City of Omaha

Master Plan

Papillion Creek Watershed

Public Works Department

Planning Department

# Sanitary Interceptor Sewer Element

Omaha, Nebraska

2009

Adopted by City Council May 19, 2009

HDR ONE COMPANY *Many Solutions*[SM]

**TABLE OF CONTENTS**

| **Chapter** | | **Page** |
|---|---|---|

## List of Figures



## List of Tables



## List Of Appendices

# CHAPTER 1
# EXECUTIVE SUMMARY

## 1.1 Study Scope

The City of Omaha retained HDR Engineering, Inc. in 2007 to update the Sanitary Interceptor Sewer Master Plan for the Papillion Creek Watershed (Watershed). Key elements include:

- Evaluation of the impact of current UNL Bureau of Business Research (BBR) population projections.
- Updating of the hydraulics computer model to include new development and new flow monitoring efforts in the Watershed. "Over-the-ridge" pumping impacts from potential developments outside of the Papillion Creek Watershed just beyond the western ridge line of Douglas County were also evaluated.
- Review of the current balance of interceptor fund and buy-out status.
- Evaluation of interceptor requirements, funding needs, and anticipated revenues.

## 1.2 Change in Modeling Approach from Previous Study

Dynamic (hydrographic time dependent) computer modeling of interceptor sewer capacity using InfoWorks® software was completed for the Watershed within both Douglas and Sarpy Counties. Data from 2005 and 2006 wastewater flow monitoring conducted by the City in response to past study recommendations at various locations within the sanitary interceptor sewer system were used for model calibration and flow projections. Such in-system flow monitoring information was not available for previous studies, which relied on the measured flow that passed through the Papio Wastewater Treatment Plant (WWTP). However, during major rainfall events, large volumes of unmetered wastewater have been bypassed to the Missouri River upstream of the headworks of the WWTP. Therefore, for past studies there was no way to ascertain the total flow in the sanitary interceptor sewer system.

The 2005 and 2006 flow monitoring data have clearly shown that per capita peak wastewater flows are significantly higher than that indicated by the City's standard population-based peaking factor equation that has been traditionally used to size sanitary interceptor sewers. For this updated study, more problem areas for relief sewers have been identified, and relief sewer pipe sizes have had to be larger to handle the higher wastewater flows. More discussion will follow, but important issues have emerged:

- There is a need to re-evaluate risk/level of protection criteria with respect to design peaking factors.
- Expanded flow monitoring and extraneous flow reduction efforts need greater emphasis.
- The City's combined sewer overflow (CSO) program may be affected in the lower reaches of the interceptor sewer system from flows higher than previously indicated.
- Consensus will be needed as to the most appropriate way to finance relief sewer projects (connection fees versus sewer revenue funds).

The baseline 2006 model was calibrated to the observed wet weather peak hour wastewater flows from flow metering immediately above the WWTP (upstream of the point of bypass). Other meters farther upstream at key points in the interceptor sewer system were used to adjust peak flow timing and distribution within the rest of the system. Peak hourly flows in response to major storms on May 31, 2005 and August 8, 2006 were normalized to population-based wastewater loadings in terms of gallons per capita per day (gpcd). Such per capita flows were used as a composite representation of both residential and commercial/industrial user categories. This flow translation procedure was used to estimate the combined impacts within the entire interceptor system and to project future needs for the 2010, 2020, 2030, 2040, and 2050 time increments established by the City of Omaha Planning Department (Planning Dept.).

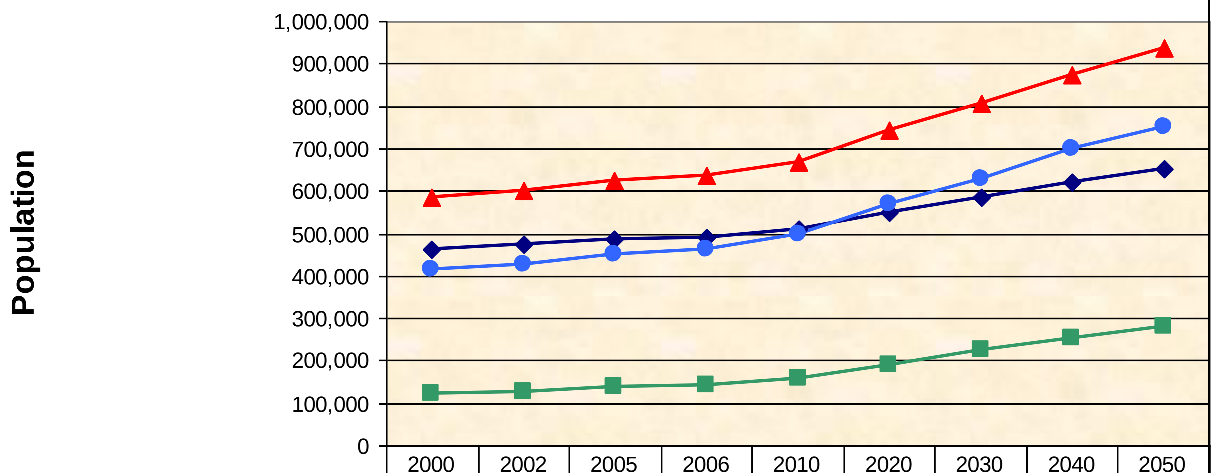
## 1.3 Study Areas, Population, and Land Use

Figure 1-1 depicts several boundaries:

- Modeling Area: The boundary for flow impact analyses within the Watershed in Douglas and Sarpy Counties.
- Study Area: The defined boundary for evaluating new interceptor sewer projects and funding needs through the Sanitary Interceptor Sewer Connection Fund. This boundary includes all of the Watershed in Douglas County and a small portion in northern Sarpy County.
- Development Zones A, B, C, Exurban (Ponca) Zone, and Zones 1 – 6. Zone A and the Ponca Zone are not a part of the designated Sanitary Interceptor Sewer System, because their sewer systems do not connect to the sewer system within the Papillion Creek Watershed. Zones B and C are in the Watershed but are essentially at a full build-out condition. Therefore, only Zones 1 – 6 were used to allocate new near-term and long-term growth.
- The Present Development Zone (PDZ) represents the western and northern peripheries of Zones 1 – 6 within which new development is targeted by the Planning Dept. Proposed changes in the PDZ are depicted by the dashed lines.
- The Future Development Zone (FDZ) is an area within the Omaha jurisdiction that depicts the conceptual future expansion limits of the PDZ as long-term growth occurs.

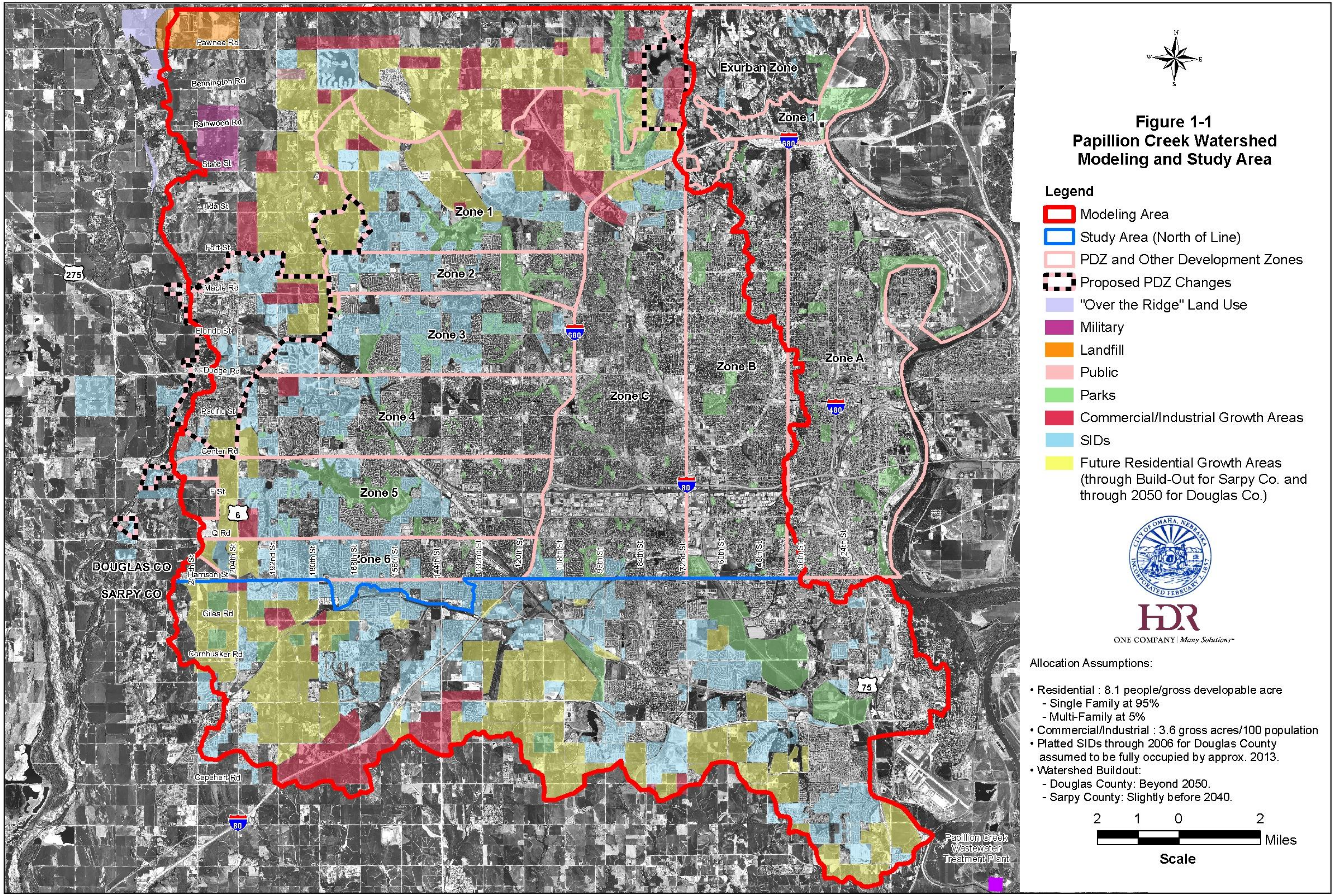
Population data provided by the BBR (April 13, 2007 Draft Final Report) were used to derive the growth trends shown in Figure 1-2. Incremental distribution of the new population was based on updated housing and S&ID data from the Omaha and Sarpy County Planning Departments, aerial photography, and input from developers.

**FIGURE 1-2 PROJECTED POPULATIONS**




| | 2000 | 2002 | 2005 | 2006 | 2010 | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|---|---|---|---|
| Douglas Total | 463,585 | 475,564 | 486,929 | 491,789 | 511,227 | 550,918 | 583,538 | 618,713 | 653,888 |
| Sarpy Total | 122,595 | 126,928 | 139,371 | 142,836 | 156,696 | 191,540 | 224,709 | 253,551 | 282,393 |
| Two-County Total | 586,180 | 602,492 | 626,300 | 634,625 | 667,923 | 742,458 | 808,247 | 872,264 | 936,281 |
| Portion in Papio Watershed | 416,065 | 428,504 | 449,956 | 462,432 | 498,329 | 567,228 | 629,234 | 700,658 | 751,373 |

**FIGURE 1-1 PAPILLION CREEK WATERSHED MODELING AND STUDY AREA**



Key population and land use assumptions used in the study are as follows (see Chapter 3 for additional details):

- Population Growth within the Watershed:

  - Douglas County: An estimated 70% (342,215) of the 2006 population resided within the Watershed; projected to increase to 77% (504,630) in 2050. This represents a straight-line increase of 1.08% per year, which is slightly lower than for the previous study. There is a small amount of "over-the-ridge" wastewater being pumped into the City's sanitary interceptor sewer system from the Sanctuary and Hampton's Subdivisions west of Highway 31 (west of 204$^{th}$ Street) near West Center Road and West Q Street, respectively.

  - Sarpy County: An estimated 84% (120,217) of the 2006 population resided within the Watershed; target to increase to 87% (246,743) in 2050. This represents a straight-line increase of 2.39% per year. The growth distribution situation for Sarpy County is less certain, because it is difficult to predict what percentage of new growth will reside beyond (south) of the Watershed ridge line. It was assumed that two-thirds of the new growth will occur within the Watershed until build-out conditions are reached. However, this could not be achieved at current densities through 2050; that is, platting build-out is predicted to occur slightly prior to 2040. Also, there is a portion of Gretna's wastewater being pumped into Omaha's sanitary interceptor sewer system from "over-the-ridge" development.

  - Two-County Composite Population: Estimated to be 462,432 in 2006; targeted to increase to 751,373 in 2050. This represents a combined straight-line increase of 1.42% per year. However, due to the Sarpy County platting build-out situation, <u>the modeled population for the Watershed became 722,677 people through 2050</u>, or 96.2% of the originally targeted value. This study will also consider the impacts from additional potential "over-the-ridge" pumping adjacent to the western ridge line in Douglas County; which, if allowed, would increase the effective contributing population slightly. At the direction of the City, no additional "over-the-ridge" pumping was considered within Sarpy County.

- Development Densities.

  - Population per Dwelling Unit. Assumed to remain relatively constant at 2.5 people per dwelling unit for the purpose of modeling, which is similar to previous study efforts. The April 2007 BBR Report did not update this statistic.

  - Gross Developable Acres to Total Acres Ratio. Calculated as being 68.2% for the period from 2003 to 2006. This ratio was used for future projections. This compares favorably to a 70% value used in the previous study.

  - Population per Gross Developable Acre. Calculated to be approximately 8.1 people per gross developable acre based on 2003 to 2006 new housing start data. This is a composite value that represents the combination of single family (SF) and multi-family (MF) housing. During this period, SF developable acres accounted for nearly 95% of total residential developable acres, and this value was used for future allocations. In prior studies, this value was approximately 75%. In reality, the overall system capacity modeling is not particularly sensitive to the SF/MF split, as long as the appropriate projected populations per time increment are fully allocated within the developable sub-basin areas.

- Commercial/Industrial Density. Where specifically indicated on the Planning Dept.'s Land Use Map, commercial/industrial acres and spatial distributions were used as shown. Where not shown, commercial/industrial acres were allocated at 3.6 gross developable acres per 100 population, as per previous studies. The 2007 BBR Report did not update this statistic.

- Land Consumption Projections. A total increase of approximately 33,630 gross developable acres of new S&IDs and commercial/industrial development land consumption from 2010 through the year 2050 is projected for the Douglas and Sarpy County service area.

- Housing Starts and Vacant Lots within Watershed.

  - Single Family Housing Starts. A significant increase in SF housing starts occurred from 2003 to 2006 due to historically low interest rates. Figure 1-1 also illustrates the S&IDs in the study area, the majority of which were created during this time period. There are some older S&IDs that are still not sufficiently occupied for annexation. From 1995 to 2002 SF family starts averaged 1,622 per year in comparison to 2,262 per year from 2003 to 2006 – a 39% increase.

  - Multi-Family Housing Units. Conversely to the above, MF housing units decreased by approximately 73% from an average of 942 per year from 1995 to 2002 to an average of 256 per year from 2003 to 2006.

  - Vacant Improved Lots. The recent increase in SF housing activity also created a larger than normal surplus of vacant improved lots and unsold new dwelling units, the residual of which will may extend beyond 2010 before a more normal level of new S&ID activity resumes. The number of SF vacant improved lots averaged 7,510 lots per year from 1995 to 2002 and 9,966 from 2003 to 2006 – nearly a 33% increase.

- Build-Out. Occupation build-out has been estimated to occur slightly before 2040 for the Sarpy County portion of the Watershed. For Douglas County, provided that development densities continue to track with recent data, occupation build-out is assumed to occur beyond 2050, as indicated by the western and northern undeveloped fringe areas in Figure 1-1. Platting build-out for both Counties may occur 10 years or more prior to occupation build-out.

### 1.4 Wastewater Modeling Design Parameters

See Chapter 4 for details. The following are highlights:

- Definitions. The following terms are used in this report:
  - "Baseline average flow" (or average flow) means a selected period of dry weather 24-hour average flow + steady-state background infiltration/inflow extending well beyond prior times of precipitation. Therefore, "baseline average flow" is <u>not</u> equivalent to an annual average flow or other long period of time that includes days of precipitation.
  - "Peak hour wet weather flow" (or peak hour flow) means the maximum hourly flow rate observed or expected to occur in response to a major storm.
  - "Peaking factor" means the ratio of the "peak hour wet weather flow" to the "baseline average flow."
- Updated Flow Metering and Pumping Information.
  - Four in-system flow meters were temporarily installed in 2005. Peak hour flows were projected forward in time from the most severe storm event, which occurred on May 31, 2005.

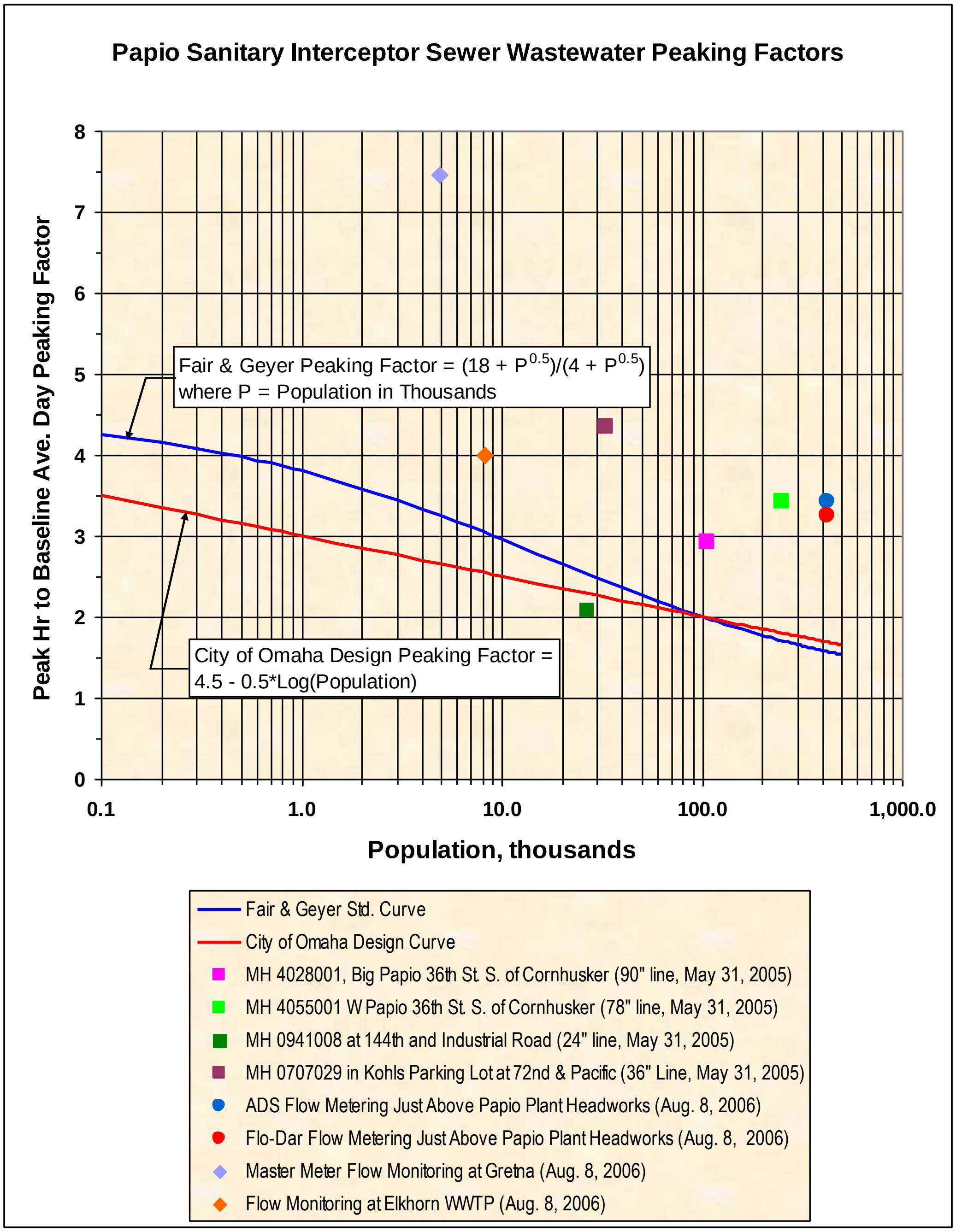
- Two flow meters were temporarily installed in the same manhole for redundancy in 2006 just above the Papio WWTP headworks and upstream of the point of bypass to the Missouri River. Peak hour flows were determined from the most severe storm event, which occurred on August 8, 2006. Since the latter storm produced a larger response than the May 31, 2005 event, peaking factors from the 2005 event were adjusted upward to match the 2006 storm response.
- Gretna. Contributing average and peak hour flows were determined from 2006 data that included the August 8, 2006 storm event from an existing metering site used for billings located near the eastern edge of the corporate limits. The wet weather response for this storm event produced a very large peaking factor, but a portion of the flow at this location includes some over-the-ridge pumped flow, which would tend to skew the peaking factor upward.
- Elkhorn WWTP. Based on City feedback, it was assumed that Elkhorn's WWTP would be de-commissioned and connected to the West Papio interceptor sewer system in 2010. According to plant records, this WWTP normally has a baseline average flow of approximately 0.5 MGD; whereas during the August 8, 2006 storm the plant flow meter limit of 2.0 MGD was exceeded. Therefore, for modeling purposes the peaking factor was assigned at 4.0, but the actual peaking factor is some unknown value greater.
- Bellevue. There is a portion of the Bellevue wastewater system that formerly discharged to the Missouri River Basin that was reportedly rerouted in 2008 to the Papio system by pumping to a point near the Papio WWTP entrance road. The peak hour contribution from this source was assigned to be the same as the design pumping rates of the lift station (dry weather peak hour at 1.296 MGD and wet weather peak hour at 2.592 MGD).

- Combined Sewer Overflow (CSO) Connections. It was assumed that the wastewater contributions in the Cole Creek and Saddle Creek CSO areas would be at the full capacity of the respective connecting pipes that convey "first flush" wastewater to the receiving dedicated sanitary interceptor sewer system. Therefore, the CSO contributions represent fixed peak flow values with no additional peaking factors applied.
- Modeled Peaking Factors.
    - Figure 1-3 shows considerably higher peaking factors from flow metering results in comparison to a common literature-based standard peaking factor equation and to the City of Omaha's current peaking factor equation.
    - Table 1-1 summarizes wastewater modeling parameters from prior studies relative to this study update. Past residential + steady-state infiltration for existing development at 126 gpcd compares favorably with the most recent 124 gpcd aggregate value.
    - Figure 1-4 shows the distribution of wet weather peaking factors throughout the sanitary interceptor sewer system that were used for modeling purposes based on estimated storm responses from the August 8, 2006 storm and the nearest flow metering sites. The flow metering results for the respective drainage areas provide a more representative estimate of wet weather peaking factors than using a standard design curve approach alone.
- Interim Recommended Future Design Peaking Factors. As further discussed in Section 1.5, the system pipe capacity design implications from the observed, much higher wet weather peaking factors are quite severe. Until such time that the City can complete more definitive flow monitoring and/or achieve significant system rehabilitation with respect to infiltration/inflow reduction, the following interim peaking factor design considerations are recommended:
    - Parallel Relief Sewers. Use the peaking factors indicated by Figure 1-4, provided that they exceed the comparable peaking factor from the City's standard design equation for the population served. Relief sewers must be designed conservatively, because there would likely be very limited opportunity to further supplement capacity at a later time.
    - Future Extensions. It is assumed that relatively "tight" sewer construction practices will be implemented for future extensions. Therefore, except for projects such as extending

new service to the existing Elkhorn sewer system or to pre-existing clustered housing with questionable septic systems, it is assumed that the City's standard population-based design equation would still be appropriate.

- Modeled Travel Times. The computer model was calibrated to the various times of peak flow response among the various flow metering sites. Refer to Figure 4-4 in Chapter 4. The cumulative travel time for peak weather flows from the upper-most portions of the sanitary interceptor system to the Papio WWTP is approximately 6 hours. This does not include the additional travel time within smaller sewer mains and laterals, which are not a part of the model.

### FIGURE 1-3 OBSERVED PEAKING FACTORS IN COMPARISON TO POPULATION-BASED EQUATIONS



## TABLE 1-1 SUMMARY OF WASTEWATER MODELING PARAMETERS

| Parameter | 2000 Report | 2004 Report | 2009 Report |
|---|---|---|---|
| Residential Contribution | 80 gpcd | 83 gpcd | 124 gpcd as an aggregate baseline average flow value based on 2006 flow metering above Papio WWTP |
| Commercial/Industrial | 1,500 gpd/acre | 1,500 gpd/acre | |
| Steady-State Infiltration for established development | 43 gpcd | 43 gpcd | |
| Steady-State Infiltration for new development | 43 gpcd | 17 gpcd [1] | |
| Peaking Factor | By standard peaking factor equation | By hydrograph relative to flow through Papio WWTP and default peaking factors by City equation [2,3] | Nearest hydrographs from in-system flow monitoring. See Chapter 4 for details |

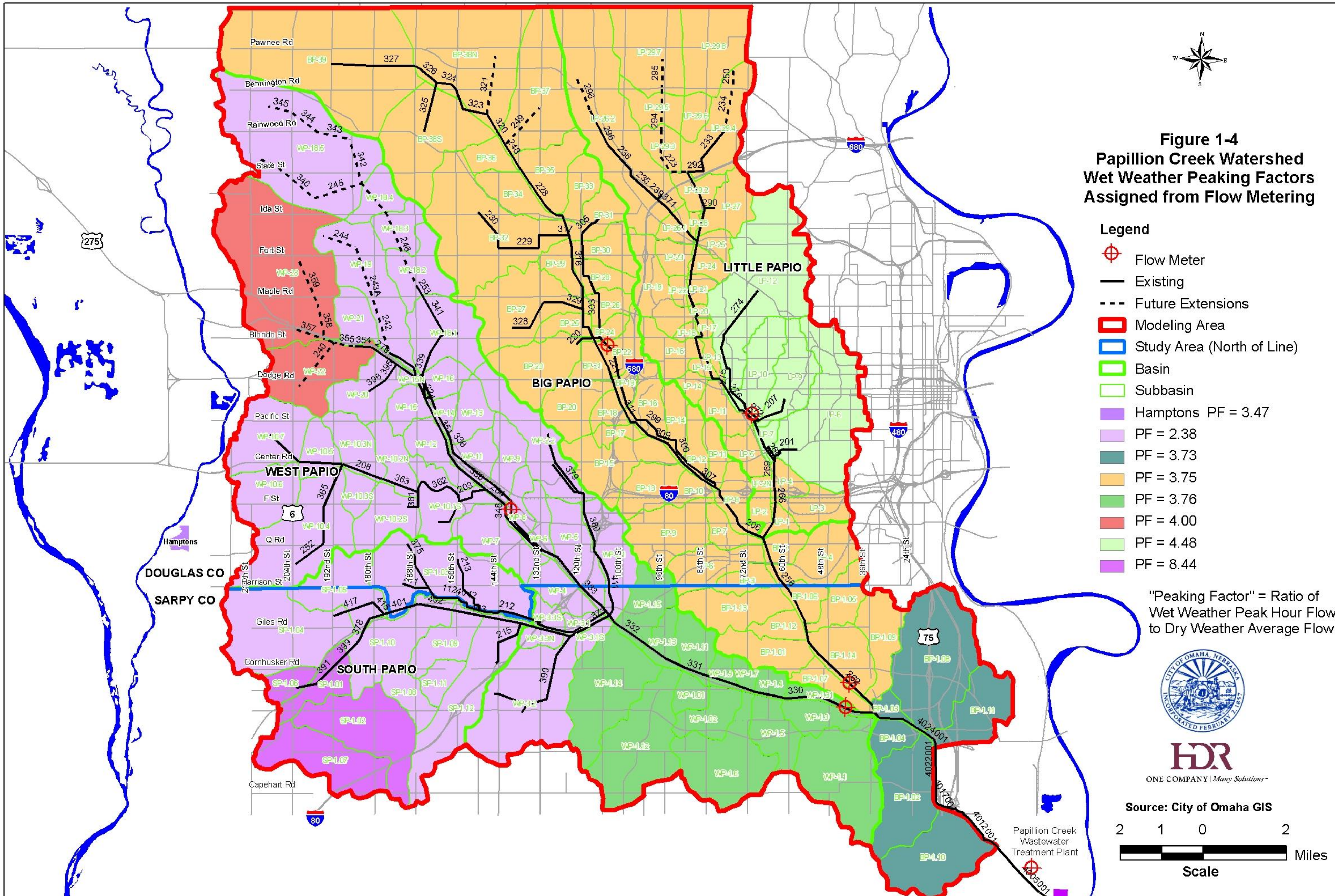
[1] Based on the Environmental Protection Agency's definition for "non-excessive" infiltration for new sewer construction at 500 gpd per inch diameter per mile allocated to equivalent population.

[2] Standard City of Omaha Equation: PF = 4.5 – 0.5 * $Log_{10}$(Population)

[3] Alternate equation for comparison purposes only from *Water Supply and Waste-Water Disposal, Fair and Geyer, 1954*, page 136:

Peaking Factor = $(18 + P^{0.5})/(4 + P^{0.5})$, where P = Population in Thousands

**FIGURE 1-4 WET WEATHER PEAKING FACTORS ASSIGNED FROM FLOW METERING**



## 1.5 Interceptor Sewer Requirements

System capacity needs to accommodate incremental development within the Watershed through 2050 were evaluated. Ultimate build-out within the Watershed was not used to size sewers because of uncertainties expressed by the Planning Dept. for future development densities with respect to low impact development (LID) strategies currently being considered. LID requires set-aside vegetated areas that could affect lot sizes. Also, the areas along the western and northern peripheries of the Watershed in Douglas County (shown as undeveloped in Figure 1-1) may become somewhat lower density "transition" areas that will abut rural estate type developments. Therefore, for ultimate build-out of the Watershed after 2050, depending on subsequent planning decisions, some interceptor extensions and relief sewers may require additional capacity if conventional urban densities will continue to extend to the ridge lines.

The following is a summary of the results from the various model runs that were completed:

- The only relief sewer project that is needed prior to 2010 is the Miracle Hills Project that runs along the west side of the Big Papillion Creek, roughly from West Dodge Road to near West Maple Road. The City is currently undertaking this project due to chronic sewer back-ups and sanitary sewer overflow (SSO) problems during severe storm events. This project has received regulatory scrutiny by the Nebraska Department of Environmental Quality (NDEQ). This area suffers from flat sewer grades and problems with grit accumulation in the lines. The computer modeling to date definitely shows a future capacity problem in this same area, but that modeling was based on a default assumption for clean, full-pipe capacity being available in the existing 36" interceptor line. There was no way to know the extent of grit accumulation to include at the time of the modeling. Since problems have already been realized from a combination of factors, the City has opted to bring this project forward at this time.

- Modeling results show the apparent need for a substantially increased number of major relief sewers in the Watershed beyond 2010 in comparison to the previous study. This has resulted from much higher wet weather peaking factors indicated by the 2005 and 2006 flow monitoring.

Table 1-2 summarizes the estimated total costs Program Projects for 2009 to 2010, Near-Term Projects for 2011 to 2020, and Future Projects for 2021 to 2050. See details in Chapter 5, including Figure 5-1, which shows the color-coded project locations. Costs include construction, ROW acquisition, utility relocation, engineering, legal, financial costs, and 10% contingency allowance. Costs were projected based on RS Means *Sitework Construction Cost Data* corrected to Omaha for each mid-period.

**TABLE 1-2 ESTIMATED PROJECT COSTS**

| Period | Pipe Extension Projects | Relief Sewer Projects | Flow Metering | Total Project Cost |
|---|---|---|---|---|
| Program Projects 2009-2010 (Coded Orange) | $7,031,000 | $6,000,000 | $355,500 | $13,386,500 |
| Near Term Projects 2011-2020 (Coded Yellow) | $12,385,000 | $33,058,000 | | $45,443,000 |
| Future Projects 2021-2030 (Coded Green) | $8,743,000 | $214,372,000 | | $223,115,000 |
| Future Projects 2031-2040 (Coded Blue) | $57,261,000 | $15,850,000 | | $73,111,000 |
| Future Projects 2041-2050 (Coded Magenta) | $41,863,000 | $66,004,000 | | $107,867,000 |
| **Totals** | **$127,283,000** | **$335,284,000** | **$355,500** | **$462,922,500** |

The significant capital costs involved for potential relief sewers based on the wet weather peaking factors derived from 2005 and 2006 flow monitoring suggest that:

- Additional flow monitoring at the key locations shown in Figure 5-1 in Chapter 5 is highly recommended prior to undertaking major capital expenditures for relief sewers. It is recommended that past monitoring sites be included, plus add new sites to expand the knowledge base and to provide for more meaningful distributions of peaking factors. The City is encouraged to also install supplemental real-time rain gauges at some of the flow metering sites.

- In addition to flow metering, the City should undergo an aggressive infiltration/inflow field inspection and flow reduction program, consisting generally of:

    - Inspection/inventory of manhole lids and frames in areas prone to surface water inundation during storm events.

    - Replacement of manhole lids and frames with solid lids having tighter, tapered machined seating surfaces where appropriate. Significant inflow reduction may be realized for this corrective measure alone.

    - Smoke and dye testing where appropriate to locate previously unknown cross connections with storm sewers - either from direct connections or via adjacent broken pipes in both utilities. Such work may be best conducted by a specialty firm that routinely provides such services, because such work is quite labor intensive, and smoke testing would require careful coordination with the public and the various fire departments.

    - Plumbing inspection for new construction should ascertain that building foundation drain water via either sump pumps or gravity drain lines are not in any way being improperly directed to the sanitary sewer system. Experience in many cities has shown that it is very tempting for building owners to simply direct sump pump discharges to the nearest floor drain as a matter of convenience. This can easily happen after plumbing inspections have been completed, unless the building owner is required, as a part of the plumbing inspection and approval process, to initially install all elements of a sump pump system, including the placement of the pump in a floor pit and all discharge piping to an approved surface outlet.

## 1.6 Construction and Acquisition Financing

Details of the construction and acquisition financing requirements are covered in Chapter 6. Following discussions with City staff concerning the estimated costs for relief sewers being significantly higher than those identified in past studies, it was decided that relief sewer needs for all time increments beyond the 2010 for Program Projects are too uncertain and should not be included in a cash flow connection fee rate analysis at this time. Such uncertainties and related needs to address them include the following:

- Additional flow metering is needed to better define the spatial distribution of wet weather peaking factors and to identify sub-basins within the sanitary interceptor sewer system that may have disproportionately high infiltration/inflow problems.

- It is presently uncertain as to how successful the City can actually be with regard to infiltration/inflow reduction and what peaking factors should legitimately be used for future design.

- There is currently a lack of field information on critical basement depths and ground elevations along the sanitary interceptor sewer corridors. Significant sums of money could be potentially saved if it were determined with confidence that at least some surcharging could be tolerated.
- Discussions must ensue as to what the appropriate cost-sharing and funding mechanisms should be for such relief sewer projects that are largely a result of extraneous flows in the current system as opposed to being strictly driven by future growth.
- The City's CSO long-term control program will significantly impact decisions for parallel relief sewer sizing for the large conduits in the lower portions of the Watershed (particularly below the confluence with the West Papio sanitary interceptor sewer system).

Table 1-3 below represents the estimated cash flow requirements for the 2009 to 2010 Program Projects and beyond <u>for sewer extensions alone</u> as discussed above in comparison to current rates.

### TABLE 1-3 ESTIMATED CASH FLOW REQUIREMENTS FOR FUTURE SEWER EXTENSIONS

| Planning Period | Projected Increase in Single Family Units | Single Family Rate | Projected Increase in Multi-Family Units | Multi-Family Rates | Projected Increase in Comm./Ind. Acres | Comm./Ind. Rate | Revenue Generated by Interceptor Fee | Total Est. New Sewer Extension Costs | Revenue Minus Project Costs | Beginning Balance [1] | Period Ending Balance (Rounded) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009-2010 | 5,022 | **$1,100** | 264 | **$858** | 0 | **$5,973** | $5,750,712 | $13,386,500 | -$7,635,788 | **$12,339,843** | **$4,704,000** |
| 2011-2020 | 14,515 | **$1,200** | 763 | **$936** | 1,375 | **$6,516** | $27,091,668 | $12,385,000 | $14,706,668 | $4,704,000 | **$19,411,000** |
| 2021-2030 | 11,989 | **$1,400** | 631 | **$1,092** | 1,140 | **$7,602** | $26,139,932 | $8,743,000 | $17,396,932 | $19,411,000 | **$36,808,000** |
| 2031-2040 | 16,829 | **$1,600** | 886 | **$1,248** | 1,592 | **$8,688** | $41,863,424 | $57,261,000 | -$15,397,576 | $36,808,000 | **$21,410,000** |
| 2041-2050 | 8,916 | **$1,800** | 469 | **$1,404** | 838 | **$9,774** | $24,897,888 | $41,863,000 | -$16,965,112 | $21,410,000 | **$4,445,000** |
| **Totals** | **57,271** | | **3,013** | | **4,945** | | **$125,743,624** | **$133,638,500** | | | |

**Connection Fee Weighting and Current Rates**

| Category | Flow Factor | Current Rates | Units |
|---|---|---|---|
| Single Family | 1 | $947 | D.U. |
| Multi-Family | 0.78 | $739 | D.U. |
| Mobile Home | 0.77 | $729 | D.U. |
| Commercial/Ind. | 5.43 | $5,142 | Acre |

<u>Notes</u>

[1] The available fund balance through February 29, 2009 was $12,339,842.59.

At the bottom of Table 1-3 note that there are "flow factors" for various land use categories in keeping with the philosophy from past studies. These factors represent the ratios of the estimated baseline average wastewater flow potential from each of the land use categories on an equivalent developable acre basis in comparison to Single Family Residential (pivot land use with 1.0 multiplier). The flow factor ratios, in turn, become the basis for the connection fee rates used in Table 1-3 above and summarized in Table 1-4 below. For example, the Commercial/Industrial rate is 5.43 times the Single Family rate.

### TABLE 1-4 RECOMMENDED CONNECTION FEES FOR STUDY AREA IN DOUGLAS COUNTY AND NORTHERN PORTION OF SARPY COUNTY

| Category | Existing | Proposed 2009 |
|---|---|---|
| Single Family/Unit | $947 | $1,100 |
| Multi-Family/Unit | $739 | $858 |
| Commercial/Industrial/Acre | $5,142 | $5,973 |
| Mobile Home/Unit | $729 | $847 |

The cash flow projections in Table 1-3 beyond the initial 2009 to 2010 time frame have an unusually large amount of uncertainty for the following reasons:

- The current economy is in a state of recession, and given that a larger than normal vacant lot and unoccupied housing surplus exists, revenue streams from new S&IDs may remain very tentative for the next two to three years. Commercial/industrial development has appeared to be less compromised than general housing type developments in recent months.
- Population projections by Census tract throughout the Watershed will be much improved when the upcoming 2010 Census is completed. The current projections within the various sub-basins are quite tentative, because of the lateness of the planning period in the 2000 – 2010 decade.

The starting (2009 to 2010) Single Family rate of $1,100 and the other companion rates for this time frame were established in order to maintain an adequate, positive end-of-period balance of approximately $4.7 million. The proposed connection fees and the estimated end-of-period balance were discussed with the Metro Omaha Builders Association (MOBA) in March 2009. It was agreed that the proposed connection fees would be acceptable and that the projected fund balance should be used to cover the estimated City reimbursement costs for lift station construction, force mains, interceptor sewers, and engineering costs for the Hampton's Subdivision (SID #517) and Sanctuary Subdivision (SID #520), which lie west of the Papio Watershed ridge lines (see Figure 5-1 in Chapter 5). The estimated reimbursement costs for those projects are approximately $1.57 million and $1.42 million, respectively.

For the remaining periods in Table 1-3, the need for future sanitary interceptor sewer extensions is expected to accelerate, as the housing surpluses are depleted to more normal levels and the general economy improves. This will require timely connection fee rate increases over time in order to build an adequate on-going end-of-period positive fund balance. The cost projections are also based on the assumption that construction costs will track with past construction cost trends. Again, this table does not include the cost of relief sewer projects. It cannot be over-emphasized that the existing system capacity will become increasingly compromised to the point of risking sewer backups and SSOs, unless countermeasures are implemented to address wet weather peaking issues to minimize the need for expensive relief sewers.

Chapter 7 includes discussion on policies. One of the recommended policy changes is:

> *"The Interceptor Sewer Fee should be collected with building permit applications. This is a change from the previous policy of collecting the fee at the time of platting from the S&ID. This will help to reduce the debt of Districts and possibly lead to subdivisions being more attractive to be annexed by the City sooner. It is believed that there is a sufficient fund balance to allow this transition. The City should monitor the expenditures, fee collections and fund balance to ensure there is not a short term deficiency in the fund that could lead to future projects not being completed in a timely manner."*

Finally, the City should continue updating this plan every three years. The next study iteration should potentially be more accurate than this one, because:

- New Census information and more accurate population and land consumption projections should be available.
- With the implementation of an expanded flow metering program, much more will be known about the spatial distribution of wet weather peaking factor issues.
- The Elkhorn WWTP will likely be connected to the existing sanitary interceptor sewer system, which will allow downstream peak flow dynamics to be better understood and simulated.
- The InfoWorks® model should be upgraded to coincide with the new flow metering information and to include more piping detail to improve overall accuracy.

# CHAPTER 2
# STUDY SCOPE

## 2.1 Background

The Sanitary Interceptor Sewer Master Plan is updated periodically to analyze the interceptor sewer requirements for the Papillion Creek Watershed and to evaluate the projected revenues and expenditures of the Interceptor Fund. The Plan was last reviewed and updated in 2004. HDR was retained by the City of Omaha to provide this 2009 update to the Master Plan.

## 2.2 Study Scope

The scope of services for this Master Plan Update was mutually developed by HDR and the City in response to objectives and criteria outlined by the City of Omaha. The following is a summary of the key elements of the study:

- Review pertinent background data provided by the City that will affect the study. This includes:
  - Most recent Bureau of Business Research population study
  - Residential housing statistics
  - Commercial and Industrial development status
  - S&ID buyout status
  - Construction status of existing projects, and
  - Current interceptor fund balances

- Use GIS with land use categories to determine population for baseline year 2006 and distribute projected populations for each of the design years according to the design densities.

- Update the model to reflect interceptor construction and existing development using updated InfoWorks® software.

- Determine the flows for the interceptors in each of the major sub-basins.

- Analyze the interceptor system for each planning period to determine interceptor needs and phasing requirements.

- Calculate required interceptor fees to maintain a positive balance in the Sanitary Interceptor Sewer Fund, based on:
  - Estimated projected construction costs
  - Construction phasing
  - S&ID buyouts, and
  - Current balance of the Interceptor Fund

- Assemble study into a report and present to the City.

# CHAPTER 3
# STUDY AREA, POPULATION AND LAND USE

## 3.1 Study Area

The Papillion Creek Watershed, from upstream to downstream, is contained within Washington, Douglas, and Sarpy Counties. The watershed contains 402 square miles (approximately 257,000 acres) and drains into the Missouri River at a point just north of the confluence of the Platte and Missouri Rivers. The primary tributaries include the Big Papillion, Little Papillion, West Papillion, and South Papillion Creeks. The basins defined by these streams form the four major hydraulic sub-units of the watershed.

The modeling and study areas for this report were previously shown in Figure 1-1 and include each of the four primary tributaries of the Papillion Creek Watershed located in Douglas and Sarpy Counties. The northern portion of the Big and Little Papillion Creek extends into Washington County. At this time the portion of the watershed in Washington County is primarily agricultural and sparsely populated. Moreover, there are no current plans to extend sewer service into Washington County; therefore, it is not included in this study.

The amount of land required to accommodate the population growth through the planning year of 2050 for the Omaha sewer system service area was based on the development of available, developable land in Douglas County. A significant amount of growth has occurred in Sarpy County. This growth is projected to continue, thus this area and the contributing population has been included to determine the impact of wastewater flows on the lower reaches of the main interceptor sewers. However, the identification of required interceptor projects in Sarpy County is not included in this study.

The distribution of land area among the four major basins is summarized in Table 3-1 below.

**TABLE 3-1 WATERSHED LAND AREA**

| Watershed | Approximate Land Area (acres) | | |
|---|---|---|---|
| | Douglas County | Sarpy County | Study Area [1] |
| Big Papillion | 44,974 | 16,910 | 44,974 |
| Little Papillion | 31,829 | 0 | 31,829 |
| West Papillion | 43,450 | 24,506 | 43,450 |
| South Papillion | 4,282 | 16,359 | 4,282 |
| **Total** | **124,535** | **57,775** | **124,535** |

[1] *Study area includes land in Douglas County and a small portion of land north of Wehrspann Lake in Sarpy County*

The total Papillion Creek Watershed land area in Douglas County and Sarpy County is approximately 182,310 acres. The remaining land area in the Watershed is in Washington County, which is not intended to be served by the Papio Sanitary Interceptor Sewer System.

The primary tributaries have been further divided into sub-basins for the purpose of distributing projected population growth according to estimated future land uses. Figure 4-3 in Chapter 4 shows the primary tributaries and sub-basins. These sub-basins are small enough to identify logical relationships between interceptor sewer requirements and corresponding land development, yet large enough to allow some flexibility for future land use forecasts. Appendix

B has the detailed sub-basin population listings. The basins in Sarpy County have been similarly subdivided for the purpose of this study. Estimated incremental population, wastewater flows, and sanitary interceptor sewer configurations are included in the model; however, their corresponding financial requirements have not been included in this study.

## 3.2 Population Projections

The study area population for development in the Papillion Creek basin to the year 2050 represents the end of the planning period and has been used to establish interceptor sewer design capacity requirements. In prior studies an evaluation of the impact of the ultimate (full) development of the basin in Douglas County was completed to assess the theoretical maximum interceptor sewer requirements and total system flows. However, for the current study, ultimate build-out within the Watershed was not used to size sewers because of uncertainties expressed by the Planning Dept. for future development densities with respect to low impact development (LID) strategies currently being considered. LID requires set-aside vegetated areas that could affect lot sizes.

Figure 1-1 in the Executive Summary shows that there may be some undeveloped areas remaining along the western and northern periphery of Douglas County by 2050. But, it may be entirely possible that platting build-out could occur by 2050 if housing densities were to decrease to accommodate LID strategies (by retaining current typical lot sizes) and/or if lower densities were to be used as a transition to rural estate type development. Therefore, depending on subsequent planning decisions, some interceptor extensions and relief sewers may require additional capacity if conventional urban densities will continue to extend to the ridge lines.

The Bureau of Business Research (BBR) provided population data used in this study. Douglas County currently is (and is projected to remain) the most populous county in the metropolitan area.

Table 3-2 and Figure 3-2 summarize the originally targeted projections used for Douglas and Sarpy Counties through 2050. Key assumptions used in the study are as follows:

- Douglas County: An estimated 70% (342,215) of the 2006 population resided within the Watershed; projected to increase to 77% (504,630) in 2050. This represents a straight-line increase of 1.08% per year, which is slightly lower than for the previous study. There is a small amount of “over-the-ridge” wastewater being pumped into the City’s sanitary interceptor sewer system from the Sanctuary and Hampton’s Subdivisions west of Highway 31 (west of 204$^{th}$ Street) near West Center Road and West Q Street, respectively.

- Sarpy County: An estimated 84% (120,217) of the 2006 population resided within the Watershed; target to increase to 87% (246,743) in 2050. This represents a straight-line increase of 2.39% per year. The growth distribution situation for Sarpy County is less certain, because it is difficult to predict what percentage of new growth will reside beyond (south) of the Watershed ridge line. It was assumed that two-thirds of the new growth will occur within the Watershed until build-out conditions are reached. However, this could not be achieved at current densities through 2050; that is, platting build-out is predicted to occur slightly prior to 2040. Also, there is a portion of Gretna’s wastewater being pumped into Omaha’s sanitary interceptor sewer system from “over-the-ridge” development.

- Two-County Composite Population: Estimated to be 462,432 in 2006; targeted to increase to 751,373 in 2050. This represents a combined straight-line increase of 1.42% per year. However, due to the Sarpy County platting build-out situation, <u>the modeled population for the Watershed became 722,677 people through 2050</u>, or 96.2% of the originally targeted value. This study will also consider the impacts from additional potential “over-the-ridge” pumping adjacent to the western ridge line in Douglas County; which, if allowed, would increase the effective contributing population slightly. At the direction of the City, no additional “over-the-ridge” pumping was considered within Sarpy County.

## TABLE 3-2 ORIGINALLY TARGETED DOUGLAS AND SARPY COUNTY POPULATION PROJECTIONS

| Area | Projected Populations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2000 | 2002 | 2005 | 2006 | 2010 | 2020 | 2030 | 2040 | 2050 |
| **Douglas County Population** [1] | **463,585** | **475,564** | **486,929** | **491,789** | **511,227** | **550,918** | **583,538** | **618,713** | **653,888** |
| City of Omaha | 390,007 | 399,695 | 408,866 | 414,514 | 437,107 | 469,266 | 495,160 | 533,376 | 550,640 |
| Missouri Basin | 128,000 | 128,000 | 128,000 | 128,000 | 128,000 | 128,000 | 128,000 | 128,000 | 128,000 |
| Omaha Jurisdiction | 51,735 | 53,407 | 55,011 | 55,701 | 58,459 | 64,521 | 69,960 | 75,975 | 81,990 |
| Elkhorn [2] | | | | | 8,656 | 9,328 | 9,881 | 10,476 | 11,072 |
| Remainder of County | 21,843 | 22,954 | 23,052 | 21,574 | 15,661 | 17,131 | 18,418 | 9,362 | 21,258 |
| Portion in Papio Watershed | 313,742 | 324,610 | 335,877 | 342,215 | 367,566 | 405,787 | 437,120 | 481,351 | 504,630 |
| Increases in Watershed | | | | 17,605 | 25,351 | 38,221 | 31,333 | 44,231 | 23,279 |
| **Sarpy County Population** [1] | **122,595** | **126,928** | **139,371** | **142,836** | **156,696** | **191,540** | **224,709** | **253,551** | **282,393** |
| Gretna [3] | 2,355 | 3,491 | 4,860 | **5,970** | **6,549** | **8,006** | **9,392** | **10,597** | **11,803** |
| Within Papio Watershed | 1,570 | 2,327 | 3,240 | 3,980 | 4,366 | 5,337 | 6,261 | 7,065 | 7,869 |
| South of Papio Ridge Line | 785 | 1,164 | 1,620 | 1,990 | 2,183 | 2,669 | 3,131 | 3,532 | 3,934 |
| Remainder of County not in Papio Watershed | 20,272 | 23,034 | 25,292 | 22,619 | 25,933 | 30,099 | 32,595 | 34,244 | 35,650 |
| Portion in Papio Watershed | 102,323 | 103,894 | 114,079 | 120,217 | 130,763 | 161,441 | 192,114 | 219,307 | 246,743 |
| Increases in Watershed | | | | 16,323 | 10,546 | 30,678 | 30,673 | 27,193 | 27,436 |
| **Total Douglas + Sarpy Co. Pop.** | 586,180 | 602,492 | 626,300 | 634,625 | 667,923 | 742,458 | 808,247 | 872,264 | 936,281 |
| **Total Population in Watershed** | **416,065** | **428,504** | **449,956** | **462,432** | **498,329** | **567,228** | **629,234** | **700,658** | **751,373** |

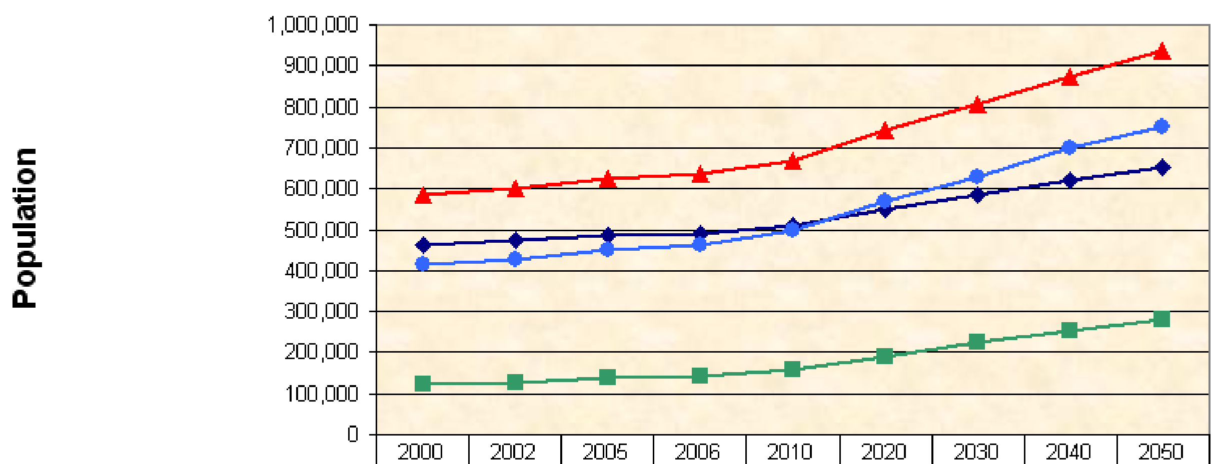
**Notes**

[1] Red = interpolated values

[2] Elkhorn population is added to the City of Omaha in the year 2010 as the treatment plant of Elkhorn is proposed to be decommissioned

[3] As per agreement with City of Omaha, it is assumed that at 2010 and beyond no aditional population contributions to wastewater will be permissible south of the Papio ridge line. For 2006 and prior, the entire Gretna population is contributing to the Papio watershed, including portions of growth south of the Papio ridge line. For 2010 and beyond, it is assumed that 2/3rd of the Gretna population is within the Papio Watershed served by existing gravity Sanitary Interceptor Sewers.

## FIGURE 3-2 ORIGINALLY TARGETED DOUGLAS AND SARPY COUNTY POPULATION PROJECTIONS




| | 2000 | 2002 | 2005 | 2006 | 2010 | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|---|---|---|---|
| Douglas Total | 463,585 | 475,564 | 486,929 | 491,789 | 511,227 | 550,918 | 583,538 | 618,713 | 653,888 |
| Sarpy Total | 122,595 | 126,928 | 139,371 | 142,836 | 156,696 | 191,540 | 224,709 | 253,551 | 282,393 |
| Two-County Total | 586,180 | 602,492 | 626,300 | 634,625 | 667,923 | 742,458 | 808,247 | 872,264 | 936,281 |
| Portion in Papio Watershed | 416,065 | 428,504 | 449,956 | 462,432 | 498,329 | 567,228 | 629,234 | 700,658 | 751,373 |

## 3.3 Housing Construction

### 3.3.1 Single/Two Family Units

The City annually records housing starts for various portions of the City. The areas of the City are subdivided into the In-City Zones (A, B, and C); Present Development Zones (PDZ) (1 through 6 and Ponca Watershed Zone) and the Future Development Zone (FDZ). Table 3-3 summarizes the Single Family/Two Family Housing Starts by zone.

**TABLE 3-3 SINGLE/TWO FAMILY DWELLING UNITS (HOUSING STARTS)**

| Area | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Exurban (Ponca) Watershed** | 6 | 8 | 5 | 2 | 0 | 6 | 6 | 6 | 4 | 5 | 3 | 5 |
| **In-City** | | | | | | | | | | | | |
| Zone A – To 42nd | 26 | 29 | 43 | 42 | 43 | 53 | 63 | 30 | 58 | 57 | 59 | 66 |
| Zone B – 42nd to 72nd | 20 | 36 | 36 | 31 | 38 | 46 | 36 | 50 | 36 | 32 | 31 | 25 |
| Zone C – 72nd to I-680 | 93 | 114 | 113 | 134 | 206 | 249 | 160 | 77 | 61 | 55 | 113 | 66 |
| **Subtotal (In-City and Ponca Watershed)** | **145** | **187** | **197** | **209** | **287** | **354** | **265** | **163** | **159** | **149** | **206** | **162** |
| **Present Development Zone (PDZ)** | | | | | | | | | | | | |
| Zone 1 – Fort North and East | 122 | 166 | 157 | 177 | 195 | 380 | 490 | 325 | 428 | 764 | 667 | 559 |
| Zone 2 – Maple to Fort | 116 | 294 | 237 | 416 | 438 | 296 | 298 | 359 | 364 | 270 | 477 | 247 |
| Zone 3 – West Dodge to Maple | 254 | 278 | 241 | 169 | 201 | 123 | 248 | 425 | 416 | 245 | 237 | 196 |
| Zone 4 – West Center to West Dodge | 93 | 167 | 147 | 253 | 230 | 182 | 190 | 233 | 347 | 348 | 259 | 163 |
| Zone 5 – Q to West Center | 167 | 139 | 136 | 101 | 172 | 166 | 239 | 304 | 362 | 427 | 391 | 261 |
| Zone 6 – Harrison to Q | 202 | 208 | 207 | 145 | 235 | 267 | 298 | 353 | 315 | 250 | 257 | 216 |
| **Future Development Zone (FDZ)** | 127 | 29 | 26 | 31 | 31 | 31 | 17 | 8 | 12 | 51 | 64 | 36 |
| **Subtotal PDZ + FDZ** | **1,081** | **1,281** | **1,151** | **1,292** | **1,502** | **1,445** | **1,780** | **2,007** | **2,244** | **2,355** | **2,352** | **1,678** |
| **Total Single/Two Family** | **1,226** | **1,468** | **1,348** | **1,501** | **1,789** | **1,799** | **2,045** | **2,170** | **2,403** | **2,504** | **2,558** | **1,840** |
| **Portion in Papillion Creek Watershed [1]** | **1,194** | **1,431** | **1,300** | **1,457** | **1,746** | **1,740** | **1,976** | **2,134** | **2,341** | **2,442** | **2,496** | **1,769** |

[1] *Excludes Ponca Watershed and In-City Zone A.*

The Ponca Watershed and Zone A are not in the Papillion Creek Watershed; therefore, these areas do not impact the Papillion Creek interceptor system. A significant increase in Single Family/Two Family housing starts occurred from 2003 to 2006 due to historically low interest rates. From 1995 to 2002 (prior study) such housing starts averaged 1,622 per year in comparison to an average of 2,262 per year from 2003 to 2006 – a 39% increase.

### 3.3.2 Multi-Family Units

The construction of new apartments is also tracked by the City for the same zones. Table 3-4 summarizes Multi-Family housing in a similar fashion as above. Conversely to the above, multi-family housing units decreased by approximately 73% from an average of 942 per year from 1995 to 2002 (prior study) to an average of 256 per year from 2003 to 2006.

### TABLE 3-4 MULTI-FAMILY UNITS (BUILDING PERMITS)

| Area | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Exurban (Ponca) Watershed** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **In-City** | | | | | | | | | | | | |
| Zone A – To 42nd | 20 | 50 | 67 | 8 | 0 | 24 | 21 | 81 | 0 | 0 | 3 | 92 |
| Zone B – 42nd to 72nd | 36 | 15 | 112 | 324 | 0 | 0 | 24 | 0 | 0 | 9 | 12 | 35 |
| Zone C – 72nd to I-680 | 62 | 200 | 223 | 243 | 43 | 12 | 124 | 196 | 66 | 0 | 0 | 3 |
| **Subtotal (In-City and Ponca Watershed)** | **118** | **265** | **402** | **575** | **43** | **36** | **169** | **277** | **66** | **9** | **15** | **130** |
| **Present Development Zone (PDZ)** | | | | | | | | | | | | |
| Zone 1 – Fort North and East | 0 | 0 | 288 | 196 | 0 | 0 | 60 | 198 | 22 | 0 | 33 | 28 |
| Zone 2 – Maple to Fort | 132 | 132 | 591 | 213 | 356 | 169 | 48 | 260 | 60 | 14 | 24 | 115 |
| Zone 3 – West Dodge to Maple | 200 | 685 | 151 | 304 | 0 | 0 | 0 | 92 | 0 | 108 | 0 | 60 |
| Zone 4 – West Center to West Dodge | 0 | 18 | 40 | 72 | 204 | 0 | 253 | 0 | 0 | 0 | 0 | 92 |
| Zone 5 – Q to West Center | 0 | 286 | 86 | 0 | 0 | 328 | 0 | 0 | 64 | 0 | 158 | 60 |
| Zone 6 – Harrison to Q | 48 | 201 | 0 | 47 | 0 | 264 | 3 | 0 | 0 | 0 | 0 | 60 |
| **Future Development Zone (FDZ)** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Subtotal PDZ + FDZ** | **380** | **1,322** | **1,156** | **832** | **560** | **761** | **364** | **550** | **146** | **122** | **215** | **415** |
| **Total Multi-Family Building Permits** | **498** | **1,587** | **1,558** | **1,407** | **603** | **797** | **533** | **827** | **212** | **131** | **230** | **545** |
| **Total Single/Two Family Housing [1]** | **1,226** | **1,468** | **1,348** | **1,501** | **1,789** | **1,799** | **2,045** | **2,170** | **2,403** | **2,504** | **2,558** | **1,840** |
| **Total Residential Units – All Zones** | **1,724** | **3,055** | **2,906** | **2,908** | **2,392** | **2,596** | **2,578** | **2,997** | **2,615** | **2,635** | **2,788** | **2,385** |
| Multi-Family – % of Total Residential Units | 28.9% | 51.9% | 53.6% | 48.4% | 25.2% | 30.7% | 20.7% | 27.6% | 8.1% | 4.9% | 8.2% | 22.8% |
| **Total Single/Two Family PDZ + FDZ [1]** | **1,081** | **1,281** | **1,151** | **1,292** | **1,502** | **1,445** | **1,780** | **2,007** | **2,244** | **2,355** | **2,352** | **1,678** |
| **Total Residential Units – PDZ + FDZ** | **1,461** | **2,603** | **2,307** | **2,124** | **2,062** | **2,206** | **2,144** | **2,557** | **2,390** | **2,477** | **2,567** | **2,093** |
| Multi-Family – % Total PDZ + FDZ Residential Units | 26.0% | 50.8% | 50.1% | 39.2% | 27.2% | 34.5% | 17.0% | 21.5% | 6.1% | 4.9% | 8.3% | 19.8% |
| **Multi-Family Portion in Papio Watershed [2]** | **478** | **1,537** | **1,491** | **1,399** | **603** | **773** | **512** | **746** | **212** | **131** | **227** | **453** |

[1] *Totals from Table 3-2.*

[2] *Excludes Ponca Watershed and In-City Zone A.*

### 3.3.3 Vacant Improved Lots

The vacant improved lots include the sites that are ready for development with utilities and other improvements in place. The supply of Single/Two Family vacant improved lots in the PDZ is summarized in Table 3-5. The number of SF vacant improved lots averaged 7,510 lots per year from 1995 to 2002 (prior study) and 9,966 from 2003 to 2006 – nearly a 33% increase. From Table 3-4, the Single/Two Family housing units constructed in the PDZ for the same period averaged 2,221 per year for 2003 to 2006. Therefore, the backlog of such lots in the Present Development Zone has averaged approximately 9,966 ÷ 2,221 = 4.5 years. The average in backlogged vacant lots has been reasonably consistent through the years. However, with the current economy in recession, there reportedly has been a relatively large number of unsold homes, so the net effect is that there has been a larger combined surplus of vacant improved lots and unoccupied homes than has been traditionally experienced. The Planning Dept's target backlog level of vacant improved lots is 4 years, but there was no way to accurately predict the increased amount of unsold homes that would ensue with a downturn of the economy.

**TABLE 3-5 SINGLE AND TWO-FAMILY VACANT IMPROVED LOTS IN THE PDZ**

| PDZ Area | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | Ave |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zone 1 – Fort North and East | 582 | 503 | 382 | 395 | 653 | 1,742 | 1,567 | 1,820 | 1,970 | 2,820 | 2,783 | 3,127 | 1,529 |
| Zone 2 – Maple to Fort | 521 | 1,633 | 2,069 | 1,663 | 2,043 | 527 | 549 | 541 | 528 | 1,413 | 1,640 | 1,394 | 1,210 |
| Zone 3 – West Dodge to Maple | 1,951 | 1,874 | 1,685 | 1,512 | 1,318 | 1,803 | 2,286 | 1,861 | 1,445 | 1,833 | 2,058 | 2,030 | 1,805 |
| Zone 4 – West Center to West Dodge | 1,064 | 1,474 | 1,552 | 1,332 | 1,443 | 1,484 | 1,716 | 1,590 | 1,350 | 1,462 | 1,482 | 1,322 | 1,439 |
| Zone 5 – Q to West Center | 519 | 793 | 670 | 604 | 809 | 1,421 | 1,442 | 1,546 | 1,592 | 1,695 | 1,523 | 1,189 | 1,150 |
| Zone 6 – Harrison to Q | 836 | 1,164 | 993 | 758 | 1,013 | 1,731 | 1,471 | 1,175 | 917 | 789 | 1,844 | 1,659 | 1,196 |
| **Total PDZ** | **5,473** | **7,441** | **7,351** | **6,264** | **7,279** | **8,708** | **9,031** | **8,533** | **7,802** | **10,012** | **11,330** | **10,721** | **8,329** |

### 3.3.4 Housing Unit Population Densities

The most recent BBR report did not update the people per housing unit statistics. Table 3-5 repeats the projected trends from the previous study. For modeling purposes, a value of 2.5 people per housing unit was used to allocate population growth.

**TABLE 3-5 PEOPLE PER HOUSING UNIT**

| Area | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|---|
| Omaha Jurisdiction | 2.54 | 2.48 | 2.42 | 2.37 | 2.31 | 2.25 |
| Douglas County | 2.41 | 2.43 | 2.44 | 2.46 | 2.47 | 2.49 |

*Source: 2003 Bureau of Business Research; includes all housing types.*

## 3.4 Commercial/Industrial Land

As residential development occurs in the drainage basin, commercial areas are developed to support the expanding population. In addition, development occurs as industries relocate or expand their manufacturing capabilities. In keeping with previous studies industrial/commercial development has been allocated at 3.6 acres per 100 population, except where specifically otherwise shown on the Planning Dept.'s maps. Certain areas, such as near Blair High Road and I-680, have been specifically designated by the City for industrial growth. These will be evaluated as such; however, the majority of commercial development occurs along major streets and highways and is distributed across all the sub-basins.

## 3.5 Land Consumption

- Land Consumption Considerations
  - "Gross Developable Acres". The term "gross developable acres" for S&IDs and commercial/industrial parcels means the total land area encompassed by a parcel's outer property boundaries, which includes interior streets and green space.
  - "Total Gross Acres". Depending on how a parcel was purchased, there are instances where certain green space areas may not be included within a development, such as major stream riparian areas and forested and/or steep terrain areas. Other external set-aside areas are not

considered part of "gross acres" within an S&ID: highways; schools; parks and native prairies; regional reservoirs; the Douglas County Landfill and its assumed eastward expansion area; and other reserved government property. Therefore, actual total land consumption ("total gross acres") will be considerably higher and will vary among sub-basins.

- Development Density Considerations. There is inherently a lot of confusion when trying to predict various development densities, because zoning can change and there are fluctuations in: population density per dwelling unit, the number of dwelling units per gross developable acre, the ratio of Single Family to Multi-Family housing units, and, finally, the ratio of commercial/industrial to residential gross developable acres. Where used in this study, commercial/industrial acres are considered as being all development involving occupied buildings that are not otherwise classified as residential.

- "Build-Out." All of the above-described development density statistics are used in an attempt to predict so-called "build-out" within the Watershed. Further, the term "build-out" can mean either "platting build-out" or "occupation build-out." Platting build-out would occur when there is no feasible remaining developable land remaining in the Watershed and may occur as much as 10 years or more prior to occupation build-out. Occupation build-out would occur when the design population and commercial/industrial acres fill the Watershed. As a practical matter, design occupation build-out must include, say, a 10% allowance for vacant improved lots and/or unoccupied dwelling units that may never quite be filled.

- Recent Land Consumption Summary. Table 3-6 represents a summary of land consumption statistics within the Omaha PDZ for 2003 through 2006.

### TABLE 3-6 LAND CONSUMPTION SUMMARY FOR PDZ (ZONES 1 - 6)

| Parameter | Year | | | | Totals | Averages |
|---|---|---|---|---|---|---|
| | 2003 | 2004 | 2005 | 2006 | | |
| Total Acres | 1,646.5 | 2,239.3 | 1,452.8 | 809.8 | 6,148.4 | 1,537.1 |
| Gross Developable Acres | 1,128.2 | 1,366.2 | 976.1 | 615.5 | 4,086.0 | 1,021.5 |
| % Gross Developable to Total Acres | 68.5% | 61.0% | 67.2% | 76.0% | | 68.2% |
| SF Gross Developable Acres | 860 | 884 | 686 | 207 | 2,637 | 659.3 |
| MF Gross Developable Acres | 27 | 22 | 42 | 26 | 117 | 29.3 |
| Total Res. Gross Developable Acres | 887 | 906 | 728 | 233 | 2,754 | 688.5 |
| Total Comm/Ind Gross Developable Acres (by subtraction) | 241 | 460 | 248 | 383 | 1,332 | 333.0 |
| SF Dwelling Units per Gross Developable Acre | 4.42 | 4.28 | 4.74 | 3.58 | | 4.26 |
| MF Dwelling Units per Gross Developable Acre | 16.00 | 18.63 | 14.2 | 12.61 | | 15.37 |
| % SF to Total Residential Acres | 97.0% | 97.5% | 94.1% | 88.9% | | 94.4% |
| % SF Gross Developable Acres | 76.3% | 64.6% | 70.4% | 33.7% | | 61.3% |
| % MF Gross Developable Acres | 2.4% | 1.6% | 4.4% | 4.2% | | 3.2% |
| % Comm/Ind Gross Developable Acres | 21.3% | 33.7% | 25.3% | 62.1% | | 35.6% |

Using the statistics from Table 3-6, the following series of calculations were made for the potential population density for 2003 to 2006 for the PDZ:

Single Family Potential Population = 2,637 gross developable acres x 4.26 dwelling units per gross developable acre x 2.5 people per dwelling unit = 28,084 people

Multi-Family Potential Population = 117 gross developable acres x 15.36 dwelling units per gross developable acre x 2.5 people per dwelling unit = 4,493 people

Total Potential Population = 32,577 people
Target Population (interpolated from Table 3-2) = 15,873 people = 48.3% of potential occupancy

Approximate Gross Residential Acres = 2,753 total gross developable acres ÷ 68.2% gross developable-to-total gross acre ratio = 4,037 total gross residential acres

Potential Population Density = 32,577 people ÷ 4,037 total gross residential acres = 8.1 people per total gross residential acres

Table 3-7 summarizes the theoretical acreage requirements within the Watershed if conventional development were to continue. These acreage requirements were based on the above statistics, and using the most recent aerial photography and GIS-based land use and S&ID information from Douglas and Sarpy Counties, new development was placed in the various sub-basins within the Watershed for modeling purposes. Considerable judgment was required to reasonably match up population with what appeared to be developable land. See Chapter 4 for additional details.

Baseline average flows in the model runs were based on gallons per capita per day (gpcd) x theoretical incremental population. Wet weather flows were, in turn, derived by multiplying appropriate peaking factors times the baseline average flows. Therefore, as long as the targeted populations were distributed reasonably well within the Watershed in keeping with the overall population projections, then the model was considered to be valid for each planning time increment for the purposes intended.

Appendix B contains the estimated sub-basin populations derived in the manner described above. Also by the above methodology, it was estimated that platting build-out in Sarpy County may occur slightly before 2040, whereas platting build-out in Douglas County may occur after 2050. These projections are highly speculative, given the large number of variables involved.

**TABLE 3-7 ORIGINALLY TARGETED DEVELOPABLE ACRE REQUIREMENTS**

| Year | Douglas Co. Population | Sarpy Co. Population | Total Population | Incremental Pop., Douglas Co. | Incremental Pop., Sarpy Co. | Total Incremental Pop in Watershed | Gross Residential Acres required | Developable Res Acres Required | Developable Comm/Ind Acres Required | Total Developable Acres Required |
|---|---|---|---|---|---|---|---|---|---|---|
| 2000 | 313,742 | 102,323 | 416,065 | | | | | | | |
| 2002 | 324,610 | 103,894 | 428,504 | | | | | | | |
| 2005 | 335,877 | 114,079 | 449,956 | ↓ | ↓ | ↓ | | | | |
| 2006 | 342,215 | 120,217 | 462,432 | 17,605 | 16,323 | 33,928 | ↓ | ↓ | ↓ | |
| 2010 | 367,566 | 130,763 | 498,329 | 25,351 | 10,546 | 35,897 | 4,432 | 3,022 | 1,292 | 4,315 |
| 2020 | 405,787 | 161,441 | 567,228 | 38,221 | 30,678 | 68,899 | 8,506 | 5,801 | 2,480 | 8,281 |
| 2030 | 437120 | 192,114 | 629,234 | 31,333 | 30,673 | 62,006 | 7,655 | 5,221 | 2,232 | 7,453 |
| 2040 | 481351 | 219,307 | 700,658 | 44,231 | 27,193 | 71,424 | 8,818 | 6,014 | 2,571 | 8,585 |
| 2050 | 504,630 | 246,743 | 751,373 | 23,279 | 27,436 | 50,715 | 6,261 | 4,270 | 1,826 | 6,096 |
| | | | | | | **Totals** | **31,240** | **21,306** | **9,110** | **30,415** |

**Assumptions**
[1] Gross Developable Acres required = incremental population ÷ 8.1 people per gross residential acre
[2] Developable Acres = 68.2 % Total Gross Acres
[3] Developable Commercial/Industrial acres are same as total Gross Acres for Gross Commercial/Industrial Acres
[4] Developable Commercial/Industrial acres required = 3.6 developable acres per 100 population

## 3.6 Distribution of Development

The vast majority of Douglas county development is anticipated to occur in the West Papillion Creek and Big Papillion Creek basins. These are also the largest of the basins, comprising 73% of the total study area. Based on discussions with the City and land use projections, the approximate distribution of existing and future Watershed population is projected to occur as summarized in Table 3-8.

**TABLE 3-8 DISTRIBUTION OF WATERSHED POPULATION THROUGH 2050**

| Sub-Basin | Percent of Population |
|---|---|
| Little Papillion | 20.5% |
| Big Papillion | 35.4% |
| West Papillion | 33.3% |
| South Papillion | 10.8% |

# CHAPTER 4
# MODEL PARAMETERS

## 4.1 General

The design of an interceptor sewer system, because of its large, diverse and variable service area, requires a range of engineering considerations from preliminary investigation through construction methods and funding sources. This report considers such factors in varying levels of detail. Final alignment and design issues are examples of parameters to be more fully addressed subsequent to this report. More basic factors, such as wastewater flow factors and service areas necessary to both preliminary and final design, are established in this report.

## 4.2 Model Parameters

Preliminary design and evaluation of the proposed system was completed by considering pertinent factors, including population, land use, terrain, existing sewer sizes, wastewater flow factors, total wastewater loading on the system, and hydraulics of the various interceptors. Following is a summary of key information and input data for the hydraulic model.

- Population allocations by sub-basin were made using GIS-based land uses.
- Population distributed among land uses and service areas allowed the calculation of wastewater flow rates and combined loadings at the various locations within the proposed interceptor sewer system.
- Future population distributions were made to sub-basins that were determined to have capacity for growth. Capacity was based on 2006 aerial photographs within the study area, and input from the City on future land use. Terrain considerations included such urban features as pavement, utilities, railroads, highways, and developed areas.
- A major factor was the gradient available for a gravity sewer system. Where no sewers exist, the gradient or slope of the sewer systems used in preliminary design was set equal to the slope of the streambed in that area. The gradient or slope used on existing sewers was based on information from the Department of Public Works.
- As mentioned in Section 1.2 of the Executive Summary, design peak wastewater flows in this updated study were determined from flow metering records from 2005 and 2006 as follows:

    - Four in-system flow meters temporarily installed in 2005. Records from a fifth meter were not considered due to suspected hydraulic interference from an upstream inverted siphon. Peak hour flows were determined from the most severe storm event that occurred on May 31, 2005. Peak hour to baseline average peaking factors for the four meters used ranged from 2.10 to 4.34.
    - Two flow meters (ADS and Flo-Dar meters) temporarily installed in the same manhole as a redundant cross check against each other in 2006 just above the Papio WWTP headworks and upstream of the point of bypass to the Missouri River. Peak hour flows were determined from the most severe storm event that occurred on August 8, 2006. Baseline average flows, which include steady-state infiltration/inflow, were determined during the week following this storm event, when no rainfall occurred. Examining the data from these two meters, it was determined that the most representative 2006 baseline average flow was approximately 59 mgd, and that the most representative peak hour flow during the August 6, 2006 storm event was approximately 185 mgd. Given the estimated population within the Watershed, the baseline flow was estimated to be 124 gpcd. Therefore, the peak hour to baseline average peaking factor near the lower portion of the Watershed was calculated as 185 mgd ÷ 59 mgd = 3.14.

- Gretna flow metering from 2006 that included the August 8, 2006 storm event. The flow metering for Gretna occurs at a weir manhole downstream of Gretna and includes a contracted amount of "over-the-ridge" pumping. The peaking factor was determined to be very high at 7.46.
- Elkhorn WWTP. Beginning in 2010, based on City staff feedback, it was assumed that Elkhorn's WWTP would be de-commissioned and connected to the West Papio interceptor sewer system. It was learned that the average flow at the plant is currently approximately 0.5 mgd. During severe storm events, including the August 6, 2006 storm event, the plant meter limit of 2.0 mgd was exceeded. Therefore, the Elkhorn WWTP currently has a peaking factor of at least 2.0 mgd ÷ 0.5 mgd = 4.0.
- Bellevue. There is a portion of the Bellevue wastewater system that currently discharges to the Missouri River Basin that is scheduled to be rerouted by pumping to the Papio system to a point near the Papio WWTP entrance road by sometime in 2008. The peak hour contribution from this source was assigned to be the design maximum pumping rate of the lift station. For dry weather flows the average flow is set at 1.296 mgd and for the wet weather flows, the peak was set at 2.592 mgd.
- Combined Sewer Overflow (CSO) Connections. It was assumed the wastewater contributions in the Cole Creek and Saddle Creek CSO areas would be at the full capacity of the pipes connecting the CSOs to the dedicated sanitary interceptor sewer system. It was found that multiplying the baseline average flows by the peaking factor yielded peak flows higher than the respective pipe capacities. On the modeled hydrograph, the peak was set at the capacity of the pipe, and to preserve the volume under the hydrograph, the excess flows were uniformly distributed between the raising and falling limb of the hydrograph

Table 4-1 shows the details of the peaking factors determinations from the above-described flow metering. A map showing the peaking factors used in the model effort is presented in Figure 1-4.

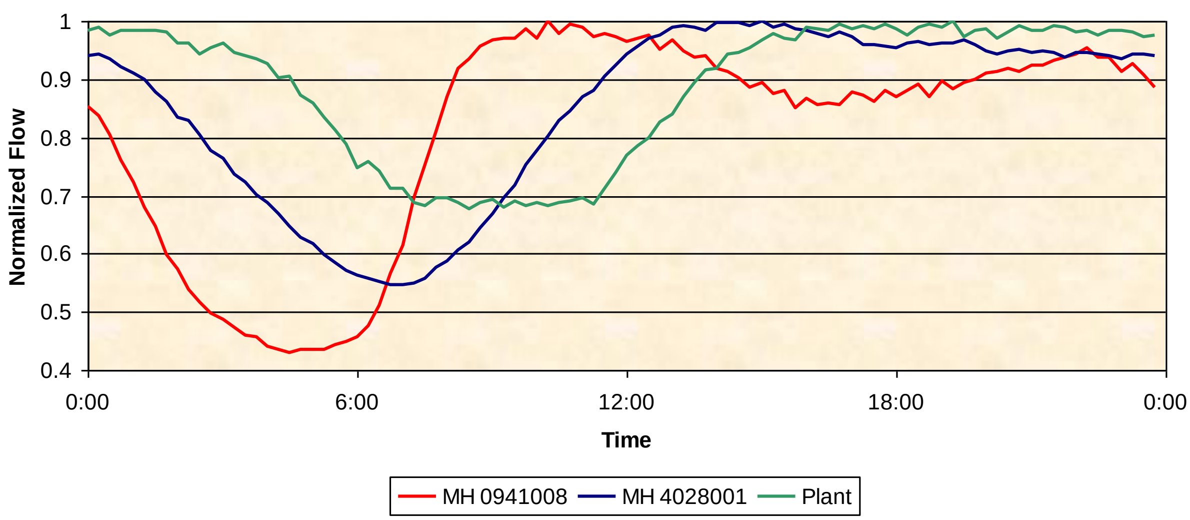
## Table 4-1 Summary of Recent Flow Metering Results

| May 5 to June 1, 2005 ADS Flow Monitoring Data | | |
|---|---|---|
| **MH 4028001**, Big Papio 36th St. S. of Cornhusker (90" line, May 31, 2005) | | |
| Est. Population | 133.944 | thousands (from prior 2004 Report) |
| Q peak | 106.2 | mgd |
| Q average | 36.26 | mgd |
| $Q_{peak}$/Qave. | 2.93 | (Total Drainage Area = 85,846 acres) |
| **MH 4055001** W Papio 36th St. S. of Cornhusker (78" line, May 31, 2005) | | |
| Est. Population | 250.056 | thousands (from prior 2004 Report) |
| Q peak | 52.74 | mgd |
| Q average | 15.40 | mgd |
| Qpeak/Qave. | 3.43 | (Total Drainage Area = 83,784 acres) |
| **MH 0941008** at 144th and Industrial Road (24" line, May 31, 2005) | | |
| Est. Population | 26.197 | thousands (from prior 2004 Report) |
| Q peak | 6.785 | mgd |
| Q average | 3.23 | mgd |
| Qpeak/Qave. | 2.10 | (Total Drainage Area = 13,933 acres) |
| **MH 0707029** in Kohls Parking Lot at 72nd & Pacific (36" Line, May 31, 2005) | | |
| Est. Population | 33.342 | thousands (from prior 2004 Report) |
| Q peak | 0.267 | mgd |
| Q average | 0.061 | mgd |
| Qpeak/Qave. | 4.34 | (Total Drainage Area = 5,564 acres) |
| **MH 0394025** at Papillion Parkway S. of Blondo (24" Line, May 31, 2005) | | |
| Est. Population | 18.747 | thousands **(Assumed Bad Meter Location)** |
| Q peak | 3.238 | mgd |
| Q average | 0.428752 | mgd |
| $Q_{peak}/Q_{design}$ | 7.55 | (Total Drainage Area = 3,330 acres) |
| **August 8 2006 Flow Monitoring Just Above Papio Plant Headworks** | | |
| **ADS Flow Metering Just Above Papio Plant Headworks (Aug. 8, 2006)** | | |
| Est. Population | 423.644 | thousands (from prior 2004 Report) |
| Q peak | 185.2 | mgd |
| Q average | 54.01125 | mgd |
| Qpeak/Qave. | 3.43 | (Total Drainage Area = 182,310 acres) |
| **Flo-Dar Flow Metering Just Above Papio Plant Headworks (Aug. 8, 2006)** | | |
| Est. Population | 423.644 | thousands (from prior 2004 Report) |
| Q peak | 193.797 | mgd |
| Q average | 59.78064 | mgd |
| Qpeak/Qave. | 3.24 | (Total Drainage Area = 182,310 acres) |
| **Master Meter Flow Monitoring at Gretna (Aug. 8, 2006)** | | |
| Est. 2005 Population | 4.860 | thousands (per projections) |
| Q peak | 4.618 | mgd |
| Q average | 0.619 | mgd |
| Qpeak/Qave. | 7.46 | |
| **Flow Monitoring at Elkhorn WWTP (Aug. 8, 2006)** | | |
| Est. 2005 Population. | 8.192 | thousands (per projections) |
| Q peak | 2.0 | mgd (meter was exceeded) |
| Q average | 0.5 | mgd |
| Qpeak/Qave. | 4.00 | (this value or higher) |

### 4.3 Base Flow Calculations

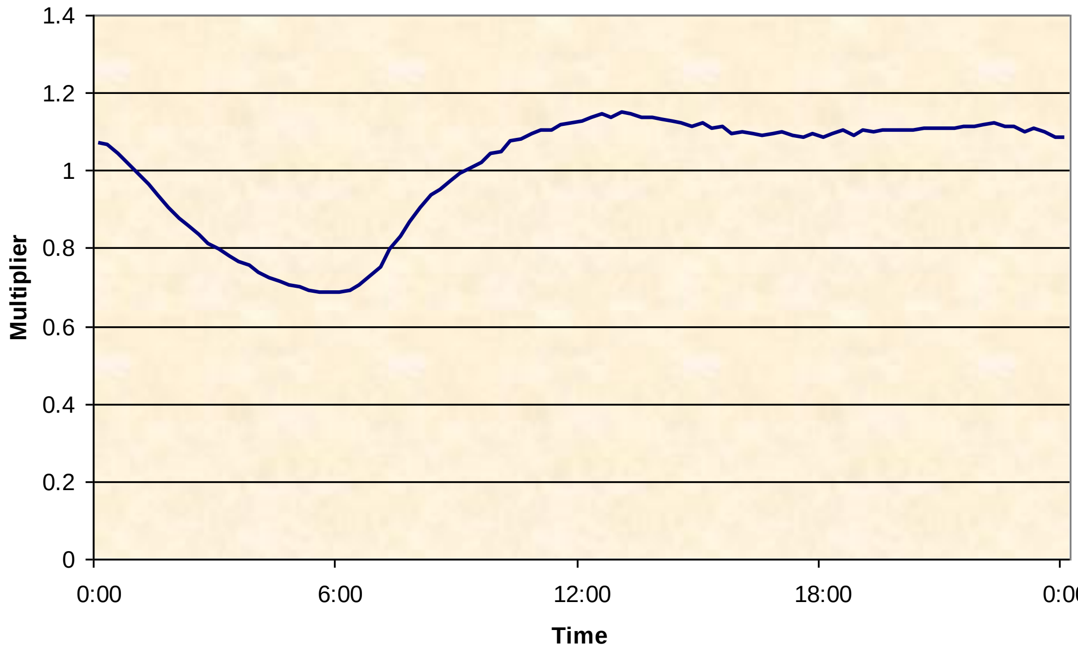
The base flow for the basins was based on the average flow for the total basin and population within the basins. True dry weather flows were not obtained because the meters were installed during the summer months and dry weather flows are usually obtained during the winter months. The base flows then include dry weather flows plus some small amount of steady-state infiltration due to prior summer storms. The Flo-Dar data at the treatment plant from 2006 was used to obtain base flows. Flow data recorded during the periods of no rainfall events were used to obtain base flow values. The base flow was calculated to be an average flow of approximately 59 mgd. Taking this value and dividing it by the estimated total population within the Watershed yielded an estimate of 124 gallons per capita per day (gpcd). The calculation of base flows for each basin is the multiplied product of time-based points on the diurnal curve, the 124 gpcd value, and the basin population. Base flows for the treatment plant and two other meters were recorded and then normalized to obtain representative hydrographs shapes that were used for modeling as illustrated by Figure 4-1.

**FIGURE 4-1 REPRESENTATIVE HYDROGRAPH SHAPES USED FOR MODELING**




The diurnal curves were taken from the wastewater flow patterns recorded at the metered sites. A typical plot of these curves is shown in Figure 4-2 and illustrates the basic wastewater production as a function of time. These curves are generated for each of the metered sites. The diurnal curve from the metered sites was applied to the basins located nearest to it.

**FIGURE 4-2 TYPICAL DIURNAL CURVE FOR ZONE 3**




### 4.4 Wet Weather Flow Calculations

This information was used to model and calculate the capacities and flows of the existing system as of 2006. The modeled results were evaluated and provided the baseline data for the study area. This was used to determine the improvements required for subsequent design year conditions. The existing sewer system is shown in Figure 4-3.

Calculation of wet weather flow hydrographs were completed for each of the basins. Flow data from the metered sites in 2005 were used to generate the hydrographs Figure 1-4. However, there were no recorded flows immediately upstream of the treatment plant headworks for that year. Meters were located at the confluence of the Papio and West Papio branches. These were summed and assumed to equal to the flow at the plant. In 2006 meters were added at the Papio plant and no meters in the basin. The largest storm event during the two years took place in 2006. Modeling was based on this larger event in 2006. To use the metered data that was collected in 2005 but apply it to the large storm that was recorded in 2006, the ratio between the 2005 and 2006 metered flow at the treatment plant was applied to the metered 2005 flows. This generated a hydrograph shape for the metered sites. These flows included the base flow. The base flow was subtracted out which leaves the wet weather flow hydrograph.

From modeling of the base flow conditions, travel times through the basin and down to the treatment plant were calculated. These are presented in Figure 4-4. Travel times were used to adjust the time to peak of the hydrographs and applied to their respective basin.

Figure 4-5 shows the peak and total rainfalls for the largest storms for 2005 and 2006. Although the rain data indicate that both the 2005 and 2006 storms were mainly located in the lower portion of the watershed, the storms were essentially extended by extrapolating the hydrographs through the Watershed.

Wet weather flow hydrographs for each sub-basin were calculated by generating the base flow for the sub-basin which is composed of the 124 gpcd, sub-basin population and diurnal curve value. To this was added the wet weather component of the hydrographs. The shape of the wet weather hydrograph was taken from the nearest metered site. The hydrograph was then scaled by the respective peaking factor assigned for each sub-basin.

## 4.5 Future Development Calculations

Modeling of future development scenario was completed by using the population projections for those years. The new population values were applied and used to adjust the base flows for that scenario. The impact on the capacity due to the population changes was calculated. Capacity analysis was also completed for wet weather conditions by adding on the wet weather hydrographs.

Modeling was completed for years 2010, 2020, 2030, 2040 and 2050. Due to current economic conditions, the slow down of housing development, and unknown future development densities, it is expected that even by 2050 the study area may not necessarily attain ultimate platting build-out. Most of the potentially undeveloped areas through 2050 were placed along the Washington County border and the northwest part of the Douglas County.

The 2050 model simulation was completed first in order to define the maximum system capacity requirements. Model simulations of the intermediate years were completed next to define segments of inadequate capacity. In the model these segments were paralleled with the recommended sewer pipe size from the 2050 simulations. These model runs defined the sewer pipe upgrade plan for the sub-basins by decade. Appendix C contains the modeled system flows and capacities for all scenarios.

At the direction of the City, a separate, special modeling run for the 2050 loading condition was performed prior to the current study to pick up the over-the-ridge pumping from the Hampton's Subdivision west of 204$^{th}$ Street (Highway 31) near West Q Street. This analysis showed that impacts to the receiving interceptor sewer system would be negligible, provided that system capacity improvements were made in a timely manner to meet the needs of the sub-basins within the Watershed without regard to such limited over-the-ridge pumping. Similarly, contributions from similar peripheral over-the-ridge peripheral areas along the northwestern edge of the Watershed were included in a 2050 run for this study. The changes in the hydraulic profiles were so slight that it was not possible to discern differences in the plots included in Appendix D. The same was judged to be true for the Sanctuary Subdivision, even though its contribution was not specifically modeled.

## FIGURE 4-3 MODELED SANITARY SEWER INTERCEPTOR SYSTEM

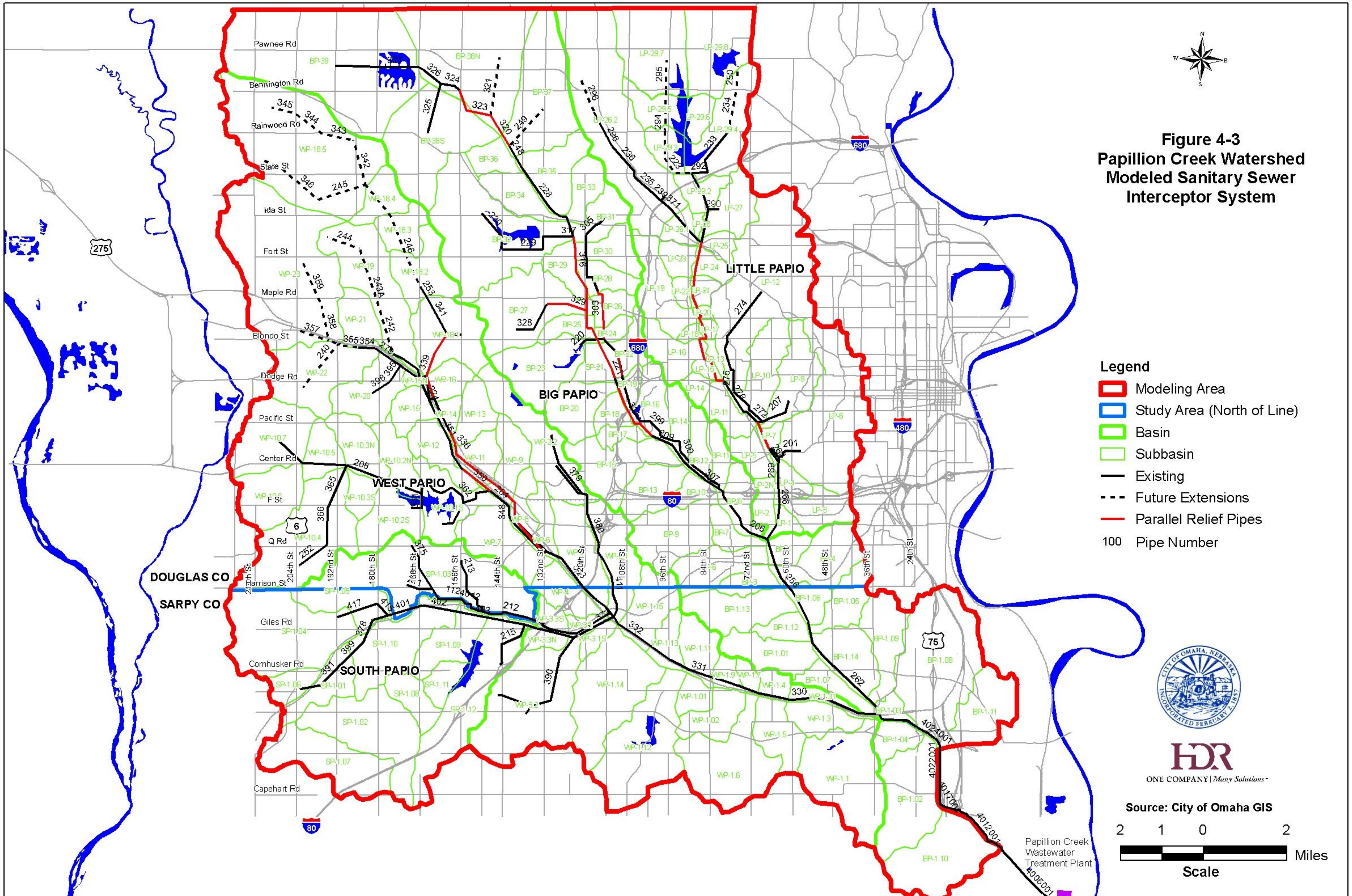
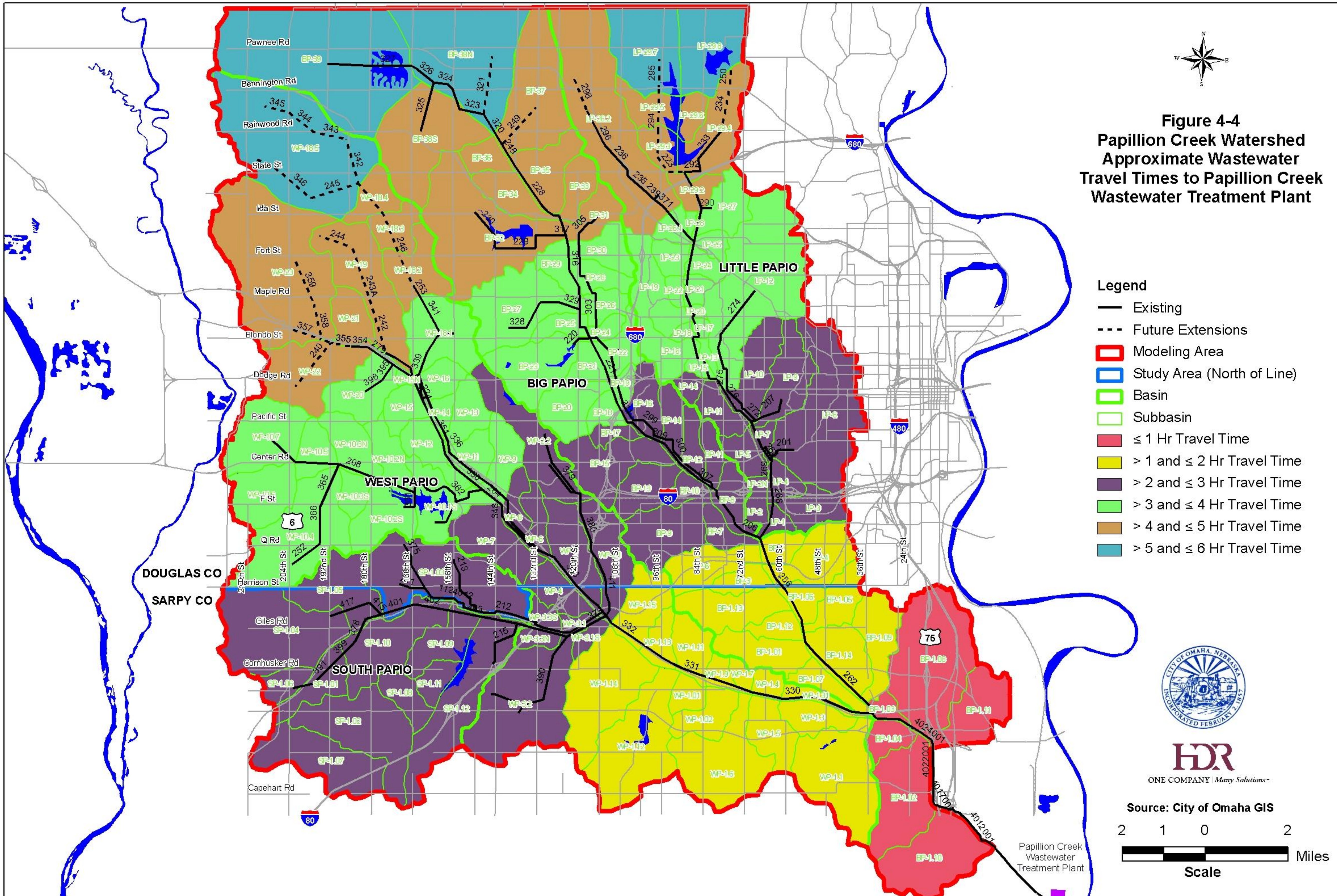
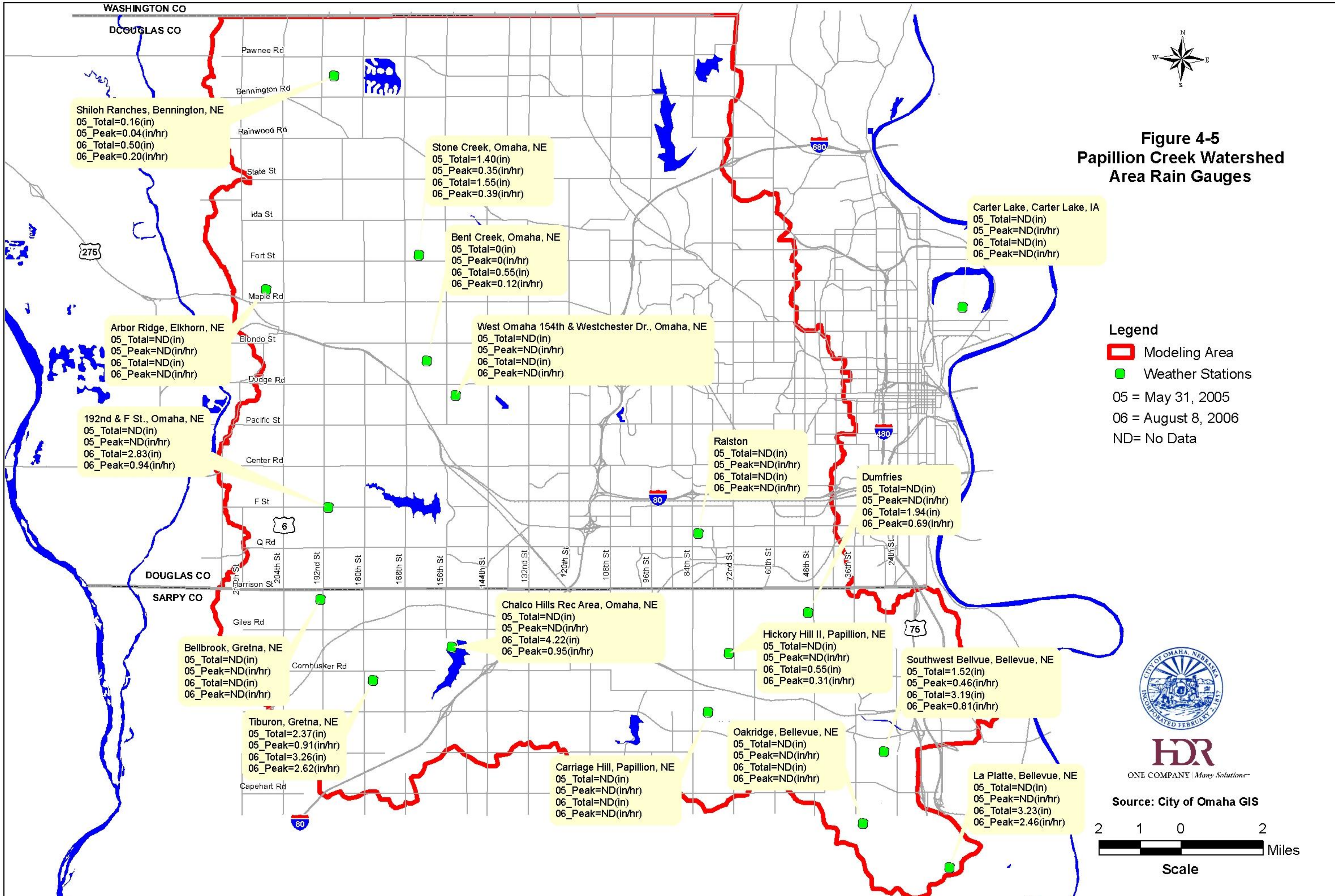


**FIGURE 4-4 PAPILLION CREEK APPROXIMATE WASTEWATER TRAVEL TIMES TO PAPILLION CREEK WASTEWATER TREATMENT PLANT**



## FIGURE 4-5 PAPILLION CREEK WATERSHED AREA RAIN GAUGES



# CHAPTER 5
# INTERCEPTOR SEWER REQUIREMENTS

## 5.1 General

As discussed in Chapter 4, design wastewater loadings were determined using baseline average flow rates based on 124 gpcd observed above the headworks of the Papio WWTP; the respective sub-basin populations; and the wet-weather hydrographs created by combining flow ratios from the 2005 in-system flow monitoring and the peak flow from the August 8, 2006 storm event at the Papillion Creek WWTP. The flows were projected forward to derive the design baseline model for existing conditions (2006).

An interceptor construction program was then developed based on incremental growth within the study area. New growth loadings to the interceptors were distributed in a sequential, contiguous order of development within each sub-basin. Major, high-cost interceptor projects to undeveloped areas that were a significant distance from existing interceptors generally were given a lower priority and were, therefore, deferred until it was judged that new development would likely abut the area in question.

Major elements in the development of the construction program included: growth analysis of the study area; use of the computer model to analyze the existing sewer system; and the evaluation of potential system improvements. Wastewater loadings were determined by applying the adjusted flow factors to the sub-basin populations as growth occurs and adding the source flows to the system at the appropriate locations. The future system flows, less the capacity of the existing system, determined the additional capacity required to serve the area. New interceptor sewers were sized generally for the projected population of the service area through the year 2050. In peripheral areas where pipe sizes to serve the 2050 population were somewhat marginal with respect to possible additional growth beyond 2050 and where a nominal increase in capacity would perhaps be beneficial, the next larger size was chosen as a matter of practicality for the analysis.

Traditional pipe sizing formulas were used, and the pipes were assumed to be flowing full or with a slight, tolerable surcharge during peak flow hourly conditions prior to considering relief sewers. Locations for prospective relief sewers were chosen where significant deviations (increases) were indicated in the hydraulic grade lines relative to the existing pipe slopes.

Preliminary design was completed with the consideration of appurtenances, materials, preliminary alignments, and construction methods. Following are cost estimating assumptions:

- Basic project construction costs were limited to piping, manholes, inverted siphons, and lift stations. Piping segments that would likely involve jacking and boring or directional drilling or especially difficult construction received additional construction cost allowances. Estimated project costs include construction, ROW acquisition, utility relocation, engineering, legal, financial costs, and 10% contingency allowance.

- Estimated construction costs provide for construction materials normally permitted by City specifications.

- Future construction costs were projected based on historical RS Means *Sitework Construction Cost Data* corrected to Omaha for each mid-period.

## 5.2 Development Scenarios

Existing baseline conditions for the Papillion Creek basin are indexed to 2006, which correlates with the most recent year-end data available from the City for housing starts/permits, available lots, and population information. The developments in the various sub-basins were evaluated in contiguous increments to define long range interceptor needs, as well as relief sewer requirements and timing along the major interceptor sewers in the Little, Big and West Papillion Creek sub-basins. Interceptor needs through the planning period (year 2050) were evaluated to establish the design year requirements. The 2050 design period is in accordance with the population projections, industrial/commercial projections and land use planning completed by the BBR and City. Following is a summary of the model scenarios:

- Baseline development was based on 2006 population.
- "Program Projects" modeling for the PDZ was initially based on the period from 2007 to 2010. PDZ boundary updates were made by the City that required some modeling changes; therefore, the "Program Projects" were re-labeled as representing the time period from 2009 to 2010.
- "Near-Term Projects" modeling was geared to the 2011 to 2020 time increment.
- Incremental development by decade was distributed thereafter through the design year 2050. This will allow logical phasing of future interceptor requirements and relief sewers.
- Ultimate build-out within the Watershed was not used to size sewers because of uncertainties expressed by the Planning Dept. for future development densities with respect to low impact development (LID) strategies currently being considered. LID requires set-aside vegetated areas that could affect lot sizes. Also, the areas along the western and northern peripheries of the Watershed in Douglas County (shown as undeveloped in Figure 1-1) may become somewhat lower density "transition" areas that will abut rural estate type developments. Therefore, for ultimate build-out of the Watershed after 2050, depending on subsequent planning decisions, some interceptor extensions and relief sewers may require additional capacity if conventional urban densities will continue to extend to the ridge lines.

## 5.3 Recommended Interceptor Projects

All recommended interceptor sewer projects were generally sized to accommodate development to the 2050 conditions. The interceptor sewer projects can be grouped into three categories based on the timing of their population demands:

- "Program Projects" are to be constructed in the next 3 to 5 years as determined from expected development pressure and input from the development community. As explained above, due to various project delays, the "Program Projects" were assigned to be those from 2009 to 2010.
- "Near-Term Projects" represent the balance of the decade; in this case, the period from 2011 to 2020 to provide service to the growing population, including relief sewers along major interceptor routes. Cost projections for the latter period would be considered somewhat less reliable than for the Program Projects.
- "Future Projects" were derived for decade increments through 2050 and are listed for informational long-term planning purposes; albeit cost estimates are not expected to be very reliable due to the many variables involved.

Table 5-1 lists the various recommended Program Projects and Figure 5-1 illustrates all projects through 2050. Detailed tabular listings for all projects are listed in Appendix A, which are intended to meet the capacity requirements for various pipe segments listed in Appendix C. Flow metering has been included to provide much needed additional information on the spatial distribution of wet weather peaking factors. It is imperative that the City engage in an on-going flow metering program and aggressively pursue reduction of infiltration/inflow to minimize the need for future costly relief sewers.

## TABLE 5-1 RECOMMENDED PROGRAM PROJECTS

| Program Projects 2009-2010 (Coded Orange) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Inflation Factor at 2010 | | | 1.17 | | | | | |
| | | | | | | | | 2007 Dollars | | | | |
| Sub-basin | Pipe ID | Overall Length, ft. | Jack & Bore Length, ft. | Assumed Add. Reservoir Length, ft. | Conduit Shape | Conduit Width, In. | Conduit Height, In. | Regular Pipe Cost | Additional Jack & Bore Cost | Pump Station Cost | Difficult Constr. Multiplier | Total Cost, Adjusted to 2010 |
| **Pipe Extensions** | | | | | | | | | | | | |
| **Cunningham Lake Area** | | | | | | | | | | | | |
| LP-29.4 | **234** (E. Side Cunningham Lake) | 5,550 | 100 | | CIRC | 21 | 21 | $1,895,000 | $43,000 | | 1.00 | $2,267,000 |
| LP-29.3 | **Pump Station** (West Side) [1] | | | | | | | | | $344,000 | 1.00 | $402,000 |
| | **293** (force main) [1] | 7,200 | 100 | | CIRC | 10 | 10 | $288,000 | $38,000 | | 1.00 | $381,000 |
| | **223** (21" gravity receiving line + 12", 15" and 18" inverted siphon) [1] | 2,800 | 100 | | CIRC | 21 | 21 | $1,412,356 | | | 1.00 | $1,652,000 |
| **NW of 180th & West Blondo** | | | | | | | | | | | | |
| WP-19 | **242** | 2,428 | 450 | | CIRC | 27 | 27 | $1,004,000 | $203,000 | | 1.00 | $1,412,000 |
| WP-19 | **243A** [2] | 2,234 | 150 | | CIRC | 18 | 18 | $720,000 | $64,000 | | 1.00 | $917,000 |
| | | | | | | | | | | | **Subtotal** | **$7,031,000** |
| **Parallel Relief Pipes** | | | | | | | | | | | | |
| **Miracle Hills Sewer Relief Project [3]** | | | | | | | | | | | | |
| BP-21 | **221** | 5,404 | | | CIRC | 54 | 54 | | | | | |
| BP-25 | **313** | 2,218 | | | CIRC | 54 | 54 | | | | | |
| BP-25 | **314** | 2,284 | | | CIRC | 54 | 54 | | | | | |
| BP-27 | **315** | 1,768 | | | CIRC | 54 | 54 | | | | | $6,000,000 |
| | | | | | | | | | | | **Subtotal** | **$6,000,000** |

**Table 5-1 Recommended Program Projects (Continued)**

| Flow Metering | | | | | |
|---|---|---|---|---|---|
| Sub-basin | MH Number | Location Description | Conduit Size | Purpose/Sub-Basins Served/Comments | Total Cost, Adjusted to 2010 [4] |
| **Permanent Site Locations** | | | | | |
| Big Papio, Lower | Unknown | Above Papio WWTP headworks and above point of bypass to river; same monitoring site used in 2006. Redundant meters to be installed per City preference | 9' x 9' Box | Total flow in entire Interceptor Sewer System; continuity with 2006 flow monitoring. Assumes use of Flo-Dar meter already possessed by City + add new ADFM Pro 20 @ $15,000 + Telog @ $3,500 + rain gauge @ $1,500 + installation @$10,000 | $30,000 |
| Big Papio | 4055001 | Near 36th St. S. of Cornhusker; same monitoring site used in 2005. | 90" Dia. | Big Papio sub-basin just above West Papio confluence; continuity with 2005 flow monitoring. Assumes new Flo-Dar or ADFM Pro 20 @ $15,000 + Telog @ $3,500 + rain gauge @ $1,500 + installation @$10,000. | $30,000 |
| West Papio, Lower | 4028001 | Near 36th St. S. of Cornhusker; same monitoring site used in 2005. | 78" Dia. | West Papio sub-basin just above Big Papio confluence; continuity with 2005 flow monitoring. Assumes new Flo-Dar or ADFM Pro 20 @ $15,000 + Telog @ $3,500 + installation @$10,000. | $28,500 |
| Little Papio, Lower | 0699027 | First MH south of L St. on Little Papio | 66" Dia. | Little Papio sub-basin just above Big Papio confluence. Assumes new Flo-Dar or ADFM Pro 20 @ $15,000 + Telog @ $3,500 + rain gauge @ $1,500 + installation @$10,000. | $30,000 |
| Big Papio | 0736047 | First MH north of L St. on Big Papio | 66" Dia. | Big Papio sub-basin just above Little Papio confluence. Assumes new Flo-Dar or ADFM Pro 20 @ $15,000 + Telog @ $3,500 + installation @$10,000. | $28,500 |
| Little Papio, East Branch | 0707029 | MH in Kohls parking lot at 72nd and Pacific; same monitoring site used in 2005. | 36" Dia. | Above Saddle Creek CSO; continuity with 2005 flow monitoring. Assumes existing ADS meter + Telog @ $3,500 + rain gauge @ $1,500 + installation @$10,000. | $15,000 |

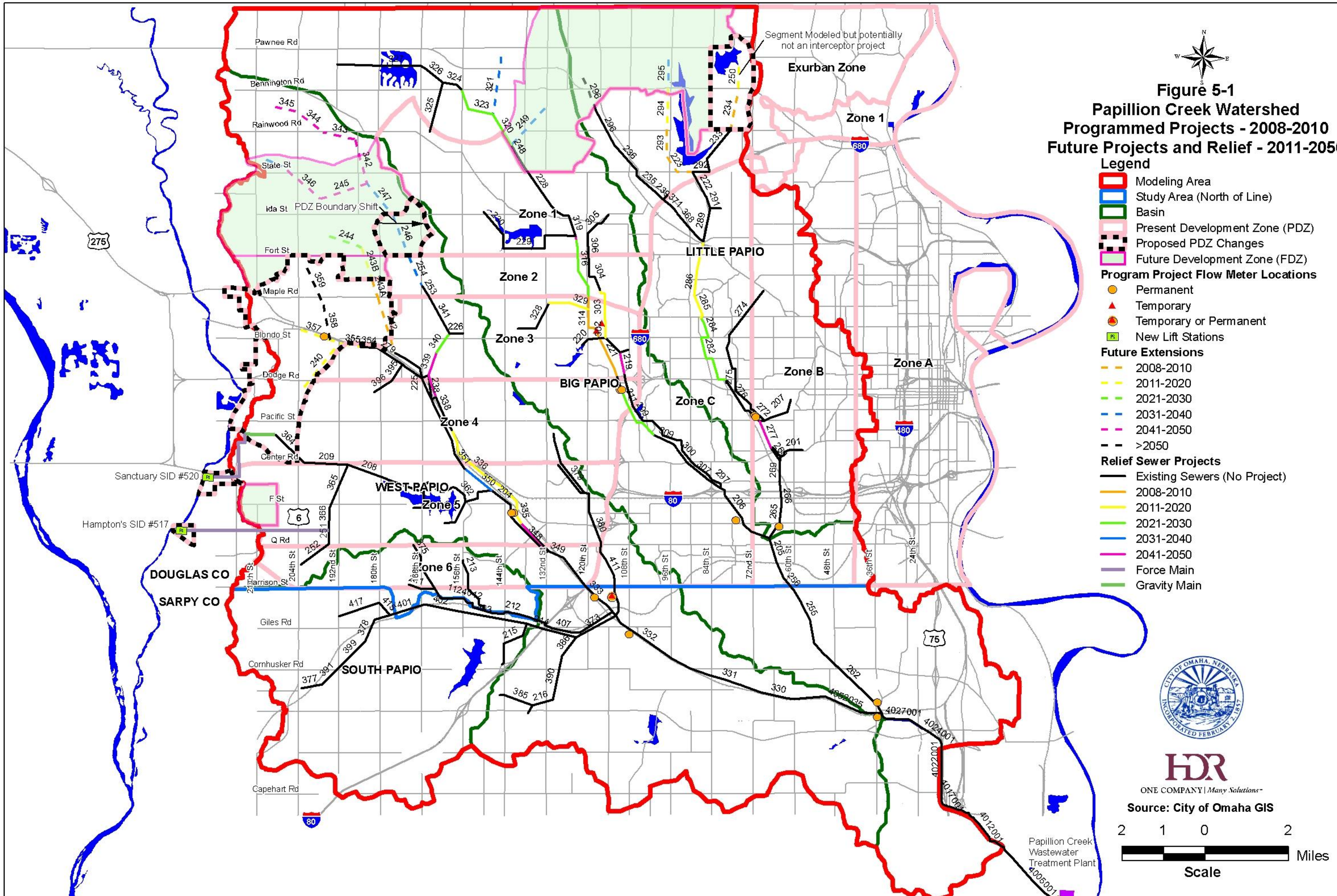
## Table 5-1 Recommended Program Projects (Continued)

| Sub-basin | MH Number | Location Description | Conduit Size | Purpose/Sub-Basins Served/Comments | Total Cost, Adjusted to 2010 [4] |
|---|---|---|---|---|---|
| **Flow Metering** | | | | | |
| **Permanent Site Locations** | | | | | |
| Little Papio, West Branch | 0707045 | MH in Kohls parking lot at 72nd and Pacific | 60" Dia. | Lower-most point of Little Papio West Branch and downstream of suspected parallel sewer relief projects. Assumes new Flo-Dar or ADFM Pro 20 @ $15,000 + Telog @ $3,500 + installation @$10,000. | $28,500 |
| Big Papio, East Branch | 0390001 | Approximately 1,350 LF S. of Dodge and W. of 108th St. along E. side of creek. | 30" Dia. | Near lower-most point of Big Papio East Branch and downstream of suspected parallel sewer relief projects. Assumes use of existing ADS meter + Telog @ $3,500 + rain gauge @ $1,500 + installation @$10,000. | $15,000 |
| Big Papio, West Branch | 0390087 | Approximately 1,350 LF S. of Dodge and near Lamp St. extended W. side of creek. | 54" Dia. | Near lower-most point of Big Papio West Branch and downstream of suspected parallel sewer relief projects. Assumes new Flo-Dar or ADFM Pro 20 @ $15,000 + Telog @ $3,500 + installation @$10,000. | $28,500 |
| West Papio | 4052017 | Approximately 870 LF S. of Giles Rd. on 108th St. extended. | 72" Dia. | Just below confluence of South Papio and other major West Papio branch lines; needed for flow mass balance calculations. Assumes new Flo-Dar or new ADFM Pro 20 @ $15,000 + Telog @ $3,500 + rain gauge @ $1,500 + installation @$10,000 | $30,000 |
| West Papio | 4051006 | Approximately 1,720 LF SE of I-80 and 800 LF SE of Harrison St. alongside 118th St. | 60" Dia. | Just above confluence of South Papio and other major West Papio branch lines; needed for flow mass balance calculations. Assumes new Flo-Dar or ADFM Pro 20 @ $15,000 + Telog @ $3,500 + installation @$10,000 | $28,500 |
| West Papio, East Branch | 0941008 | Near 144th and Industrial Road; same monitoring site used in 2005. | 30" Dia. | Near mid-point of West Papio East Branch and near suspected parallel sewer relief projects. Assumes use of existing ADS meter + Telog @ $3,500 + rain gauge @ $1,500 + installation @$10,000. | $15,000 |

**Table 5-1 Recommended Program Projects (Continued)**

| Flow Metering | | | | | |
|---|---|---|---|---|---|
| Sub-basin | MH Number | Location Description | Conduit Size | Purpose/Sub-Basins Served/Comments | Total Cost, Adjusted to 2010 [4] |
| Permanent Site Locations | | | | | |
| West Papio, West Branch | 0942015 | Manhole is E. of 143rd St. on opposite side of creek from 144th and Industrial Road site above. Go to end of Dayton Circle; manhole is behind (east side of) building between parking lot and creek. | 48" Dia. | Near mid-point of West Papio West Branch; needed for flow mass balance calculations. Assumes use of existing ADS meter + Telog @ $3,500 + installation @$10,000. | $13,500 |
| West Papio, West Branch | Unknown | Just above headworks of Elkhorn WWTP | Unknown | Existing meter at Elkhorn WWTP "pegged" during 2006 major storm; therefore deficient on peak flow span. Switch to in-system permanent meter, since WWTP is to be de-commissioned. Assumes existing ADS meter + Telog @ $3,500 + rain gauge @ $1,500 + installation @$10,000. | $15,000 |
| | | | | **Permanent Sites Subtotal** | **$336,000** |
| Temporary Site Locations (April - September) | | | | | |
| Big Papio, East Branch | 421003 | Approximately 140 LF SW of 115th St. and Papillion Parkway. Per GIS plot, manhole is located in center island. | 24" Dia. | Ascertain flow balances down east and west branches due to downstream siphon operation near Blondo Street. Assumes new Isco 2150 or ADS Flow Shark @ $4,000 (no telemetry) + $2,500 installation. | $6,500 |
| Big Papio, West Branch | 420005 | Approximately 900 LF N. of Blondo on W. side of creek and E. side of parking lot. | 36" Dia. | Ascertain flow balances down east and west branches due to downstream siphon operation near Blondo Street. Assumes new Isco 2150 or ADS Flow Shark @ $4,000 (no telemetry) + $2,500 installation. | $6,500 |
| West Papio, North Branch | 4052005 | Approximately 1,400 LF S. of Harrison St. where Olive St. crosses creek. | 30" Dia. | Just above confluence of South Papio on North Branch line; needed for flow mass balance calculations. Assumes new Isco 2150 or ADS Flow Shark @ $4,000 (no telemetry) + $2,500 installation. | $6,500 |
| | | | | **Temporary Sites Subtotal** | **$19,500** |
| | | | | **Flow Metering Total** | **$355,500** |
| | | | | **Total Program Projects 2009 - 2010** | **$13,386,500** |

FIGURE 5-1 PROGRAMMED PROJECTS 2008 – 2010 AND FUTURE PROJECTS AND RELIEF 2011 – 2050



# CHAPTER 6
# CONSTRUCTION AND ACQUISITION FINANCING

## 6.1 General

The proposed improvements for the report are identified in Chapter 5. These projects are required to serve near-term development as well as the longer range development and relief sewers required by growth within the Papillion Creek basins through the year 2050.

For purposes of this study, the definition of an interceptor sewer is defined as follows:

> *"An interceptor sewer serves an area greater than 1,000 acres or more than 10,000 people; or has two or more upstream S&ID outfall connections."*

The growth and development that occurs in the basins can be very dynamic and must be monitored by the City. If specific areas of growth accelerate beyond projections, the estimated construction date of the various improvements projects may need to be adjusted forward dependent upon the financial limitations of the City and status of the Interceptor Sanitary Sewer Improvement Fund.

## 6.2 Revenue Available

The City of Omaha has an Interceptor Sanitary Sewer Improvement Fund that is used to pay for costs related to interceptor sewer acquisition and construction. The funds are collected from sewer connection fees and are used for new construction, interceptor acquisition, or other outstanding obligations. The Fund had a balance of $12,339,842.59 through February 29, 2009, and there were no outstanding obligations. Periodic updates of the study are scheduled every three to four years.

## 6.3 Project Costs

Estimated project costs are detailed in Appendix A. Table 6-1 (same as Table 1-2) summarizes estimated project costs through 2050.

**TABLE 6-1 ESTIMATED PROJECT COSTS**

| Period | Pipe Extension Projects | Relief Sewer Projects | Flow Metering | Total Project Cost |
|---|---|---|---|---|
| Program Projects 2009-2010 (Coded Orange) | $7,031,000 | $6,000,000 | $355,500 | $13,386,500 |
| Near Term Projects 2011-2020 (Coded Yellow) | $12,385,000 | $33,058,000 | | $45,443,000 |
| Future Projects 2021-2030 (Coded Green) | $8,743,000 | $214,372,000 | | $223,115,000 |
| Future Projects 2031-2040 (Coded Blue) | $57,261,000 | $15,850,000 | | $73,111,000 |
| Future Projects 2041-2050 (Coded Magenta) | $41,863,000 | $66,004,000 | | $107,867,000 |
| **Totals** | **$127,283,000** | **$335,284,000** | **$355,500** | **$462,922,500** |

## 6.4 Land Use Categories and Flow Factors

The sources of revenue for the interceptor fund include single family, multi-family, commercial/industrial and mobile home land use categories.

The ratios (multipliers) for the various categories as compared to single-family units are based on typical occupancy rates and winter time dry weather flows (without significant infiltration/inflow) for single family, multi-family and mobile homes. The flow from an acre of commercial/industrial is also used to determine the ratio. Table 6-2 summarizes the various flow factors used in the previous study. It was judged that development densities and dry weather winter time average flows have not changed enough to warrant updating the flow factors for this study.

**TABLE 6-2 FLOW CONTRIBUTION FACTORS FROM PREVIOUS 2004 STUDY**

| Category | Density Persons per unit | Peaking Factor | Dry Weather Peak Flow (gpd) | Flow Factors = Ratio to Single Family |
|---|---|---|---|---|
| Single Family | 2.67 | 2.5 | 553 | 1.0 |
| Multi-Family | 2.07 | 2.5 | 430 | 0.78 |
| Mobile Home | 2.05 | 2.5 | 425 | 0.77 |
| Commercial and Industrial | -- | 2.0 | 3,000 | 5.43 |

The flow factors thus determined become the same ratios applied to connection fees discussed in the next sub-section.

## 6.5 Recommended Connection Fees and Cash Flow

The connection fees are based on the flow calculations for the various housing types and commercial and industrial areas. Based on updated flow, and population density numbers, Table 6-3 (same as Table 1-3) shows the proposed rate changes. The estimated cash flow requirements are for the 2009 to 2010 Program Projects and beyond <u>for sewer extensions alone</u>. After discussions with City staff and MOBA representatives earlier in March 2009, it was agreed that potential relief sewer projects beyond the Program Project time frame would be enormously expensive based on the current modeling outputs and there is much uncertainty with respect to wet weather peak flow predictability due to limited available flow metering data. That is why additional flow metering is being urged and included as a part of Program Projects. This strategy will give the City an opportunity to learn more about the sanitary interceptor sewer system and pursue infiltration/inflow reduction with improved focus; particularly during a time when new development activity and new wastewater loadings will be somewhat lower than normal. Otherwise, the sheer amount of relief sewer projects would overwhelm both the Connection Fee Fund and the regular Sewer Fund paid by rate payers.

**TABLE 6-3 ESTIMATED CASH FLOW REQUIREMENTS FOR FUTURE SEWER EXTENSIONS**

| Planning Period | Projected Increase in Single Family Units | Single Family Rate | Projected Increase in Multi-Family Units | Multi-Family Rates | Projected Increase in Comm./ Ind. Acres | Comm. /Ind. Rate | Revenue Generated by Interceptor Fee | Total Est. New Sewer Extension Costs | Revenue Minus Project Costs | Beginning Balance [1] | Period Ending Balance (Rounded) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009-2010 | 5,022 | **$1,100** | 264 | **$858** | 0 | **$5,973** | $5,750,712 | $13,386,500 | -$7,635,788 | **$12,339,843** | **$4,704,000** |
| 2011-2020 | 14,515 | **$1,200** | 763 | **$936** | 1,375 | **$6,516** | $27,091,668 | $12,385,000 | $14,706,668 | $4,704,000 | **$19,411,000** |
| 2021-2030 | 11,989 | **$1,400** | 631 | **$1,092** | 1,140 | **$7,602** | $26,139,932 | $8,743,000 | $17,396,932 | $19,411,000 | **$36,808,000** |
| 2031-2040 | 16,829 | **$1,600** | 886 | **$1,248** | 1,592 | **$8,688** | $41,863,424 | $57,261,000 | -$15,397,576 | $36,808,000 | **$21,410,000** |
| 2041-2050 | 8,916 | **$1,800** | 469 | **$1,404** | 838 | **$9,774** | $24,897,888 | $41,863,000 | -$16,965,112 | $21,410,000 | **$4,445,000** |
| **Totals** | **57,271** | | **3,013** | | **4,945** | | **$125,743,624** | **$133,638,500** | | | |

**Connection Fee Weighting and Current Rates**

| Category | Flow Factor | Current Rates | Units |
|---|---|---|---|
| Single Family | 1 | $947 | D.U. |
| Multi-Family | 0.78 | $739 | D.U. |
| Mobile Home | 0.77 | $729 | D.U. |
| Commercial/Ind. | 5.43 | $5,142 | Acre |

Notes
[1] The available fund balance through February 29, 2009 was $12,339,842.59.

## 6.6 Fee Assessment

This topic is further covered in Chapter 7, but is repeated here for convenience. The single-family, multi-family and commercial/industrial fees are assessed for all construction in the Present Development Zone (PDZ). The fee for construction within "In-City" zones, which are located inside the Interstate 680, is waived to encourage in-fill within the City. Development within the In-city zones has occurred, and the amount of land available has decreased. Some of the more moderate-income housing developments have occurred in these zones. A diverse cross-section of housing types is also desirable in the PDZ.

To facilitate the development of affordable housing in the PDZ, the City has proposed to waive the sewer connection fee for all single family housing units having a total cost of less than $95,000. The impact on revenues for the interceptor sewer fund is difficult to project; however, an estimate of 50 units per year of affordable housing has been traditionally assumed. Since the initial impact on the total revenues is anticipated to be very small, the sewer connection fee structure should not be modified to compensate. The City should track the impact of this fee waiver and adjust the amount for the construction cost as additional data becomes available so that the desired diversity of housing types can be attained.

# CHAPTER 7
# CONCLUSIONS, RECOMMENDATIONS AND POLICIES

Following are the conclusions and recommendations regarding the Master Plan for the Sanitary Sewer Interceptor Element for the Papillion Creek Watershed.

## 7.1 Conclusions

Strong growth in the Papillion Creek Watershed has occurred in the recent years since the last study just prior to the majority of the modeling work. This strong growth was due to historical low interest rates and a lead-in robust economy. Beginning in 2008, the national and local economies began to decline, and that pattern has largely continued through the time of writing of this report. The following bullets summarize the recent development activity.

- Housing Starts within Watershed.
  - Single Family (SF) Housing Starts. A significant increase in SF housing starts occurred from 2003 to 2006 due to historically low interest rates. Figure 1-1 illustrates the S&IDs in the study area, the majority of which were created during this time period. There are some older S&IDs that are still not sufficiently occupied for annexation. From 1995 to 2002 SF family starts averaged 1,622 per year in comparison to 2,262 per year from 2003 to 2006 – a 39% increase.
  - Multi-Family (MF) Housing Units. Conversely to the above, MF housing units decreased by approximately 73% from an average of 942 per year from 1995 to 2002 to an average of 256 per year from 2003 to 2006.
- Vacant Improved Lots. The recent increase in SF housing activity also created a larger than normal surplus of vacant improved lots and unsold new dwelling units, the residual of which may extend beyond 2010 before a more normal level of new S&ID activity resumes. The number of SF vacant improved lots averaged 7,510 lots per year from 1995 to 2002 and 9,966 from 2003 to 2006 – nearly a 33% increase.

## 7.2 Recommendations and Policies

- Sizing of future sewers should be generally based on 2050 development potential of Douglas County rather than ultimate development in the Watershed service area due to the lack of certainty about future development densities in the peripheral areas.
- The City should limit any new over-the-ridge pumping to the western edge of the study area in Douglas County and east of the Elkhorn River. There are very few developable acres remaining along this peripheral area, and the City, at its discretion may elect to accommodate such development, provided that no downstream system deficiencies are present at the time of the developer's request. This consideration was given prior precedence by the acceptance of pumped flows from the Hampton's and Sanctuary Subdivisions.
- Conversely, the City should not accept additional over-the-ridge pumping from Sarpy County, other than that which is already contracted from Gretna. Sarpy County has completed its own sewer master plan for dealing with such service areas.

- Program Projects are listed in Table 5-1 for continued expansion of the interceptor system to serve potential development areas to the north and west. This is consistent with the Urban Form Section of the Concept Element of the City's Master Plan, which encourages concentric growth.

- Substantial progress has been made by the City in acquisition of S&ID interceptor sewers.

- Funding the estimated costs of the projects will require an increase in the connection fee. Connection fees are recommended to be re-balanced in 2009 as per Tables 1-4 and 6-3 to reflect updated modeling and cost information. When normal development activity resumes, it would be prudent to make further connection fee adjustments to build additional reserves for future higher demands for funds.

- The remaining Near-Term and Future Projects, as identified in Appendix A, should not be financed as a general obligation debt of a Sanitary and Improvement District if possible. The developer shall be paid back for the cost only when adequate funds are available in the Sanitary Interceptor Sewer Improvements Fund and only when the plan has been formally amended to include the project with Program Projects, and the fee has been adjusted accordingly.

- The current practice of encouraging in-fill development in the I-680 loop by waiving the fee should be continued. This concept can be expanded by waiving the fee for single-family houses with a total cost for land and improvements under $95,000 to encourage diversity and affordable housing in the PDZ.

- Continued regular updating of this Plan on a 3 to 4-year basis is recommended to reflect actual development trends and future planning requirements.

- Additional flow monitoring at key locations is strongly recommended to determine when existing interceptors are at or near capacity and siting considerations are made in accordance with the other policies herein. Recommend flow monitoring locations are described in the Program Project list in Table 5-1 and shown on Figure 5-1.

- The Interceptor Sewer Fee should be collected with building permit applications. This is a change from the previous policy of collecting the fee at the time of platting from the S&ID. This will help to reduce the debt of Districts and possibly lead to subdivisions being more attractive to be annexed by the City sooner. It is believed that there is a sufficient fund balance to allow this transition. The City should monitor the expenditures, fee collections and fund balance to ensure there is not a short term deficiency in the fund that could lead to future projects not being completed in a timely manner.

- Areas outside the present development zone, as defined by the City, may be pursued, however:

    - Any interceptor sewer required to develop the area must be financed privately. Eligible cost for the interceptor may be reimbursed when the project is included in a future update of the interceptor plan; however, no interim financial costs (interest on debt) will be included as an eligible cost.

    - Major streets adjacent to the development (including bridges, road realignments, etc.) and between the development and the nearest City of Omaha final platted subdivision must be improved as a privately financed expense as follows:

        - Grade all major streets for a five (5) lane roadway section directly adjoining the development to the specifications and requirements of the County Engineer.

        - Grade all major streets correcting for substandard horizontal and vertical curves for a three (3) lane roadway section from the edge of the development to the nearest final platted City of Omaha subdivision per the specifications and requirements of the City Engineer/County Engineer.

        - Pave a three (3) lane section of major street adjacent to the proposed development to the nearest final platted City of Omaha subdivision per the specifications and requirements of the City Engineer/County Engineer.

    - Park Fees and improvements as identified by the City's Park Master Plan must be paid privately.

- The following are recommended policies contained in previous reports that should remain essentially unchanged.

    - Where possible, the City of Omaha should provide for the design and construction of the programmed construction projects to help minimize total project costs to be reimbursed for this from the Sanitary Interceptor Sewer Improvement Fund.

    - The current policy of transferring ownership of newly constructed S&ID outfall sewers to the City should be maintained.

    - It is recommended that interceptor sewer plans follow the guidelines and policies as set forth in the City's Master Plan.

    - The cost of any deviations from the plan or a restudy to justify the deviation will be paid by the developer prior to the planned future study updates.

    - Acquisition payments will be made to S&ID's entering into agreements as funds are available. Condemnation will be considered for interceptors planned for acquisition but without agreements.

    - The balance in the Fund should be kept at a minimum, thus reducing the accumulation of interest, which is not returned to the Fund, but rather added to the City's general fund.