Build Kansas Fund | Fiscal Year 2024 Application Package | Memo

To: Senator Ty Masterson, Chair, Build Kansas Advisory Committee
Murl Riedel, Kansas Legislative Research Department
Shauna Wake, Office of the Kansas State Treasurer

From: Matthew A. Volz, P.E., Executive Director, Kansas Infrastructure Hub

RE: Build Kansas Fund Application # 2024-022-NoEDD

Date: April 12, 2024

Attached, please find an application made to the Build Kansas Fund by the City of Topeka.

The application packet includes the following items:

- Coversheet – provides a high-level overview of the application including a unique identification number, page 1 of 43 of the Build Kansas Fund Application Package.
- Build Kansas Fund Application – includes information submitted with the Build Kansas Fund Application, pages 2-8. Page 8 provides the table of funding sources.
- Attachments – Hazard Mitigation Grant Program (HMGP) Application, pages 9-43

Project Overview

The City of Topeka seeks funding from the Federal Emergency Management Agency (FEMA) for funding available through the Hazard Mitigation Grant Program (HMGP) to complete SW Prairie Road Storm Sewer Improvements.

HMGP is a discretionary BIL program that has a local match requirement of 25%. The City of Topeka is requesting $223,750.00 from the Build Kansas Fund. This request has the potential to unlock $895,000.00 in federal funds.

The deadline for HMGP applications is October 1,2024. The Build Kansas Fund application was received on February 23, 2024.

Build Kansas Fund Steering Committee Recommendation

The Build Kansas Fund Steering Committee reviewed this application on March 20, 2024, following a successful completeness check. The Steering Committee **RECOMMENDS APPROVAL** of Build Kansas Funding to the Build Kansas Advisory Committee for final advice.

Build Kansas Fund | Fiscal Year 2024 Application Package | Coversheet

Build Kansas Fund Application Number	2024-022-NoEDD	
Project Name	SW Prairie Rd Storm Sewer Improvements	
Entity Type	Local Government	
Economic Development District (EDD) Planning Commission	No-EDD	
Infrastructure Sector(s)	Water	
BIL Program	Hazard Mitigation Grant Program (HMGP)	
BIL Program Type	Discretionary	
BIL Application Deadline	10/1/2024	
Build Kansas Fund Request	$223,750	
Technical Assistance Received	General	Yes
	BIL Application	No
	Build Kansas Fund Application	Yes
	Other (Brief Description): Discussed BIL and BKF programs, TA available, and supported BKF Application submission process	
Application Notes	Build Kansas Fund contribution of $223,750 will unlock $895,000 in federal BIL funding.	

Steering Committee Funding Recommendation	**DATE | Recommend or Deny**
Advisory Committee Target Review	**DATE**
Advisory Committee Funding Recommendation	**DATE | Approve or Deny**

Completeness Review Data

Date Build Kansas Application Received:	2/23/2024
Date Of Completeness Check:	2/26/2024
Date Forwarded to Steering Committee:	2/27/2024

Title

City of Topeka, Kansas

02/23/2024

by **Alleigh Weems** in **Build Kansas Fund Fiscal Year 2024 Application**

id. 45661892

apweems@topeka.org

Original Submission

02/27/2024

Score	n/a
	Part 1: Applicant Information
The name of the entity applying for the Build Kansas Fund:	City of Topeka, Kansas
Project Name:	SW Prairie Rd Storm Sewer Improvements
Entity type:	Local Government
Applicant Contact Name:	Alleigh Weems
Applicant Contact Position/Title:	Management Analyst
Applicant Contact Telephone Number:	+17853683036
Applicant Contact Email Address:	apweems@topeka.org
Applicant Contact Address:	620 SE Madison St
Applicant Contact Address Line 2 (optional):	2nd Floor - Engineering
Applicant Contact City:	Topeka
Applicant Contact State:	Kansas
Applicant Contact Zip Code:	66607

Is the Project Contact the same as the Applicant Contact?	Yes
	Part 2: Build Kansas Fund - Eligibility Criteria
Certify that you are pursuing a viable Bipartisan Infrastructure Law (BIL) funding opportunity for which your entity is eligible:	Yes
Certify that the Bipartisan Infrastructure Law (BIL) funding opportunity you are pursuing has a required non-federal match component:	Yes
What is the primary county that the project will occur in?	Shawnee County

The Build Kansas Fund is intended to support Kansas-based infrastructure projects. Please provide a list of all the zip codes this project will be located in, along with an estimated percent [%] of the project located in that zip code. For example, if seeking funding for road infrastructure, provide a rough percent of the roads expected in each zip code:

Zip Code Percentage.xlsx

	Part 3: Bipartisan Infrastructure Law (BIL) - Grant Application Information Please Note: This information is related to the federal Bipartisan Infrastructure Law (BIL) funding opportunity to which you will apply. This is NOT information for the Build Kansas Match Fund.
Please enter the Bipartisan Infrastructure Law (BIL) funding opportunity title that the entity is applying for:	Hazard Mitigation Grant Program - Building Resilient Infrastructure and Communities
What is the funding agency for this Bipartisan Infrastructure Law (BIL) funding opportunity?	Federal Emergency Management Agency (FEMA)

What is the Assistance Listing Number (ALN) for this Bipartisan Infrastructure Law (BIL) funding opportunity?	97.039 Hazard Mitigation Grant
What is the application due date for this Bipartisan Infrastructure Law (BIL) funding opportunity?	10/1/2024
What is the federal fiscal year for this Bipartisan Infrastructure Law (BIL) funding opportunity?	2024
Enter the amount of funding being applied for, from the Bipartisan Infrastructure Law (BIL) funding opportunity:	$895,000.00
Enter the required non-federal match percentage:	25.0
	Part 4: Build Kansas Fund - Match Application Information
Enter the non-federal match amount being requested from the Build Kansas Fund:	$223,750.00
Is the project able to move forward with a lesser match amount than requested?	Yes
If you are awarded less match than the amount requested, at what amount would your project NOT be able to move forward?	0.0

Expected breakdown of funding sources to support the project: Enter the funding source and projected amount from each source to support this project:

Kansas+DOT+table.xlsx

	Part 5: Build Kansas Fund - Means Test
Confirm that there are no available funding sources currently planned to go unused by your entity that could be leveraged for this project:	Yes
Confirm there are no available American Rescue Plan Act (ARPA) or Coronavirus State & Local Fiscal Recovery Fund monies that could be used for this match:	Yes
Confirm that you have explored other readily available funding sources (federal or non-federal) to be used for this match:	Yes
Briefly describe your efforts to find other available funding sources for this project:	This project (Phase 1 and 2) is included as a sub-project under the City's Stormwater Conveyance System Rehabilitation & Replacement Program beginning in 2024.
	Part 6: Additional Information

Please upload a copy of the Bipartisan Infrastructure Law (BIL) program application associated with this request OR a 2-page executive summary providing an overview of the project:

Hazard_Mitigation_LOI_SW_Prairie_Rd.pdf

Topeka_SW_Prairie_Road_Drainage_Study_-_501081.10.pdf

Provide any additional information about this project (optional):	
	Part 7: Terms and Conditions

Understanding of Fund Release Requirements:	checked
Understanding of Use of Funds:	checked
Understanding of Reporting Requirements:	checked
Authority to Make Grant Application:	checked
Persons and Titles: The following persons are responsible for making this Build Kansas Fund application.	Alleigh Weems
Position/Title:	Management Analyst
Additional:	
Position/Title:	
Additional:	
Position/Title:	
Additional:	
Position/Title:	

Internal Form

Score	n/a
	Pre-Award Information:
Eligible for Build Kansas Fund?	
ED District:	Non EDD/Tribal
Project Primary Zip Code:	
Sector:	
Application ID:	2024-022-NoEDD

Total BKF Pre-Obligated:	
	Post-Award Information:
Awarded BIL Grant?	
Total Awarded Federal Funding:	
Total Build Kansas Match Fund Award:	
Build Kansas Match Fund Award Deobligation:	

Source	Amount	Zip Code	% of project in zip code
BIL Federal Funds (applied for)	$ 895,000.00	66614	100%
Build Kansas Funds (non-federal match)	$ 223,750.00		in Kansas
Additional Project Contribution (if applicable)	$ 2,085,250.00		
Total Project Cost	$ 3,204,000.00		

THE ADJUTANT GENERALS DEPARTMENT
Kansas Division of Emergency Management
2800 S.W. Topeka Blvd.
Topeka, Kansas 66611-1287

STATE OF KANSAS – Hazard Mitigation Letter of Intent (LOI)

Applicant Information: *Eligible applicants include – local units of government, Indian tribes, and private non-profit organizations (PNP). This information is intended to provide a general idea of the solution proposed. Based on this information you may receive a full application for a mitigation project under the Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC), Flood of Fire Mitigation Assistance (FMA).*

Check appropriate box
Local Government: ☒
Indian Tribe: ☐
PNP: ☐

Applicant/Organization:	**County:**
City of Topeka	Shawnee

Point of Contact: (name & title)	**Phone #:**
Alleigh Weems - Management Analyst	785-368-3036
	Fax #:
	E-mail address: apweems@topeka.org

Address:
620 SE Madison St.
Topeka, KS 66607

Does your community participate in the National Flood Insurance Program (NFIP)?
Check appropriate box
YES ☒
NO ☐
UNK ☐

Hazard Mitigation: *an action intended to reduce or eliminate repetitive losses from future natural disasters.*
Use an attachment, if necessary, to describe or provide and required information

What hazard / problem does this project address?

Storm sewer improvements which will alleviate flooding in areas surrounding and including the intersection of SW Prairie Road and SW 22nd Park.

Describe in detail the scope of work associated with the proposed project *(will project require ground disturbance, removal of vegetation)***:**

Phase 1
- Inlets Replaced - 4
- 30" RCP – 262 feet
- 78" RCP – 910 feet (assumes twin pipes installed)
- 63" X 98" RCP – 120 feet (assumes twin pipes installed)

Phase 2
- Inlets Replaced - 5
- 18" RCP – 32 feet
- 24" RCP – 333 feet
- 78" RCP – 967 feet

History of damages: *(cause(s) of damage, type of property, agriculture, and structures involved; severity of damages, etc.)*

The City of Topeka (City), located in Shawnee County, Kansas, contracted JEO Consulting Group, Inc. (JEO) to evaluate a storm sewer system discharging to an open channel just east of the intersection of SW Morningside Road and SW 23rd Street. The drainage analysis was requested in response to flood concerns in the project area. During the week of July 27, 2020, Topeka experienced 5.61 inches of rainfall including 2.53 inches on July 29 (National Weather Service Climate: https://w2.weather.gov/climate/index.php?wfo=top). The rainfall resulted in numerous flooding locations throughout the city. The flooding at 2212 SW Prairie Road prompted a citizen to file a claim for flood damage to their vehicle and residence.

Description of area *(include water surfaces (e.g., ponds, lakes, rivers, streams, wetlands, other waterbodies), population affected and/or benefited by the project; provide site photos if applicable)***:**

The study area is comprised of approximately 156 acres consisting of primarily ¼ acre residential subdivision lots and commercial land. The homes along SW Prairie Road were constructed in the 1950s. The existing stormwater system was augmented in 1971 with large special designed inlet that is approximately 50 feet wide.

Physical location of proposed project *(include street numbers (or neighborhoods), city, county, and zip codes)***:**

The detailed study area was limited to the drainage catchment area generally bounded by SW Fairlawn Road on the west, the storm sewer outfall on the east, SW 21st Street on the north, and SW 23rd Street on the south. (Topeka, Shawnee, 66614)

Do jurisdictions where the mitigation action will take place have a signed resolution of adoption for the Regional Mitigation Plan on file? (Please contact your local officials or county emergency manager)**:**

Regional Mitigation Plan: https://www.snco.us/floodplain/document/Region_J_Hazard_Mitigation_Plan.pdf
Signed City Resolution:
https://topeka-resolutions.s3.amazonaws.com/02021/9261-concerning_the_Kansas_Homeland_Security_Region_J_Hazard_Mitigation_Plan.pdf

Is the proposed activity consistent with current Community Plans, Goals, and Jurisdictional Mitigation Actions identified in the Regional Plan? (What Mitigation Action is identified?):

Not applicable

Does the proposed activity provide (or plan to provide) direct risk benefits to an Economically Disadvantaged Rural Community (EDRC) or small impoverished population? (In what way?)

Not applicable

Does the proposed activity address climate change adaptation and resiliency with consideration of future impacts and risks? *(If so, how?)***:**

As climate change continues, the frequency and intensity of storm events may increase as a result. These projects will help mitigate that impact and this analysis uses the most up-to-date data available to analyze these risks.

If the property involves "private property" how is the public served and what are the public benefits? *(Will there be any right-of-way issues involved with the project?)***:**

Construction in Phase 1 would require temporary easement beyond the existing drainage easements and could conflict with the 8" (vcp) sanitary sewer collector. Alternatively, the pipes may be routed south within the City ROW and then east along SW 23rd St to the outfall. Implementation of this project would substantially reduce ponding at the sump location for the 10-year event but impacts to adjacent landowners would still be expected under 100-year conditions. In Phase 2, a drainage easement will need to be identified at the sump location where SW Meadows Land and SW 22nd St intersect. A second alternative would be to allow the overland flow down SW Prairie Rd to continue as is and focus on the creation of an engineered overland flow path. At a minimum, the two homes identified on Figure 4 should be purchased so that a large swale and inlet drop structure can be constructed to capture the overland flows. Upstream of the SW Prairie Rd sump location, the current analysis indicates there are a few homes which may be impacted by the 100-Year flood event on the east side of the road, however, this analysis was completed using best available LiDAR data. A more detailed analysis including full topographic survey of the street and adjacent land may prove these houses are not truly impacted.

Are there any known historic site issues connected to this project? *(If so, does the project area have a possibility to preserve or damage a historical site?)***:**

Following flood events of 2020, a resident was prompted to file claims for property damage caused by intense flooding in the area.

How is the project unique to mitigating a disaster/hazard? *(Describe what makes this project stand out from other projects?)***:**

Analysis shows the full implementation of Phase I and II projects would protect 22 houses from impacts of a 100-year event that are currently at risk.

What lifeline does the proposed project address:

☒ Safety and Security - Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
☐ Food, Water, Shelter - Food, Water, Shelter, Agriculture
☐ Health and Medical - Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
☐ Energy - Power Grid, Fuel
☐ Communications - Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch

Additional information – *HMGP projects are funded on a **75/25% cost share**, applicants must be able to provide 25% match.*

Supplanting *(Are local funds already budgeted for this project), If yes, explain*:

This project (Phase 1 and 2) is included as a sub-project under the City's Stormwater Conveyance System Rehabilitation & Replacement Program beginning in 2024.

Has a Benefit-Cost Analysis (BCA) been developed for this proposed project? (*If so, what was the Benefit-Cost Ratio (BCR))?)*

Though a BCA was not undertaken in the drainage study, existing conditions for the system were assessed using the XPStorm Model, in addition to the Soil Conservation Service Method, which informed subsequent recommendations/proposed conditions. (Appendix A and C)

List source of local matching funds: *(Non-federal grants, taxes, bonds, existing budget, volunteer, donation, in-kind services/materials, etc.)*

Revenue Bonds and City's Stormwater Operating Fund

Has a Federal disaster Project Worksheet (PW) been written for any portion of this project?
Check appropriate box

YES ☐
NO ☒
UNK ☐

Signature of Applicant:_____ Date: _____

Return the completed form by to the following address:

Kansas Division of Emergency Management
Attn: HMGP/BRIC/FMA Program
2800 S.W. Topeka Blvd.
Topeka, Ks. 66611-1287

Or FAX to: 785-274-1426

SW PRAIRIE ROAD DRAINAGE STUDY

TOPEKA, KANSAS

CITY PROJECT #501081.10
JEO PROJECT #201668.00
JANUARY 2021

PREPARED BY JEO CONSULTING GROUP FOR
THE CITY OF TOPEKA, KANSAS

JASON MATTHEW PEEK
LICENSED
25500
KANSAS
PROFESSIONAL ENGINEER

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1. Background and Purpose of Assessment

The City of Topeka (City), located in Shawnee County, Kansas, contracted JEO Consulting Group, Inc. (JEO) to evaluate a storm sewer system discharging to an open channel just east of the intersection of SW Morningside Road and SW 23rd Street. The drainage analysis was requested in response to flood concerns in the project area. The detailed study area was limited to the drainage catchment area generally bounded by SW Fairlawn Road on the west, the storm sewer outfall on the east, SW 21st Street on the north, and SW 23rd Street on the south (See Figure 1).

During the week of July 27, 2020, Topeka experienced 5.61 inches of rainfall including 2.53 inches on July 29 (National Weather Service Climate https://w2.weather.gov/climate/index.php?wfo=top). The rainfall resulted in numerous flooding locations throughout the city. The flooding at 2212 SW Prairie Road prompted a citizen to file a claim for flood damage to their vehicle and residence.

The purpose of this evaluation was to separately analyze the stormwater conveyance system (trunk lines) and stormwater collection system (inlets) to determine if adequate capacity in accordance with City of Topeka Design Criteria for both components exist. This assessment evaluates potential options for storm sewer improvements which will alleviate ponding in these areas, most notably at the intersection of SW Prairie Road and SW 22nd Park.

2. Field Mapping and Data Review

The study area is comprised of approximately 156 acres consisting of primarily ¼ acre residential subdivision lots and commercial land. The homes along SW Prairie Road were constructed in the 1950s. The existing stormwater system was augmented in 1971 with large special designed inlet (Facility ID # 6983) that is approximately 50 feet wide (Supplemental Construction Main Storm Sewer District No. 8 Phase I - as built provided by City). This project added additional capacity to the existing systems. Based on field observation, a second project also occurred in SW Prairie Road that installed a large 5’ x 5’ RCB upstream of manhole #1936. This system provided a 42” X 60” elliptical pipe from manhole #1936 that connects to the large inlet (Facility ID #6983). The elliptical pipe was installed at roughly the same invert elevation as the existing 54” ACCMP that flows from manhole 1936 to manhole 1937.

JEO field crews reviewed the storm sewer system through field inspection. The field inspection was limited to the downstream nodes of the larger storm network. The inspection included 10 inlets, 6 manholes, and 4 outfalls. Field crews measured the depth of structure from top of structure to bottom of structure. Field crews made visual observations of the structure interior to identify pipe size, material, and condition of the structure. These notes were recorded in ArcGIS collector and compared with the City’s inventory information. Overall, the inventory information for depth of structure was consistent with field measurements. JEO staff did not find evidence warranting field survey of pipe inverts. The review of inventory was also supported by review of CCTV information provided by the City of Topeka.

There were two errors on the system inventory with respect to stormwater pipes. The following errors were found:

Facility ID	DS Structure ID	US Structure ID	City Inventory	Field Observation
Manhole # 3056	101283	1937	No Detail	Could not find*
Manhole #1933	20458	6983	Only one US & DS pipe	Two US & DS pipes

Review of CCTV suggest Manhole #3056 does not exist. Storm pipes 9998642 and 9998643 flow through manhole #1933. These errors were noted and provided to the City's Technical Support Group to review and update the geodatabase files.

3. HYDROLOGIC AND HYDRAULIC ANALYSIS

Hydrologic and hydraulic analyses were completed for drainage areas within the study area using both XPStorm software version 2019.1.1 and Bentley Flow Master.

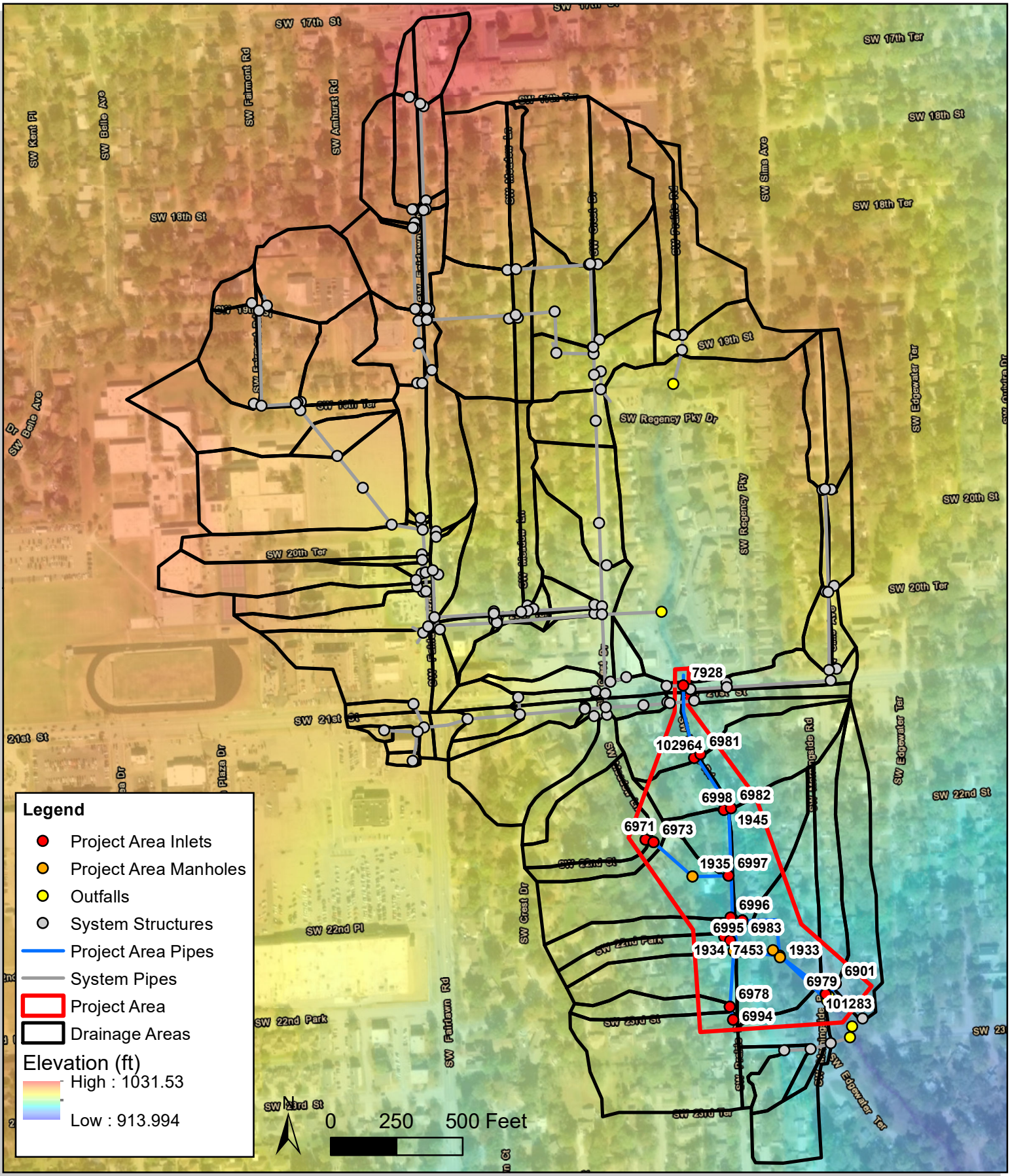
3.1 Hydrology

The Soil Conservation Service (SCS) Method, which calculates both the peak and volume of discharge, was used for the hydrologic evaluation of the 10- and 100-year period runoff events. Drainage areas to individual inlets were determined using LiDAR coupled with storm system GIS data obtained from the City. A curve number was established for each sub-basin based on the percentage of land cover shown to be impervious using the 2016 National Land Cover Percent Imperviousness database and the USDA-NRCS Web Soil Survey hydrologic soil group. An initial curve number of 80, open parks in good condition with a hydrologic soil group of D, was assigned to each basin. This number was adjusted based upon the percent of impervious land using the equation shown below.

$$CN = (98 - CN_{\text{i}}) \times I + CN_{\text{i}}$$

- CN_i – initial curve number
- I – percent impervious

A time of concentration is also used to represent the amount of time elapsed after the beginning of a storm event to the point at which runoff rates peak. The total time of concentration was calculated using the SCS lag equation which is an empirical equation relating flow length and overland slope travel time. The SCS lag equation was chosen for its ease of use, and direct application to urban areas with small drainage areas and low time of concentrations. Finally, a 24-hour, NRCS MSE4 nested rainfall distribution storm hyetograph was used with a total rainfall depth of 5.07 and 7.86 inches for the 10- and 100-Year storm event, respectively. Hydrologic analysis was based on an Antecedent Moisture Condition II. Drainage area delineations can be seen in Figure 1. Peak flows for individual sub-basins are provided in Appendix A.



Created By: CEO
Date: 12/1/2020
Software: ArcGIS 10.7.1

Figure 1: SW Prairie Drainage Overview

Topeka, Kansas

This map was prepared using information from record drawings supplied by JEO and/or other applicable city, county, federal, or public or private entities. JEO does not guarantee the accuracy of this map or the information used to prepare this map. This is not a scaled plat.

JEO CONSULTING GROUP INC

3.2 Hydraulics

The drainage system includes a total of 175 pipes, 99 catchments, an open channel and intake and outlet headwalls. The outfall of the system ends at eastern edge of SW Morningside Road that discharges into an open channel that flows to Shunga Creek. All pipes were included in the analysis to better determine the actual peak flows to the area of interest. However, a detailed analysis was only completed on the network south of SW 21st St with particular attention paid to the sump location at the intersection of SW 22nd Park and SW Prairie Road and the outfall pipes from that location.

Field review of the City's GIS data only found a few errors with respect to size of pipes and connectivity of pipes. This information was provided to the Technical Support group to adjust the City's authoritative data. Pipe inverts were accurate with respect to the depth of structure. Field crews measured the depth of structures and reviewed depth information against GIS elevation data. Survey to verify accuracy of GIS elevations data was not part of this scope.

Hydraulic performance of the storm sewer system was modeled using XPStorm. Storm sewer network information including pipe materials, flow directions, diameters, and invert elevations were determined using a combination of survey completed as part of this project and as-built plans provided by the City.

Stormwater Conveyance System

The conveyance analysis defines the ability of the underground piping system to adequately convey flows through the storm sewer system. This evaluation was conducted by assuming that all the calculated peak flows for a catchment would be fully captured by the associated inlet. This provides a conservative look at the storm sewer trunk lines. As part of this analysis, the hydraulic grade line was calculated throughout the system as well as the calculated pipe max flow vs. the design flow for the 10-Year storm event. The storm sewer conveyance pipes were deemed adequate if maximum flow for the 10-Year storm event was less than the calculated pipe design flow. The storm sewer system was deemed adequate if the hydraulic grade line remained a minimum of 0.5' below the ground elevation for the 10-Year storm event and was no more than 0.5' above the roadway crown for the 100-Year storm event.

Stormwater Collection System

Evaluation of the stormwater collection system was specifically targeted at the capacity of surface intakes at the sump location at the intersection of SW 22nd Park and SW Prairie Road. A total of ten curb inlets were identified and analyzed. The total capacity of the inlets was estimated in Bentley's Flow Master based on field measurements and assuming a street cross slope of 0.03125 and inlet depression of 3 inches based on the City of Topeka standard plans for paved streets.

3.3 Existing Conditions

Hydraulic performance for the existing conditions was assessed using the XPStorm Model. Results for the 10-year and 100-year events were examined to determine potential deficiencies. In several locations, the stormwater conveyance trunk lines were operating under pressure flow (pipe max flow was greater than pipe design flow) and in most cases were resulting in hydraulic grade lines which were rising above the ground surface. Under these conditions, water would be pushed out of the storm sewer system and onto the roadway, resulting in significant overland flow and ponding.

Major findings from the existing conditions model are:

- The main trunkline from SW 21st St to the sump location at SW 22nd Park is undersized for the 10- and 100-Year flood events. The entire system is surcharged resulting in the hydraulic grade line being more than 0.5' above the crown of the road for all structures except for manhole 1935. Significant overland flow is observed overtopping SW 21st Street and running south down SW Prairie Road to the sump location at SW 22nd Park and SW Prairie Road. Peak overland flows just upstream of the sump location were estimated at approximately 185 and 510 cfs for the 10- and 100-Year storm events, respectively. Many of the lateral pipes are also showing negative flows due to the pressure built up in the main trunk line.

- The total inlet capacity at the sump location at the intersection of SW 22nd Park and SW Prairie road is approximately 333 cfs. Peak flows from the directly contributing drainage areas for the 100-Year storm event are approximately 98.9 cfs, leaving a total inlet capacity of 233.9 cfs available for bypass flows from upstream. Based on this it appears the sump location should be capable of capturing the flows for the 10-Year storm event. Details of the inlets analyzed, and results are shown in Table 1.

Table 1: Inlet Analysis

Inlet Results - Existing Conditions							
Facility ID	Inlet Type	Inlet Opening Length (ft)	Inlet Opening Area (sqft)*	# of Inlets	10-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)	Inlet Capacity (cfs)*
6995	Curb	2.33	1.17	3	12.0	20.6	19.6
7453	Curb	2.33	1.17	2	6.0	10.3	13.1
7454	Curb	2.33	1.17	2	7.1	12.1	13.1
6996	Combination	3.00	2.10	2	19.2	33.7	42.0
6983	Combination	52.50	113.60	1	12.7	22.2	245.0
Upstream Bypass					185	510	--
Total Incoming Flow					**242.1**	**608.9**	**332.8**

- The main trunkline downstream of the sump location is undersized for the 10- and 100-Year storm events. The system is surcharged resulting in excessive ponding in the sump location before overland flow is achieved to the east through private property. The pipes are not sufficiently sized to accommodate the flows from the upstream main trunk line, let alone to capture any overland flows that would be captured by the inlets in the sump. The design pipe capacity of the system ranges from approximately 140 cfs (combined capacity of pipes 9998643 and 99953851) to 225 cfs (combined capacity of pipes 9997157 and 9998636) whereas the combined pipe and overland

upstream flows for the 10-Year storm event just upstream of the sump location is approximately 440 cfs.

A summary of existing conditions deficiencies is depicted in Figures 2 and 3 as well as in Table 2. Detailed results are shown in Appendix A.

Table 2 - Existing Conditions System Results							
Facility ID	Structure Type	RIM Elevation ft*	Invert Elevation ft	10-Year Max Water Elevation ft	10-Year Freeboard < 0.5 feet	100-Year Max Water Elevation ft	100-Year Ponded Depth @ Roadway Crown**
6998	Inlet	960.43	956.01	962.35	Yes	963.01	2.08
6982	Inlet	960.54	956.51	962.49	Yes	963.20	2.17
6997	Inlet	957.32	953.13	959.83	Yes	960.52	2.70
7454	Inlet	959.01	956.03	959.77	Yes	960.51	1.00
7453	Inlet	958.86	955.40	959.77	Yes	960.50	1.14
6995	Inlet	958.07	955.27	959.77	Yes	960.53	1.96
6983	Inlet	956.47	948.43	959.76	Yes	960.49	3.52
6996	Inlet	956.70	952.27	959.79	Yes	960.54	3.34
6994	Inlet	964.40	961.53	965.65	Yes	965.87	0.96
6978	Inlet	964.47	960.52	964.72	Yes	964.83	0.00
6971	Inlet	973.29	970.06	973.81	Yes	974.33	0.54
6973	Inlet	972.68	968.73	973.62	Yes	974.31	1.13
6979	Inlet	950.84	945.22	951.91	Yes	952.25	0.91
101283	Inlet	952.31	945.63	953.31	Yes	953.95	1.14
7928	Inlet	969.12	958.86	971.07	Yes	971.54	1.91
102964	Inlet	964.20	960.00	965.16	Yes	965.78	1.08
6981	Inlet	963.30	958.40	964.99	Yes	965.54	1.74
1945	Manhole	961.64	953.81	963.58	Yes	964.23	2.60
1934	Manhole	959.29	952.02	959.62	Yes	960.34	1.04
1937	Manhole	959.27	948.74	959.58	Yes	960.29	1.02
1936	Manhole	956.78	950.04	959.81	Yes	960.54	3.76
1935	Manhole	964.17	959.70	962.12	No	962.82	0.00
1933	Manhole	955.32	947.08	955.44	Yes	956.07	0.76
11214	Outfall	952.12	945.14	951.52	NA	952.00	NA
20456	Outfall	951.55	946.55	951.92	NA	952.24	NA
20458	Outfall	952.00	945.16	951.52	NA	952.00	NA
10968	Manhole	970.00	958.70	970.90	Yes	971.40	1.40
10967	Manhole	969.67	958.25	970.35	Yes	970.91	1.24
10966	Manhole	958.03	951.50	960.98	Yes	961.67	3.64
10969	Manhole	964.37	956.13	966.56	Yes	967.17	2.80

*Rim elevation reported for inlets is 0.5' lower than value shown in city GIS data based on assumed curb depth

**Ponded depth calculated as 100-Year Max Water Elevation minus rim elevation as reported in city GIS data

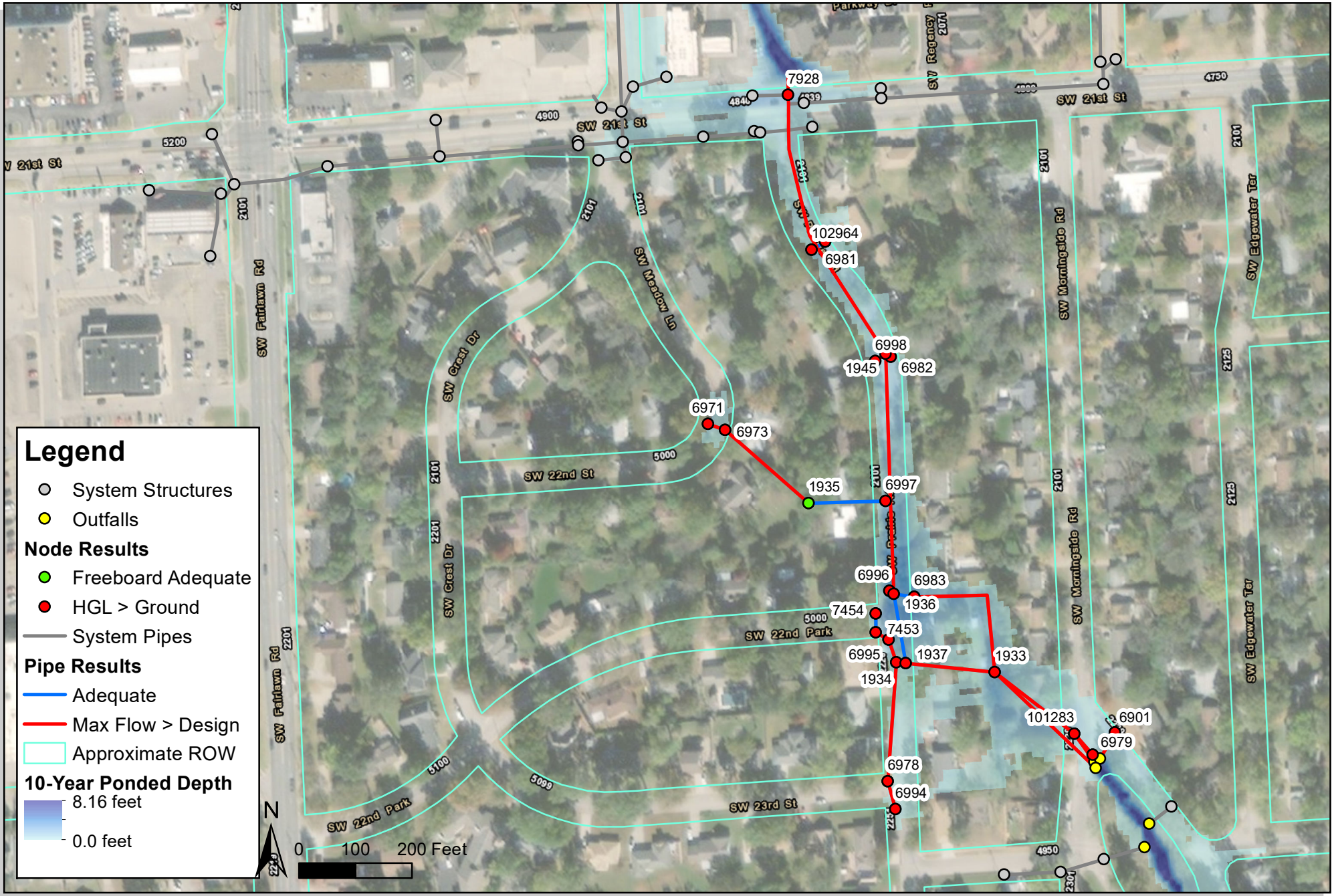


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Figure 2: Existing Conditions for 10-year

Topeka, Kansas

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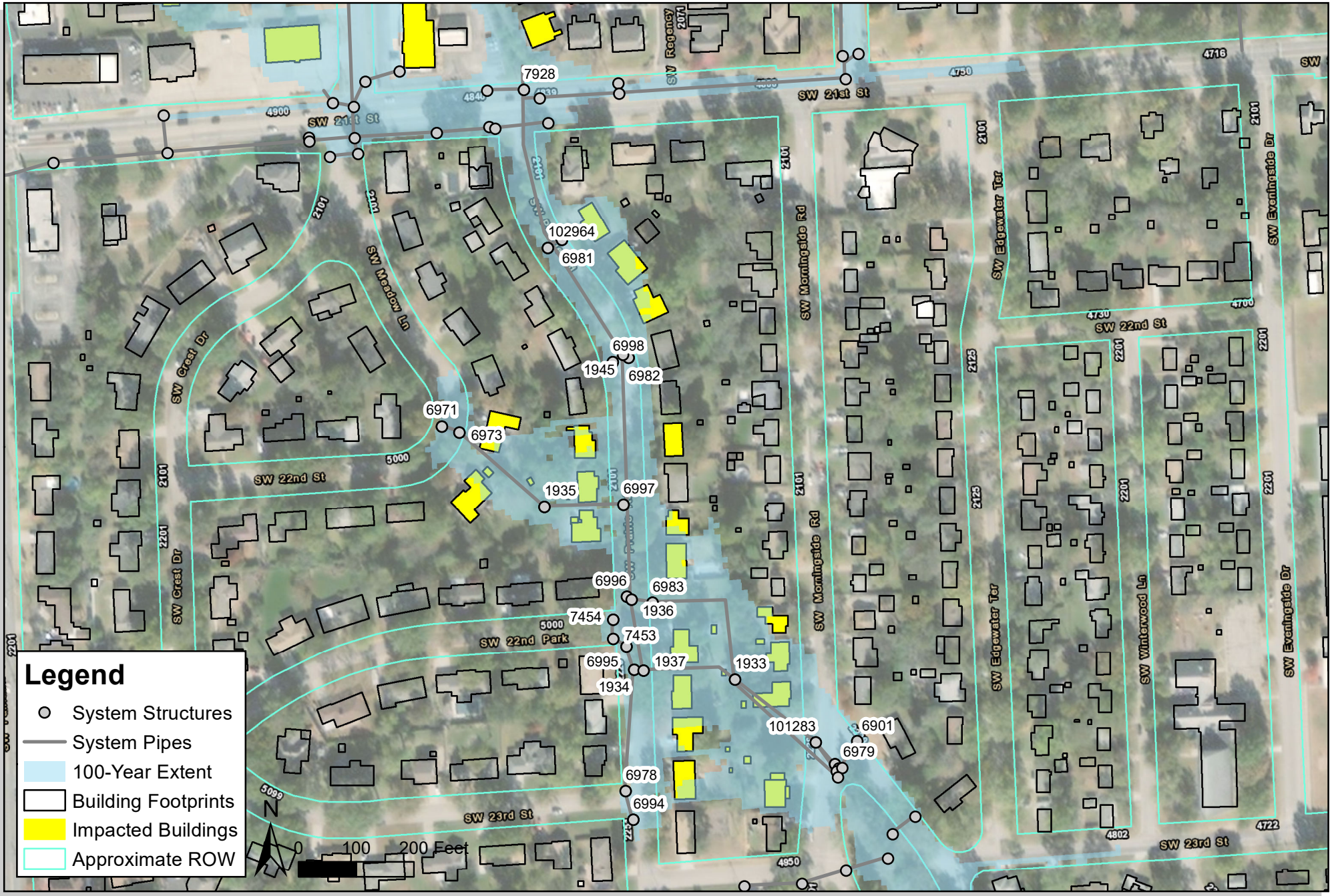

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Figure 3: Existing Conditions for 100-year

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4. RECOMMENDATIONS

Based on the existing conditions results, improvement recommendations have been developed to address the conveyance deficiencies.Overall, the projects in this report are preliminary and do not represent a detailed design effort. Should design proceed on any individual recommendation project details will likely require adjustments as design progresses.

Recommendations:

Conveyance recommendations were broken up into two separate projects based upon the deficiencies observed. Additional inlets recommended as well as total length and size of pipes to be added or replaced include:

- Phase 1
    - Inlets Replaced - 4
    - 30" RCP – 262 feet
    - 78" RCP – 910 feet (assumes twin pipes installed)
    - 63" X 98" RCP – 120 feet (assumes twin pipes installed)
- Phase 2
    - Inlets Replaced - 5
    - 18" RCP – 32 feet
    - 24" RCP – 333 feet
    - 78" RCP – 967 feet

Details of the proposed recommendations are identified below.

Phase 1:

Phase 1 includes alternatives to increase the conveyance downstream of the sump location at SW Park and SW Prairie Road. Additional or upsized pipes are recommended from Inlet 6983 to the outfall to convey the 10-Year storm event. The ideal alignment would roughly follow the existing pipe alignments and replace the existing 54" CMP and 27" X 43" CMP pipes with twin 78" RCP or round equivalent pipes such as a 63" X 98" elliptical RCP. The twin pipes are recommended solely for the purpose of conveying the flows which will be conveyed by the additional upstream network discussed in Phase 2. Should the City opt not to pursue the construction of an upstream twin trunk line as highlighted in Phase 2, a single 78" RCP or equivalent is recommended. Construction would require temporary easement beyond the existing drainage easements and could conflict with the 8" (vcp) sanitary sewer collector. Alternatively, the pipes may be routed south within the City ROW and then east along SW 23rd Street to the outfall. The pipe slope would be going against the surface grade resulting in a maximum pipe depth of approximately 20' at the intersection of SW 23rd Street and SW Prairie Road. Additionally, the lateral pipes at the intersection of SW 23rd Street and SW Prairie Road should be upsized to 30" RCP and it is likely additional inlets will need installed to capture flows prior to reaching the sump location as shown in Figure 4. Final lengths of curb inlets needed should be optimized when the project proceeds to design.

Implementation of this project would substantially reduce ponding at the sump location for the 10-year event but impacts to adjacent landowners would still be expected under 100-year conditions.

A program level opinion of cost has been developed for the ideal alignment of Phase I which supports the installation of Phase 2. The total construction cost is $1,250,000, including 20% contingency. however, if Phase 2 will not be installed the project cost of Phase I could reduce to approximately $745,000. The opinion of cost assumes roadways are replaced with similar pavement and includes cost for three water and three sanitary sewer utility conflicts. Cost opinions also assume that 78" and 63" X 98" pipes maybe

unavailable in the area, thus 84" and 84" round equivalent pipes were used. Final pipe sizes available and able to fit below grade should be determined during the design phase. An easement exists along the current alignment though it is anticipated that an additional easement will be needed to complete the project. A break down of the cost opinion can be found in Appendix B.

Phase 2:

The goal of Phase 2 is to increase the conveyance upstream of the sump location at SW Park and SW Prairie Road.

The recommended alternative includes the addition of a parallel 78" RCP trunk line on the east side of the street from the open channel north of SW 21st Street to the sump location at inlet 6983 to convey the 10-Year and 100-Year storm events. The trunk line would connect directly to the existing inlets to convey flows from those drainage basins. The existing pipes which currently convey flow from the inlets to the existing 4.5' X 4.5' concrete box culvert would remain in place to help equalize the flow distribution between the parallel trunk lines. This will significantly reduce the overland flow down SW Prairie Road and excessive ponding in the sump location.

Analysis was completed with the trunk line improvements. Results indicate the excessive ponding and overland flow at the sump location where SW Meadows Lane and SW 22nd St intersect is not because of the trunk line deficiencies but rather it is due to the undersized lateral pipes. Five structures were being shown as potentially impacted by the 100-Year flood event. Lateral pipes were increased to 18" and 24" RCP to eliminate the overland flow. It is also not clear if there is an existing drainage easement. It is likely the curb inlet lengths will also need to be increased. This should be optimized if the project proceeds to design.

A program level opinion of cost has been developed for the recommended alignment. The total construction cost for Phase 2 with a 20% contingency is $1,442,000. This cost assumes roadways are replaced with similar pavement and includes cost for one potential water line conflict and three potential sanitary sewer line conflicts. Cost opinions also assume that 78" maybe unavailable in the area, thus 84" pipes were used. Exact pipe sizes available and able to fit below grade should be determined during the design phase. An easement exists along the current alignment though it is anticipated that an additional easement will be needed to complete the project. A break down of the cost opinion can be found in Appendix B.

A second alternative would be to allow the overland flow down SW Prairie Road to continue as is and focus on the creation of an engineered overland flow path. At a minimum the two homes identified on Figure 4 should be purchased so that a large swale and inlet drop structure can be constructed to capture the overland flows. The current combined Shawnee County tax appraisal of these two homes totals $189,480. Upstream of the SW Prairie Road sump location the current analysis indicates there are a few homes which may be impacted by the 100-Year flood event on the east side of the road, however, this analysis was completed using best available LiDAR data. A more detailed analysis including full topographic survey of the street and adjacent land may prove these houses are not truly impacted. Following a more detailed analysis the City could look to purchase the homes which are still impacted during the 100-Year flood event.

Results:

Results of the implementation of Phase 1 and 2 are shown in Figures 6 and 7 respectively and Appendix C. It should be noted this study focused on the area south of SW 21st Street. Model results indicate deficiencies upstream of this area, however, any improvements in upstream conveyance would likely have a negative impact in the study area. It is recommended that the City investigate the potential for upland

storage if it is desired to improve drainage deficiencies within this area as this could potentially improve drainage concerns both upstream and within the current project area.

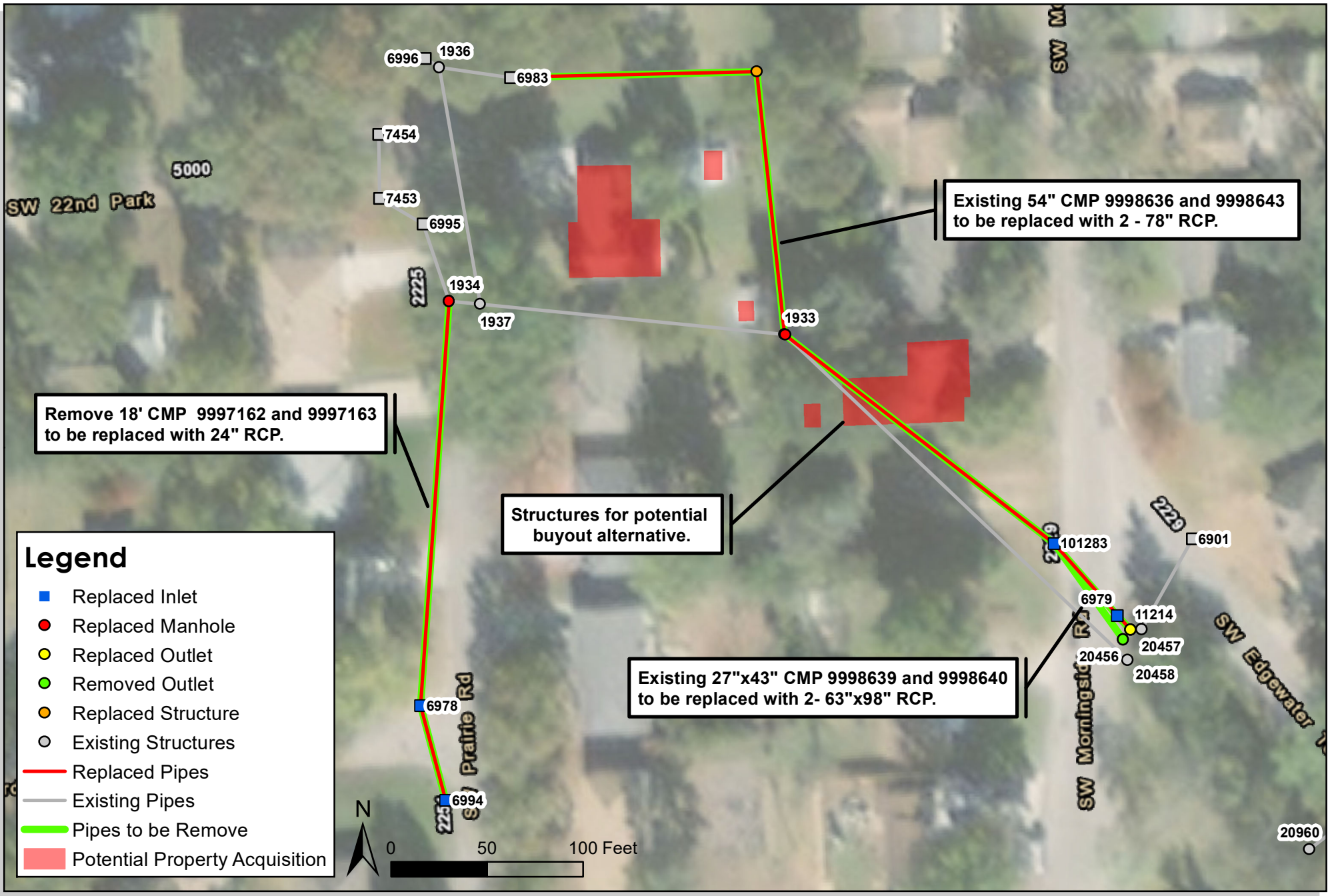

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Figure 4: Phase 1 - SW 23rd Trunkline

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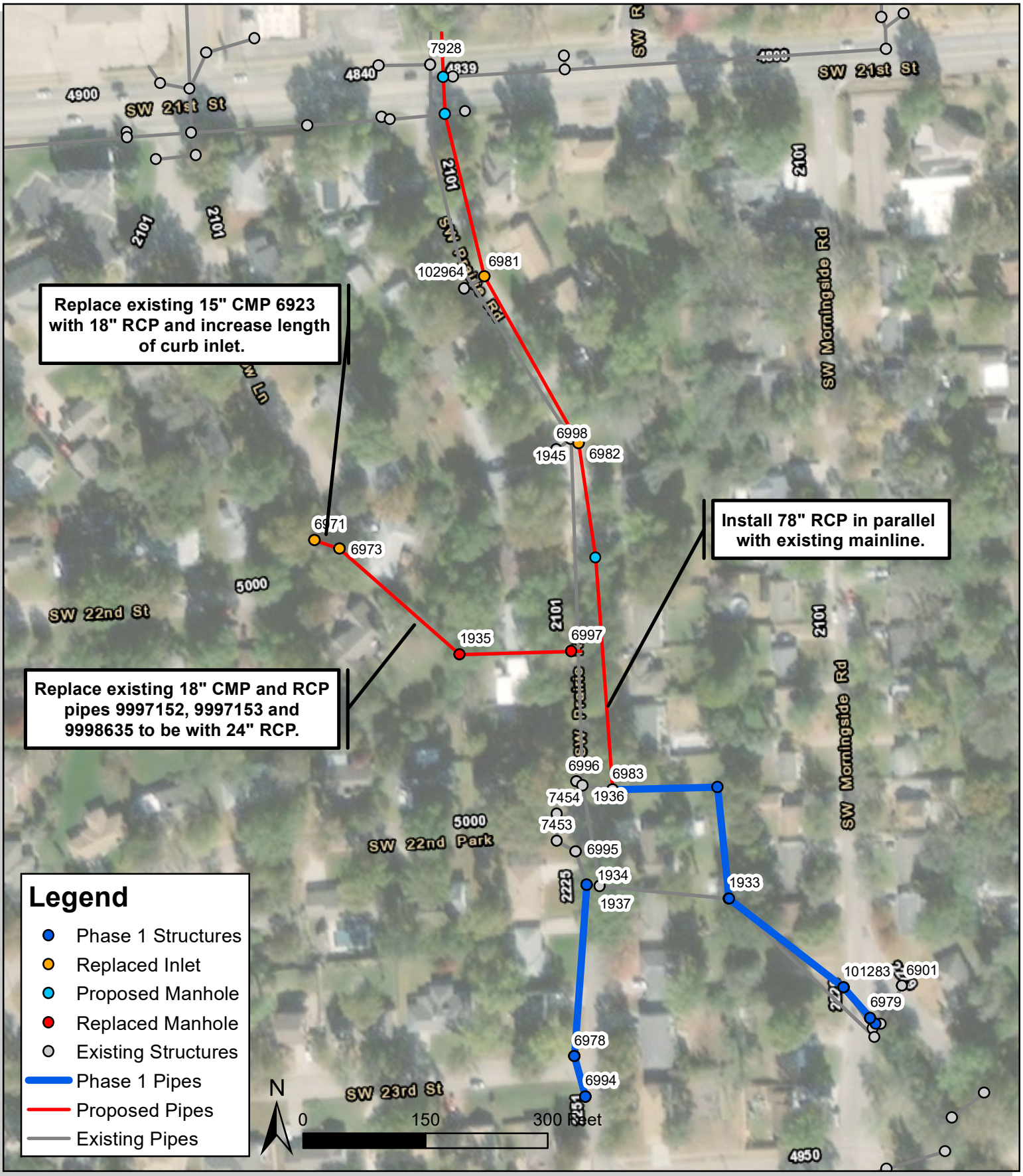

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Figure 5: Phase 2 - SW Prairie Rd Trunkline

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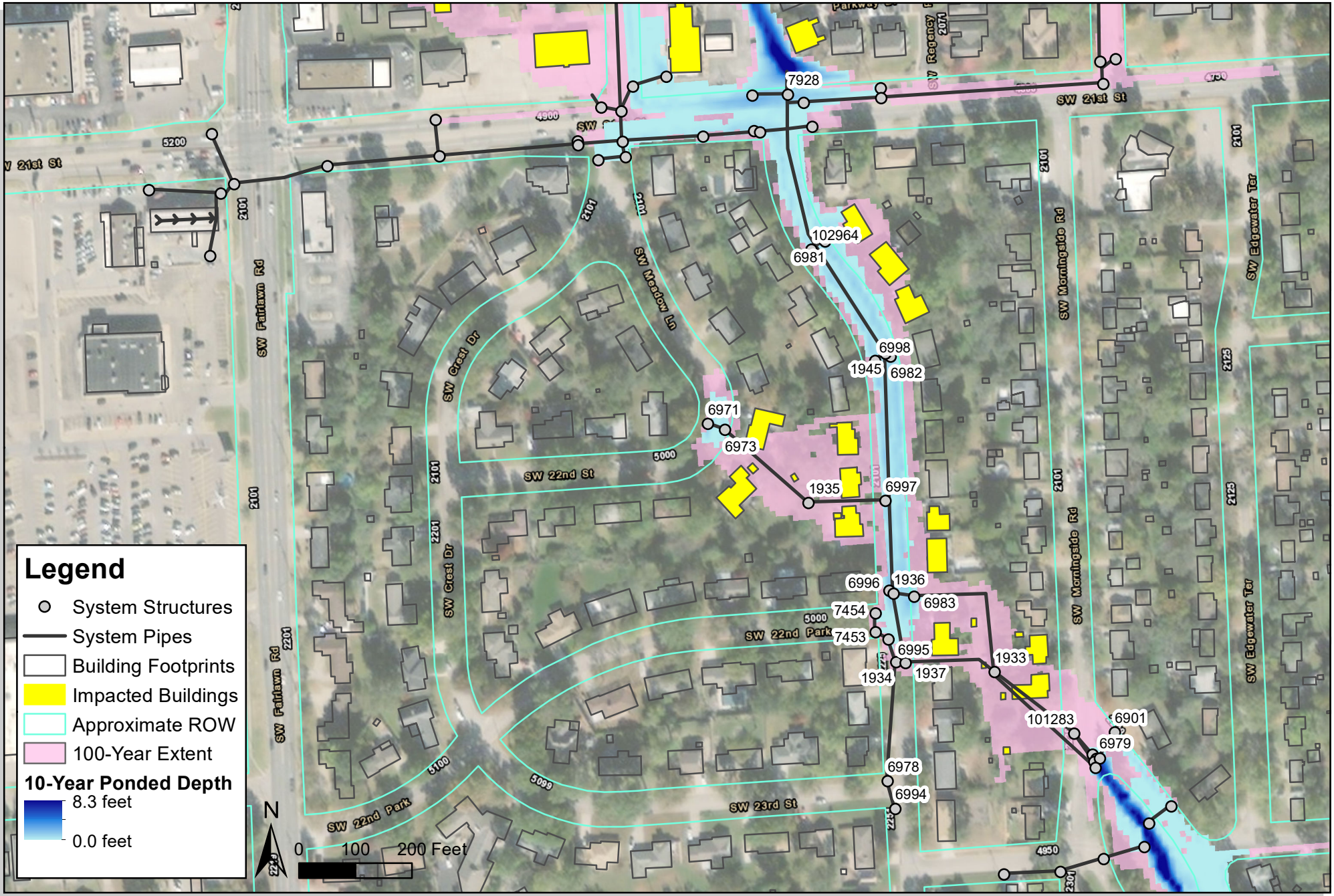

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Figure 6: Proposed Conditions Phase 1

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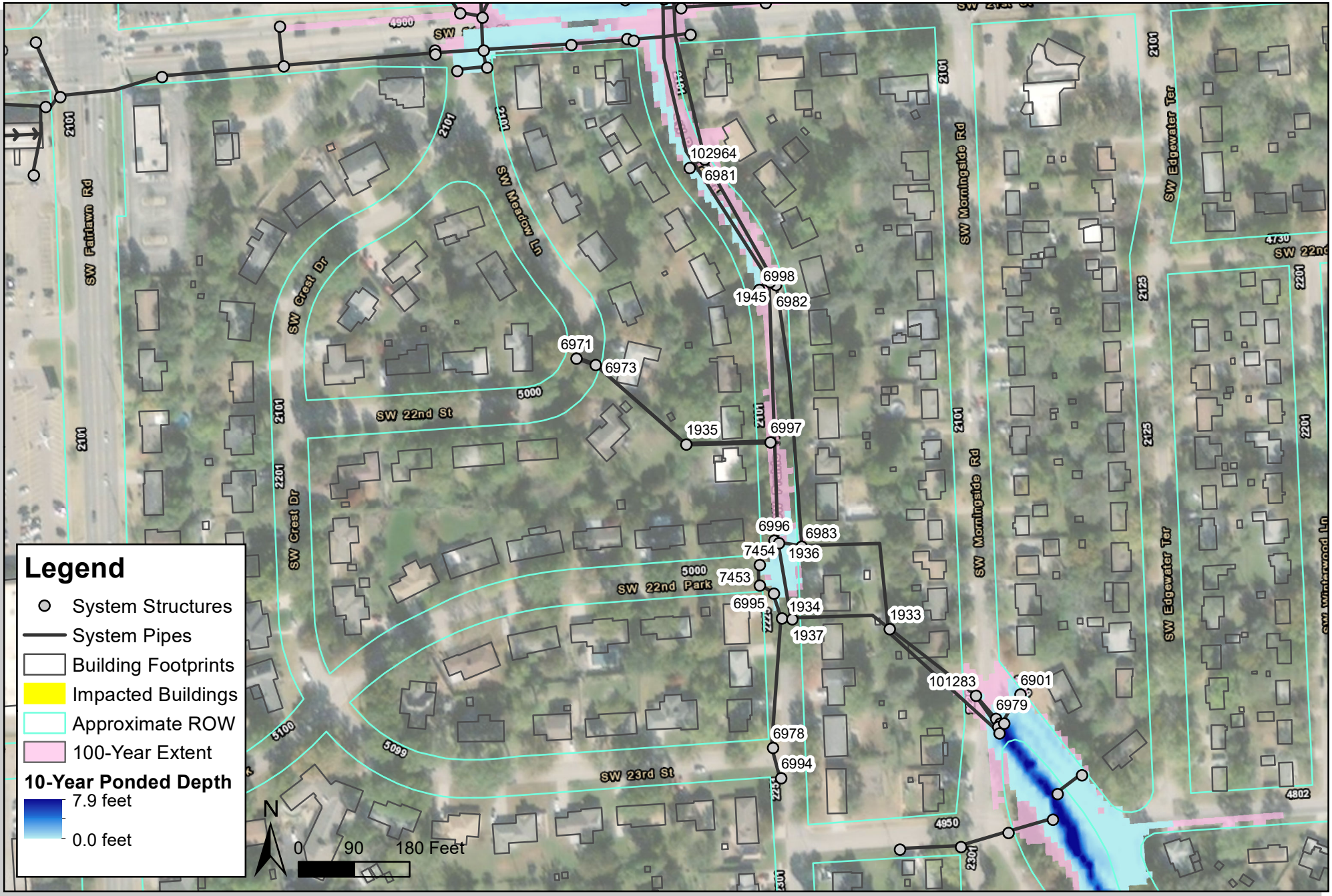

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Figure 7: Proposed Conditions Phase 2

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APPENDIX A – EXISTING CONDITIONS

Catchment Results - Existing Conditions					
Facility ID	Drainage Area (acres)	Curve number	Time of Concentration	Peak Flow cfs	
				10-Year	100-Year
2080	3.3	87.6	5.7	19.2	32.2
2081	2.2	89.3	5.0	13.6	22.3
2086	2.7	85.7	5.0	15.7	26.8
2091	1.6	85.5	5.0	9.1	15.5
2092	0.4	89.5	5.0	2.2	3.6
2093	0.1	89.0	5.0	0.7	1.2
2094	4.1	86.3	10.5	19.0	32.5
2095	2.3	91.8	9.8	12.7	20.6
2096	1.2	92.6	5.1	8.1	13.0
2097	0.6	94.3	5.0	3.8	6.1
2098	0.1	89.2	5.0	0.7	1.2
2099	3.3	86.4	7.4	17.5	29.7
2100	1.8	86.5	5.0	10.6	17.9
2102	4.4	87.9	7.7	24.0	40.1
2103	1.3	88.8	5.0	8.1	13.4
2104	2.0	87.3	5.0	12.2	20.4
2105	1.8	84.7	5.0	10.2	17.5
2106	2.2	86.3	5.0	13.0	22.0
2108	1.8	85.6	5.0	10.3	17.5
2111	3.3	86.1	5.0	19.3	32.6
2112	3.4	86.9	7.2	18.4	31.0
2113	0.8	87.2	5.0	4.7	7.9
2114	1.0	87.2	5.0	5.8	9.7
2117	1.9	86.4	5.0	11.4	19.3
2119	1.5	88.1	6.5	8.9	14.8
2148	0.9	89.2	9.1	4.7	7.7
2149	0.2	85.1	5.2	1.3	2.3
2150	0.6	86.7	5.0	3.3	5.5
2151	0.4	86.8	5.0	2.2	3.7
2152	0.8	86.9	5.0	4.8	8.1
2153	1.1	86.7	5.0	6.7	11.3
6899	1.5	85.9	5.0	8.6	14.6
6901	1.9	86.0	5.0	11.0	18.6
6971	2.6	85.1	9.2	12.7	21.8
6972	1.1	86.2	5.0	6.2	10.4
6973	1.0	84.5	5.0	5.9	10.1
6976	0.7	87.1	5.0	4.3	7.2
6977	0.4	88.8	5.0	2.5	4.1
6978	0.9	85.6	5.0	5.4	9.1
6979	1.4	85.8	5.0	8.0	13.7
6981	1.1	90.3	5.0	7.2	11.7
6982	2.9	85.6	5.0	16.6	28.2
6983	2.4	83.3	6.1	12.7	22.2
6994	4.8	84.7	5.5	26.7	46.0
6995	2.2	84.9	6.1	12.0	20.6
6996	3.6	83.0	5.2	19.2	33.7
6997	0.9	84.0	6.5	4.7	8.2
6998	1.1	84.9	5.0	6.2	10.7
7250	0.5	95.3	5.0	3.4	5.4
7453	1.1	85.4	5.0	6.0	10.3

Catchment Results - Existing Conditions					
Facility ID	Drainage Area (acres)	Curve number	Time of Concentration	Peak Flow cfs	
				10-Year	100-Year
7454	1.2	85.7	5.0	7.1	12.1
7924	0.3	95.1	5.1	1.9	3.0
7925	0.5	94.9	5.0	3.6	5.7
7926	0.3	93.9	5.0	1.9	3.0
7927	1.0	92.7	5.0	6.4	10.3
7928	0.2	90.8	5.9	1.3	2.2
7929	1.0	88.1	5.0	5.9	9.8
7952	0.6	90.6	5.0	3.7	6.0
7953	0.5	92.2	5.0	3.3	5.3
7954	0.8	92.5	5.0	5.1	8.1
7955	0.5	93.0	5.0	3.2	5.1
7956	0.4	94.9	5.0	2.5	4.0
8743	1.2	92.9	5.0	7.6	12.2
8744	0.8	90.8	5.0	5.3	8.5
8745	0.1	89.4	5.0	0.6	1.1
8746	0.6	90.6	5.0	3.7	6.0
8747	0.2	91.0	5.0	1.5	2.5
8748	1.9	89.2	5.0	11.6	19.1
8749	0.0	90.3	5.0	0.3	0.4
8750	0.8	88.8	5.0	4.7	7.7
8751	0.5	95.7	5.0	3.3	5.2
8752	3.0	95.0	5.1	20.3	32.0
8753	1.5	94.6	6.2	9.8	15.4
8754	0.2	92.6	5.0	1.1	1.7
8755	0.2	91.5	5.0	1.3	2.0
8756	2.4	92.0	8.3	13.7	22.1
8757	0.1	94.4	5.0	0.4	0.6
8758	1.1	93.8	5.0	7.1	11.3
8759	1.2	93.2	5.0	8.3	13.2
8760	1.8	86.8	5.0	10.5	17.6
8761	0.1	83.2	5.0	0.3	0.6
8762	1.3	86.4	5.0	7.6	12.8
8763	0.9	89.0	5.0	5.6	9.2
8764	0.3	88.8	5.0	2.1	3.5
14172	0.5	96.0	5.0	3.4	5.3
24800	19.8	88.8	15.5	83.5	139.1
101014	1.6	89.1	5.1	9.7	16.0
101015	0.4	87.1	5.0	2.5	4.2
101267	0.2	90.0	5.0	1.2	2.0
101268	1.1	87.7	7.3	5.8	9.7
101269	2.3	87.9	5.0	14.1	23.5
101283	3.9	84.6	7.0	20.0	34.5
101284	2.9	87.5	5.0	17.3	28.8
101285	0.4	89.4	5.0	2.3	3.8
101289	3.0	84.4	13.9	12.1	21.1
101310	0.8	94.8	5.0	5.5	8.7
102964	1.5	89.2	5.0	9.0	14.8
102985	5.7	93.5	9.6	31.8	50.7

Conveyance Results - Existing Conditions											
Facility ID	10-Year Max Flow cfs*	Shape	Size	Material	Length ft	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Conduit Slope %	Design Full Flow cfs	Maximum Water Elevation (US) ft	Max Flow/Design Flow (fraction) %
9997150	-15.9	Circular	15"	RCP	22	956.01	956.16	-0.7	5.4	962.35	3.0
9997148	-21.9	Circular	15"	RCP	11	956.51	957.07	-5.2	14.8	962.49	1.5
9997152	-40.4	Circular	18"	RCP	8	953.13	952.00	13.6	38.7	959.83	1.0
9997158	3.8	Circular	15"	CMP	33	956.03	955.44	1.8	4.6	959.77	0.8
9997159	7.0	Circular	18"	CMP	26	955.40	955.35	0.2	2.4	959.77	2.9
9997160	12.2	Circular	18"	CMP	42	955.27	954.03	2.9	9.7	959.77	1.3
9998636	140.9	Circular	54"	CMP	280	948.43	947.08	0.6	73.9	959.76	1.9
9997156	17.2	Circular	18"	RCP	9	952.27	952.73	8.6	23.9	959.79	0.7
9997162	10.6	Circular	18"	CMP	51	961.53	960.55	3.0	7.9	965.65	1.4
9997163	11.7	Circular	18"	CMP	211	960.52	953.93	3.0	10.1	964.72	1.2
6923	10.4	Circular	15"	CMP	32	970.06	969.05	3.1	6.2	973.81	1.7
9998635	13.9	Circular	18"	CMP	196	968.73	959.70	4.6	12.2	973.62	1.1
9998640	72.7	Special	27" X 43"	CMP	10	945.22	945.14	0.6	27.4	951.92	2.7
9998639	58.7	Special	27" X 43"	CMP	50	945.63	945.22	0.6	27.5	953.31	2.1
9998641	121.5	Special	35" X 59"	CMP	62	946.83	946.55	0.5	53.4	953.31	2.3
1009620	268.5	Rectangular	4.5' X 4.5'	RCP	17	958.86	958.70	1.0	248.9	971.07	1.1
9998659	-26.0	Circular	15"	RCP	10	960.00	956.13	37.6	39.6	965.17	0.7
9998660	-20.2	Circular	15"	RCP	18	958.40	956.13	12.8	23.1	965.00	0.9
6962	253.5	Rectangular	4.5' X 4.5'	RCP	260	953.81	951.50	0.9	235.7	963.58	1.1
9997161	23.5	Circular	24"	RCP	16	952.02	950.90	6.8	59.1	959.62	0.4
9998642	129.5	Circular	48"	CMP	170	948.74	947.08	1.0	77.0	959.58	1.7
9997157	116.5	Rectangular	4.5' X 4.5'	RCP	125	950.04	948.74	1.0	255.4	959.82	0.5
1011040	142.7	Special	42" X 68"	RCP	37	950.04	948.43	4.3	421.9	959.82	0.3
9997153	13.9	Circular	18"	RCP	137	959.70	953.40	4.6	22.5	962.12	0.6
99953851	145.6	Circular	54"	CMP	240	947.08	945.16	0.8	95.1	955.45	1.5
9998643	126.5	Circular	54"	CMP	175	947.08	945.63	0.5	96.7	955.45	1.3
9998657	244.7	Rectangular	49" X 91"	RCP	39	962.60	958.92	9.4	1309.8	971.18	0.2
1009621	276.2	Rectangular	4.5' X 4.5'	RCP	46	958.70	958.25	1.0	249.0	970.90	1.1
1009622	336.1	Rectangular	4.5' X 4.5'	RCP	215	958.25	956.13	1.0	248.9	970.35	1.4
1009619	223.5	Rectangular	4.5' X 4.5'	RCP	165	951.50	950.22	0.8	220.7	960.98	1.0
9998658	290.8	Rectangular	4.5' X 4.5'	RCP	226	956.13	953.90	1.0	248.9	966.56	1.2

*Negative values shown due to surcharged backflow

APPENDIX B – OPINIONS OF COST

ENGINEER'S CONCEPTUAL OPINION OF PROBABLE COST

SW Prairie Road - Phase 1

Topeka, Kansas

Date Prepared:

January 12, 2021

JEO Project No. 201617.00

ESTIMATE OF QUANTITIES

Item #	Description	Unit	Quantity	Unit Price	Total
PHASE 1					
1.	Mobilization	LS	1	$71,000.00	$71,000
2.	Bonding and Insurance	LS	1	$24,000.00	$24,000
3.	Temporary Traffic Control Measures	LS	1	$5,000.00	$5,000
4.	Clearing and Grubbing	LS	1	$10,000.00	$10,000
5.	Remove Asphalt	SY	480	$25.00	$12,000
6.	Remove Curb and Gutter	LF	250	$11.00	$2,750
7.	Remove Driveway	SY	18	$10.00	$180
8.	Asphalt Concrete	TONS	165	$120.00	$19,800
9.	Concrete Curb and Gutter	LF	250	$85.00	$21,250
10.	6" Concrete Driveway	SY	18	$60.00	$1,080
11.	Remove CMP Storm Sewer Pipe	LF	840	$28.00	$23,520
12.	Remove Storm Sewer Structure	EA	8	$1,000.00	$8,000
13.	30" RCP, Class III	LF	262	$150.00	$39,300
14.	84" RCP, Class III	LF	910	$650.00	$591,500
15.	84" Round Equivalent RCP or RCBox, Class III	LF	120	$700.00	$84,000
16.	Curb Inlet, 9 ft width	EA	1	$6,500.00	$6,500
17.	Curb Inlet w/Junction Box, 4-6 ft width	EA	1	$8,000.00	$8,000
18.	Curb Inlet w/Junction Box, 9 ft width	EA	2	$8,000.00	$16,000
19.	Storm Sewer Manhole/Box	EA	3	$8,500.00	$25,500
20.	84" Round Equivalent RCP Flared End Section	EA	2	$5,000.00	$10,000
21.	Connect to Existing Storm Sewer	EA	5	$3,500.00	$17,500
22.	Utility Conflict Resolution - Water	EA	3	$5,000.00	$15,000
23.	Utility Conflict Resolution - Sewer	EA	3	$5,000.00	$15,000
24.	Erosion Control	LS	1	$4,000.00	$4,000
25.	Seeding, Fertilizer and Mulch	ACRE	1.00	$4,500.00	$4,500
				Construction Subtotal	$1,036,000
	Additional Permanent Easement	SF	5,000.00	$ 1.00	$5,000
				Construction and Easement Subtotal	$1,041,000
				Contingency 20%	$209,000
				Total Opinion of Construction Cost	**$1,250,000**

JEO Consulting Group Inc.'s (JEO) Opinions of Probable Cost provided for herein are to be made on the basis of JEO's experience and qualifications and represent JEO's best judgment. However, since JEO has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, JEO cannot and does not guarantee that proposals, bids, or actual construction cost will not vary from Opinions of Probable Cost prepared by JEO.

ENGINEER'S CONCEPTUAL OPINION OF PROBABLE COST

SW Prairie St - Phase 2

Topeka, Kansas

JEO Project No. 201668.00

Date Prepared:
January 12, 2021

ESTIMATE OF QUANTITIES

Item #	Description	Unit	Quantity	Unit Price	Total
PHASE 2					
1.	Mobilization	LS	1	$82,000.00	$82,000
2.	Bonding and Insurance	LS	1	$28,000.00	$28,000
3.	Temporary Traffic Control Measures	LS	1	$5,000.00	$5,000
4.	Clearing and Grubbing	LS	1	$10,000.00	$10,000
5.	Remove Asphalt	SY	35	$25.00	$875
6.	Remove Concrete	SY	1,800	$10.00	$18,000
7.	Remove Curb and Gutter	LF	1,000	$11.00	$11,000
8.	Remove Driveway	SY	90	$10.00	$900
9.	Remove Concrete Sidewalk	SF	60	$3.00	$180
10.	Asphalt Concrete	TONS	12	$150.00	$1,800
11.	8" Concrete Pavement	SY	1,800	$80.00	$144,000
12.	Concrete Curb and Gutter	LF	1,000	$85.00	$85,000
13.	6" Concrete Driveway	SY	90	$60.00	$5,400
14.	5" Concrete Sidewalk	SF	60	$15.00	$900
15.	Detectable Warning Panels	SF	32	$30.00	$960
16.	Remove CMP Storm Sewer Pipe	LF	370	$28.00	$10,360
17.	Remove Storm Sewer Structure	EA	6	$1,000.00	$6,000
18.	18" RCP, Class III	LF	32	$100.00	$3,200
19.	24" RCP, Class III	LF	333	$120.00	$39,960
20.	84" RCP, Class III	LF	967	$650.00	$628,550
21.	Curb Inlet, 4-6 ft width	EA	3	$5,000.00	$15,000
22.	Curb Inlet w/Junction Box, 4-6 ft width	EA	2	$8,000.00	$16,000
23.	Storm Sewer Manhole/Box	EA	4	$8,500.00	$34,000
24.	Connect to Existing Storm Sewer	EA	6	$3,500.00	$21,000
25.	Utility Conflict Resolution - Water	EA	1	$5,000.00	$5,000
26.	Utility Conflict Resolution - Sewer	EA	3	$5,000.00	$15,000
27.	Erosion Control	LS	1	$4,000.00	$4,000
28.	Seeding, Fertilizer and Mulch	ACRE	1.00	$4,500.00	$4,500
				Construction Subtotal	$1,197,000
	Additional Permanent Easement	SF	4,000.00	$ 1.00	$4,000
				Construction and Easement Subtotal	$1,201,000
				Contingency 20%	$241,000
				Total Opinion of Construction Cost	**$1,442,000**

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APPENDIX C – PROPOSED CONDITION

Phase 1 Conveyance Results												
Facility ID	10-Year Max Flow cfs*	Shape	Size	Material	Length ft	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Conduit Slope %	Design Full Flow cfs	Maximum Water Elevation (US) ft	Max Flow/ Design Flow (fraction) %	Modifications
9997150	11.0	Circular	15"	RCP	22	956.01	956.16	-0.7	5.4	961.98	2.1	
9997148	11.0	Circular	15"	RCP	11	956.51	957.07	-5.2	14.8	962.11	0.8	
9997152	28.0	Circular	18"	RCP	8	953.13	952.00	13.6	38.7	958.48	0.7	
9997158	4.1	Circular	15"	CMP	33	956.03	955.44	1.8	4.6	959.01	0.9	
9997159	7.9	Circular	18"	CMP	26	955.40	955.35	0.2	2.4	958.86	3.3	
9997160	15.4	Circular	18"	CMP	42	955.27	954.03	2.9	9.7	958.47	1.6	
9998636	375.1	Circular	Twin 78"	RCP	280	948.43	946.64	0.6	418.6	954.19	0.9	Upsized from 54" CMP
9997156	24.9	Circular	18"	RCP	9	952.27	952.73	8.6	23.9	958.04	1.0	
9997162	26.7	Circular	30"	RCP	51	959.89	958.36	3.0	71.1	960.97	0.4	Upsized from 18" CMP
9997163	32.0	Circular	30"	RCP	211	958.36	952.02	3.0	71.1	959.56	0.5	Upsized from 18" CMP
6923	10.7	Circular	15"	CMP	32	970.06	969.05	3.1	6.2	973.81	1.7	
9998635	14.6	Circular	18"	CMP	196	968.73	959.70	4.6	12.2	973.52	1.2	
9998640	375.6	Special	2 - 63" X 98"	RCP	10	945.20	945.14	0.6	432.6	951.84	0.9	Upsized from 27" X 43" CMP
9998639	390.0	Special	2 - 63" X 98"	RCP	50	945.52	945.20	0.6	431.4	952.10	0.9	Upsized from 27" X 43" CMP
9998641	Removed											
1009620	285.7	Rectangular	4.5' X 4.5'	RCP	17	958.86	958.70	1.0	248.9	970.97	1.1	
9998659	-19.8	Circular	15"	RCP	10	960.00	956.13	37.6	39.6	964.96	0.5	
9998660	-15.8	Circular	15"	RCP	18	958.40	956.13	12.8	23.1	964.83	0.7	
6962	318.7	Rectangular	4.5' X 4.5'	RCP	260	953.81	951.50	0.9	235.7	962.11	1.4	
9997161	47.3	Circular	24"	RCP	16	952.02	950.90	6.8	59.1	955.24	0.8	
9998642	87.4	Circular	48"	CMP	170	948.74	947.08	1.0	77.0	954.89	1.1	
9997157	67.1	Rectangular	4.5' X 4.5'	RCP	125	950.04	948.74	1.0	255.4	954.98	0.3	
1011040	326.7	Special	42" X 68"	RCP	37	950.04	948.43	4.3	421.9	954.98	0.8	
9997153	14.6	Circular	18"	RCP	137	959.70	953.40	4.6	22.5	961.01	0.6	
99953851	74.8	Circular	54"	CMP	240	947.08	945.16	0.8	95.1	952.97	0.8	
9998643	383.3	Circular	Twin 78"	RCP	175	946.64	945.52	0.5	418.7	952.97	0.9	Upsized from 54" CMP
9998657	265.7	Rectangular	49" X 91"	RCP	39	962.60	958.92	9.4	1309.8	971.10	0.2	
1009621	295.0	Rectangular	4.5' X 4.5'	RCP	46	958.70	958.25	1.0	249.0	970.76	1.2	
1009622	358.7	Rectangular	4.5' X 4.5'	RCP	215	958.25	956.13	1.0	248.9	970.14	1.4	
1009619	346.1	Rectangular	4.5' X 4.5'	RCP	165	951.50	950.22	0.8	220.7	958.01	1.6	
9998658	323.6	Rectangular	4.5' X 4.5'	RCP	226	956.13	953.90	1.0	248.9	965.81	1.3	

*Negative values shown due to surcharged backflow

Phase 1 System Results							
Facility ID	Structure Type	RIM Elevation ft*	Invert Elevation ft	10-Year Max Water Elevation ft	10-Year Freeboard < 0.5 feet	100-Year Max Water Elevation ft	100-Year Ponded Depth @ Roadway Crown**
6998	Inlet	960.43	956.01	961.98	Yes	962.90	1.98
6982	Inlet	960.54	956.51	962.11	Yes	963.09	2.05
6997	Inlet	957.32	953.13	958.47	Yes	960.03	2.22
7454	Inlet	959.01	956.03	959.01	Yes	959.75	0.24
7453	Inlet	958.86	954.58	958.86	Yes	959.75	0.39
6995	Inlet	958.07	953.44	958.47	Yes	959.75	1.18
6983	Inlet	956.47	948.43	954.19	No	958.40	1.44
6996	Inlet	956.70	952.27	958.03	Yes	959.75	2.55
6994	Inlet	964.40	959.89	960.97	No	962.40	0.00
6978	Inlet	964.47	958.36	959.56	No	961.79	0.00
6971	Inlet	973.29	970.06	973.81	Yes	974.32	0.53
6973	Inlet	972.68	968.73	973.52	Yes	974.31	1.13
6979	Inlet	950.84	945.20	951.84	Yes	952.96	1.62
101283	Inlet	952.31	945.52	952.10	Yes	953.45	0.64
7928	Inlet	969.12	958.86	970.96	Yes	971.54	1.92
102964	Inlet	964.20	960.00	964.96	Yes	965.70	0.99
6981	Inlet	963.30	958.40	964.83	Yes	965.47	1.67
1945	Manhole	961.64	953.81	962.11	Yes	963.38	1.75
1934	Manhole	959.29	952.00	955.22	No	958.58	0.00
1937	Manhole	959.27	948.74	954.88	No	958.35	0.00
1936	Manhole	956.78	950.04	954.97	No	958.94	2.16
1935	Manhole	964.17	959.70	961.01	No	962.43	0.00
1933	Manhole	955.32	946.64	952.97	No	955.86	0.54
11214	Outfall	952.12	945.14	951.80	NA	952.86	NA
20456	Outfall	Removed					
20458	Outfall	952.00	945.16	951.80	NA	952.86	NA
10968	Manhole	970.00	958.70	970.76	Yes	971.48	1.48
10967	Manhole	969.67	958.25	970.13	Yes	970.84	1.16
10966	Manhole	958.03	951.50	958.01	Yes	960.42	2.39
10969	Manhole	964.37	956.13	965.81	Yes	966.73	2.36

*Rim elevation reported for inlets is 0.5' lower than value shown in city GIS data based on assumed curb depth

**Ponded depth calculated as 100-Year Max Water Elevation minus rim elevation as reported in city GIS data

Phase 2 Conveyance Results												
Facility ID	10-Year Max Flow cfs*	Shape	Size	Material	Length ft	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Conduit Slope %	Design Full Flow cfs	Maximum Water Elevation (US) ft	Max Flow/ Design Flow (fraction) %	Modifications
9997150	6.9	Circular	15"	RCP	22	956.01	956.16	-0.7	5.4	959.89	1.3	
9997148	-27.0	Circular	15"	RCP	11	956.51	957.07	-5.2	14.8	957.76	1.8	
9997152	22.6	Circular	24"	RCP	8	953.13	952.00	13.6	83.3	957.12	0.3	Upsized from 18" RCP
9997158	4.1	Circular	15"	CMP	33	956.03	955.44	1.8	4.6	959.01	0.9	
9997159	7.9	Circular	18"	CMP	26	955.40	955.35	0.2	2.4	958.86	3.3	
9997160	15.4	Circular	18"	CMP	42	955.27	954.03	2.9	9.7	958.47	1.6	
9998636	505.0	Circular	Twin 78"	RCP	280	948.43	946.64	0.6	418.6	953.55	0.6	Phase 1
9997156	24.1	Circular	18"	RCP	9	952.27	951.50	8.6	30.9	954.39	0.8	
9997162	26.6	Circular	30"	RCP	51	959.89	958.36	3.0	71.1	960.96	0.4	Phase 1
9997163	32.0	Circular	30"	RCP	211	958.36	952.02	3.0	71.1	959.54	0.5	Phase 1
6923	12.6	Circular	18"	RCP	32	970.06	969.05	3.1	18.6	970.97	0.7	Upsized from 15" CMP
9998635	17.8	Circular	24"	RCP	196	968.73	959.70	4.6	48.5	969.57	0.4	Upsized from 18" CMP
9998640	463.2	Special	Twin 63" X 98"	RCP	10	945.20	945.14	0.6	432.6	954.72	1.0	Phase 1
9998639	538.8	Special	Twin 63" X 98"	RCP	50	945.52	945.20	0.6	431.4	952.75	0.6	Phase 1
9998641	Removed											
1009620	204.4	Rectangular	4.5' X 4.5'	RCP	17	958.86	958.70	1.0	248.9	966.59	0.8	
9998659	9.4	Circular	15"	RCP	10	960.00	956.13	37.6	39.6	962.79	0.2	
9998660	-23.2	Circular	15"	RCP	18	958.40	956.13	12.8	23.1	960.64	1.0	
6962	255.8	Rectangular	4.5' X 4.5'	RCP	260	953.81	951.50	0.9	235.7	959.65	1.1	
9997161	46.9	Circular	24"	RCP	16	952.02	950.90	6.8	59.1	954.63	0.8	
9998642	80.4	Circular	48"	CMP	170	948.74	947.08	1.0	77.0	954.17	1.0	
9997157	47.2	Rectangular	4.5' X 4.5'	RCP	125	950.04	948.74	1.0	255.4	954.18	0.2	
1011040	284.4	Special	42" X 68"	RCP	37	950.04	948.43	4.3	421.9	954.18	0.7	
9997153	17.8	Circular	24"	RCP	137	959.70	953.40	4.6	48.5	960.60	0.4	Upsized from 18" RCP
99953851	49.7	Circular	54"	CMP	240	947.08	945.16	0.8	95.1	953.11	0.5	
9998643	521.5	Circular	Twin 78"	RCP	175	946.64	945.52	2.3	418.7	953.11	0.6	Phase 1
9998657	205.7	Rectangular	49" X 91"	RCP	39	962.60	958.92	9.4	1309.8	966.21	0.2	
1009621	201.3	Rectangular	4.5' X 4.5'	RCP	46	958.70	958.25	1.0	249.0	966.46	0.8	
1009622	290.3	Rectangular	4.5' X 4.5'	RCP	215	958.25	956.13	1.0	248.9	965.85	1.2	
1009619	278.7	Rectangular	4.5' X 4.5'	RCP	165	951.50	950.22	0.8	220.7	956.93	1.3	
9998658	276.9	Rectangular	4.5' X 4.5'	RCP	226	956.13	953.90	1.0	248.9	962.52	1.1	

*Negative values shown due to surcharged backflow

Phase 2 System Results							
Facility ID	Structure Type	RIM Elevation ft*	Invert Elevation ft	10-Year Max Water Elevation ft	10-Year Freeboard < 0.5 feet	100-Year Max Water Elevation ft	100-Year Ponded Depth @ Roadway Crown**
6998	Inlet	960.43	956.01	959.88	No	961.54	0.62
6982	Inlet	960.54	954.42	957.08	No	960.47	0.00
6997	Inlet	957.32	953.13	957.12	Yes	958.51	0.69
7454	Inlet	959.01	956.03	959.01	Yes	959.01	0.00
7453	Inlet	958.86	955.40	958.86	Yes	958.86	0.00
6995	Inlet	958.07	955.27	958.47	Yes	958.67	0.10
6983	Inlet	956.47	948.43	953.55	No	955.85	0.00
6996	Inlet	956.70	952.27	954.39	No	957.64	0.44
6994	Inlet	964.40	959.89	960.96	No	961.76	0.00
6978	Inlet	964.47	958.36	959.54	No	961.04	0.00
6971	Inlet	973.29	970.06	970.97	No	971.90	0.00
6973	Inlet	972.68	968.73	969.57	No	969.88	0.00
6979	Inlet	950.84	945.20	952.59	Yes	953.31	1.97
101283	Inlet	952.31	945.52	952.75	Yes	953.56	0.74
7928	Inlet	969.12	958.86	966.26	No	966.19	0.00
102964	Inlet	964.20	960.00	962.57	No	963.96	0.00
6981	Inlet	963.30	957.74	959.98	No	962.83	0.00
1945	Manhole	961.64	953.81	959.64	No	961.10	0.00
1934	Manhole	959.29	952.02	954.63	No	957.60	0.00
1937	Manhole	959.27	948.74	954.16	No	956.46	0.00
1936	Manhole	956.78	950.04	954.18	No	956.51	0.00
1935	Manhole	964.17	959.70	960.60	No	961.25	0.00
1933	Manhole	955.32	946.64	953.11	No	954.48	0.00
11214	Outfall	952.12	945.14	952.57	NA	953.28	NA
20456	Outfall	Removed					
20458	Outfall	952.00	945.16	952.57	NA	953.28	NA
10968	Manhole	970.00	958.70	966.30	No	966.18	0.00
10967	Manhole	969.67	958.25	965.84	No	965.93	0.00
10966	Manhole	958.03	951.50	956.89	No	958.44	0.41
10969	Manhole	964.37	956.13	962.43	No	963.53	0.00

*Rim elevation reported for inlets is 0.5' lower than value shown in city GIS data based on assumed curb depth

**Ponded depth calculated as 100-Year Max Water Elevation minus rim elevation as reported in city GIS data