J-13-12	N/A	N/A	N/A	3.54	5.76	3.2	11.40	224	0.0270	8-inch	Concrete	0.013	1.99	19.64	25.69	23.77	30.24	3.46	3.88	223.25	23.77	
P-13-508	J-13-12	J-13-13	N/A	N/A	N/A	2.12	5.27	3.27	7.00	346	0.1627	8-inch	Concrete	0.013	4.87	25.69	81.97	30.24	109	3.88	26.36	146.32	30.24	
P-13-509	J-13-13	4016	N/A	N/A	N/A	1.42	5.08	3.3	4.71	156	0.1626	8-inch	Concrete	0.013	4.87	81.97	107.34	109	113.21	26.36	5.2	132.67	109	
P-13-510	4060	1086	0.59	0.8	0.47	0.94	5.14	3.29	3.13	28	0.0646	8-inch	Concrete	0.013	3.07	19.29	21.1	23.77	22.8	3.81	1.03	25.65	23.77	
P-13-511	1086	1085	0.59	0.8	0.47	0.47	5	3.31	1.57	38	0.0095	8-inch	PVC	0.01	1.53	21.19	21.55	22.8	23.09	0.94	0.87	23.18	22.8	
P-13-512	4060	1087	0.59	0.8	0.47	0.47	5	3.31	1.57	46	0.1713	8-inch	Concrete	0.013	5	18.99	26.87	23.77	28.02	4.11	0.48	27.45	23.77	
P-13-513	J-13-11	1088	0.59	0.8	0.47	0.47	5	3.31	1.57	8	0.2325	8-inch	Concrete	0.013	5.83	19.64	21.5	23.77	23.95	3.46	1.78	23.91	23.77	
P-13-514	J-13-12	1089	0.59	0.8	0.47	1.42	5.75	3.2	4.56	13	0.0269	8-inch	Concrete	0.013	1.98	25.69	26.04	30.24	30.24	3.88	3.53	32.1	30.24	
P-13-515	1089	1090	0.59	0.8	0.47	0.47	5	3.31	1.57	11	0.0327	6-inch	Concrete	0.013	1.02	28.13	28.49	30.24	30.29	1.61	1.3	31.11	30.24	
P-13-516	1089	1091	0.59	0.8	0.47	0.47	5	3.31	1.57	202	0.0220	8-inch	Concrete	0.013	1.79	26.04	30.49	30.24	34.24	3.53	3.08	33.67	30.24	
P-13-517	J-13-13	1063	0.59	0.6	0.35	0.35	5	3.31	1.18	11	2.2045	6-inch	Concrete	0.013	8.33	81.97	106.22	109	108.8	26.53	2.08	109.49	109	
P-13-518	J-13-13	1062	0.59	0.6	0.35	0.35	5	3.31	1.18	16	1.5400	6-inch	Concrete	0.013	6.96	81.97	106.61	109	109.57	26.53	2.46	109.71	109	
P-13-519	4016	1060	0.59	0.6	0.35	0.35	5	3.31	1.18	26	0.1058	6-inch	Concrete	0.013	1.82	108.23	110.98	113.21	112.07	4.48	0.59	114.36	113.21	
P-13-520	4016	1061	0.59	0.6	0.35	0.35	5	3.31	1.18	29	0.0776	6-inch	Concrete	0.013	1.56	107.61	109.86	113.21	111.91	5.1	1.55	114.5	113.21	
P-13-521	4016	1059	0.59	0.6	0.35	0.35	5	3.31	1.18	26	0.0704	6-inch	Concrete	0.013	1.49	107.79	109.62	113.21	111.56	4.92	1.44	114.36	113.21	
P-13-522	4016	1058	0.59	0.6	0.35	0.35	5	3.31	1.18	29	0.0203	6-inch	Concrete	0.013	0.8	108.19	108.78	113.21	111.95	4.52	2.67	114.5	113.21	

System Flow > Pipe Capacity
Ground elevation interpolated from nearest structure
Invert elevation interpolated from upstream and downstream nodes

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Table 13.2 - Existing Pipe Totals

Pipe Size	Concrete	PVC	Clay	HDPE	Total	Percentage
4-inch	0	117	0	0	**117**	**1.39%**
6-inch	983	239	0	0	**1222**	**14.56%**
8-inch	2,645	98	397	0	**3140**	**37.41%**
10-inch	780	0	0	0	**780**	**9.29%**
12-inch	666	0	0	751	**1417**	**16.88%**
24-inch	1,718	0	0	0	**1718**	**20.47%**
Total	**6792**	**454**	**397**	**751**	**8,394**	**100.00%**
Percentage	**80.91%**	**5.41%**	**4.73%**	**8.95%**	**100.00%**	

Kelso Stormwater Management Plan
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Table 13.3 - Recommended Trunk Line Improvements

Pipe	Exist. Size	Prop. Size	Length
P-13-100	24-inch	48-inch	144
P-13-101	24-inch	48-inch	156
P-13-102	24-inch	90-inch	364
P-13-103	24-inch	54-inch	286
P-13-104	24-inch	54-inch	13
P-13-105	24-inch	54-inch	214
P-13-106	10-inch	24-inch	23
P-13-107	10-inch	18-inch	40
P-13-108	10-inch	18-inch	198
P-13-117	24-inch	42-inch	56
P-13-300	24-inch	42-inch	213
P-13-301	8-inch	18-inch	41
P-13-302	8-inch	18-inch	244
P-13-400	24-inch	30-inch	175
P-13-401	24-inch	30-inch	97
P-13-402	12-inch	24-inch	277
P-13-403	6-inch	18-inch	57
P-13-404	8-inch	18-inch	194
P-13-406	6-inch	18-inch	258
P-13-500	10-inch	18-inch	17
P-13-501	10-inch	18-inch	206
P-13-502	12-inch	18-inch	53
P-13-505	10-inch	24-inch	247
P-13-506	8-inch	18-inch	26
P-13-507	8-inch	18-inch	224
Total			**3,823**

Kelso Stormwater Management Plan
Phase II
Basin 13

Table 13.4 - Preliminary Opinion of Probable Cost

Item	Description	QTY	Unit	Price	Total
1	Mobilization	1	LS	$ 41,800	$ 41,800
2	Traffic Control	1	LS	$ 10,000	$ 10,000
3	Clearing and Grubbing	1	LS	$ 5,000	$ 5,000
4	Removal of Structures and Obstructions	1	LS	$ 7,500	$ 7,500
5	Removal of Existing Asphalt	2,855	SY	$ 10	$ 28,550
6	Construction Fabric	2,005	SY	$ 2	$ 4,010
7	CSBC	930	Tons	$ 20	$ 18,600
8	CSTC	330	Tons	$ 22	$ 7,260
9	HMA	515	Tons	$ 150	$ 77,250
10	12-inch HDPE	0	LF	$ 40	$ -
10	18-inch HDPE	1,558	LF	$ 50	$ 77,900
11	24-inch HDPE	547	LF	$ 65	$ 35,555
12	30-inch HDPE	272	LF	$ 80	$ 21,760
13	42-inch HDPE	269	LF	$ 135	$ 36,315
14	48-inch HDPE	300	LF	$ 170	$ 51,000
15	54-inch HDPE	513	LF	$ 180	$ 92,340
16	90-inch HDPE	364	LF	$ 240	$ 87,360
17	Catch Basins	5	EA	$ 1,200	$ 6,000
18	Manholes	3	EA	$ 1,500	$ 4,500
19	Import Trench Backfill (assume 3' avg)	2,005	CY	$ 8	$ 16,040
20	Trench Safety Systems	1	LS	$ 10,000	$ 10,000
	Subtotal				$ 638,740
	Contingency @	20%			$ 127,760
	Total Opinion of Probable Cost				**$ 766,500**

Kelso Stormwater Management Plan
Phase II
Basin 13

Table 13.5 All Undersized Pipes

Pipe	Exist. Size	Prop. Size	Length (ft)
P-13-105	24-inch	54-inch	214
P-13-104	24-inch	24-inch	13
P-13-102	24-inch	18-inch	364
P-13-101	24-inch	18-inch	156
P-13-100	24-inch	12-inch	144
P-13-106	10-inch	12-inch	23
P-13-107	10-inch	12-inch	40
P-13-109	8-inch	12-inch	36
P-13-114	4-inch	12-inch	117
P-13-117	24-inch	12-inch	56
P-13-103	24-inch	12-inch	286
P-13-108	10-inch	12-inch	198
P-13-121	12-inch	12-inch	6
P-13-122	6-inch	12-inch	55
P-13-123	8-inch	12-inch	8
P-13-120	6-inch	12-inch	31
P-13-110	8-inch	12-inch	267
P-13-130	6-inch	12-inch	27
P-13-200	12-inch	12-inch	19
P-13-201	12-inch	12-inch	164
P-13-202	12-inch	12-inch	86
P-13-300	24-inch	12-inch	213
P-13-318	6-inch	18-inch	51
P-13-302	8-inch	12-inch	244
P-13-303	8-inch	12-inch	213
P-13-301	8-inch	12-inch	41
P-13-306	12-inch	12-inch	53
P-13-309	6-inch	12-inch	98
P-13-311	6-inch	12-inch	81
P-13-312	8-inch	12-inch	10
P-13-316	6-inch	30-inch	26
P-13-315	6-inch	18-inch	13
P-13-304	8-inch	18-inch	24
P-13-400	24-inch	12-inch	175
P-13-401	24-inch	18-inch	97
P-13-402	12-inch	12-inch	277
P-13-419	8-inch	12-inch	18
P-13-404	8-inch	12-inch	194
P-13-418	8-inch	12-inch	50
P-13-410	6-inch	12-inch	46
P-13-416	6-inch	12-inch	34
P-13-403	6-inch	12-inch	57
P-13-413	12-inch	12-inch	19
P-13-406	6-inch	12-inch	258
P-13-405	8-inch	18-inch	16

Table 13.5 All Undersized Pipes

Pipe	Exist. Size	Prop. Size	Length (ft)
P-13-414	6-inch	12-inch	33
P-13-501	10-inch	24-inch	206
P-13-500	10-inch	12-inch	17
P-13-505	10-inch	12-inch	247
P-13-506	8-inch	12-inch	26
P-13-510	8-inch	12-inch	28
P-13-508	8-inch	12-inch	346
P-13-511	8-inch	12-inch	38
P-13-502	12-inch	12-inch	53
P-13-514	8-inch	12-inch	13
P-13-515	6-inch	12-inch	11
P-13-507	8-inch	12-inch	224
Total			**5,860**

Kelso Stormwater Management Plan
Phase II
Basin 13

Table 13.6 - Basin 13 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1017	305,821.535	1,030,326.946	82.835	ex cb type 1	13	
1058	305,466.286	1,030,749.538	111.947	ex cb type 2	13	
1059	305,476.320	1,030,712.240	111.556	ex cb type 2	13	
1060	305,439.695	1,030,701.312	112.074	ex cb type 2	13	
1061	305,428.250	1,030,738.294	111.905	ex cb type 2	13	
1062	305,299.109	1,030,695.969	109.573	ex cb type 2	13	
1063	305,305.992	1,030,669.954	108.804	ex cb type 1	13	
1064	305,563.273	1,030,292.230	86.506	ex cb type 2	13	
1065	305,335.133	1,030,278.234	48.446	ex cb type 2	13	
1066	305,298.008	1,030,236.303	40.406	ex cb type 2	13	
1067	305,242.091	1,030,429.312	58.534	ex cb type 2	13	
1068	305,362.174	1,030,178.370	41.283	ex cb type 1	13	
1069	305,371.497	1,030,129.717	39.914	ex cb type 1	13	
1070	305,393.146	1,029,931.820	36.451	ex cb type 1	13	
1071	305,426.046	1,029,941.523	37.435	ex cb type 1	13	
1072	305,446.660	1,029,936.427	38.473	ex cb type ?	13	
1073	305,458.955	1,029,893.587	38.276	ex cb type ?	13	
1074	305,650.601	1,029,938.348	51.955	ex cb type 1	13	
1075	305,695.511	1,029,951.022	53.728	ex cb type 1	13	
1076	305,693.847	1,030,007.052	54.171	ex cb type ?	13	
1077	305,673.434	1,030,012.949	53.211	ex cb type 1	13	
1078	305,645.974	1,030,005.385	51.931	ex cb type ?	13	
1079	305,656.812	1,030,225.164	68.457	ex cb type 1	13	
1080	305,623.248	1,030,250.901	66.961	ex cb type 1	13	
1081	305,129.087	1,030,061.215	21.932	ex cb type 1	13	
1082	305,140.713	1,030,077.232	22.543	ex cb type 1	13	
1083	305,136.461	1,030,118.758	22.354	ex cb type 1	13	
1084	305,116.426	1,030,129.283	21.145	ex cb type 1	13	
1085	305,071.918	1,030,292.289	23.095	ex cb type 1	13	
1086	305,060.451	1,030,328.964	22.796	ex cb type 2	13	
1087	305,078.689	1,030,362.363	28.02	ex cb type 1	13	
1088	305,036.850	1,030,370.620	23.946	ex cb type 1	13	
1089	304,966.935	1,030,598.378	30.236	ex cb type 1	13	
1090	304,978.044	1,030,595.540	30.286	ex cb type ?	13	
1091	304,909.922	1,030,791.672	34.244	ex cb type 2	13	
1092	304,909.552	1,030,597.531	30.347	ex cb type 1	13	
1093	304,986.513	1,030,358.915	23.798	ex cb type 1	13	
1094	304,992.988	1,030,304.969	23.172	ex cb type 1	13	
1095	305,066.338	1,030,112.754	21.672	ex cb type 1	13	
1096	305,085.015	1,030,045.741	21.626	ex cb type 1	13	
1097	304,876.811	1,030,037.711	20.735	ex cb type 1	13	
1098	304,810.043	1,030,054.189	20.115	ex cb type 1	13	
1099	304,746.565	1,030,421.773	18.031	ex cb type 1	13	

Table 13.6 - Basin 13 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1101	304,326.411	1,030,478.286	16.512	ex cb type 1	13	
1102	305,589.736	1,030,299.586	87.041	ex cb type 2	13	
1103	304,786.934	1,030,299.898	16.92	ex cb type 1	13	
1132	304,330.168	1,030,629.622	15.468	ex cb type 1	13	
1233	305,304.063	1,029,297.663	23.905	ex cb type 1	13	
1234	305,341.220	1,029,307.081	23.708	ex cb type 2	13	
1239	305,576.230	1,029,431.154	34.361	ex cb type 1	13	
1240	305,528.626	1,029,416.290	32.861	ex cb type 1	13	
1241	305,342.209	1,029,362.319	23.791	ex cb type 2	13	
1270	305,239.308	1,029,551.688	22.659	ex cb type 1	13	
1271	305,270.242	1,029,555.047	22.32	ex cb type 2	13	
1272	305,276.315	1,029,576.418	22.273	ex cb type 2	13	
1273	305,257.437	1,029,610.996	22.147	ex cb type 2	13	
1274	305,500.080	1,029,673.665	36.321	ex cb type 1	13	
1275	305,495.267	1,029,691.019	35.804	ex cb type 1	13	
1276	305,460.701	1,029,689.781	35.236	ex cb type 1	13	
1277	305,219.738	1,029,825.107	23.688	ex cb type 1	13	
1278	305,198.243	1,029,809.277	22.08	ex cb type 1	13	
1279	305,145.500	1,029,789.266	22.83	ex cb type 1	13	
1280	305,122.103	1,029,750.356	23.052	ex cb type 1	13	
1281	305,136.275	1,029,640.994	26.355	ex cb type 1	13	
1282	305,162.682	1,029,507.776	34.739	ex cb type 1	13	Deleted - On Allen St. bridge, connection unknown
1283	305,194.485	1,029,385.811	43.887	ex cb type 1	13	Deleted - On Allen St. bridge, connection unknown
1284	305,247.502	1,029,399.483	43.786	ex cb type 1	13	Deleted - On Allen St. bridge, connection unknown
1285	305,216.871	1,029,519.825	34.772	ex cb type 1	13	Deleted - On Allen St. bridge, connection unknown
1286	305,202.843	1,029,643.321	26.099	ex cb type 1	13	
1287	305,203.061	1,029,673.721	24.614	ex cb type 1	13	
1288	305,224.751	1,029,715.336	22.963	ex cb type 1	13	
1289	305,121.358	1,029,841.093	22.998	ex cb type 1	13	
1290	305,042.466	1,029,777.077	21.753	ex cb type 1	13	
1291	304,957.230	1,029,742.637	20.49	ex cb type 1	13	
1292	304,911.544	1,029,732.764	20.6	ex cb type 1	13	
1293	304,914.185	1,029,861.845	20.105	ex cb type 1	13	
1295	304,887.440	1,029,850.772	20.01	ex cb type 1	13	
1296	304,897.053	1,029,776.378	20.209	ex cb type 1	13	
1507	305,452.562	1,029,658.881	34.208	ex cb type 1	13	
1508	305,454.347	1,029,851.702	36.517	ex cb type 1	13	
4016	305,452.823	1,030,723.648	113.214	ex mh type ?	13	
4017	305,329.249	1,030,164.569	39.477	ex mh type ?	13	

Table 13.6 - Basin 13 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
4018	305,424.656	1,029,926.644	37.814	ex mh type ?	13	
4019	305,434.574	1,029,924.826	38.137	ex mh type ?	13	
4020	305,629.289	1,029,985.107	51.512	ex mh type ?	13	
4021	305,652.248	1,029,992.851	52.61	ex mh type ?	13	
4022	304,780.622	1,030,310.048	17.584	ex mh type ?	13	
4023	304,859.376	1,030,034.861	20.66	ex mh type ?	13	
4024	304,863.226	1,030,016.121	20.907	ex mh type ?	13	
4029	304,333.311	1,030,631.261	15.871	ex mh type ?	13/12	
4054	305,099.326	1,030,102.972	22.121	ex mh type ?	13	
4055	305,077.011	1,030,100.052	21.885	ex mh type ?	13	
4056	305,190.624	1,029,858.978	23.041	ex mh type ?	13	
4057	305,153.200	1,029,841.462	23.203	ex mh type ?	13	
4060	305,036.205	1,030,343.828	23.775	ex mh type ?	13	
4081	305,309.779	1,029,315.580	24.351	ex mh type ?	13	
4083	305,545.169	1,029,417.810	34.279	ex mh type ?	13	
4096	305,232.676	1,029,581.666	22.894	ex mh type ?	13	
4098	304,933.928	1,029,776.209	21.846	ex mh type ?	13	
4099	304,909.740	1,029,858.502	20.251	ex mh type ?	13	

Appendix F

Basin 14

BASIN 14

SYSTEM ASSESSMENT

Basin Description: Basin 14 consists of the structures along Columbia Avenue, Crawford Avenue and Cowlitz Way, from 9th Street west to 1st Street. It drains an area between the bank of the Cowlitz River dike on the west and the east edge of 9th Street to the east, from Columbia Avenue to Cowlitz Way. Figure 14.1 shows an aerial photograph of Basin 14. It contains 84 structures (55 catch basin, 14 manholes and 15 assumed connections), the majority on Crawford Avenue and Cowlitz Way, and outlets into the Cowlitz River at node 8000. Structure 8001 contains a gate valve and a flapper valve. The total drainage area for Basin 14 is 30.82 acres and the land use is approximately 67% residential, 18% special retail, 7% open space, 4% multi-family residential, and 4% town center. See Figure 14.2 for the land use areas in Basin 14.

System Modeling: Table 14.1 lists the structure information and connections, along with total flows and capacities. Figure 14.3 shows a schematic of the structure locations and piping layout. As stated in Chapter 2, junctions were entered into the model where blind connections were assumed to occur using the prefix J in the numbering system for easy identification. Field data for catch basins 1032, 1034 and 1035 indicates these catch basins are connected into the system through a blind connection. However, as stated previously, blind connections cannot be modeled, and these catch basins were entered into the model as connecting into catch basin 1033, rather than creating three separate junctions in the same vicinity. The city should assume these pipes connect at 90-degrees to the main line pipe.

Other assumptions were made in the modeling, such as interpolating an invert or rim elevation when junctions were added to the system. The field data for manhole 4006 indicates that no pipes are entering this structure. However, catch basins 1009 through 1012 each had one pipe leaving the structure and heading toward manhole 4006. Again, for modeling purposes, these four catch basins were assumed to connect to the

interpolated invert of this manhole. It is recommended that additional investigation be performed to determine how these catch basins connect to the system.

As seen in Table 14.1, the majority of pipes with insufficient capacity (82%) are less than 12-inch in diameter. Utilizing the current slopes, the majority of pipes less than 12-inch in diameter will gain capacity by upsizing to 12-inch HDPE pipe. Pipes P-14-102 through P-14-105 and P-14-200 through P-14-204 have sufficient slope, but are undersized based on the modeled amount of flow in the system. Increasing these pipes from the existing to HDPE in the diameter listed in Table 14.3, keeping the same slope, will provide increased capacity in the system.

System Issues

Pipe size: The first system issue identified for Basin 14 is the presence of small diameter pipe, that is, pipe less than 12-inches in diameter. Approximately 77% of the system is comprised of pipe with a diameter less than 12-inches. Table 14.2 shows the pipe compilation by size and material. The small diameter pipe severely inhibits the capacity of the piping system due to the reduced flow capacity. A preliminary recommendation is to remove any trunk lines with piping less than 12-inches in diameter and replace with a minimum of 12-inch diameter pipe.

Pipe Material: Basin 14 is comprised of three modeled material types: concrete, PVC and clay, with only one 2-foot section of pipe consisting of PVC. The majority of the system (86%) consists of concrete and the remaining (14%) of clay. Both of these types of pipe are similar in properties, with a relatively low Manning's coefficient. However, both concrete and clay piping are rigid materials that provide movement only at the joints, and are susceptible to separation, fracture or breakage in the pipe if ground movement occurs. Typically, the most common failure in older concrete pipe occurs at the joints as the rubber gaskets become brittle and disintegrate, providing an opportunity for the pipe to separate. Overtime, this can lead to deposit of unwanted material in the pipe and degradation or failure of the pipe. Material in the pipe opening blocks the path of flow for storm water, making it less effective. In addition, the life expectancy of

concrete pipe is approximately 40-years versus HDPE which has a projected life span in excess of 100 years. Material such HDPE is more flexible and less likely to degrade overtime; HDPE has a life expectancy of over 100 years. For this reason it is recommended replacement of any concrete or clay pipe be completed with HDPE.

System Maintenance: The final contributing issue to the City of Kelso Basin 14 storm water system is maintenance. During the inventory of structures and pipes, several notes were made in regards to cleaning a structure or pipe connection. Cleaning of a structure took place where needed to obtain existing data, and it is recommended the system continue to be cleaned on an annual or semi-annual basis to maintain the function of the system until recommended improvements can be made.

RECOMMENDATIONS

System Replacements: It is recommended at a minimum that the main pipes down Crawford, Columbia, Cowlitz and Pacific Avenue (considered trunk line pipes) be replaced with HDPE pipe in the diameter size listed in Table 14.3. This would allow for increased pipe capacity and act as storage for the system should downstream tail-water conditions occur. Many of the smaller lines in the system are connecting into the trunk line and do not appear to be causing a significant problem to the system. However, it is recommended that any new or replaced pipe be composed of HDPE at a minimum diameter of 12-inches.

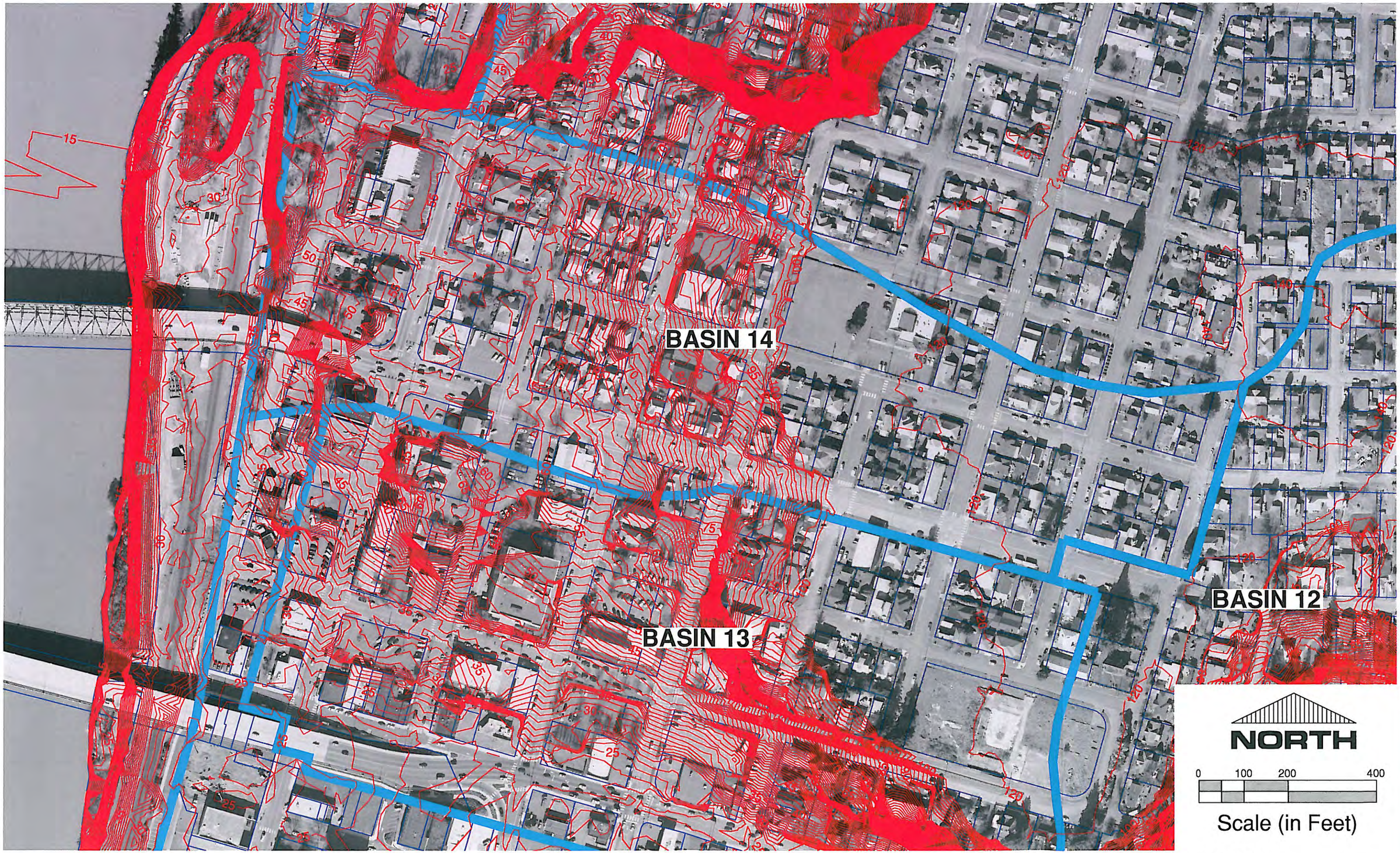
Capital Improvements: The estimated budget to upgrade from the existing pipe sizes to the pipe sizes listed is approximately $500,000, as shown in Table 14.4. This cost is based on contracting the work to be done by other than City of Kelso forces.

Operation and Maintenance: A guideline for order of precedence for the CIP has been developed such that budget consideration can be included and is suggested as follows:

1. Clean catch basins and storm drain manholes;
2. Clean and television storm drain pipes to determine if blockages are encountered;

3. Replace concrete and clay pipes with HDPE pipe such as ADS N-12 or similar;
4. Upgrade storm drain pipes on trunk lines to sizes recommended to handle flow from side systems and to provide additional storage during larger storm events;
5. Upgrade storm drain pipes on side streets to sizes recommended, and eliminate as many blind connections as possible during the improvement process.

These recommendations are based on a planning level assessment only. There may be physical constraints that make it impossible to install the large pipes recommended for upgrading the system. A detailed engineered design of the proposed system will be required, which takes into account the existing surrounding environment. The individual and overall system budget estimates have been developed based on the cost to remove and replace the pipes with the sizes as shown, and to repair the existing surface to its current condition. Consideration should be given to the shallow cover and other utilities within the City's right of way which may require additional engineering solutions and add unknown costs to those provided in this report.



NORTH

0 100 200 400

Scale (in Feet)

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City of Kelso
Stormwater Management Plan
Phase II - Aerial Photo of Basin 14
Figure 14.1

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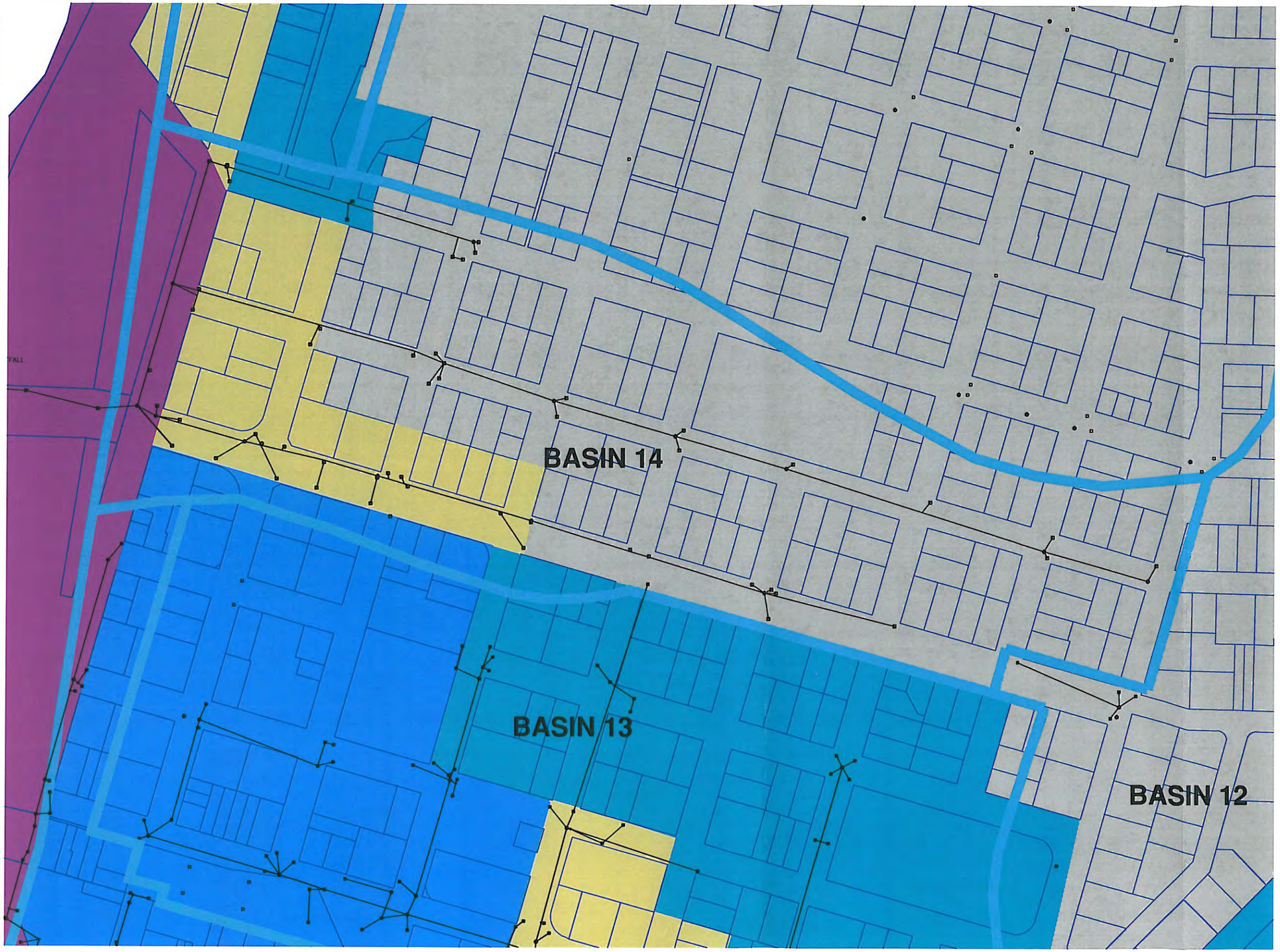

LEGEND

- KELSO CITY LIMITS
- OPEN SPACE
- RESIDENTIAL MULTI-FAMILY
- RESIDENTIAL SINGLE FAMILY
- SPECIAL RETAIL DISTRICT
- TOWN CENTER COMMUNITY

NORTH

0 100 200 400

Scale (in Feet)

City of Kelso
Stormwater Management Plan
Phase II - Basin 14 with Zoning
Figure 14.2

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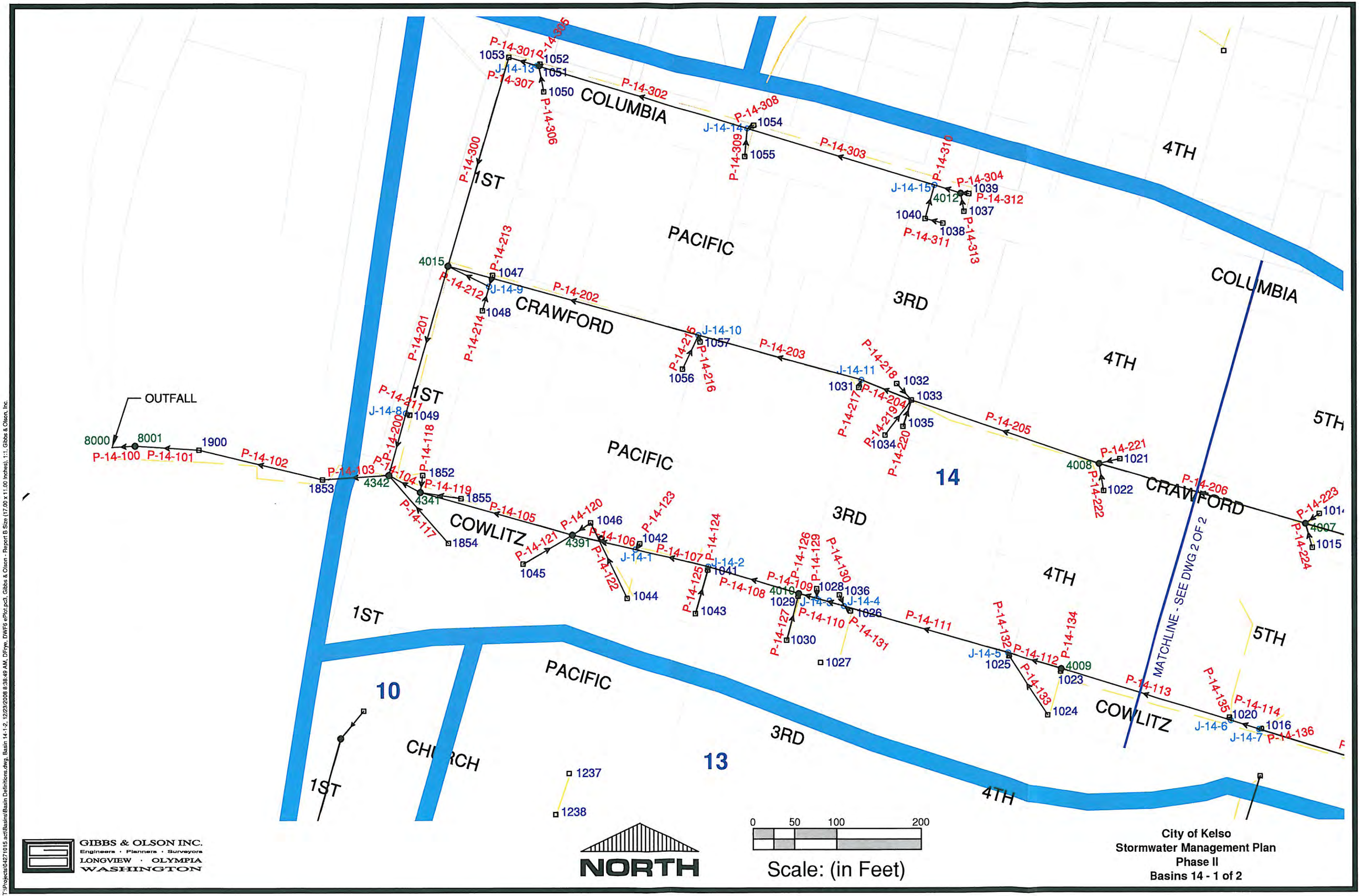
T:\Projects\04271015.act\Basins\Kelso zoning.dwg, Fig 14.2, 12/23/2008 1:42:18 PM, DFrye, DWF6 ePlot.pc3, Gibbs & Olson - Report B Size (17.00 x 11.00 Inches), 1:1, Gibbs & Olson, Inc.



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City of Kelso
Stormwater Management Plan
Phase II
Basins 14 - 1 of 2

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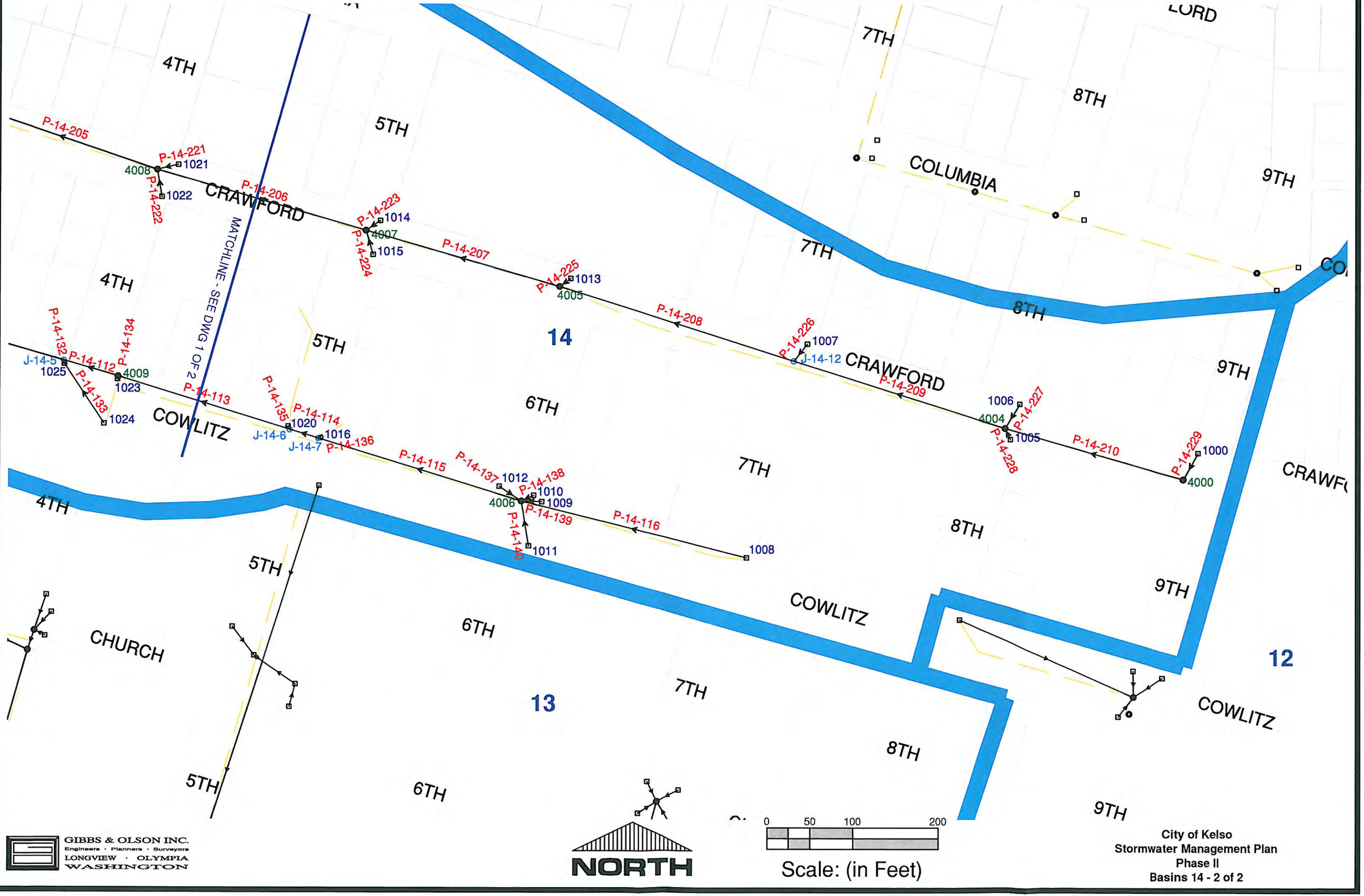

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NORTH

0 50 100 200

Scale: (in Feet)

City of Kelso
Stormwater Management Plan
Phase II
Basins 14 - 2 of 2

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Kelso Stormwater Management Plan
Phase II
Summary Legend

Legend

	System Flow > Pipe Capacity
	Ground elevation interpolated from nearest structure
	Invert elevation interpolated from upstream and downstream nodes
-0.02	Negative slope based on data provided
J	Junction
O	Outlet
Conc.	Concrete
T-cotta	Terracotta
DI	Ductile Iron
PVC	Polyvinyl Chloride
HDPE	High Density Polyethylene
CMP	Corrugated Metal Pipe
1000's	Catch Basins
4000's	Manholes or Curb Inlets
NDA	No Data Available

Kelso Stormwater Management Plan
Phase II
Basin 14

Table 14.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-14-100	8000	8001	N/A	N/A	N/A	16.54	10.59	2.51	41.91	27	0.0411	24	Conc.	0.013	45.87	19.31	20.42	21.31	40.16	0.00	17.74	22.38	21.03
P-14-101	8001	1900	0.56	0.27	0.15	16.54	10.52	2.52	42.01	77	0.0411	24	Conc.	0.013	45.84	20.42	23.58	40.16	32.20	17.74	6.62	25.54	22.38
P-14-102	1900	1853	0.56	0.27	0.15	16.39	10.33	2.53	41.87	151	0.0162	24	Conc.	0.013	28.76	23.62	26.06	32.20	32.86	6.58	4.80	30.78	25.58
P-14-103	1853	4342	N/A	N/A	N/A	16.24	10.23	2.54	41.61	80	0.0141	24	Conc.	0.013	26.88	26.28	27.41	32.86	42.15	4.58	12.74	33.49	30.78
P-14-104	4342	4341	N/A	N/A	N/A	8.06	6.95	3.09	25.09	43	0.0956	12	Conc.	0.013	11.01	27.59	31.70	42.15	42.60	13.56	9.90	49.92	28.59
P-14-105	4341	4391	N/A	N/A	N/A	7.17	6.85	3.10	22.40	187	0.0914	12	Conc.	0.013	10.77	31.90	49.00	42.60	56.10	9.70	6.10	116.50	42.60
P-14-106	4391	J-14-1	N/A	N/A	N/A	5.82	6.81	3.10	18.22	78	0.0115	10	Conc.	0.013	2.35	50.17	51.07	56.10	55.40	5.10	3.50	110.06	56.10
P-14-107	J-14-1	J-14-2	N/A	N/A	N/A	5.38	6.76	3.11	16.85	89	0.0115	10	Conc.	0.013	2.35	51.07	52.09	55.40	55.89	3.50	2.97	108.05	55.40
P-14-108	J-14-2	4010	N/A	N/A	N/A	4.48	6.69	3.12	14.08	113	0.0115	10	Conc.	0.013	2.35	52.09	53.39	55.89	57.01	2.97	2.79	102.56	55.89
P-14-109	4010	J-14-3	N/A	N/A	N/A	3.58	6.67	3.12	11.27	22	0.0300	8	Conc.	0.013	2.09	53.41	54.07	57.01	56.34	2.93	1.60	76.14	57.01
P-14-110	J-14-3	J-14-4	N/A	N/A	N/A	3.14	6.65	3.12	9.87	34	0.0300	8	Conc.	0.013	2.09	54.07	55.09	56.34	57.65	1.60	1.89	79.01	56.34
P-14-111	J-14-4	J-14-5	N/A	N/A	N/A	2.24	6.49	3.14	7.09	203	0.0300	8	Conc.	0.013	2.09	55.09	61.18	57.65	63.83	1.89	1.98	127.55	57.65
P-14-112	J-14-5	4009	N/A	N/A	N/A	1.79	6.31	3.16	5.71	67	0.0300	8	Conc.	0.013	2.09	61.18	63.19	63.83	66.72	1.98	2.86	78.79	63.83
P-14-113	4009	J-14-6	N/A	N/A	N/A	1.57	6.06	3.19	5.04	211	0.0662	8	Conc.	0.013	3.11	63.77	77.74	66.72	81.61	2.28	3.20	103.42	66.72
P-14-114	J-14-6	J-14-7	N/A	N/A	N/A	1.34	6.02	3.19	4.33	35	0.0660	8	Conc.	0.013	3.1	77.74	80.05	81.61	83.01	3.20	2.29	86.10	81.61
P-14-115	J-14-7	4006	N/A	N/A	N/A	1.12	5.62	3.24	3.66	249	0.0662	8	Conc.	0.013	3.11	80.05	96.54	83.01	101.56	2.29	4.35	105.82	83.01
P-14-116	4006	1008	0.56	0.40	0.22	0.22	5.00	3.31	0.75	273	0.0662	8	Conc.	0.013	3.11	96.54	114.62	101.56	116.47	4.35	1.18	115.03	101.56
P-14-117	4342	1854	0.56	0.80	0.45	0.45	5.00	3.31	1.49	107	0.1879	6	Conc.	0.013	2.43	38.60	58.71	42.15	59.71	3.05	0.50	59.20	38.88
P-14-118	4341	1852	0.56	0.80	0.45	0.45	5.00	3.31	1.49	20	0.0780	6	Conc.	0.013	1.57	39.29	40.85	42.60	43.52	2.81	2.17	44.02	42.60
P-14-119	4341	1855	0.56	0.80	0.45	0.45	5.00	3.31	1.49	49	0.3924	6	Conc.	0.013	3.51	39.51	58.74	42.60	59.74	2.59	0.50	59.23	42.60
P-14-120	4391	1046	0.56	0.80	0.45	0.9	5.39	3.27	2.95	26	0.0519	6	Conc.	0.013	1.28	51.18	52.53	56.10	55.33	4.42	2.30	63.28	56.10
P-14-121	4391	1045	0.56	0.80	0.45	0.45	5.00	3.31	1.49	68	0.0303	6	Conc.	0.013	0.98	51.60	53.66	56.10	56.81	4.00	2.65	60.93	56.10
P-14-122	1046	1044	0.56	0.80	0.45	0.45	5.00	3.31	1.49	100	0.0080	8	Conc.	0.013	1.08	52.44	53.24	55.33	56.14	2.22	2.23	56.86	55.33
P-14-123	J-14-1	1042	0.56	0.80	0.45	0.45	5.00	3.31	1.49	9	0.1833	8	Conc.	0.013	5.17	51.07	52.72	55.40	55.34	3.66	1.95	55.54	55.40
P-14-124	J-14-2	1041	0.56	0.80	0.45	0.9	5.12	3.30	2.98	4	0.2575	6	Conc.	0.013	2.85	52.09	53.12	55.89	55.89	3.30	2.27	57.02	55.89
P-14-125	1041	1043	0.56	0.80	0.45	0.45	5.00	3.31	1.49	54	0.0120	6	Conc.	0.013	0.62	53.09	53.74	55.89	56.13	2.30	1.89	59.72	55.89
P-14-126	4010	1029	0.56	0.80	0.45	0.9	5.12	3.30	2.98	3	-0.0200	6	Conc.	0.013	-0.79	53.43	53.37	57.01	56.52	3.08	2.65	57.85	57.01
P-14-127	1029	1030	0.56	0.80	0.45	0.45	5.00	3.31	1.49	54	0.0181	6	Conc.	0.013	0.76	53.37	54.35	56.52	56.66	2.65	1.81	60.35	56.52
P-14-129	J-14-3	1028	0.56	0.80	0.45	0.45	5.00	3.31	1.49	11	0.0227	6	Conc.	0.013	0.85	54.07	54.32	56.34	56.12	1.77	1.30	57.12	56.34
P-14-130	J-14-4	1036	0.56	0.80	0.45	0.45	5.00	3.31	1.49	14	-0.0486	6	Conc.	0.013	-1.24	55.09	54.41	57.65	56.82	2.06	1.91	58.64	57.65
P-14-131	J-14-4	1026	0.56	0.80	0.45	0.45	5.00	3.31	1.49	9	-0.0467	6	Conc.	0.013	-1.21	55.09	54.67	57.65	57.47	2.06	2.30	58.29	57.65
P-14-132	J-14-5	1025	0.56	0.40	0.22	0.45	6.47	3.14	1.42	4	-0.0625	8	Conc.	0.013	-3.02	61.18	60.93	63.83	63.83	1.98	2.23	63.89	63.83
P-14-133	1025	1024	0.56	0.40	0.22	0.22	5.00	3.31	0.75	84	0.0180	12	Conc.	0.013	4.78	60.95	62.46	63.83	65.36	1.88	1.90	63.87	63.83
P-14-134	4009	1023	0.56	0.40	0.22	0.22	5.00	3.31	0.75	3	0.0033	6	Conc.	0.013	0.32	63.20	63.21	66.72	66.16	3.02	2.45	66.77	66.72
P-14-135	J-14-6	1020	0.56	0.40	0.22	0.22	5.00	3.31	0.75	4	0.5600	6	Conc.	0.013	4.2	77.74	79.98	81.61	81.61	3.37	1.13	81.68	81.61
P-14-136	J-14-7	1016	0.56	0.40	0.22	0.22	5.00	3.31	0.75	3	0.2533	6	Conc.	0.013	2.82	80.05	80.81	83.01	83.01	2.46	1.70	83.06	83.01
P-14-137	4006	1012	0.56	0.40	0.22	0.22	5.00	3.31	0.75	31	0.0616	6	Conc.	0.013	1.39	96.54	98.45	101.56	100.23	4.52	1.28	102.11	101.56
P-14-138	4006	1010	0.56	0.40	0.22	0.22	5.00	3.31	0.75	16	0.1738	6	Conc.	0.013	2.34	96.54	99.32	101.56	101.87	4.52	2.05	101.84	101.56
P-14-139	4006	1009	0.56	0.40	0.22	0.22	5.00	3.31	0.75	24	0.1413	6	Conc.	0.013	2.11	96.54	99.93	101.56	101.93	4.52	1.50	101.99	101.56
P-14-140	4006	1011	0.56	0.40	0.22	0.22	5.00	3.31	0.75	53	0.0487	6	Conc.	0.013	1.24	96.54	99.12	101.56	100.87	4.52	1.25	102.50	101.56
P-14-200	4342	J-14-8	N/A	N/A	N/A	7.73	10.18	2.55	19.83	76	0.0568	12	Conc.	0.013	8.49	27.49	31.81	42.15	45.80	13.66	12.99	57.04	33.49
P-14-201	J-14-8	4015	N/A	N/A	N/A	7.28	10.05	2.56	18.76	181	0.0568	12	Conc.	0.013	8.49	31.81	42.09	45.80	53.39	12.99	10.30	95.97	45.80
P-14-202	4015	J-14-10	N/A	N/A	N/A	3.58	9.65	2.78	10.04	310	0.0213	12	Conc.	0.013	5.2	42.16	48.77	53.39	54.83	10.23	5.06	67.81	43.15
P-14-203	J-14-10	J-14-11	N/A	N/A	N/A	3.14	9.35	2.81	8.89	201	0.0213	12	Conc.	0.013	5.2	48.77	53.06	54.83	57.31	5.06	3.25	67.36	54.83
P-14-204	J-14-11	1033	0.56	0.40	0.22	2.91	9.25	2.83	8.29	64	0.0213	12	Conc.	0.013	5.19	53.06	54.42	57.31	57.76	3.25	2.34	60.78	57.31
P-14-205	1033	4008	N/A	N/A	N/A	2.02	8.88	2.87	5.83	237	0.0732	10	Conc.	0.013	5.93	54.33	71.67	57.76	75.71	2.60	3.21	74.53	57.76
P-14-206	4008	4007	N/A	N/A	N/A	1.57	8.54	2.91	4.59	256	0.0795	10	Conc.	0.013	6.18	71.81	92.15	75.71	96.49	3.07	3.51	92.97	74.53
P-14-207	4007	4005	N/A	N/A	N/A	1.12	8.21	2.94	3.32	237	0.0912	8	Conc.	0.013	3.65	92.43	114.04	96.49	118.09	3.39	3.38	114.70	92.93
P-14-208	4005	J-14-12	N/A	N/A	N/A	0.9	7.59	3.01	2.72	289	0.0106	8	Conc.	0.013	1.24	114.12	117.17	118.09	122.00	3.30	4.16	129.46	114.77

Kelso Stormwater Management Plan
Phase II
Basin 14

Table 14.1 - System Summary

Pipe	Downstream Structure	Upstream Structure	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Flow Time (min)	System Rainfall Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size (inches)	Material	Manning's n	Full Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Cover (ft)	Upstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-14-209	J-14-12	4004	N/A	N/A	N/A	0.67	6.87	3.10	2.10	260	0.0105	8	Conc.	0.013	1.24	117.17	119.91	122.00	123.35	4.16	2.77	129.84	122.00
P-14-210	4004	4000	N/A	N/A	N/A	0.22	5.15	3.29	0.74	219	0.0066	8	Conc.	0.013	0.98	119.99	121.44	123.35	124.69	2.69	2.58	124.18	123.35
P-14-211	J-14-8	1049	0.56	0.80	0.45	0.45	5.00	3.31	1.49	5	2.3320	6	Conc.	0.013	8.57	31.81	43.47	45.80	45.33	13.49	1.36	46.15	45.80
P-14-212	4015	J-14-9	N/A	N/A	N/A	0.9	5.07	3.30	2.98	54	0.0307	6	Conc.	0.013	0.98	47.14	48.86	53.39	52.84	5.75	3.54	62.90	47.64
P-14-213	J-14-9	1047	0.56	0.80	0.45	0.45	5.00	3.31	1.49	14	0.0971	6	Conc.	0.013	1.75	48.86	50.22	52.84	52.56	3.48	1.84	53.83	52.84
P-14-214	J-14-9	1048	0.56	0.80	0.45	0.45	5.00	3.31	1.49	30	0.0320	6	Conc.	0.013	1	48.86	49.82	52.84	51.92	3.48	1.60	54.97	52.84
P-14-215	J-14-10	1056	0.56	0.40	0.22	0.22	5.00	3.31	0.75	44	0.0757	6	Conc.	0.013	1.54	48.77	52.10	54.83	54.35	5.56	1.75	55.61	54.83
P-14-216	J-14-10	1057	0.56	0.4	0.22	0.22	5.00	3.31	0.75	8	0.4263	6	Conc.	0.013	3.66	48.77	52.18	54.83	54.33	5.56	1.65	54.97	54.83
P-14-217	J-14-11	1031	0.56	0.40	0.22	0.22	5.00	3.31	0.75	10	0.1260	6	Conc.	0.013	1.99	53.06	54.32	57.31	56.81	3.75	1.99	57.49	57.31
P-14-218	1033	1032	0.56	0.40	0.22	0.22	5.00	3.31	0.75	26	0.0392	6	Conc.	0.013	1.11	54.42	55.44	57.76	57.39	2.84	1.45	58.22	57.76
P-14-219	1033	1034	0.56	0.40	0.22	0.22	5.00	3.31	0.75	52	0.0237	6	Conc.	0.013	0.86	54.42	55.65	57.76	57.40	2.84	1.25	58.68	57.76
P-14-220	1033	1035	0.56	0.40	0.22	0.22	5.00	3.31	0.75	33	0.0273	6	Conc.	0.013	0.93	54.42	55.32	57.76	57.78	2.84	1.96	58.35	57.76
P-14-221	4008	1021	0.56	0.40	0.22	0.22	5.00	3.31	0.75	25	0.0916	6	Conc.	0.013	1.7	72.51	74.80	75.71	76.40	2.70	1.10	75.23	74.53
P-14-222	4008	1022	0.56	0.40	0.22	0.22	5.00	3.31	0.75	33	0.0070	6	Conc.	0.013	0.47	72.60	72.83	75.71	75.58	2.61	2.25	75.11	74.53
P-14-223	4007	1014	0.56	0.40	0.22	0.22	5.00	3.31	0.75	20	0.1380	6	Conc.	0.013	2.08	92.73	95.49	96.49	97.26	3.26	1.27	95.92	92.94
P-14-224	4007	1015	0.56	0.40	0.22	0.22	5.00	3.31	0.75	30	0.0567	6	Conc.	0.013	1.34	92.70	94.40	96.49	96.57	3.29	1.67	94.83	92.97
P-14-225	4005	1013	0.56	0.40	0.22	0.22	5.00	3.31	0.75	16	0.0800	6	Conc.	0.013	1.59	114.50	115.78	118.09	117.93	3.09	1.65	116.21	114.75
P-14-226	J-14-12	1007	0.56	0.40	0.22	0.22	5.00	3.31	0.75	26	0.1092	6	Conc.	0.013	1.85	117.17	120.01	122.00	121.50	4.33	0.99	122.46	122.00
P-14-227	4004	1006	0.56	0.40	0.22	0.22	5.00	3.31	0.75	33	0.0497	6	Conc.	0.013	1.25	120.08	121.72	123.35	123.17	2.77	0.95	123.94	123.35
P-14-228	4004	1005	0.56	0.40	0.22	0.22	5.00	3.31	0.75	14	0.0407	6	Conc.	0.013	1.13	120.09	120.66	123.35	123.01	2.76	1.85	123.60	123.35
P-14-229	4000	1000	0.56	0.40	0.22	0.22	5.00	3.31	0.75	35	0.0454	6	Conc.	0.013	1.2	121.35	122.94	124.69	124.18	2.84	0.74	124.80	124.18
P-14-300	4015	1053	0.56	0.80	0.45	2.8	6.56	3.08	8.68	259	0.0061	10	Clay	0.011	2.02	42.20	43.78	53.39	47.00	10.36	2.39	82.50	53.39
P-14-301	1053	J-14-13	N/A	N/A	N/A	2.35	6.52	3.08	7.31	35	0.0183	10	Clay	0.011	3.5	43.90	44.54	47.00	47.07	2.27	1.70	49.79	47.00
P-14-302	J-14-13	J-14-14	N/A	N/A	N/A	1.34	5.96	3.17	4.29	262	0.0182	10	Clay	0.011	3.49	44.54	49.30	47.07	53.00	1.70	2.87	54.26	47.07
P-14-303	J-14-14	J-14-15	N/A	N/A	N/A	0.9	5.25	3.27	2.96	233	0.0183	10	Clay	0.011	3.5	49.30	53.56	53.00	57.50	2.87	3.11	56.04	53.00
P-14-304	J-14-15	4012	N/A	N/A	N/A	0.45	5.05	3.30	1.49	33	0.0182	10	Clay	0.011	3.49	53.56	54.16	57.50	58.06	3.11	3.07	56.15	56.04
P-14-305	1051	1052	0.56	0.60	0.34	0.34	5.00	3.31	1.12	3	0.0333	8	Conc.	0.013	2.21	45.77	45.87	47.07	47.16	0.63	0.62	47.10	47.07
P-14-306	1051	1050	0.56	0.60	0.34	0.34	5.00	3.31	1.12	31	0.0332	8	Conc.	0.013	2.2	45.11	46.14	47.07	48.19	1.29	1.38	47.34	47.07
P-14-307	J-14-13	1051	0.56	0.60	0.34	1.01	5.16	3.29	3.34	2	0.1650	8	PVC	0.01	6.38	44.54	44.87	47.07	47.07	1.86	1.53	47.16	47.07
P-14-308	J-14-14	1054	0.56	0.40	0.22	0.22	5.00	3.31	0.75	9	0.2289	6	Conc.	0.013	2.68	49.30	51.36	53.00	52.77	3.20	0.91	53.16	53.00
P-14-309	J-14-14	1055	0.56	0.40	0.22	0.22	5.00	3.31	0.75	33	0.0797	6	Conc.	0.013	1.58	49.30	51.93	53.00	53.71	3.20	1.28	53.59	53.00
P-14-310	J-14-15	1040	0.56	0.40	0.22	0.45	5.10	3.30	1.49	41	0.0290	6	Clay	0.011	1.13	53.55	54.74	57.50	57.30	3.45	2.06	58.10	56.04
P-14-311	1040	1038	0.56	0.40	0.22	0.22	5.00	3.31	0.75	22	0.0341	6	Clay	0.011	1.22	54.78	55.53	57.30	57.63	2.02	1.60	57.58	57.30
P-14-312	4012	1039	0.56	0.40	0.22	0.22	5.00	3.31	0.75	10	0.1200	8	Clay	0.011	4.95	54.38	55.58	58.06	57.68	3.01	1.43	56.16	56.15
P-14-313	4012	1037	0.56	0.40	0.22	0.22	5.00	3.31	0.75	22	0.0586	8	Clay	0.011	3.46	54.36	55.65	58.06	57.65	3.03	1.33	56.18	56.15

System Flow > Pipe Capacity
Ground elevation interpolated from nearest structure
Invert elevation interpolated from upstream and downstream nodes

Kelso Stormwater Management Plan
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Basin 14

Table 14.2 - Existing Pipe Totals

Pipe Size	Conc.	PVC	Clay	Total	Percentage
6-inch	1,103	0	63	1166	17.88%
8-inch	2,246	2	32	2280	34.96%
10-inch	773	0	822	1595	24.46%
12-inch	1,146	0	0	1146	17.57%
15-inch	0	0	0	0	0.00%
18-inch	0	0	0	0	0.00%
21-inch	0	0	0	0	0.00%
24-inch	335	0	0	335	5.14%
30-inch	0	0	0	0	0.00%
36-inch	0	0	0	0	0.00%
Total	**5603**	**2**	**917**	**6,522**	**100.00%**
Percentage	**85.91%**	**0.03%**	**14.06%**	**100.00%**	

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Phase II
Basin 14

Table 14.3 - Recommended Trunk Line Improvements

Pipe	Exist. Size	Prop. Size	Length
P-14-102	24-inch	30-inch	151
P-14-103	24-inch	30-inch	80
P-14-104	12-inch	24-inch	43
P-14-105	12-inch	24-inch	187
P-14-106	10-inch	24-inch	78
P-14-107	10-inch	24-inch	89
P-14-108	10-inch	24-inch	113
P-14-109	8-inch	18-inch	22
P-14-110	8-inch	18-inch	34
P-14-111	8-inch	18-inch	203
P-14-112	8-inch	12-inch	67
P-14-113	8-inch	12-inch	211
P-14-114	8-inch	12-inch	35
P-14-115	8-inch	12-inch	249
P-14-200	12-inch	18-inch	76
P-14-201	12-inch	18-inch	181
P-14-202	10-inch	18-inch	310
P-14-203	10-inch	18-inch	201
P-14-204	10-inch	18-inch	64
P-14-205	10-inch	12-inch	237
P-14-206	10-inch	12-inch	256
P-14-207	8-inch	12-inch	237
P-14-208	8-inch	12-inch	289
P-14-209	8-inch	12-inch	260
P-14-300	10-inch	18-inch	259
P-14-301	10-inch	12-inch	35
P-14-302	10-inch	12-inch	262
Total			**4,229**

Kelso Stormwater Management Plan
Phase II
Basin 14

Table 14.4 - Preliminary Opinion of Probable Cost

Item	Description	QTY	Unit	Price	Total
1	Mobilization	1	LS	$ 27,000	$ 27,000
2	Traffic Control	1	LS	$ 10,000	$ 10,000
3	Clearing and Grubbing	1	LS	$ 5,000	$ 5,000
4	Removal of Structures and Obstructions	1	LS	$ 7,500	$ 7,500
5	Removal of Existing Asphalt	2520	SY	$ 10	$ 25,200
6	Construction Fabric	1580	SY	$ 2	$ 3,160
7	CSBC	735	Tons	$ 20	$ 14,700
8	CSTC	260	Tons	$ 22	$ 5,720
9	HMA	455	Tons	$ 150	$ 68,250
10	12-inch HDPE	2138	LF	$ 40	$ 85,520
11	18-inch HDPE	1350	LF	$ 50	$ 67,500
12	24-inch HDPE	510	LF	$ 65	$ 33,150
13	30-inch HDPE	231	LF	$ 80	$ 18,480
14	Catch Basins	9	EA	$ 1,200	$ 10,800
15	Manholes	5	EA	$ 1,500	$ 7,500
16	Import Trench Backfill (assume 3' avg)	1580	CY	$ 8	$ 12,640
17	Trench Safety Systems	1	LS	$ 10,000	$ 10,000
	Subtotal				$ 412,120
	Contingency @	20%			$ 82,500
	Total Opinion of Probable Cost				**$ 494,620**

Kelso Stormwater Management Plan
Phase II
Basin 14

Table 14.5 - All Undersized Pipes

Pipe	Exist. Size	Prop. Size	Length
P-14-102	24-inch	30-inch	151
P-14-103	24-inch	30-inch	80
P-14-104	12-inch	18-inch	43
P-14-105	12-inch	18-inch	187
P-14-106	10-inch	24-inch	78
P-14-107	10-inch	24-inch	89
P-14-108	10-inch	24-inch	113
P-14-109	8-inch	18-inch	22
P-14-110	8-inch	18-inch	34
P-14-111	8-inch	18-inch	203
P-14-112	8-inch	12-inch	67
P-14-113	8-inch	12-inch	211
P-14-114	8-inch	12-inch	35
P-14-115	8-inch	12-inch	249
P-14-120	6-inch	12-inch	26
P-14-121	6-inch	12-inch	68
P-14-122	8-inch	12-inch	100
P-14-124	6-inch	6-inch	4
P-14-125	6-inch	12-inch	54
P-14-126	6-inch	18-inch	3
P-14-127	6-inch	12-inch	54
P-14-129	6-inch	12-inch	11
P-14-130	6-inch	12-inch	14
P-14-131	6-inch	12-inch	9
P-14-132	8-inch	12-inch	4
P-14-134	6-inch	12-inch	3
P-14-200	12-inch	18-inch	76
P-14-201	12-inch	18-inch	181
P-14-202	12-inch	18-inch	310
P-14-203	12-inch	18-inch	201
P-14-204	12-inch	18-inch	64
P-14-208	8-inch	12-inch	289
P-14-209	8-inch	12-inch	260
P-14-212	6-inch	12-inch	54
P-14-214	6-inch	12-inch	30
P-14-222	6-inch	12-inch	33
P-14-300	10-inch	18-inch	259
P-14-301	10-inch	18-inch	35
P-14-302	10-inch	12-inch	262
P-14-310	6-inch	12-inch	41
Total			**4,007**

Kelso Stormwater Management Plan
Phase II
Basin 14

Table 14.6 - Basin 14 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1000	305,860.144	1,031,360.211	124.178	ex cb type 1	14	
1005	305,876.544	1,031,139.075	123.007	ex cb type 1	14	
1006	305,917.793	1,031,150.191	123.174	ex cb type 1	14	
1007	305,987.808	1,030,900.898	121.496	ex cb type 1	14	
1008	305,737.791	1,030,829.505	116.47	ex cb type 1	14	
1009	305,803.031	1,030,588.403	101.931	ex cb type 1	14	
1010	305,810.437	1,030,578.875	101.886	ex cb type 1	14	
1011	305,751.565	1,030,572.773	100.873	ex cb type 1	14	
1012	305,820.930	1,030,538.645	100.229	ex cb type 1	14	
1013	306,063.970	1,030,622.110	117.933	ex cb type 1	14	
1014	306,131.578	1,030,398.347	97.257	ex cb type 1	14	
1015	306,091.606	1,030,389.786	96.574	ex cb type 1	14	
1016	305,877.246	1,030,328.668	83.013	ex cb type 1	14	
1020	305,890.749	1,030,290.635	81.606	ex cb type 1	14	
1021	306,196.898	1,030,160.770	76.403	ex cb type 1	14	
1022	306,159.088	1,030,141.588	75.585	ex cb type 1	14	
1023	305,945.644	1,030,089.914	66.161	ex cb type 2	14	
1024	305,893.809	1,030,074.117	65.362	ex cb type 2	14	
1025	305,963.522	1,030,027.337	63.828	ex cb type 1	14	
1026	306,017.283	1,029,838.847	57.47	ex cb type 1	14	
1027	305,956.509	1,029,803.287	57.003	ex cb type 1	14	
1028	306,043.719	1,029,798.957	56.116	ex cb type 1	14	
1029	306,034.977	1,029,776.767	56.516	ex cb type 2	14	
1030	305,982.788	1,029,763.157	56.658	ex cb type 2	14	
1031	306,281.822	1,029,849.006	56.815	ex cb type 2	14	
1032	306,286.495	1,029,894.383	57.389	ex cb type 2	14	
1033	306,267.021	1,029,911.380	57.764	ex cb type ?	14	
1034	306,225.479	1,029,880.305	57.403	ex cb type 2	14	
1035	306,235.927	1,029,901.471	57.784	ex cb type 1	14	
1036	306,036.295	1,029,825.932	56.821	ex cb type 2	14	
1037	306,490.723	1,029,974.008	57.653	ex cb type 2	14	
1038	306,476.759	1,029,948.884	57.627	ex cb type 2	14	
1039	306,512.066	1,029,980.054	57.682	ex cb type 2	14	
1040	306,482.362	1,029,927.839	57.295	ex cb type 2	14	
1041	306,065.931	1,029,668.904	55.892	ex cb type 1	14	
1042	306,097.044	1,029,587.709	55.343	ex cb type 1	14	
1043	306,014.139	1,029,654.030	56.134	ex cb type 2	14	
1044	306,032.265	1,029,572.425	56.142	ex cb type 1	14	
1045	306,072.988	1,029,448.378	56.811	ex cb type 1	14	
1046	306,121.867	1,029,529.102	55.333	ex cb type 1	14	
1047	306,415.316	1,029,412.362	52.565	ex cb type 1	14	
1048	306,373.315	1,029,400.108	51.92	ex cb type 1	14	
1049	306,249.780	1,029,313.901	45.329	ex cb type 1	14	

Table 14.6 - Basin 14 Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1050	306,633.750	1,029,473.427	48.186	ex cb type 2	14	
1051	306,664.400	1,029,467.365	47.066	ex cb type 2	14	
1052	306,666.610	1,029,468.956	47.162	ex cb type 2	14	
1053	306,674.858	1,029,431.877	47	ex cb type 2	14	
1054	306,593.654	1,029,723.846	52.77	ex cb type 1	14	
1055	306,556.505	1,029,713.163	53.713	ex cb type 1	14	
1056	306,303.834	1,029,639.136	54.346	ex cb type 1	14	
1057	306,335.980	1,029,660.078	54.328	ex cb type 2	14	
1852	306,178.077	1,029,328.967	43.452	ex cb type 1	14	
1853	306,172.960	1,029,209.510	32.86	ex cb type 1	14	
1854	306,097.877	1,029,359.498	59.708	ex cb type ?	14	
1855	306,150.524	1,029,374.655	655.59	ex cb type ?	14	
1900	306,208.360	1,029,062.663	32.201	ex cb type ?	14	
4000	305,829.499	1,031,343.112	124.695	ex mh type ?	14	
4003	305,555.735	1,031,280.090	122.706	ex mh type ?	14	Deleted - SS per City
4004	305,889.455	1,031,132.672	123.345	ex mh type ?	14	
4005	306,054.667	1,030,608.899	118.086	ex mh type ?	14	
4006	305,803.707	1,030,564.230	101.557	ex mh type ?	14	
4007	306,120.199	1,030,381.556	96.486	ex mh type ?	14	
4008	306,191.211	1,030,135.969	75.708	ex mh type ?	14	
4009	305,948.913	1,030,090.505	66.72	ex mh type ?	14	
4010	306,038.155	1,029,777.590	57.007	ex mh type ?	14	
4012	306,512.601	1,029,970.130	58.059	ex mh type ?	14	
4013	306,103.323	1,029,541.717	56.063	ex mh type ?	14	Deleted - SS per City
4015	306,426.144	1,029,359.253	53.39	ex mh type ?	14	
4341	306,158.030	1,029,326.460	0		14	
4342	306,178.421	1,029,288.825	42.153	ex mh type ?	14	
4391	306,107.448	1,029,506.969	56.098	ex mh type ?	14	
8000	306,211.667	1,028,958.613	19.308	OUTFALL	14	
8001	306,213.000	1,028,986.000	40.163	ex mh type ?	14	

Appendix G

Additional Data

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
133	297,228.250	1,031,814.369	12.933	709		Control Point
134	305,036.075	1,029,047.871	26.025	CTY_50		Control Point
136	297,228.211	1,031,814.396	12.934	709		Control Point
137	297,228.264	1,031,814.367	13.029	709		Control Point
138	297,228.243	1,031,814.405	12.96	709		Control Point
139	297,228.230	1,031,814.364	13.048	709		Control Point
140	297,228.257	1,031,814.371	12.984	709		Control Point
141	297,228.203	1,031,814.399	12.972	WCCS		Control Point
147	297,228.232	1,031,814.445	13.038	709		Control Point
709	297,228.140	1,031,814.310	12.98	WCCS		Control Point
1000	305,860.144	1,031,360.211	124.178	ex cb type 1	14	
1001	305,597.643	1,031,319.697	121.829	ex cb type 1	12	
1002	305,605.792	1,031,284.815	121.622	ex cb type 1	12	
1003	305,552.539	1,031,267.332	121.812	ex cb type 1	12	
1004	305,665.549	1,031,079.502	122.576	ex cb type 1	12	
1005	305,876.544	1,031,139.075	123.007	ex cb type 1	14	
1006	305,917.793	1,031,150.191	123.174	ex cb type 1	14	
1007	305,987.808	1,030,900.898	121.496	ex cb type 1	14	
1008	305,737.791	1,030,829.505	116.47	ex cb type 1	14	
1009	305,803.031	1,030,588.403	101.931	ex cb type 1	14	
1010	305,810.437	1,030,578.875	101.886	ex cb type 1	14	
1011	305,751.565	1,030,572.773	100.873	ex cb type 1	14	
1012	305,820.930	1,030,538.645	100.229	ex cb type 1	14	
1013	306,063.970	1,030,622.110	117.933	ex cb type 1	14	
1014	306,131.578	1,030,398.347	97.257	ex cb type 1	14	
1015	306,091.606	1,030,389.786	96.574	ex cb type 1	14	
1016	305,877.246	1,030,328.668	83.013	ex cb type 1	14	
1017	305,821.535	1,030,326.946	82.835	ex cb type 1	13	
1020	305,890.749	1,030,290.635	81.606	ex cb type 1	14	
1021	306,196.898	1,030,160.770	76.403	ex cb type 1	14	
1022	306,159.088	1,030,141.588	75.585	ex cb type 1	14	
1023	305,945.644	1,030,089.914	66.161	ex cb type 2	14	
1024	305,893.809	1,030,074.117	65.362	ex cb type 2	14	
1025	305,963.522	1,030,027.337	63.828	ex cb type 1	14	
1026	306,017.283	1,029,838.847	57.47	ex cb type 1	14	
1027	305,956.509	1,029,803.287	57.003	ex cb type 1	14	
1028	306,043.719	1,029,798.957	56.116	ex cb type 1	14	
1029	306,034.977	1,029,776.767	56.516	ex cb type 2	14	
1030	305,982.788	1,029,763.157	56.658	ex cb type 2	14	
1031	306,281.822	1,029,849.006	56.815	ex cb type 2	14	
1032	306,286.495	1,029,894.383	57.389	ex cb type 2	14	
1033	306,267.021	1,029,911.380	57.764	ex cb type ?	14	
1034	306,225.479	1,029,880.305	57.403	ex cb type 2	14	
1035	306,235.927	1,029,901.471	57.784	ex cb type 1	14	
1036	306,036.295	1,029,825.932	56.821	ex cb type 2	14	
1037	306,490.723	1,029,974.008	57.653	ex cb type 2	14	
1038	306,476.759	1,029,948.884	57.627	ex cb type 2	14	
1039	306,512.066	1,029,980.054	57.682	ex cb type 2	14	
1040	306,482.362	1,029,927.839	57.295	ex cb type 2	14	

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1041	306,065.931	1,029,668.904	55.892	ex cb type 1	14	
1042	306,097.044	1,029,587.709	55.343	ex cb type 1	14	
1043	306,014.139	1,029,654.030	56.134	ex cb type 2	14	
1044	306,032.265	1,029,572.425	56.142	ex cb type 1	14	
1045	306,072.988	1,029,448.378	56.811	ex cb type 1	14	
1046	306,121.867	1,029,529.102	55.333	ex cb type 1	14	
1047	306,415.316	1,029,412.362	52.565	ex cb type 1	14	
1048	306,373.315	1,029,400.108	51.92	ex cb type 1	14	
1049	306,249.780	1,029,313.901	45.329	ex cb type 1	14	
1050	306,633.750	1,029,473.427	48.186	ex cb type 2	14	
1051	306,664.400	1,029,467.365	47.066	ex cb type 2	14	
1052	306,666.610	1,029,468.956	47.162	ex cb type 2	14	
1053	306,674.858	1,029,431.877	47	ex cb type 2	14	
1054	306,593.654	1,029,723.846	52.77	ex cb type 1	14	
1055	306,556.505	1,029,713.163	53.713	ex cb type 1	14	
1056	306,303.834	1,029,639.136	54.346	ex cb type 1	14	
1057	306,335.980	1,029,660.078	54.328	ex cb type 2	14	
1058	305,466.286	1,030,749.538	111.947	ex cb type 2	13	
1059	305,476.320	1,030,712.240	111.556	ex cb type 2	13	
1060	305,439.695	1,030,701.312	112.074	ex cb type 2	13	
1061	305,428.250	1,030,738.294	111.905	ex cb type 2	13	
1062	305,299.109	1,030,695.969	109.573	ex cb type 2	13	
1063	305,305.992	1,030,669.954	108.804	ex cb type 1	13	
1064	305,563.273	1,030,292.230	86.506	ex cb type 2	13	
1065	305,335.133	1,030,278.234	48.446	ex cb type 2	13	
1066	305,298.008	1,030,236.303	40.406	ex cb type 2	13	
1067	305,242.091	1,030,429.312	58.534	ex cb type 2	13	
1068	305,362.174	1,030,178.370	41.283	ex cb type 1	13	
1069	305,371.497	1,030,129.717	39.914	ex cb type 1	13	
1070	305,393.146	1,029,931.820	36.451	ex cb type 1	13	
1071	305,426.046	1,029,941.523	37.435	ex cb type 1	13	
1072	305,446.660	1,029,936.427	38.473	ex cb type ?	13	
1073	305,458.955	1,029,893.587	38.276	ex cb type ?	13	
1074	305,650.601	1,029,938.348	51.955	ex cb type 1	13	
1075	305,695.511	1,029,951.022	53.728	ex cb type 1	13	
1076	305,693.847	1,030,007.052	54.171	ex cb type ?	13	
1077	305,673.434	1,030,012.949	53.211	ex cb type 1	13	
1078	305,645.974	1,030,005.385	51.931	ex cb type ?	13	
1079	305,656.812	1,030,225.164	68.457	ex cb type 1	13	
1080	305,623.248	1,030,250.901	66.961	ex cb type 1	13	
1081	305,129.087	1,030,061.215	21.932	ex cb type 1	13	
1082	305,140.713	1,030,077.232	22.543	ex cb type 1	13	
1083	305,136.461	1,030,118.758	22.354	ex cb type 1	13	
1084	305,116.426	1,030,129.283	21.145	ex cb type 1	13	
1085	305,071.918	1,030,292.289	23.095	ex cb type 1	13	
1086	305,060.451	1,030,328.964	22.796	ex cb type 2	13	
1087	305,078.689	1,030,362.363	28.02	ex cb type 1	13	
1088	305,036.850	1,030,370.620	23.946	ex cb type 1	13	
1089	304,966.935	1,030,598.378	30.236	ex cb type 1	13	

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1090	304,978.044	1,030,595.540	30.286	ex cb type ?	13	
1091	304,909.922	1,030,791.672	34.244	ex cb type 2	13	
1092	304,909.552	1,030,597.531	30.347	ex cb type 1	13	
1093	304,986.513	1,030,358.915	23.798	ex cb type 1	13	
1094	304,992.988	1,030,304.969	23.172	ex cb type 1	13	
1095	305,066.338	1,030,112.754	21.672	ex cb type 1	13	
1096	305,085.015	1,030,045.741	21.626	ex cb type 1	13	
1097	304,876.811	1,030,037.711	20.735	ex cb type 1	13	
1098	304,810.043	1,030,054.189	20.115	ex cb type 1	13	
1099	304,746.565	1,030,421.773	18.031	ex cb type 1	13	
1100	303,993.125	1,030,546.056	22.186	ex cb type 1	10	
1101	304,326.411	1,030,478.286	16.512	ex cb type 1	13	
1102	305,589.736	1,030,299.586	87.041	ex cb type 2	13	
1103	304,786.934	1,030,299.898	16.92	ex cb type 1	13	
1104	304,699.259	1,031,438.806	32.964	ex cb type 1	12	
1105	304,677.102	1,031,713.098	26.813	ex cb type 1	12	
1106	304,681.068	1,031,966.363	20.787	ex cb type 1	12	
1107	304,811.207	1,032,287.992	16.742	ex cb type 1	12	
1108	304,933.817	1,032,607.962	13.804	ex cb type 1	12	
1109	304,993.570	1,032,667.036	14.303	ex cb type 1	12	
1110	305,052.707	1,032,603.285	14.148	ex cb type 1	12	Deleted - Heads to WSDOT grate
1111	305,070.778	1,032,640.499	14.398	ex cb type 1	12	Deleted - Heads to WSDOT grate
1112	304,902.396	1,032,321.270	16.393	ex cb type 1	12	
1113	304,773.191	1,031,976.122	20.97	ex cb type 1	12	
1114	304,737.546	1,031,711.025	26.715	ex cb type 1	12	
1115	304,762.381	1,031,418.738	33.404	ex cb type 1	12	
1116	304,836.742	1,031,216.596	35.974	ex cb type 2	12	
1117	303,951.438	1,030,750.424	14.965	ex cb type 1	12	
1118	303,908.782	1,030,772.935	14.996	ex cb type 1	12	
1119	303,938.106	1,031,006.162	13.851	ex cb type 2	12	
1120	303,898.690	1,031,031.688	14.47	ex cb type 1	12	
1121	303,889.325	1,031,258.809	14.22	ex cb type 1	12	
1122	304,096.144	1,031,332.454	13.665	ex cb type 1	12	
1123	304,132.112	1,031,315.286	12.76	ex cb type 1	12	
1124	304,104.174	1,031,302.776	12.904	ex cb type 2	12	
1125	304,192.485	1,031,114.980	13.442	ex cb type 2	12	
1126	304,158.316	1,031,104.079	13.284	ex cb type 2	12	
1127	304,166.570	1,031,071.429	13.437	ex cb type 2	12	
1128	304,202.297	1,031,080.592	13.413	ex cb type 2	12	
1129	304,228.399	1,030,864.282	14.593	ex cb type 2	12	
1130	304,235.821	1,030,831.188	14.786	ex cb type 1	12	
1131	304,271.982	1,030,838.198	14.85	ex cb type 1	12	
1132	304,330.168	1,030,629.622	15.468	ex cb type 1	13	
1133	304,548.920	1,030,956.345	13.751	ex cb type 2	12	
1134	304,562.769	1,030,924.963	14.235	ex cb type 2	12	
1135	304,454.533	1,031,154.039	13.299	ex cb type 2	12	
1136	304,446.208	1,031,187.236	13.559	ex cb type 2	12	
1137	304,512.901	1,031,689.849	11.615	ex cb type 1	12	
1138	304,482.674	1,031,688.293	11.601	ex cb type 1	12	

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1139	303,352.469	1,030,946.661	21.623	ex cb type 1	10	
1140	303,859.434	1,031,309.261	15.408	ex cb type ?	12	
1141	303,923.548	1,031,251.886	13.563	ex cb type 1	12	
1142	303,715.011	1,031,331.599	19.219	ex cb type ?	11	
1143	303,641.229	1,031,871.062	18.227	ex cb type ?	11	
1144	303,961.568	1,032,025.178	19.339	ex cb type ?	12	
1145	304,094.008	1,032,405.501	21.394	ex cb type ?	12	
1146	304,084.327	1,032,503.013	21.445	ex cb type ?	12	
1147	304,209.184	1,031,764.636	17.702	ex cb type 1	12	
1148	304,259.697	1,031,779.127	16.395	ex cb type 1	12	
1149	304,329.136	1,031,792.411	14.333	ex cb type ?	12	
1150	304,202.488	1,031,916.006	18.215	ex cb type ?	12	
1151	304,372.749	1,032,018.931	18.32	ex cb type ?	12	
1152	304,370.111	1,032,091.946	18.495	ex cb type 1	12	
1153	304,265.696	1,032,095.798	20.572	ex cb type 1	12	
1154	304,188.585	1,032,244.782	19.908	ex cb type ?	12	
1155	304,314.654	1,032,240.425	19.864	ex cb type ?	12	
1156	304,445.232	1,032,207.635	19.749	ex cb type ?	12	
1157	304,479.893	1,032,602.693	17.291	ex cb type ?	12	
1158	304,633.036	1,032,364.071	19.656	ex cb type 1	12	
1159	304,662.833	1,032,403.046	19.285	ex cb type ?	12	
1160	304,778.649	1,032,326.041	18.717	ex cb type ?	12	
1161	304,623.106	1,032,111.243	19.884	ex cb type ?	12	
1162	304,509.712	1,032,228.053	19.529	ex cb type ?	12	
1163	303,126.752	1,031,545.723	19.181	ex cb type ?	11	
1164	302,907.526	1,031,423.818	19.154	ex cb type ?	11	
1165	302,661.340	1,031,634.245	18.425	ex cb type ?	11	
1166	302,680.615	1,031,970.538	18.555	CB	11	Deleted - Duplicate of 1168
1167	302,849.663	1,031,850.362	20.515	ex cb type 1	11	
1168	302,680.619	1,031,970.470	18.527	ex cb type ?	11	
1169	302,801.052	1,032,235.174	19.31	ex cb type ?	11	
1170	303,059.618	1,032,320.927	18.909	ex cb type ?	11	
1171	303,207.425	1,032,323.983	20.797	ex cb type ?	11	
1172	303,346.455	1,032,421.679	20.394	ex cb type ?	11	
1173	303,621.938	1,032,419.982	18.687	ex cb type ?	12	
1174	303,927.099	1,032,323.972	18.951	ex cb type ?	12	
1175	304,253.672	1,031,787.359	17.094	ex cb type 1	11	
1176	303,612.970	1,031,445.456	19.936	ex cb type 1	11	
1177	303,674.838	1,031,365.932	19.836	ex cb type 1	11	
1178	303,568.657	1,031,513.177	20.585	ex cb type 1	11	Deleted - per City of Kelso
1179	303,483.460	1,031,378.404	20.551	ex cb type 1	11	
1180	303,466.743	1,031,466.121	21.532	ex cb type 1	11	Deleted - per City of Kelso
1181	303,354.372	1,031,223.789	20.545	ex cb type 1	11	
1182	303,321.824	1,031,219.852	19.834	ex cb type 1	11	
1183	303,286.250	1,031,215.566	19.571	ex cb type ?	11	
1184	304,477.696	1,031,198.108	13.6	ex cb type 2	12	
1185	304,588.600	1,032,306.000	19.16	ex cb type 1	12	
1186	302,416.582	1,031,625.778	20.406	ex cb type 1	11	
1187	302,331.737	1,031,876.987	19.777	ex cb type ?	11	

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1188	302,331.380	1,032,077.494	21.637	ex cb type 1	11	
1189	302,398.781	1,032,062.022	21.869	ex cb type 1	11	
1190	302,437.473	1,032,055.550	21.127	ex cb type 1	11	
1191	302,497.357	1,032,104.231	20.902	ex cb type 1	11	
1192	302,632.156	1,032,420.419	22.735	ex cb type 1	11	
1193	302,729.944	1,032,432.171	24.17	ex cb type 1	11	
1194	306,051.106	1,031,452.880	138.48	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1195	306,078.289	1,031,478.330	139.151	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1196	306,237.306	1,032,079.695	114.722	ex cb type 1	12	
1197	303,301.422	1,031,761.086	19.036	ex cb type ?	11	
1198	305,536.614	1,032,317.838	99.717	ex cb type 1	12	
1199	305,546.220	1,032,285.342	102.806	ex cb type 2	12	
1200	305,539.105	1,031,631.949	94.622	ex cb type 1	12	
1201	305,815.693	1,031,779.154	113.671	ex cb type 1	12	
1202	305,254.778	1,031,159.210	120.966	ex cb type 2	12	
1203	305,899.492	1,029,258.614	35.418	ex cb type 1	10	
1204	305,643.764	1,029,189.341	24.89	ex cb type 2	10	
1205	305,611.044	1,029,180.164	25.009	ex cb type 2	10	
1206	305,601.518	1,029,166.168	24.912	ex cb type 2	10	
1207	305,419.766	1,029,114.080	25.773	ex cb type 2	10	
1208	305,397.073	1,029,115.259	25.408	ex cb type 1	10	
1209	305,354.451	1,029,115.918	25.069	ex cb type 1	10	
1210	305,352.915	1,029,086.723	26.335	ex cb type 1	10	
1211	305,328.700	1,029,084.973	26.329	ex cb type 1	10	
1212	305,276.686	1,029,071.044	22.39	ex cb type 1	10	
1213	305,260.516	1,029,060.853	26.188	ex cb type 1	10	
1214	305,157.716	1,029,050.390	25.592	ex cb type 1	10	
1215	305,143.273	1,029,023.490	25.55	ex cb type 1	10	
1216	305,093.373	1,029,057.606	25.459	ex cb type 1	10	
1217	304,794.447	1,028,972.058	24.876	ex cb type 1	10	
1218	304,485.976	1,028,879.118	25.761	ex cb type 1	10	
1219	304,483.812	1,028,929.091	24.645	ex cb type 1	10	
1220	304,391.544	1,028,902.640	24.662	ex cb type 1	10	
1221	304,328.883	1,028,884.866	24.644	ex cb type 1	10	
1222	303,814.620	1,028,882.173	23.355	ex cb type 1	1	Deleted - Phase I
1223	304,196.784	1,028,992.873	23.701	ex cb type 1	10	
1224	304,307.465	1,029,008.566	23.548	ex cb type 1	10	
1225	304,446.833	1,029,066.130	23.568	ex cb type 2	10	
1226	304,343.354	1,029,022.643	23.933	ex cb type 1	10	
1227	304,557.670	1,029,087.138	23.858	ex cb type 2	10	
1228	304,590.557	1,029,095.787	24.062	ex cb type 2	10	
1229	304,697.315	1,029,138.034	23.962	ex cb type 2	10	
1230	304,948.968	1,029,210.023	23.927	ex cb type 2	10	
1231	305,094.460	1,029,252.587	24.398	ex cb type 1	10	
1232	305,194.265	1,029,280.315	24.277	ex cb type 1	10	
1233	305,304.063	1,029,297.663	23.905	ex cb type 1	13	
1234	305,341.220	1,029,307.081	23.708	ex cb type 2	13	
1235	303,909.290	1,028,699.835	23.559	ex cb type 1	1	Deleted - Phase I
1236	303,886.125	1,028,719.333	24.436	ex cb type 1	1	Deleted - Phase I

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1237	305,825.261	1,029,502.814	47.944	ex cb type 1	10	Deleted - Bubblers, insufficient data to connect to system
1238	305,776.794	1,029,486.546	45.342	ex cb type 2	10	Deleted - Bubblers, insufficient data to connect to system
1239	305,576.230	1,029,431.154	34.361	ex cb type 1	13	
1240	305,528.626	1,029,416.290	32.861	ex cb type 1	13	
1241	305,342.209	1,029,362.319	23.791	ex cb type 2	13	
1242	305,183.522	1,029,316.955	23.762	ex cb type 2	10	
1243	304,937.830	1,029,246.715	23.767	ex cb type 2	10	
1244	304,685.824	1,029,174.592	23.896	ex cb type 2	10	
1245	304,435.480	1,029,102.976	23.892	ex cb type 2	10	
1246	304,185.004	1,029,032.963	23.819	ex cb type 1	10	
1247	303,803.160	1,028,924.032	23.257	ex cb type 1	1	Deleted - Phase I
1248	303,675.914	1,029,124.680	21.801	ex cb type 2	1	Deleted - Phase I
1249	303,669.279	1,029,145.578	21.588	ex cb type 1	1	Deleted - Phase I
1250	303,734.506	1,029,164.070	21.39	ex cb type 2	10	
1251	303,740.403	1,029,144.260	21.307	ex cb type 2	10	
1252	303,959.033	1,029,228.563	21.637	ex cb type 2	10	
1253	303,964.770	1,029,207.377	21.651	ex cb type 2	10	
1254	304,023.563	1,029,247.090	21.635	ex cb type 2	10	
1255	304,030.217	1,029,225.923	21.649	ex cb type 2	10	
1256	304,281.735	1,029,291.855	21.75	ex cb type 2	10	
1257	304,273.505	1,029,324.673	21.797	ex cb type 2	10	
1258	304,454.206	1,029,376.463	22.017	ex cb type 2	10	
1259	304,466.131	1,029,345.357	25.891	ex cb type 2	10	
1260	304,531.174	1,029,363.188	22.124	ex cb type 2	10	
1261	304,522.088	1,029,395.785	21.92	ex cb type 2	10	
1262	304,707.728	1,029,448.961	22.161	ex cb type 2	10	
1263	304,717.502	1,029,416.295	22.12	ex cb type 2	10	
1264	304,781.777	1,029,470.276	22.204	ex cb type 2	10	
1265	304,791.423	1,029,437.723	22.146	ex cb type 2	10	
1266	304,960.166	1,029,521.462	21.627	ex cb type 2	10	
1267	304,969.012	1,029,488.448	21.995	ex cb type 2	10	
1268	305,027.702	1,029,505.555	22.076	ex cb type 1	10	
1269	305,040.820	1,029,541.650	21.938	ex cb type 1	10	
1270	305,239.308	1,029,551.688	22.659	ex cb type 1	13	
1271	305,270.242	1,029,555.047	22.32	ex cb type 2	13	
1272	305,276.315	1,029,576.418	22.273	ex cb type 2	13	
1273	305,257.437	1,029,610.996	22.147	ex cb type 2	13	
1274	305,500.080	1,029,673.665	36.321	ex cb type 1	13	
1275	305,495.267	1,029,691.019	35.804	ex cb type 1	13	
1276	305,460.701	1,029,689.781	35.236	ex cb type 1	13	
1277	305,219.738	1,029,825.107	23.688	ex cb type 1	13	
1278	305,198.243	1,029,809.277	22.08	ex cb type 1	13	
1279	305,145.500	1,029,789.266	22.83	ex cb type 1	13	
1280	305,122.103	1,029,750.356	23.052	ex cb type 1	13	
1281	305,136.275	1,029,640.994	26.355	ex cb type 1	13	
1282	305,162.682	1,029,507.776	34.739	ex cb type 1	13	Deleted - On Allen St. bridge, connection unknown

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1283	305,194.485	1,029,385.811	43.887	ex cb type 1	13	Deleted - On Allen St. bridge, connection unknown
1284	305,247.502	1,029,399.483	43.786	ex cb type 1	13	Deleted - On Allen St. bridge, connection unknown
1285	305,216.871	1,029,519.825	34.772	ex cb type 1	13	Deleted - On Allen St. bridge, connection unknown
1286	305,202.843	1,029,643.321	26.099	ex cb type 1	13	
1287	305,203.061	1,029,673.721	24.614	ex cb type 1	13	
1288	305,224.751	1,029,715.336	22.963	ex cb type 1	13	
1289	305,121.358	1,029,841.093	22.998	ex cb type 1	13	
1290	305,042.466	1,029,777.077	21.753	ex cb type 1	13	
1291	304,957.230	1,029,742.637	20.49	ex cb type 1	13	
1292	304,911.544	1,029,732.764	20.6	ex cb type 1	13	
1293	304,914.185	1,029,861.845	20.105	ex cb type 1	13	
1294	304,878.578	1,029,995.611	20.563	ex cb type 1	10	
1295	304,887.440	1,029,850.772	20.01	ex cb type 1	13	
1296	304,897.053	1,029,776.378	20.209	ex cb type 1	13	
1297	304,693.474	1,029,659.777	21.1	ex cb type 2	10	
1298	304,662.075	1,029,672.363	20.947	ex cb type 2	10	
1299	304,459.634	1,029,617.215	20.054	ex cb type 2	10	
1300	304,450.140	1,029,641.539	19.765	ex cb type 2	10	
1301	304,387.951	1,029,623.584	19.792	ex cb type 2	10	
1302	304,395.442	1,029,598.850	20.102	ex cb type 2	10	
1303	304,199.346	1,029,570.621	19.979	ex cb type 1	10	
1304	304,211.762	1,029,541.191	20.26	ex cb type 1	10	
1305	304,043.551	1,029,525.029	20.141	ex cb type 2	10	
1306	304,050.572	1,029,500.528	20.311	ex cb type 2	10	
1307	303,942.691	1,029,447.708	20.495	ex cb type 2	10	
1308	303,921.791	1,029,441.673	20.552	ex cb type 2	10	
1309	303,894.994	1,029,455.739	20.486	ex cb type 2	10	
1310	303,887.581	1,029,480.376	20.611	ex cb type 2	10	
1311	303,654.607	1,029,383.396	21.106	ex cb type 1	10	
1312	303,623.752	1,029,375.548	21.135	ex cb type 2	10	
1313	303,598.918	1,029,397.794	21.005	ex cb type 2	10	
1314	303,562.674	1,029,610.056	19.949	ex cb type 2	10	
1315	303,519.116	1,029,620.558	19.745	ex cb type 2	10	
1316	303,513.175	1,029,641.600	19.662	ex cb type 2	10	
1317	303,583.734	1,029,616.025	19.885	ex cb type 2	10	
1318	303,624.377	1,029,673.403	19.713	ex cb type 2	10	
1319	303,630.768	1,029,652.476	19.742	ex cb type 2	10	
1320	303,806.516	1,029,702.848	19.315	ex cb type 2	10	
1321	303,799.918	1,029,723.712	19.126	ex cb type 2	10	
1322	303,850.486	1,029,691.247	19.399	ex cb type 2	10	
1323	303,871.179	1,029,697.650	19.382	ex cb type 2	10	
1324	303,910.437	1,029,732.637	19.2	ex cb type 2	10	
1325	303,904.121	1,029,753.481	19.174	ex cb type 2	10	
1326	304,064.824	1,029,799.528	18.675	ex cb type 2	10	
1327	304,070.592	1,029,778.493	18.55	ex cb type 2	10	
1328	304,144.383	1,029,799.722	18.427	ex cb type 1	10	

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1329	304,230.376	1,029,824.294	18.396	ex cb type 1	10	
1330	304,224.189	1,029,845.006	18.413	ex cb type 1	10	
1331	304,350.492	1,029,834.342	18.958	ex cb type 2	10	
1332	304,371.305	1,029,840.528	18.903	ex cb type 2	10	
1333	304,468.737	1,029,892.776	18.687	ex cb type 2	10	
1334	304,463.838	1,029,913.541	18.94	ex cb type 2	10	
1335	304,600.371	1,029,906.239	19.164	ex cb type 2	10	
1336	304,621.262	1,029,912.243	18.904	ex cb type 2	10	
1337	304,634.603	1,029,940.147	18.946	ex cb type 2	10	
1338	304,629.198	1,029,961.137	18.91	ex cb type 2	10	
1339	304,772.186	1,030,024.317	20.299	ex cb type 1	10	
1340	304,246.530	1,030,093.585	18.395	ex cb type ?	10	
1341	303,810.947	1,029,962.666	18.857	ex cb type 1	10	
1342	303,776.053	1,029,947.182	18.517	ex cb type 1	10	
1343	303,502.276	1,029,913.325	16.962	ex cb type 2	1	Deleted - Phase I
1344	303,509.667	1,029,884.313	17.272	ex cb type 2	1	Deleted - Phase I
1345	303,481.577	1,029,876.573	17.118	ex cb type 2	1	Deleted - Phase I
1346	303,473.017	1,029,904.949	17.052	ex cb type 2	1	Deleted - Phase I
1347	303,033.541	1,031,083.162	20.262	ex cb type 1	10	
1348	303,327.824	1,030,908.939	21.629	ex cb type 1	10	
1349	303,971.181	1,030,510.930	22.343	ex cb type 1	10	
1350	303,015.258	1,030,526.383	11.213	ex cb type 2	10	
1351	303,004.635	1,030,672.663	10.424	ex cb type 2	10	
1352	302,971.555	1,030,693.824	10.69	ex cb type 2	10	
1353	302,965.628	1,030,834.184	9.898	ex cb type 1	10	
1354	302,997.302	1,030,905.926	11.232	ex cb type 1	10	
1355	302,958.575	1,031,073.390	17.99	ex cb type 1	10	
1356	303,056.817	1,031,122.516	20.143	ex cb type 1	10	
1357	302,601.400	1,031,339.650	20.065	ex cb type 1	10	
1358	302,625.768	1,031,378.094	19.92	ex cb type 1	10	
1359	302,509.465	1,031,001.359	11.342	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1360	302,554.532	1,030,979.547	11.505	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1361	302,558.630	1,030,850.988	11.055	ex cb type 1	10	
1362	302,524.465	1,030,849.988	10.957	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1363	302,510.277	1,031,337.255	19.544	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1364	301,921.084	1,031,428.540	11.868	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1365	301,914.755	1,031,469.170	11.95	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1366	301,597.944	1,031,238.789	10.121	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1367	301,564.431	1,031,228.500	9.83	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1368	301,550.380	1,031,265.126	10.087	ex cb type 1	11	
1369	301,633.071	1,030,982.568	8.393	ex cb type ?	1	Deleted - Phase I
1370	301,761.735	1,031,055.896	8.457	ex cb type ?	10	Excluded from model due to insuffient downstream data to connect to system.
1371	301,881.150	1,031,090.923	8.374	ex cb type ?	10	Excluded from model due to insuffient downstream data to connect to system.
1372	301,891.602	1,031,059.917	8.678	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1373	301,956.505	1,031,112.490	8.121	ex cb type ?	10	Excluded from model due to insuffient downstream data to connect to system.
1374	302,113.891	1,031,167.915	10.098	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1375	302,123.611	1,031,129.943	9.519	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1376	302,156.502	1,031,139.623	10.292	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1377	302,145.799	1,031,169.022	10.613	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1378	302,263.825	1,031,200.893	10.737	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1379	302,499.965	1,031,268.214	15.597	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1380	302,369.302	1,030,949.966	10.508	ex cb type ?	10	Excluded from model due to insuffient downstream data to connect to system.
1381	302,378.901	1,030,926.999	9.801	ex cb type ?	10	Excluded from model due to insuffient downstream data to connect to system.
1382	302,206.236	1,030,875.665	11.368	ex cb type 2	10	Excluded from model due to insuffient downstream data to connect to system.

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1383	302,233.670	1,030,782.075	10.545	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1384	302,257.262	1,030,787.882	10.688	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1385	302,023.574	1,030,649.481	10.653	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1386	301,997.992	1,030,642.368	10.714	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1387	301,187.088	1,031,160.908	11.357	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1388	302,135.394	1,031,746.722	21.986	ex cb type 1	11	
1390	302,161.653	1,031,732.921	22.043	ex cb type 1	11	
1391	302,672.087	1,031,240.063	10.421	ex cb type 1	10	
1392	302,805.464	1,031,151.119	9.71	ex cb type 1	10	
1393	302,405.404	1,031,394.280	11.221	ex cb type 1	10	
1394	302,309.597	1,031,451.849	10.786	ex cb type 1	10	Excluded from model due to insuffient downstream data to connect to system.
1395	302,644.058	1,032,494.715	16.581	ex cb type ?	11	Deleted - Connection unknown, assumed to drain to future basin
1396	306,133.522	1,031,226.592	125.62	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1397	306,164.024	1,031,217.886	125.674	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1398	306,205.612	1,030,975.809	121.535	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1399	306,226.821	1,030,981.829	121.122	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1400	306,447.815	1,031,032.538	119.964	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1401	306,681.607	1,030,285.243	73.764	ex cb type ?	N/A	Deleted - Not in Phase II Basins
1402	306,809.615	1,030,864.223	110.655	ex cb type 1	N/A	Deleted - Not in Phase II Basins
1403	306,710.080	1,031,063.205	113.64	ex cb type 1	N/A	Deleted - Not in Phase II Basins
1404	306,697.855	1,031,104.695	114.128	ex cb type 1	N/A	Deleted - Not in Phase II Basins
1405	306,645.327	1,032,059.731	107.476	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1406	306,609.224	1,032,058.383	107.786	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1407	306,924.949	1,031,397.054	112.547	ex cb type ?	N/A	Deleted - Not in Phase II Basins
1408	306,886.605	1,031,388.223	112.639	ex cb type ?	N/A	Deleted - Not in Phase II Basins
1409	306,947.439	1,031,175.635	111.819	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1410	306,989.742	1,031,187.538	112.058	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1411	307,062.309	1,030,936.399	108.006	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1412	307,019.761	1,030,925.134	108.102	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1413	307,032.547	1,030,885.327	107.32	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1414	307,239.249	1,031,259.112	117.867	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1415	307,310.560	1,031,008.655	108.518	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1416	307,270.477	1,030,996.790	108.156	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1417	307,320.998	1,030,967.914	107.612	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1418	307,382.140	1,030,745.001	91.2	ex cb type 2	N/A	Deleted - Not in Phase II Basins

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1422	307,488.799	1,031,330.577	118.702	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1423	307,561.480	1,031,079.568	109.057	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1424	307,572.620	1,031,042.443	108.397	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1425	307,519.961	1,031,069.172	109.42	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1507	305,452.562	1,029,658.881	34.208	ex cb type 1	13	
1508	305,454.347	1,029,851.702	36.517	ex cb type 1	13	
1852	306,178.077	1,029,328.967	43.452	ex cb type 1	14	
1853	306,172.960	1,029,209.510	32.86	ex cb type 1	14	
1854	306,097.877	1,029,359.498	59.708	ex cb type ?	14	
1855	306,150.524	1,029,374.655	655.59	ex cb type ?	14	
1856	301,766.038	1,030,633.714	11.281	ex cb type 2	10	Excluded from model due to insuffient downstream data to connect to system.
1857	301,719.339	1,030,770.289	10.548	ex cb type 2	1	Deleted - Phase I
1858	301,672.159	1,030,846.822	9.487	ex cb type ?	1	Deleted - Phase I
1859	301,667.996	1,031,298.937	9.888	ex cb type ?	11	Excluded from model due to insuffient downstream data to connect to system.
1900	306,208.360	1,029,062.663	32.201	ex cb type ?	14	
4000	305,829.499	1,031,343.112	124.695	ex mh type ?	14	
4002	305,575.514	1,031,285.118	122.465	ex mh type ?	12	
4003	305,555.735	1,031,280.090	122.706	ex mh type ?	14	Deleted - SS per City
4004	305,889.455	1,031,132.672	123.345	ex mh type ?	14	
4005	306,054.667	1,030,608.899	118.086	ex mh type ?	14	
4006	305,803.707	1,030,564.230	101.557	ex mh type ?	14	
4007	306,120.199	1,030,381.556	96.486	ex mh type ?	14	
4008	306,191.211	1,030,135.969	75.708	ex mh type ?	14	
4009	305,948.913	1,030,090.505	66.72	ex mh type ?	14	
4010	306,038.155	1,029,777.590	57.007	ex mh type ?	14	
4012	306,512.601	1,029,970.130	58.059	ex mh type ?	14	
4013	306,103.323	1,029,541.717	56.063	ex mh type ?	14	Deleted - SS per City
4015	306,426.144	1,029,359.253	53.39	ex mh type ?	14	
4016	305,452.823	1,030,723.648	113.214	ex mh type ?	13	
4017	305,329.249	1,030,164.569	39.477	ex mh type ?	13	
4018	305,424.656	1,029,926.644	37.814	ex mh type ?	13	
4019	305,434.574	1,029,924.826	38.137	ex mh type ?	13	
4020	305,629.289	1,029,985.107	51.512	ex mh type ?	13	
4021	305,652.248	1,029,992.851	52.61	ex mh type ?	13	
4022	304,780.622	1,030,310.048	17.584	ex mh type ?	13	
4023	304,859.376	1,030,034.861	20.66	ex mh type ?	13	
4024	304,863.226	1,030,016.121	20.907	ex mh type ?	13	
4025	303,937.789	1,030,778.862	15.757	ex mh type ?	12	
4026	304,106.267	1,031,331.564	13.792	ex mh type ?	12	
4027	304,201.951	1,031,086.930	14.076	ex mh type ?	12	
4028	304,272.253	1,030,847.461	15.446	ex mh type ?	12	
4029	304,333.311	1,030,631.261	15.871	ex mh type ?	13/12	
4030	304,562.382	1,030,929.429	14.674	ex mh type ?	12	
4031	304,412.124	1,031,418.385	14.994	ex mh type ?	12	
4032	304,419.562	1,031,395.558	14.411	ex mh type ?	12	

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
4033	304,643.005	1,031,475.867	15.358	ex mh type ?	12	
4034	304,552.424	1,031,452.688	15.962	ex mh type ?	12	
4035	304,499.210	1,031,650.191	12.374	ex mh type ?	12	Deleted - Insufficient data to connect to system
4036	304,340.817	1,031,604.950	15.934	ex mh type ?	12	
4037	303,901.844	1,031,377.414	17.677	ex mh type ?	12	Deleted - Assumed SS
4038	303,833.029	1,031,304.124	15.84	ex mh type ?	12	Deleted - Assumed SS
4040	303,916.889	1,031,262.695	14.404	ex mh type ?	12	
4041	304,146.724	1,031,683.372	18.956	ex mh type ?	11	
4042	304,371.584	1,032,046.576	18.797	ex mh type ?	12	
4043	304,479.570	1,032,274.297	20.255	ex mh type ?	12	
4044	304,462.123	1,032,508.952	19.605	ex mh type ?	12	
4045	304,553.734	1,032,453.284	20.071	ex mh type ?	12	
4046	302,876.577	1,031,853.101	21.678	ex mh type ?	11	
4047	302,726.411	1,032,073.901	20.453	ex mh type ?	11	
4048	302,966.182	1,032,290.781	20.96	ex mh type ?	11	
4049	303,666.243	1,031,457.935	21.193	ex mh type ?	11	
4050	303,577.103	1,031,674.602	19.784	ex mh type ?	11	
4051	302,754.423	1,031,553.441	20.606	ex mh type ?	11	
4052	302,470.108	1,031,611.248	22.063	ex mh type ?	11	
4053	302,408.903	1,031,731.121	22.311	ex mh type ?	11	
4054	305,099.326	1,030,102.972	22.121	ex mh type ?	13	
4055	305,077.011	1,030,100.052	21.885	ex mh type ?	13	
4056	305,190.624	1,029,858.978	23.041	ex mh type ?	13	
4057	305,153.200	1,029,841.462	23.203	ex mh type ?	13	
4058	304,693.428	1,031,973.796	21.167	ex mh type ?	12	
4059	304,674.096	1,032,014.973	20.403	ex mh type ?	12	
4060	305,036.205	1,030,343.828	23.775	ex mh type ?	13	
4061	304,485.036	1,031,168.144	13.913	ex mh type ?	12	
4062	306,071.517	1,031,429.321	138.545	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4063	305,866.546	1,029,231.177	35.042	ex mh type ?	10	
4065	305,624.234	1,029,162.724	25.993	ex mh type ?	10	
4066	305,422.251	1,029,105.592	26.098	ex mh type ?	10	
4067	305,142.142	1,029,027.740	25.718	ex mh type ?	10	
4068	304,981.635	1,029,024.860	25.577	ex mh type ?	10	
4069	304,790.898	1,028,970.138	24.829	ex mh type ?	10	
4070	304,383.500	1,028,894.893	24.885	ex mh type ?	10	
4071	304,625.039	1,028,962.971	25.628	ex mh type ?	10	
4072	304,335.561	1,028,900.400	25.163	ex mh type ?	10	
4073	303,979.520	1,028,765.232	24.771	ex mh type ?	10	
4074	304,298.545	1,029,028.302	24.523	ex mh type ?	10	
4075	304,303.887	1,029,028.058	24.583	ex mh type ?	10	
4076	304,570.676	1,029,103.913	25.159	ex mh type ?	10	
4077	304,804.189	1,029,170.564	24.747	ex mh type ?	10	
4078	304,971.670	1,029,219.782	24.603	ex mh type ?	10	
4079	305,069.639	1,029,246.703	25.119	ex mh type ?	10	
4080	305,174.773	1,029,277.766	24.629	ex mh type ?	10	
4081	305,309.779	1,029,315.580	24.351	ex mh type ?	13	
4082	305,552.100	1,029,386.833	34.143	ex mh type ?	10	Deleted - SS per City

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
4083	305,545.169	1,029,417.810	34.279	ex mh type ?	13	
4084	304,323.552	1,029,107.153	24.389	ex mh type ?	10	
4085	303,670.542	1,029,142.299	22.119	ex mh type ?	1	Deleted - Phase I
4086	303,735.380	1,029,161.093	22.007	ex mh type ?	10	
4087	303,998.679	1,029,236.345	22.531	ex mh type ?	10	
4088	304,212.959	1,029,297.217	21.934	ex mh type ?	10	
4089	304,205.589	1,029,301.629	22.313	ex mh type ?	10	
4090	304,212.815	1,029,275.822	22.472	ex mh type ?	10	
4091	304,281.218	1,029,322.607	22.195	ex mh type ?	10	
4092	304,484.242	1,029,380.798	22.744	ex mh type ?	10	
4093	304,652.402	1,029,428.151	22.719	ex mh type ?	10	
4094	304,771.284	1,029,463.330	22.755	ex mh type ?	10	
4095	304,970.098	1,029,529.524	22.08	ex mh type ?	10	
4096	305,232.676	1,029,581.666	22.894	ex mh type ?	13	
4097	303,928.659	1,031,008.064	14.831	ex mh type ?	12	
4098	304,933.928	1,029,776.209	21.846	ex mh type ?	13	
4099	304,909.740	1,029,858.502	20.251	ex mh type ?	13	
4100	304,413.741	1,029,626.893	20.685	ex mh type ?	10	
4101	304,209.014	1,029,568.226	20.44	ex mh type ?	10	
4102	304,156.271	1,029,553.990	20.489	ex mh type ?	10	
4103	304,159.077	1,029,511.805	21.306	ex mh type ?	10	
4104	303,927.002	1,029,488.634	20.764	ex mh type ?	10	
4105	303,643.443	1,029,407.440	21.419	ex mh type ?	10	
4106	303,572.260	1,029,655.479	20.014	ex mh type ?	10	
4107	303,855.909	1,029,736.684	19.542	ex mh type ?	10	
4108	304,088.584	1,029,759.245	19.59	ex mh type ?	10	
4109	304,093.005	1,029,753.723	19.222	ex mh type ?	10	
4110	304,132.323	1,029,776.742	19.381	ex mh type ?	10	
4111	304,128.317	1,029,814.337	18.918	ex mh type ?	10	
4112	304,582.159	1,029,956.928	19.566	ex mh type ?	10	
4113	304,586.012	1,029,945.750	19.306	ex mh type ?	10	
4114	304,771.777	1,030,010.462	20.853	ex mh type ?	10	
4115	304,126.197	1,030,020.901	18.836	ex mh type ?	10	
4116	304,118.407	1,030,043.077	18.447	ex mh type ?	10	
4117	304,124.103	1,030,080.462	18.978	ex mh type ?	10	
4118	304,077.838	1,030,068.497	18.681	ex mh type ?	10	
4119	304,079.533	1,030,013.806	18.355	ex mh type ?	10	
4120	303,965.471	1,030,015.532	19.123	ex mh type ?	10	
4121	303,965.270	1,030,021.440	19.12	ex mh type ?	10	
4122	303,803.719	1,029,974.378	19.017	ex mh type ?	10	
4123	303,943.147	1,030,500.043	24.14	ex mh type ?	10	
4124	303,012.879	1,031,042.598	13.737	ex mh type ?	11	
4125	302,689.976	1,031,346.067	21.064	ex mh type ?	10	Deleted - SS per City
4126	302,573.596	1,031,305.131	13.312	ex mh type ?	10	
4127	302,519.875	1,030,990.129	11.999	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
4128	301,552.387	1,031,252.855	10.5	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4129	301,582.306	1,031,259.304	10.424	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4130	302,123.119	1,031,162.038	10.866	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4131	302,201.445	1,030,899.640	11.361	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4132	302,012.155	1,030,642.719	11.385	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4133	301,228.149	1,031,156.516	11.809	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4134	301,283.417	1,031,187.062	11.364	ex mh type ?	11	Excluded from model due to insuffient downstream data to connect to system.
4135	302,411.978	1,031,518.288	21.887	ex mh type ?	11	Deleted - Assumed SS
4136	302,421.108	1,031,531.841	22.665	ex mh type ?	11	
4137	302,425.965	1,031,538.903	23.162	ex mh type ?	11	
4138	302,297.873	1,031,466.187	12.229	ex mh type ?	10	Outfall for Basin 10
4139	302,306.523	1,031,468.774	14.668	ex mh type ?	11	
4140	302,070.711	1,031,393.831	11.812	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4141	303,490.134	1,029,889.275	17.918	ex mh type ?	10	
4142	304,198.326	1,029,387.948	21.471	ex mh type ?	10	
4143	306,139.116	1,031,192.672	125.73	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4144	306,166.702	1,031,096.984	124.026	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4145	306,206.126	1,030,957.527	122.136	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4146	306,562.487	1,030,763.621	114.672	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4147	306,783.465	1,030,827.188	111.805	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4148	306,745.162	1,031,077.261	114.492	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4149	306,965.021	1,031,140.378	112.29	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4150	307,036.011	1,030,893.055	108.349	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4151	307,309.198	1,030,971.421	108.36	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4152	307,414.157	1,030,597.827	76.797	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4153	307,414.837	1,031,487.156	117.876	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4154	307,463.801	1,031,280.877	119.059	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4155	307,561.143	1,031,043.999	109.15	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4341	306,158.030	1,029,326.460	0		14	
4342	306,178.421	1,029,288.825	42.153	ex mh type ?	14	
4343	304,478.485	1,031,186.439	13.659	ex mh type ?	12	
4344	304,241.039	1,030,864.952	15.759	ex mh type ?	12	
4345	304,108.642	1,031,316.787	13.952	ex mh type ?	12	

Table G-1 All Points Listing

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
4346	304,794.157	1,031,970.671	15.084	ex mh type ?	12	
4347	304,799.967	1,031,972.984	15.23	ex mh type ?	12	
4348	304,169.569	1,031,114.484	14.524	ex mh type ?	12	
4349	303,961.398	1,032,601.532	25.583	ex mh type ?	12	
4350	304,625.832	1,031,956.426	11.101	ex mh type ?	10	Deleted - Assumed SS
4351	304,788.784	1,032,295.944	17.255	ex mh type ?	12	
4352	304,444.092	1,032,636.027	21.965	ex mh type ?	12	
4353	304,452.761	1,032,636.725	21.938	ex mh type ?	12	
4354	304,896.251	1,032,557.944	12.922	ex mh type ?	12	
4355	304,467.413	1,032,635.757	23.42	ex mh type ?	12	
4356	304,342.651	1,029,875.989	18.71	ex mh type ?	10	
4357	301,719.339	1,030,770.289	10.548	ex mh type ?	10	Excluded from model due to insuffient downstream data to connect to system.
4358	302,294.475	1,031,479.765	13.534	ex mh type ?	11	Outfall for Basin 11
4391	306,107.448	1,029,506.969	56.098	ex mh type ?	14	
5029	297,228.142	1,031,814.314	12.1817	gps		Control Point
8000	306,211.667	1,028,958.613	19.308	OUTFALL	14	
8001	306,213.000	1,028,986.000	40.163	ex mh type ?	14	
8002	301,176.663	1,031,183.950	7.838	OUTFALL	10	Excluded from model due to insuffient downstream data to connect to system.

Table G-2 Unused Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
133	297,228.250	1,031,814.369	12.933	709		Control Point
134	305,036.075	1,029,047.871	26.025	CTY_50		Control Point
136	297,228.211	1,031,814.396	12.934	709		Control Point
137	297,228.264	1,031,814.367	13.029	709		Control Point
138	297,228.243	1,031,814.405	12.96	709		Control Point
139	297,228.230	1,031,814.364	13.048	709		Control Point
140	297,228.257	1,031,814.371	12.984	709		Control Point
141	297,228.203	1,031,814.399	12.972	WCCS		Control Point
147	297,228.232	1,031,814.445	13.038	709		Control Point
709	297,228.140	1,031,814.310	12.98	WCCS		Control Point
1194	306,051.106	1,031,452.880	138.48	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1195	306,078.289	1,031,478.330	139.151	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1222	303,814.620	1,028,882.173	23.355	ex cb type 1	1	Deleted - Phase I
1235	303,909.290	1,028,699.835	23.559	ex cb type 1	1	Deleted - Phase I
1236	303,886.125	1,028,719.333	24.436	ex cb type 1	1	Deleted - Phase I
1237	305,825.261	1,029,502.814	47.944	ex cb type 1	1	Deleted - Phase I
1238	305,776.794	1,029,486.546	45.342	ex cb type 2	1	Deleted - Phase I
1247	303,803.160	1,028,924.032	23.257	ex cb type 1	1	Deleted - Phase I
1248	303,675.914	1,029,124.680	21.801	ex cb type 2	1	Deleted - Phase I
1249	303,669.279	1,029,145.578	21.588	ex cb type 1	1	Deleted - Phase I
1343	303,502.276	1,029,913.325	16.962	ex cb type 2	1	Deleted - Phase I
1344	303,509.667	1,029,884.313	17.272	ex cb type 2	1	Deleted - Phase I
1345	303,481.577	1,029,876.573	17.118	ex cb type 2	1	Deleted - Phase I
1346	303,473.017	1,029,904.949	17.052	ex cb type 2	1	Deleted - Phase I
1369	301,633.071	1,030,982.568	8.393	ex cb type ?	1	Deleted - Phase I
1396	306,133.522	1,031,226.592	125.62	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1397	306,164.024	1,031,217.886	125.674	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1398	306,205.612	1,030,975.809	121.535	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1399	306,226.821	1,030,981.829	121.122	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1400	306,447.815	1,031,032.538	119.964	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1401	306,681.607	1,030,285.243	73.764	ex cb type ?	N/A	Deleted - Not in Phase II Basins
1402	306,809.615	1,030,864.223	110.655	ex cb type 1	N/A	Deleted - Not in Phase II Basins
1403	306,710.080	1,031,063.205	113.64	ex cb type 1	N/A	Deleted - Not in Phase II Basins
1404	306,697.855	1,031,104.695	114.128	ex cb type 1	N/A	Deleted - Not in Phase II Basins
1405	306,645.327	1,032,059.731	107.476	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1406	306,609.224	1,032,058.383	107.786	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1407	306,924.949	1,031,397.054	112.547	ex cb type ?	N/A	Deleted - Not in Phase II Basins
1408	306,886.605	1,031,388.223	112.639	ex cb type ?	N/A	Deleted - Not in Phase II Basins
1409	306,947.439	1,031,175.635	111.819	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1410	306,989.742	1,031,187.538	112.058	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1411	307,062.309	1,030,936.399	108.006	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1412	307,019.761	1,030,925.134	108.102	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1413	307,032.547	1,030,885.327	107.32	ex cb type 2	N/A	Deleted - Not in Phase II Basins

Table G-2 Unused Points

Point	Northing	Easting	Elevation	Full Description	Basin	Comment
1414	307,239.249	1,031,259.112	117.867	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1415	307,310.560	1,031,008.655	108.518	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1416	307,270.477	1,030,996.790	108.156	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1417	307,320.998	1,030,967.914	107.612	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1418	307,382.140	1,030,745.001	91.2	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1419	307,393.580	1,031,775.344	118.993	ex cb type 1	N/A	Deleted - Not in Phase II Basins
1420	307,407.527	1,031,494.863	116.976	ex cb type 1	N/A	Deleted - Not in Phase II Basins
1421	307,438.152	1,031,497.125	117.609	ex cb type 1	N/A	Deleted - Not in Phase II Basins
1422	307,488.799	1,031,330.577	118.702	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1423	307,561.480	1,031,079.568	109.057	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1424	307,572.620	1,031,042.443	108.397	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1425	307,519.961	1,031,069.172	109.42	ex cb type 2	N/A	Deleted - Not in Phase II Basins
1857	301,719.339	1,030,770.289	10.548	ex cb type 2	1	Deleted - Phase I
1858	301,672.159	1,030,846.822	9.487	ex cb type ?	1	Deleted - Phase I
4062	306,071.517	1,031,429.321	138.545	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4085	303,670.542	1,029,142.299	22.119	ex mh type ?	1	Deleted - Phase I
4143	306,139.116	1,031,192.672	125.73	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4144	306,166.702	1,031,096.984	124.026	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4145	306,206.126	1,030,957.527	122.136	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4146	306,562.487	1,030,763.621	114.672	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4147	306,783.465	1,030,827.188	111.805	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4148	306,745.162	1,031,077.261	114.492	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4149	306,965.021	1,031,140.378	112.29	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4150	307,036.011	1,030,893.055	108.349	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4151	307,309.198	1,030,971.421	108.36	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4152	307,414.157	1,030,597.827	76.797	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4153	307,414.837	1,031,487.156	117.876	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4154	307,463.801	1,031,280.877	119.059	ex mh type ?	N/A	Deleted - Not in Phase II Basins
4155	307,561.143	1,031,043.999	109.15	ex mh type ?	N/A	Deleted - Not in Phase II Basins
5029	297,228.142	1,031,814.314	12.1817	gps		Control Point