CITY OF HOUSTON
Public Works and Engineering Department

Capital Improvement Plan Process Manual for Infrastructure Programs

M – Storm Drainage
N – Street & Traffic Control

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Acknowledgements

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SECTION 1 - OVERVIEW

A healthy infrastructure is a necessary ingredient for a robust economy. The growth and development of the City requires the provision of extensive capital improvements to provide this infrastructure. Public Works infrastructure includes streets, bridges, traffic signals, drainage systems, drinking water systems and wastewater systems. These systems must work both independently, and in coordination, to support the needs of the residents and businesses in the City. These systems are designed as individual capital projects that can cost millions of dollars, require acquisition of land and take years to design and construct. Once the investment is made, the resulting infrastructure asset can remain in service for decades with appropriate operations and maintenance.

An infrastructure asset can be viewed through its life cycle, with the majority of the lifespan being spent in operations and maintenance. Planning is initiated to identify needs and develop projects for new infrastructure and for replacement or expansion of existing infrastructure. Programming is the step of prioritizing specific infrastructure projects for allocation of funding by fiscal year. Delivery includes their design and construction. Once constructed, the department manages the operation and maintenance of the City's infrastructure, which is continually assessed through the planning process for needed improvements or upgrades. PWE has existing formalized procedures for the delivery of infrastructure projects through the design and construction process. This manual is the formalization of processes and procedures for the identification and development of projects through planning and the prioritization of projects for programming in the Capital Improvement Plan.

1.1 Purpose

This manual formally communicates a transparent process to develop and prioritize infrastructure projects that will be recommended by the Department of Public Works and Engineering (PWE) for implementation of the Five-Year Capital Improvement Plan (CIP). When the ReBuild Houston implementation plan was presented to City Council and the public in December 2010, one of the key steps was to revise the methodology for capital improvement planning and programming, with a target date set for February 2011. The first version of this document and the inclusion of this document on the *www.ReBuildHouston.org* website was delivered in late January 2011 as the fulfillment of that key step and a commitment to progress made in the December 2010 report. This revision builds on the previous versions and continues to address comments, questions and input provided to PWE.

This document will be updated as necessary to reflect lessons learned, advances in technology and tools, and changes in public priorities. It requires coordination between the various infrastructure categories such that Candidate Projects addressing separate needs (such as drinking water versus structural flooding) can be addressed through one project where possible. It also aims to provide a mechanism to incorporate energy efficiency, environmental sensitivity and sustainable approaches into project planning and design. Consideration of full life-cycle costs will consider both the up-front and the long-term operations and maintenance costs. This approach will help identify the best investment for the City. Systematic planning will lead to defensible choices with design and construction that is not slowed by change orders and other unexpected expenses.

It is important to note that this process is not a new process nor was it created in response to the voters' passage of Proposition One on November 2, 2010. Rather it compiles, formalizes, refines and provides for the evolution of steps that have been, and will continue to be, performed at various levels within PWE. In 1983 City Council resolved that the City of Houston develop and annually revise a CIP (Resolution 83-91), requiring a systematic planning, financial and management process in order to be efficient and effective. Subsequently, the Mayor published Administrative Procedure 4-5 (formerly Administration Procedure 2-7) establishing a continuous CIP. Proposition One brought a heightened focus on transparency in identification and prioritization of needs, and the development of specific projects to address those needs. Additionally, the CIP horizon for streets and drainage was expanded from five years to a 10-year outlook (the "5+5 Plan"). The first five years of this plan (years 1 through 5) conforms to the current project-specific plan and is prepared through the Programming Phase as detailed in Section 3. The second five years (years 6 through 10) presents prioritized need areas for streets and drainage where solutions for these defined problems or infrastructure deficiencies are developed into Candidate Projects. Planning is detailed in Section 2 of this manual. These Candidate Projects are compared and prioritized citywide in subsequent years based on specific criteria outlined in this document for funding in future CIPs (years 1 to 5).

1.2 Programming the Capital Improvement Plan

Administrative Procedure 4-5 establishes standards for preparation and review of the CIP. The CIP sets forth proposed capital projects and related expenditures to be incurred in the succeeding fiscal year, and each fiscal year following, over a rolling period of five years. It describes each project, its source(s) of funding and the amounts allocated to the various stages, phases or aspects of the project. It is updated annually to reflect:

- Revised annual funding limits: based on projections from revenues (ad valorem (property) taxes, drainage charges, impact fees and third party funds) and bond capacity (water and wastewater Combined Utility System) supported by the City's debt models, where allowable;
- New and better data: including updated cost estimates, refined project scopes and revised delivery schedules based on available funding and other obstacles encountered during planning, design or acquisition of right-of-way (ROW); and
- Additional projects: new proposed design or construction starts, particularly within the fifth year of the CIP as years 1 through 4 continue to implement the intent of the most recently adopted CIP.

This annual process includes both internal steps and external/stakeholder input from Council Members and the public. It culminates in approval of the proposed 5-year CIP by the City Council. The CIP flowchart can be found in Administrative Procedure 4-5, Attachment A.

Programming (Years 1-5)

- Prioritize candidate projects based on benefits, benefitted users and estimated cost defined in this manual
- Recommend schedule of projects and associated expenditures within available funds
- Annually present and secure approval of 5-year CIP

The number of projects and corresponding area or population served by the projects recommended in the CIP is limited by the available funding. Passage of Proposition One addressed several funding limitations that would have impacted the ability to reinvest in the City's infrastructure:

- No identified funding source existed for the design and construction of storm drainage projects beyond fiscal year 2012, and
- The current voter approved bond authorization for street and drainage projects would be exhausted in fiscal year 2013.

The annual bond capacity had eroded between 2006 and 2010 from $80 million per year to $65 million per year mainly due the City's overall bonding capacity and the overall decrease in the total ad valorem tax base citywide. It was anticipated that this annual allocation would be further reduced in upcoming CIPs based on the continued stagnant or downward trend in property values citywide.

With voter passage of Proposition One, Houstonians committed dedicated funds to address street and drainage needs through the City and require a pay-as-you-go fiscal approach. This approach can reduce the amount paid for each specific project (versus the construction cost) by one-half or more. The funds available to design and construct infrastructure projects generated by the passage of Proposition One will begin to increase over the historic annual investment starting around fiscal year 2017. Significant increases are anticipated to be realized in 2019. The planning and engineering necessary to program and deliver more projects allowed by these funding levels was initiated in Fiscal Year 2012 in order to deliver projects in a timely, systematic and transparent manner.

Each year, City Council faces the challenge of selecting the projects that merit the highest priority for allocation of limited citywide funding available in the CIP. A thorough planning and programming process looks at needs over the short term (1-5 years), near term (5-20 years) and long term (20-50 years). The process identifies and selects projects that address the worst problems first in the short term and are subsequently recommended for inclusion in the 5-year CIP. The recommended projects are the result of this multi-step, integrated process and based on a prioritization system that uses objective criteria to identify needs, define projects and ultimately rank projects in each infrastructure category. While balancing the needs of individual districts against citywide needs, Council acts on these recommendations and adopts a 5-year CIP. The five-year window provides for continuity from year to year while still providing the ability to respond to changing conditions, development, regulations and community goals that have been identified beyond those five years. When the Ordinance to implement ReBuild Houston was adopted by City Council on April 6, 2011, an additional "plus 5" horizon was created. This "5+5 Plan" will present both the traditional 5-Year CIP and an additional 5-Year planning level document.

Prioritization of Candidate Projects is based on objective criteria. This criteria is more fully described in Section 3 of this manual. A Candidate Project Priority Score is calculated for each Candidate Project based on the benefits derived, the benefitted users and the estimated cost to implement a Candidate Project. The transparency of planning and programming methods and tools are critical to ensure that the greatest needs are recommended first. This allows Elected Officials and the public to have valuable information on how projects compare to each other. The objective criteria must be transparent, allowing for independent review both by technical experts and the general public.

1.3 Planning for the Capital Improvement Plan

The Planning Phase evaluates infrastructure needs for the near term (5-20 year) and long term (20-50 year) resulting in the identification of candidate projects for the CIP. Planning plays a critical role in the CIP process by referring Candidate Projects for programming in the CIP. Candidate Projects are solutions that are developed to address identified and prioritized needs.

Planning
(Years 6-10 and beyond)

- Identify infrastructure replacement Needs based on condition
- Identify expansion Needs for additional capacity
- Prioritize areas of greatest Need for improvements
- Develop Solutions to address the priority Need Areas
- Refer Candidate Projects for Programming with defined scope of work, estimated cost and time to implement

1.4 Infrastructure Categories

PWE has primary responsibility for planning, programming, delivering, operating and maintaining the infrastructure included in the following categories, as defined by Administrative Procedure 4-5:

- Code M – Storm Drainage
- Code N – Street and Traffic Control (also includes bridges, bicycle and pedestrian facilities)
- PWE also supports planning and programming within the Code T - Tax Increment Reinvestment Zones.

The Storm Drainage category is divided into the following components:

- Area storm drainage, and
- Local drainage projects.

The Street and Traffic category is divided into the following components:

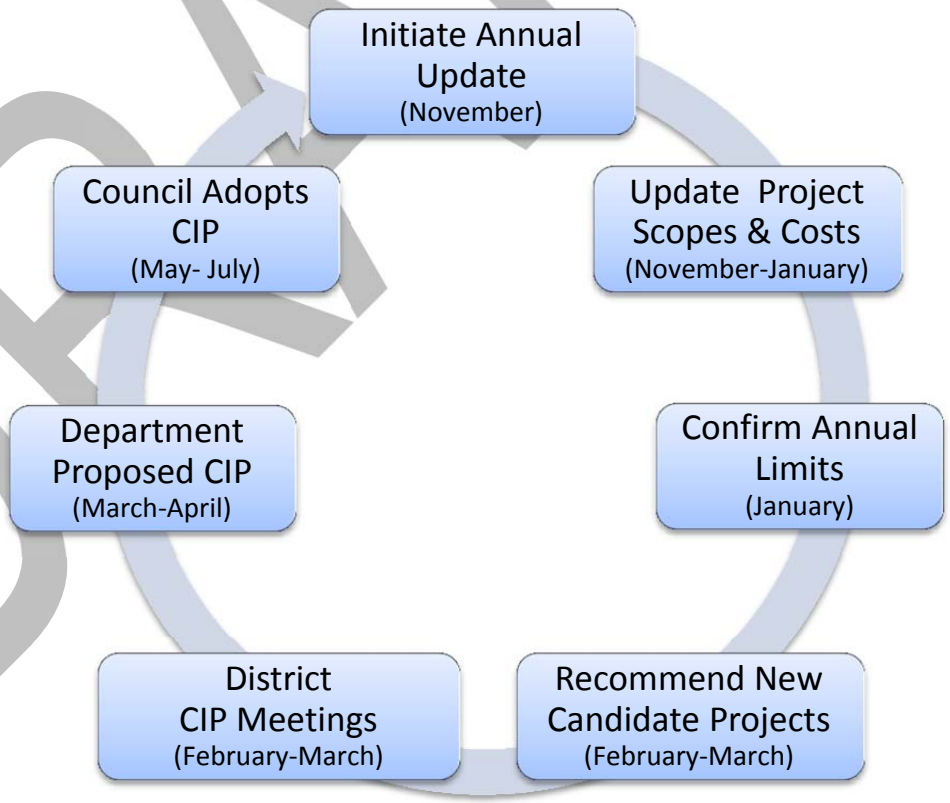
- Major thoroughfare and collector streets,
- Local streets (residential and non-residential),
- Focused projects, including:
  - Intersections
  - Pedestrian/bicycle
  - Access management
  - Neighborhood traffic management
  - Railroad safety and quiet zones.

1.5 Annual CIP Update

It is the goal to adopt the five-year CIP each spring to complement adoption of the City's budget. Administrative Procedure 4-5 establishes a schedule to accommodate annual adoption by the end of April. Other consideration may lead to a later adoption by City Council, but it is the responsibility of the Departments to have the recommended CIP prepared for council action with sufficient time for adoption prior to the end of the current fiscal year.

The recommended CIP starts with the previously adopted CIP as the base. Projects within the adopted 5-year CIP have already been through needs assessment, project development and citywide prioritization. Information gathered since the last adoption is used to refine scopes and cost estimates. Additionally, the total amount of available annual funding is reviewed against the City's debt models and, with the voter passage of Proposition One, the projected revenue from the drainage charge and increased availability of the dedicated ad valorem tax revenue as debt is paid off. Additionally if unanticipated third party funding becomes available, it may become possible to accelerate delivery of projects.

The following illustration represents the major milestones during the annual process to update the CIP. This process is coordinated citywide by the Finance Department.



The annual programming process and the resulting recommended CIP is further detailed in Section 3 of this manual.

SECTION 2 – INFRASTRUCTURE PLANNING

Infrastructure Planning plays a critical role in the CIP process by:

- Identifying areas of need for infrastructure improvements,
- Prioritizing which areas to address first, and
- Developing solutions to resolve the infrastructure deficiencies in the objectively determined areas of greatest need.

The Planning process separates need identification from project identification, focusing first on identifying areas with a need for infrastructure improvements. Areas of need are prioritized based on objective criteria. Areas at the top of the prioritization list become Candidate Needs and are passed into the solution development step. In this step, pre-engineering is performed to identify and develop Candidate Projects for inclusion in future CIPs. Candidate Projects identified and developed during the planning phase are not automatically added to the CIP. During the programming phase (see Section 3), Candidate Projects are evaluated and recommended for inclusion in the CIP based on comparison of costs and benefits to other Candidate Projects in the city to maximize the available annual funding.

The objective of the Planning process is to create Candidate Projects for programming in future CIPs that are based on solutions that address the needs in identified areas. Thorough planning is essential to maximize benefits, streamline project delivery and minimize future conflicts or bottlenecks during the design and construction phases.

Typically, there are more needs to be addressed than there is funding within any given year. Needs that are identified but not prioritized for initiation of pre-engineering are catalogued and reconsidered during future year's need prioritization steps. The Planning process is a closed loop which recycles needs if a solution is not identified until a candidate project(s) is identified and referred to the Programming Phase. The Planning phase is funded in the CIP. However, since the end product of the planning process is a developed project for inclusion in future CIPs, this funding is not allocated to individual projects but rather to each infrastructure category.

2.1 Identify Needs

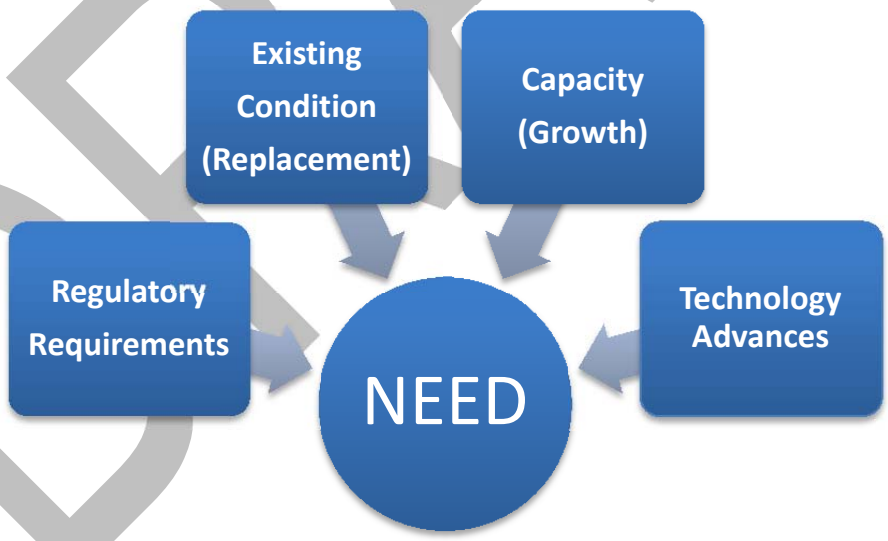
Need identification is the first step of the Planning phase and starts with a comprehensive assessment of existing conditions. A Need is determined every time that the existing infrastructure does not meet the level of service defined in the City of Houston's Infrastructure Design Manual (IDM). Need is a yes/no determination with regards to regulations, condition and capacity. Advances in technology are evaluated as new technologies are established and proven to be implementable or function reliably. Needs are prioritized during the second step of Planning.

A need for an infrastructure improvement is driven by the City of Houston standards for level of service. Each infrastructure category has defined criteria establishing the level of service goal. A need is identified where the current infrastructure does not meet the design level of service. In other words, if existing infrastructure doesn't meet the expected level of service, a need exists. A need for infrastructure improvement is primarily driven by two factors:

Replacement because the condition of the existing infrastructure no longer meets the standard level of service and it is beyond routine maintenance or

Growth in demand that results in conditions like congestion or inadequate capacity where the existing infrastructure no long meets the standard level of service.

Additionally, changing regulatory requirements, typically environmentally related, and technological advances can drive a need for infrastructure improvements.



Infrastructure in all areas of the City is being assessed based on a standard l*evel of service (LOS)*. This ensures that all areas in Houston are treated equitably and are provided with the same service level of infrastructure when new or replacement infrastructure is designed and constructed.

In order to identify a need, the existing infrastructure conditions are compared to this pre-defined level of service. These comparisons are performed through previous and on-going efforts. The

Comprehensive Drainage Plan (CDP) performed a citywide analysis of the capacity of storm drainage systems that are served by underground systems (i.e., pipes). The Street and Drainage Division is currently performing a pilot program to measure roadside ditches that may lead to a more detailed citywide evaluations of open ditch systems. The City has also purchased a van outfitted with specialized cameras and lasers, the Street Surface Assessment Vehicle (SSAV), that measures cracks, surface smoothness and other characteristics that can be used to measure how far a road is from a desired condition. The SSAV assigns a score or Pavement Condition Rating (PCR) that allows a relative comparison between city streets during need prioritization.

The LOS standards presented in this manual will be used each year as Candidate Needs are identified and considered further for development of candidate projects. Comparison of existing infrastructure condition against the standard LOS through time also creates the ability to track and monitor the City's performance in addressing substandard infrastructure, whether its deficiency is due to poor condition, exceeded capacity, changing regulations, advances in technology or other criteria.

A) Storm Drainage Need Identification

Storm drainage systems include infrastructure to handle both the Design (more common) Event and the Extreme Event. These are designed as coordinated systems. The Design Event system being utilized during every rainfall event and the Extreme Event system being used for larger, less frequent rain events. Storm drainage needs are determined for the existing storm drainage systems across the city.

The *Design Event* is the smaller rain event, typically 1 to 2 inches of rain over the course of an hour. The Design Event is the rainfall event that storm sewer (pipes) and roadside ditches are designed to carry. Specific criteria for Design Event Level of Service are:

- Curb and gutter: 2-year hydraulic grade line (HGL) below gutter line
- Roadside ditch: 2-year HGL 6" below edge of pavement
- For Local Streets (Residential): width of one lane passable during the 2-year storm

The *Extreme Event* is the higher volume, but less frequent, event (100-year rainfall event) and is defined as approximately 12 to 13 inches of rainfall over 24 hours. During the Extreme Event the pipes or roadside ditches are overwhelmed and the road or overland system carry the excess water to the bayou. This runoff should be carried within the public right-of-way. Houston's streets constructed since the mid 1980s are designed to convey stormwater when more rain falls than the design system can carry. Streets constructed prior to that time were not specifically designed to address the Extreme Event Level of Service, which are:

- 100-year Water surface elevation (WSE) below the maximum ponding elevation (MPE). MPE is established to prevent structural flooding and is the lowest of:
- Natural ground at the right-of-way line
- Curb and gutter: 6" above top-of-curb at pavement high points
- Curb and gutter: 18" above top-of-curb at pavement low points
- Roadside ditch: below slab or finished floor elevation of any adjacent structure

The existing infrastructure is evaluated against these levels of service to identify need. The design event drainage system has not been analyzed citywide. The CDP analyzed most of the city currently served by pipes. Areas that had interconnected pipe systems, or that were served by roadside ditches, were not analyzed for capacity. For these areas, other observations such as documented structural flooding and streets that must pond to more than two feet of depth (currently based on LiDAR information) before flowing toward the bayou are used to determine adequacy that is used to indicate a need.

The process that is used to determine the Storm Drainage Design Event System Adequacy and Extreme Event System Adequacy is shown in Process 2.1. Each year as part of the CIP update, this process will be used to determine if new needs are identified and to reflect needs that have been addressed over the previous year.

B) Street and Traffic Control Need Identification

Street and Traffic Control Systems include pavement infrastructure that handles the needs of vehicles, mass transit, pedestrians and the commuting bicyclist. It also includes the traffic signals and signage used to control and direct traffic flow. Street and Traffic Control Needs are determined by infrastructure component based on Level of Service.

The two primary needs for Street and Traffic Control projects are Condition and Capacity. The Condition of a street is based on the physical condition of the roadway – travel surface cracking, potholes, spalling, base failure and other pavement deficiencies. Safety is not a measured factor for this prioritization since existing infrastructure identified as having a safety issue is immediately mitigated through the maintenance and repair programs. The Capacity of a street is a measure of the streets ability to carry the number of vehicles that desire to travel that roadway. Streets that are over-capacity experience congestion. Capacity is determined using a relationship between the actual traffic and the existing number of lanes. Technology advances and increasing traffic volumes drive needs to upgrade the City's traffic signals.

Needs are determined in the following categories:

Major Thoroughfares and Collectors are defined in the City's Major Thoroughfare and Freeway Plan (MTFP) and are evaluated for both Condition and Capacity. Major thoroughfares and collectors support and promote general mobility throughout the City. These projects are commonly the city's major roads and connect employment and commercial centers. Thoroughfares include the functional classifications of Principal Thoroughfare, Thoroughfare and Collector. These streets are identified in the City's Major Thoroughfare and Freeway Plan (MTFP), adopted originally in 1942 and updated annually to reflect current needs and development. The MTFP is a graphic illustration of a network of various types of streets and highways which are designated to provide maximum accessibility to all parts of the urban area and facilitate a high level of mobility for our citizens.

Specific criteria for the Level of Service of existing roadways are:

- Condition – Pavement Condition Rating (PCR) is measured by the City's SSAV and composited between major thoroughfare intersections. A PCR that is in the lowest 30% citywide is currently a need.

- Capacity – Traffic Level of Service is calculated based on existing number of lanes and field traffic counts. A Traffic Level of Service below a "C" ("D" during peak hours) determines a need.
- Traffic Level of Service (TLOS) is a measure of the ability of a roadway to handle traffic or the effectiveness of a roadway in maintaining an acceptable standard of traffic flow. Roadways are assigned a "grade" of A through F based on measured or projected traffic volumes as follows:

  A Primarily free-flow operations at average travel speeds
  B Reasonably unimpeded operation at average travel speed
  C Stable operations with some impact to maneuver or lane change options
  D Beginning to approach unstable flow with a more profound impact to lane changes and general maneuverability
  E Significant approach delays and average travel speeds 1/3 of free-flow
  F Intersection congestion and average travel speeds less than 1/3 of free-flow

Local Streets include both residential and non-residential streets. Local streets do not carry large volumes of traffic, serve of general purpose of providing access to adjacent properties and the needs are evaluated based on Condition. A composited PCR in the lowest 30% citywide is considered a need.

Intersection improvements include upgrading equipment and associated hardware and software to support traffic signal timing and coordination. In some cases reconfiguration of turning lanes or lane configuration can improve area-wide flow. Need for improvements to signalized intersections is driven by two factors, replacement of prior technologies or non-functioning equipment and intersection performance. Intersections with equipment that are not capable of being coordinated area-wide are considered a need. In the future these intersections will also be evaluated for capacity. Need for new signalized intersections will be analyzed separately by the Manual on Unified Traffic Control Devices (MUTCD) signal warrant process.

Focused Projects include sidewalks, neighborhood traffic management, railroad quiet zones and commuter bicyclist infrastructure. These needs are currently request based. Bicyclist need is primarily determined by gaps in the current bikeway network. These gaps are being identified through the current master plan update and are based on PWE's physical inventory along with input from CIP Town Hall meetings and the City's Bikeways website.

2.2 Prioritize Needs

The current or existing condition of the City's infrastructure does not meet the standard LOS in many areas. It was estimated in the Comprehensive Drainage Plan back in the late 1990s that it would take more than $1.2 billion to bring the City's storm drainage infrastructure up to a standard LOS. If there were sufficient funding, all existing infrastructure that does not meet standards would be reconstructed or replaced immediately. Currently it is estimated that more than one billion dollars of improvements would be necessary to bring existing infrastructure up to standards. Because of limited funding, it is important to identify the areas of highest need to develop solutions for those areas first.

Historically, need was identified using a largely reactive, subjective process, based on input from field maintenance personnel, requests received at annual CIP Town Hall meetings and requests referred from District Council members. Continued advances in technology resulting in citywide

condition assessment data has made it possible to perform needs identification proactively across large areas as opposed to responding to individual requests addressed individually in a reactive manner.

In order to determine the worst, a score or rating that measures the existing condition is determined for each piece of infrastructure within each infrastructure component. The lower the score is, the higher the need. These scores can be compared to other areas of need. The need prioritization process is based on these objective criteria.

The City has developed and is now using a tool that is based on a Geographic Information System (GIS) to evaluate and compare information citywide. This tool was originally developed for prioritization of storm drainage needs and named the Storm Water Enhanced Evaluation Tool or SWEET. The SWEET is being further refined and developed by PWE to become the need identification tool for all infrastructure categories. The comparison to a standard LOS is achieved through customized criteria for each infrastructure component. These criteria have been determined and are included in the sections below. The SWEET, using the determined criteria for each infrastructure component, develops a ranked list of the areas of greatest need for each infrastructure component across the city. The infrastructure components which use the SWEET need identification tool to identify and prioritize need for infrastructure improvements include:

Need Prioritization (SWEET)

- Major Thoroughfares and Collectors
- Local Streets (Residential and Non-Residential)
- Intersection Upgrades and Replacement
- Storm Drainage Design and Extreme Event Systems

Some types of projects, which are more tailored to specific citizen requests or operational issues, will be handled through a traditional or more responsive and immediate request system. These types of projects will typically be evaluated on a first in – first out basis, when merited, and as funding allows. These processes may also include consideration of city-wide master plans to determine areas of need and prioritization of need. The infrastructure components which use request based processes to identify and prioritize need for infrastructure improvements include:

Request Based Needs

- Railroad Safety and Quiet Zones
- Neighborhood Traffic Management
- Access Management
- Sidewalks (key segments, where missing)

Need prioritization is performed for each infrastructure category. A need area is defined by a prioritized need in any one infrastructure category. It is not necessary for there to be need in multiple infrastructure categories for the need to be moved forward to the development of a solution. However during the development of a solution(s), all infrastructure within the need area will be evaluated.

Each year, the need prioritization step will result in a map of need areas. This map will show need prioritization and highlight areas that will be moved forward to develop solutions based on available

funding. Areas of need which are not selected for initiation of pre-engineering, will be reconsidered during future years' need prioritization step. Areas of need identified through citizen or Council Member input may be added by the Director. This process ensures that all requests are considered fairly and are not removed from the Planning process if they are not able to be addressed in the current year's CIP Programming. Following is the process for prioritizing needs within each infrastructure component.

A) Storm Drainage Need Prioritization

Storm Drainage Need is prioritized by a combination of factors that indicate an inability of infrastructure to address storm drainage needs – primarily resulting in structural flooding. Need Prioritization based on the adequacy of the storm drainage system is performed using SWEET as detailed in Process 2.2. SWEET allows the weighting of specific parameters to prioritize need areas citywide. These parameters are combined within a uniform grid system to allow comparison citywide. The grid system utilized is the Lambert map system or grid that is also used by the Harris County Appraisal District and is reflected in the MTFP. As discussed under Storm Drainage Need Identification (Chapter 2.1(A)), there is not currently a citywide analysis of the design event and extreme event drainage systems. Since there is not a single analysis to compare citywide, the SWEET utilizes several citywide databases to allow for comparison.

These databases include existing storm drainage analyses, other city databases that represent the capacity of the existing storm infrastructure, surface flow data derived from LiDAR, existence of structural flooding and drainage impacts to mobility. These include documented flooding (structural and non-structural), flood insurance claims and repetitive losses, flooding that makes streets impassable and underpasses with documented flooding. Table 2.1 shows the parameters and associated weights that are included in the SWEET.

The SWEET evaluates parameters related to need for drainage improvements and creates a need score for each Lambert grid. Each of these areas is ranked citywide based on the following criteria.

- Capacity of the Existing Infrastructure
  - Design Event System Adequacy
  - Extreme Event System Adequacy
  - Reported "Non-Structural" Flooding
- Existence of Structural Flooding
  - Documented "Structural" Flooding
  - Number of FEMA insurance claims
- Drainage Impacts to Mobility
  - Documented "Street Impassable" Flooding

Weighting factors shown in Table 2.1 for each parameter will be reviewed each year based on input from stakeholders and evolution of drainage priorities and revised if appropriate. The SWEET calculates a score for storm drainage needs and then allows for ranking need areas across the City. Higher scores indicate increased need.

B) Street and Traffic Control Need Prioritization

Need Prioritization for Street and Traffic Control infrastructure is performed using the following parameters as shown in the Process 2.3.

Needs are prioritized by the SWEET within the following categories as follows:

Major Thoroughfares and Collectors are defined in the City's Major Thoroughfare and Freeway Plan (MTFP) and are evaluated for a combination of Condition and Capacity. Weighting criteria for need prioritization are shown in Table 2.2. Major thoroughfares are evaluated on a linear basis between major thoroughfare intersections, as opposed to the grid system used for storm drainage and local streets. Specific criteria for the Level of Service are:

- Condition – the composite Pavement Condition Rating (PCR) between major thoroughfare intersections is determined based on the output of the Street Surface Assessment Vehicle (SSAV). As a separate screening, localized needs may be identified for limited reconstruction. This may occur when a pavement score for a short segment of roadway is significantly lower than the composite PCR between major thoroughfare intersections. These localized needs will be compiled for field investigation and possible repair.
- Capacity – the Traffic Level of Service is computed between major thoroughfare intersections using a regional travel-demand computer model (CUBE). This model is used across the various jurisdictions in the region by the Harris-Galveston Area Council. This model uses current field traffic counts and the existing lane configuration to determine a level of service score.
- Un-Built Segments – priority for un-built segments will be determined by utilizing the future conditions travel demand model to represent the major thoroughfare grid built out and prioritizing the un-built segments that would carry the highest traffic volume in the future with other un-built segments citywide.

Local Streets are evaluated by pavement condition assessed within a specific neighborhood area based on a modification of the subdivision layer that uses freeways, major thoroughfares and bayous as additional divisions.. The PCRs are determined as shown in Table 2.3 and aggregated to the neighborhood to allow for comparison citywide.

Intersection needs are prioritized based on current traffic counts and the type of existing equipment. Table 2.4 shows the weighting criteria for prioritization of intersection needs.

Each year, prioritized need areas will be presented to City Council and are planned to be presented at the CIP Town Hall meetings. Based on the available funding by infrastructure component, these need areas will be referred to pre-engineering for project development in the following fiscal year.

2.3 Develop Solutions

Once the areas of highest need have been prioritized, solutions to address those needs can be developed into a specific project(s). Pre-engineering is the tool for defining the problem, finding the source of the problem (even if outside the identified Nee Area) and evaluating possible solutions. Extent of surface drainage impacting the Need Area will be a high priority to determine. The steps are shown in Process 2.4. A recommended solution can always be traced back to the original need

or problem. However, a developed project will consider all infrastructure types within the area to see if there is overlap or chances for synergy between the different infrastructure components. During this step, areas of greatest need in each component are selected for initiation of pre-engineering. Pre-engineering defines a general project scope, the cost to implement the project, and the benefits of the project (number of vehicles, residences, etc.). Cost estimates at this level are based on planning level estimates such as cost per lane mile or cost per acre. These estimates provide an uncertainty of up to 50%. Scope and cost estimate will be further refined during the design process.

The number of need areas for pre-engineering assigned to each infrastructure component will be based on the available funding in the CIP allocation. Budgets for annual pre-engineering are determined based on the planned CIP expenditures for a later construction year in the CIP cycle. The goal is to plan and develop projects representing approximately 125% to 150% of the construction funding required for year six and seven of the upcoming CIP cycle. By initiating this surplus of pre-engineering, an inventory of Candidate Projects will be in place so that an increase in programmed projects can be accommodated as funding levels increase and so that programming for delivery remains competitive for developed projects. This also allows for future infusions of unanticipated funding from the Federal government, TxDOT and others.

Pre-engineering is designed to help improve project definition, promote coordination, maximize efficiency and minimize future conflicts. This process develops, evaluates and compares specific solutions, for each priority Need Area. Thorough pre-engineering will streamline the project delivery (design and construction) process.

During pre-engineering, priority areas of need for street and drainage improvements will be compared to priority areas of need for water and wastewater upgrades. In addition, coordination with entities such as Harris County, County Flood Control and Drainage Districts, Texas Department of Transportation (TxDOT), and METRO will be required to coordinate regional planning efforts and to incorporate priority and/or scheduling considerations for infrastructure improvements which meet the needs of or support critical regional transportation or flood control efforts. For example, structural flooding may be the result of inadequate bayou or stream capacity and require the involvement of Harris County Flood Control District to resolve the identified need.

Additionally, mitigation needs are determined for each solution as required to address potential for impacts, particularly to storm drainage. As individual drainage projects are implemented across the city, improved conveyance may lead to increased discharges to receiving streams or bayous. To maintain the existing level of protection as defined by the designated special flood hazard area as shown in the effective Flood Insurance Rate Maps (FIRMs) and supporting models and studies, it may be necessary to mitigate impacts to receiving streams or bayous. While this may be accomplished on a project by project basis, this can also be accomplished through the construction of regional or sub-regional mitigation.

Storm Drainage solutions are first developed without being constrained by the receiving channel. A cost estimate is determined for this base scenario. Next the potential for impact to this receiving channel (increasing the Base Flood Elevation as designated on the FIRMs) is calculated. If no

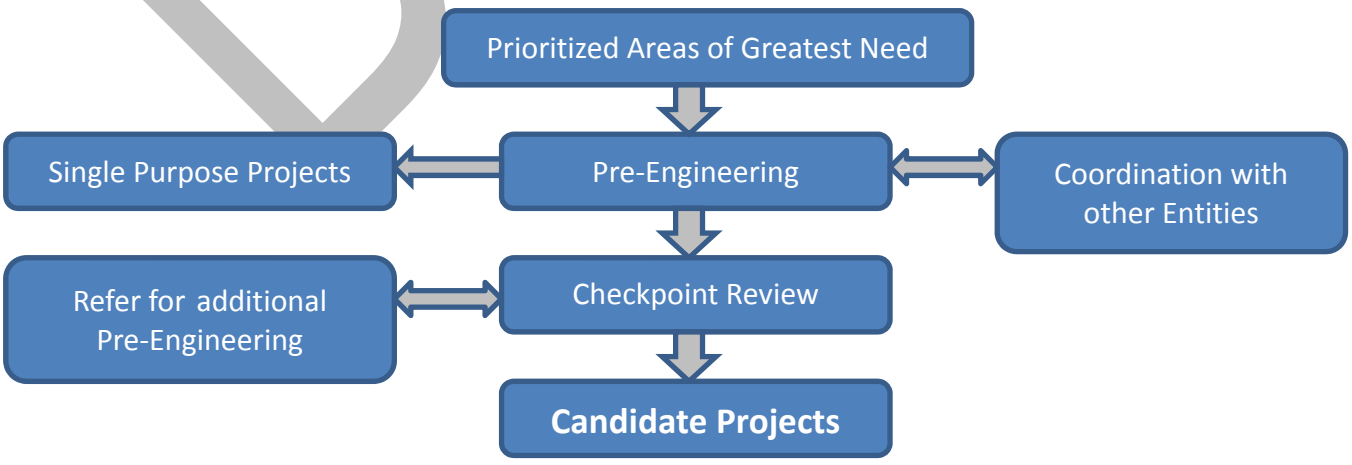
potential impact is determined, no mitigation is required. If there is potential for an impact, the additional cost for this mitigation will be determined based on the following options:

- Mitigation within the right-of-way – mitigation will be accomplished within the street right-of-way through upsizing or oversizing storm sewer pipes, open ditches (either roadside or the median) or public easements, or other techniques to provide both design and extreme event level of service contained within the ROW,
- Mitigation within the Project Service Area outside the right-of-way - maintaining the design event system size, directing the extreme event flow to a detention facility within the project service area (note: this option may require purchase of land and estimated costs for this purchase will be included in the project cost estimate), or
- Mitigation on a regional or sub-regional basis - maintaining the design event system size, directing the extreme event flow to the receiving channel and utilizing all or a portion of land that is under City of Houston PWE control near the project service area.

If undeveloped land that is not in public ownership is identified near, but not within, the project service area, this land may be investigated for a sub-regional detention site to be used with other public needs in the area. These planning efforts help to identify potential sites for regional or sub-regional detention basins. Need identification and prioritization for sub-regional detention will be driven by the prioritized need areas that are located closely enough to efficiently use joint detention, and is generally performed in coordination with other infrastructure improvement projects.

The pre-engineering process results in the creation of Candidate Projects which will be considered for inclusion in the CIP during the Programming phase. When a Candidate Project(s) is identified, it is referred for Programming. During the Programming phase, Candidate Projects are ranked and prioritized based on the Candidate Project Priority Score developed as part of the pre-engineering as described in Section 3 of this document. During pre-engineering, it may be determined that the solution to a Need is most efficiently addressed through a a single purpose project such as a local drainage or access management project. This step ensures the Need will be addressed in the most cost and schedule efficient manner to address the infrastructure needs of an area. It should be noted that some pre-engineering may determine that there is not a feasible solution for the identified need and this need will be recycled for future consideration as conditions change or technologies develop that may allow the need to be addressed.

The solution development step is summarized in the chart below:



Throughout pre-engineering, coordination is expected between all geographically related infrastructure components. In addition, coordination with outside agencies is required to ensure the project is adequately addressing all known concerns. For example, a storm drainage conveyance project needs to work with:

- Street and Traffic to ensure capacity upgrades are properly addressed
- Water to ensure water system upgrades are properly addressed
- Wastewater to ensure wastewater system upgrades are properly addressed
- City Floodplain Management Office and County Flood Control and Drainage Districts to ensure impact to receiving streams is mitigated or accommodated by related projects.

Coordination is essential to ensuring limited funding is spent most cost-effectively and projects are developed that comprehensively address the varied needs of our City. Significant emphasis in both the need identification and project development phases is placed on developing multi-purpose projects which address multiple infrastructure needs in one project. This coordination process also helps to identify obstacles to the successful completion of the proposed project.

A Checkpoint Review, conducted by the Pre-Engineering Review Committee (PRC), is the final review meeting for pre-engineering. Should issues be identified during the Checkpoint Review which have not been adequately addressed, projects can be sent back for additional development. Particular emphasis is placed on issues which could delay the construction of the candidate project, such as unidentified or poorly defined impact mitigation needs or right-of-way availability issues. At the conclusion of the Checkpoint Review, pre-engineering is approved and the assessment's recommended solution(s) is officially designated as a Candidate Project or sequence of Candidate Projects. Only approved Candidate Projects will be considered for programming to the CIP.

Thorough pre-engineering, regardless of infrastructure component, will include the following information:

- Problem Source – the underlying cause of infrastructure inadequacy (ie – condition of pavement or capacity of storm sewer system)
- Project Definition – includes limits, requirements, and description of construction to be performed
- Project Purpose and Justification – includes documentation of needs and assessment of existing conditions
- Project Obstacles – includes permitting, ROW, mitigation needs and related projects that must be completed prior to or subsequent to this project
- Estimates – includes cost, benefit and schedule/duration estimates as well as identification of potential outside funding
- Other Jurisdictions or Funding Partners – includes other entities, public or private that may provide funding for implementation of the Candidate Project
- Impacts during construction – includes secondary impacts outside the project limits that may be encountered during construction such as traffic, temporary drainage, etc.

Project benefits determined should include:

- Improved drainage system compared to level of service standards,
- Improved mobility (level of service, safety, etc.),
- Improved pavement condition,
- Improved water distribution system, and
- Improved wastewater collection system.

Estimated project costs and duration should be defined for:

- Design
- Construction
- Land acquisition
- Permitting
- Private or Other Public Utility relocation costs if paid by the City (required to be performed by others prior to construction)
- Impact mitigation
- Operating and maintenance costs

Complexity and level of effort required for the pre-engineering is dependent on the type of project. Multipurpose and inter-agency projects require more in-depth and multidisciplinary feasibility assessments while single purpose projects can be moved forward with streamlined pre-engineering.

Pre-engineering will require a proactive and integrated approach to drainage. Dynamic hydrologic and hydraulic modeling may be required for projects involving modifications to the major drainage system. Emphasis will be placed on understanding both local and regional drainage issues and developing solutions that improve conveyance of storm water in both frequent and more extreme storm events. Particular attention will be paid to impact mitigation. Whether through the use of regional or sub-regional detention, project specific mitigation, green infrastructure, or low impact development techniques, all projects must address potential impacts to upstream or downstream neighborhoods and waterways. All street and drainage projects will be held to the same storm water level of service standards, ensuring that every project contributes to the reduction of flood risk across the City whether identified as a storm drainage project or not.

2.4 Refer Candidate Projects

Once a year during the CIP update process, the Candidate Projects identified and developed over the previous year will be formally transferred to Programming to compete for funding in future CIPs. A referred Candidate Project will include:

- Identified need being addressed and other needs identified during the feasibility assessment
- Scope of design and construction to be performed
- Definition of any needed Right-of-Way or other acquisition
- List of private utilities potentially affected
- List of other agencies possibly affected or with overlapping jurisdiction
- Estimated costs of acquisition, design and construction
- Schedule to perform design and construction
- Permits, interlocals or other agreements necessary to implement the project
- Construction impacts to be mitigated

- Benefits of the projects

These costs and benefits will be used during programming to prioritize projects citywide. Once programmed to the CIP and funded for the current year, projects will enter a streamlined design phase which streamlines finalization of the Preliminary Engineering Report and final design. In the design phase, the pre-engineering, which contains the majority of components required for a Preliminary Engineering Report, will be updated to meet the requirements for a Preliminary Engineering Report then presented to the Technical Review Committee during the design phase for approval to move into final design.

Once referred to Programming, the Need Area(s) address will be designated as “addressed by a Candidate Project” for future Planning efforts and vacated within further cycles of Needs Identification and Prioritization.

SECTION 3 – CAPITAL IMPROVEMENT PROGRAMMING

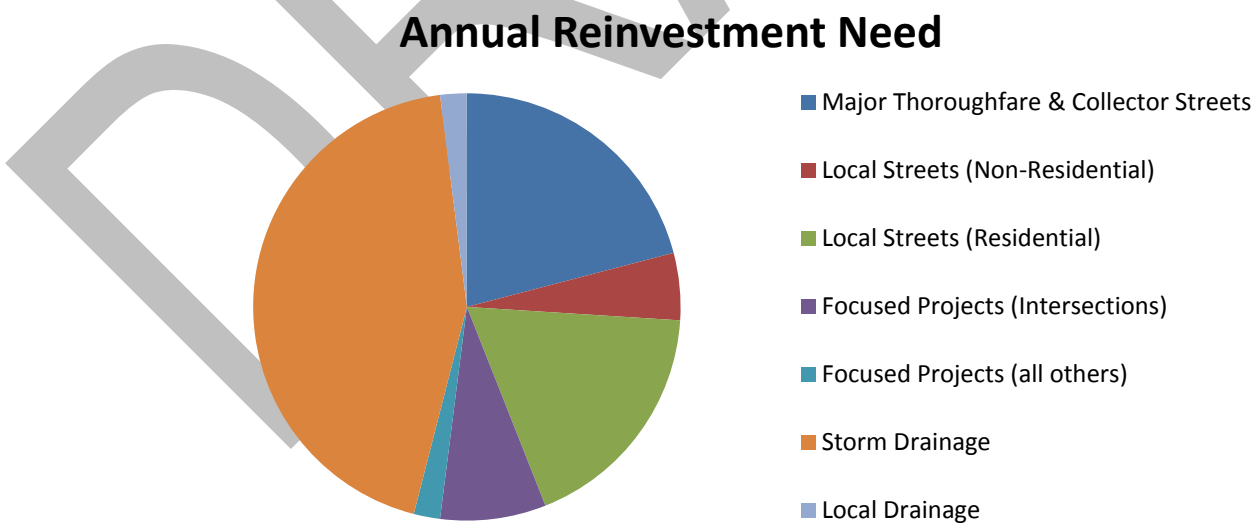
Programming is the exercise of scheduling projects within the available funds to produce the five-year CIP. The first step in programming is to determine the allocation of available funds between the various categories and types of projects. Next, candidate projects are weighed against each other using objective criteria.

3.1 Recommended Program Allocation

The amount of funding per fiscal year allocated to each category within the CIP greatly influences how quickly each infrastructure asset is addressed. The program allocation process aims to divide available funding among the various categories to meet the long term reinvestment needs. In the street and storm drainage categories, approximately $650 million would be needed to replace infrastructure based on the existing infrastructure and the service life of each of the infrastructure components shown in this table:

Category	Estimated Annual Reinvestment Need (2012 Dollars)	
Major Thoroughfares & Collector Streets*	$136 m	21%
Local Streets (Non-Residential)	$33 m	5%
Local Streets (Residential)	$117 m	18%
Focused Projects (Intersections)	$52 m	8%
Focused Projects	$13 m	2%
Storm Drainage	$286 m	44%
Local Drainage Projects	$13 m	2%
TOTAL	**$650 m**	**100%**

*Historically, construction of drainage infrastructure for streets is at least 20% of the project Costs.



In Fiscal Year 2013, annual funding for street and drainage improvements was approximately $230 million. However, with the voter approved Proposition One being implemented as Phase II of ReBuild Houston, annual funding levels could meet the $650 million annual level by 2035. PWE will

recommend program levels in future years that adjust toward the annual reinvestment needs by category by allocating increments of the additional investment capacity with the funding growth.

3.2 Annual CIP Update

It is the goal to adopt the 5-year CIP each spring to complement adoption of the City's budget. Administrative Procedure 4-5 establishes a schedule to accommodate annual adoption by the end of April. Other considerations may lead to a later adoption by City Council, but it is the responsibility of the Departments to have the recommended CIP prepared for Council Action with sufficient time for adoption prior to the end of the current Fiscal Year.

The recommended CIP starts with the previously adopted CIP as the base. Projects within the adopted 5-year CIP have already been through needs assessment, project development and citywide prioritization. The total amount of available annual funding is updated and information gathered since the last adoption is used to refine scopes and cost estimates of projects. Additionally, programming may be adjusted if unanticipated third party funding becomes available that impact the benefit cost evaluation.

Following are the major steps and the approximate time frames that PWE performs each year to recommend a 5-year CIP:

- Initiate Annual Update – each winter the Finance Department initiates the annual review and update of the CIP
- Update Scopes and Costs – project managers review both on-going design and construction projects and provide updates to reflect:
  - Supplements for additional design or construction management costs
  - Revised construction costs based on most current estimate
  - Update acquisition costs based on actual appraisals or current estimates
  - Update schedules based on current status and known obstacles to implementation
- Confirm Annual Limits – Annual limits based on debt capacity or revenue from charges and projected property taxes
- Add Prioritized, Candidate Projects to Proposed Program – when the adjustments to cost and timing have been made based on project manager input, additional capacity should exist in the new fifth year and possibly some capacity in what becomes years 1 through 4.
- District CIP Meetings – each spring, District Council Members host town hall meetings to gain citizen input. At these meetings, current status of projects in the CIP and the needs that have been identified for evaluation in feasibility in the upcoming planning year is presented.
- Department Proposed CIP – based on updating the projects in the adopted CIP and adding new projects from planning, a proposed CIP is compiled for presentation to City Council.
- Council Adopts CIP – City Council considers the department recommended CIP and adopts as is or with revisions for the new Fiscal Year.

3.3 Project Prioritization for Programming

In order to prioritize projects citywide, prioritization criteria is defined for each type of project. Prioritization of projects includes both primary criteria similar to factors considered during needs identification and also additional secondary factors. The criteria considered for each type of project

is detailed in the sections below. The prioritization criteria have been developed to prioritize projects which:

- Address critical needs
- Result in the greatest benefit compared to their ReBuild Houston cost
- Offer benefits to the most residents/businesses compared to their ReBuild Houston cost
- Address multiple types of need in one project
- Leverage funds to expand the reach of the Program
- Address areas of community or environmental concern.

A priority score will be developed for all approved Candidate Projects when using the SWEET Programming Tool. Candidate projects are ranked by the SWEET Programming Tool according to infrastructure component. Candidate projects will be compared only against projects of the same infrastructure component, but include a weighting for benefits to other infrastructure components to allow for a more comprehensive and effective method of project delivery. All approved Candidate Projects will be included in this process.

$$\textbf{Candidate Project Priority Score} = \textbf{Service Area Benefit Factor} \times \frac{\textbf{Benefitted Population}}{\textbf{City ReBuild Houston Funds}}$$

Candidate Project Priority Score is a calculated score that is associated with the specific service area of the candidate project. This score will be used to compare Candidate Projects within the same infrastructure component to prioritize for funding and recommended inclusion in the CIP.

Benefitted Population is a count of the users that are determined to directly benefit from the candidate projects. The users are specific to the primary need being addressed by the candidate project (i.e., number of vehicles along a major thoroughfare).

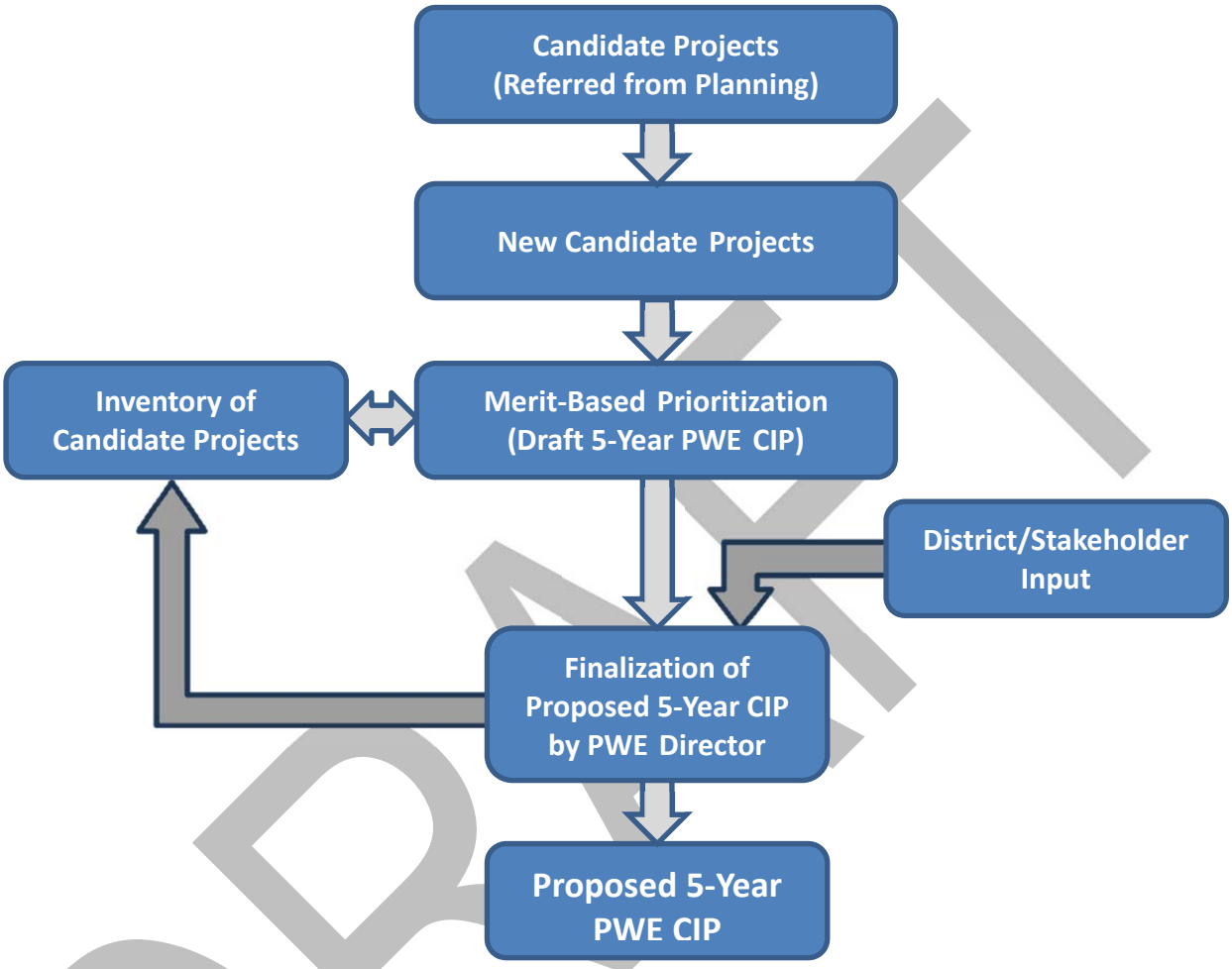
Service Area Benefit Factor is a score of 0 to 100 that is a measure of the benefits to all PWE infrastructure components within the candidate project service area. The majority of the benefit score will be derived from the primary need being addressed. The benefit score is allocated within the various infrastructure components based on the primary need being addressed.

City ReBuild Houston Funds (in 1,000s of dollars) are only those funds that are routine revenue to the ReBuild Houston program. Additional funds that are received through a grant or leveraged through partnerships are not included in this figure.

Based on the desired allocation of funding for each component, candidate projects will be added to the 'Draft 5-year PWE CIP' according to their prioritization ranking, until the allocated budget for each infrastructure component has been fully assigned.

The 'Draft 5-year PWE CIP' is presented to the PWE Director, who may adjust the initial prioritization with advice of the Oversight Committee and through consultation with Council Members and other key stakeholders. This process is limited but does accommodate critical economic development activities, emergency projects, logistical concerns or other pressing public concerns. The Director finalizes the 'Proposed 5-year PWE CIP' after the District Town Hall meetings, which is then presented by the Director of Finance to the Mayor and City Council for adoption along with the other programs of the CIP. Projects which are not programmed to the 5-year CIP remain in the inventory

of 'Candidate Projects' and will be reconsidered during the following year's CIP Programming phase. Once submitted to Programming, the inventory of Candidate Projects will be maintained by the Programming Section with further input from Planning and others and will be updated as needed to account for inflation, cost variations and changes to circumstances.



Projects that have multiple Sub-Projects will be managed as a grouping such that all Sub-Projects have the same score as the overall project. Sub-Projects may be programmed into different years depending on available funding.

For each infrastructure component described in the section below, the ReBuild Houston Oversight Committee will have the opportunity to provide input on the weighting factors in prioritizing candidate projects for inclusion in the ten-year (5+5) plan.

3.4 Storm Drainage Prioritization Criteria

Need is assessed for each infrastructure component as the first step in identifying areas in need of infrastructure improvement. Need is determined based on the defined or acceptable level of service established for each component. Areas which do not meet the defined level of service standards

have a need for infrastructure improvement. The following sections describe criteria used to assess need for each component.

A) Area Drainage

The City has developed and is now utilizing a Geographic Information System (GIS) based tool to identify and prioritize problem areas citywide in need of drainage improvement. The tool, called Storm Water Enhanced Evaluation Tool or SWEET, uses objective criteria to develop a ranked list of the highest priority needs areas across the city, and is also used to prioritize candidate storm drainage projects. The projects selected for program funding have the highest need for drainage improvements. Each project will be designed to contain the standard design rainfall runoff in the underground storm pipe or roadside ditch. Each project has the objective of reducing the potential for structural flooding by containing the rainfall runoff from the extreme event in the public right-of-way to protect adjacent properties. Properties adjacent to HCFCD channels or located in a special flood hazard area are susceptible to riverine flooding. Riverine flooding is most commonly attributable to channels with a low level of service which reach capacity and flood waters spill over the top of bank. The Storm Drainage Program may not protect properties from the adverse impacts of overbank flooding until the HCFCD completes complimentary channel capacity improvement projects.

Sub-regional detention projects are identified in response to solution development of prioritized storm drainage needs or in coordination with other agencies and infrastructure improvement projects. The SWEET Programming Tool is not currently used to prioritize and rank regional detention projects.

The following criteria will be used to prioritize and rank storm drainage projects as shown in Table 3.1:

Component	Weighting Factor
Drainage System	75%
Streets (pavement condition)	15%
Water	5%
Wastewater	5%

B) Local Drainage Projects (LDP)

Local drainage projects are addressed on a first in – first out basis, as merited, through the nomination and screening process. Drainage system deficiencies, noted through routine operations and maintenance actions, are nominated for local versus area/system improvements by the Assistant Director of the Storm Drainage Maintenance Branch .The SWEET Programming Tool is not used to prioritize and rank local drainage projects. The number of projects completed each year is dependent on the allocated CIP budget for local drainage projects. Local drainage projects will be delivered, within available funding, as solutions are developed for individual needs through a detailed, methodical process as described in Section 2. Construction will remain driven by the first in – first out basis.

3.5 Street and Traffic Control Prioritization Criteria

A) Major Thoroughfares and Collectors

PWE is responsible for recommending the streets with highest need for replacement/reconstruction (primarily due to condition) and expansion (primarily due to traffic congestion). Consideration will also be given for drainage, water and wastewater needs. Candidate Projects will be evaluated using the following criteria as shown on Tables 3.2 and 3.3. This analysis will also be used to prioritize un-built segments.

Component	Weighting Factor
Streets (condition and capacity)	75%
Drainage System	15%
Water	5%
Wastewater	5%

B) Local Streets

Local Streets (Non-Residential) serve multi-family facilities, small commercial centers and in some cases light industry. These projects historically have received limited funding compared to major thoroughfares, collectors and neighborhood/area streets.

- There are approximately 2,100 lane miles of local non-residential streets
- Local streets (non-residential) can be expected to have a service life of 50 years
- Approximately 42 lane-miles should be replaced annually as a reasonable replacement rate. This would represent an annual investment of $33 million.

Local Streets (Residential), also known as neighborhood streets, serve single family residential neighborhoods. These are low volume, low speed streets.

- There are approximately 8,000 lane miles of Neighborhood Streets
- Neighborhood Streets can be expected to have a service life of 60 years
- Approximately 135 miles should be replaced annually as a reasonable replacement rate. This would represent an annual investment of $117 million and could be addressed through local residential street or neighborhood/area storm drainage projects.

Candidate Projects will be evaluated within the SWEET tool using the following criteria as shown on Tables 3.4 and 3.5.

Component	Weighting Factor
Streets (pavement condition)	60%
Drainage System	20%
Water	10%
Wastewater	10%

C) Focused Street and Traffic Projects

Intersections

Intersection improvements typically include upgrading equipment and supporting infrastructure to support traffic signal timing and coordination. In some cases reconfiguration of turning lanes or lane configuration can improve area-wide traffic flow.

- There are approximately 2,500 signalized intersections in the city's transportation system
- Signalized Intersections have a designed service life of 20 to 25 years
- Approximately 100 signal installations should be replaced annually as a reasonable replacement rate
- Approximately 25 intersections are replaced in conjunction with street reconstruction projects. This would represent an annual investment of $52 million.

Intersection replacement projects are prioritized based on the SWEET Need Score established in the need prioritization phase. The SWEET Need Score is based on type of in-place signal control equipment, current and future levels of service of each intersection. Projects with the highest SWEET Need Score will be implemented first. The number of projects completed each year is dependent on the allocated CIP budget for intersection improvement projects.

Access Management

Access management projects improve operations and safety of major thoroughfares and collectors by reducing conflict points. Typical projects include consolidation of median openings and driveways. Need for access management projects is driven by operational considerations, neighborhood/business requests or other forms of citizen input.

Access management projects are addressed on a first in – first out basis, as merited, through the neighborhood request process. The SWEET Programming Tool is not used to prioritize and rank local access management projects. The number of projects completed each year is dependent on the allocated CIP budget for access management projects.

Neighborhood Traffic Management

Neighborhood traffic management projects address cut-through traffic and vehicle speeds on local streets. These traffic calming measures are designed to improve neighborhood quality of life while enhancing the safety of pedestrians and bicyclists on residential streets. Typical projects include addition of speed humps, street closures, or other more substantial street modifications. Need for neighborhood traffic management projects is driven by neighborhood request or citizen input.

Neighborhood traffic management projects are addressed on a first in – first out basis, as merited, through the neighborhood request process. The SWEET Programming Tool is not used to prioritize and rank neighborhood traffic management projects. The number of projects completed each year is dependent on the allocated CIP budget for neighborhood traffic management projects.

Railroad Safety and Quiet Zones

Railroad safety and quiet zone projects involve the upgrade of rail crossings to improve safety and to minimize noise associated with train horns. Need for railroad safety and quiet zone projects is driven by neighborhood request or citizen input.

Railroad safety and quiet zone projects are addressed on a first in – first out basis, as merited, through the neighborhood request process. The SWEET Programming Tool is not used to prioritize and rank railroad safety and quiet zone projects. The number of projects completed each year is dependent on the allocated CIP budget for railroad safety and quiet zone projects.

Sidewalks

Sidewalks serve pedestrian needs including access to schools and mass transit. Sidewalks are typically constructed in conjunction with street reconstruction or, in separate limited projects, as part of the safe sidewalks program. Significant effort is also taken to address pedestrian accessibility issues for people with disabilities. Sidewalks are also planned around future METRO light rail stations.

- There are approximately 1,200 miles of sidewalks currently in the city
- Sidewalks have a design life of 50 years
- Approximately 50 miles should be replaced annually for best management practices
- This would represent an annual investment of $13 million

Need is determined by neighborhood request, accessibility issues, gaps serving schools and mass transit and locations along major thoroughfares. Need identification and prioritization will be driven by neighborhood request and existing master plans for pedestrian facilities.

Independent sidewalk projects are addressed via prioritizations determined through neighborhood/citizen request or master plans for pedestrian facilities. The SWEET Programming Tool is not used to prioritize and rank sidewalk projects. The number of projects completed each year is dependent on the allocated CIP budget for sidewalk.

Bikeways

Bikeways, including on-street and off-street facilities, serve bicyclist needs. There are four types of facilities within the City of Houston that comprise the bikeway network, three are on-street, such as bike lanes, signed bike routes, signed shared roadways, while one is predominately off-street: shared-use paths. These bikeways are identified in the City's Bikeways Master Plan, adopted originally in 1993, which is being updated to reflect current needs and development. The Master Plan also introduces a process to prioritize various bikeway projects, with emphasis upon the function, feasibility, funding and maintenance of a proposed bikeway.

PWE is responsible for determining the prioritization of on-street bikeway projects that address transportation needs. Generally, on-street bikeway projects will be part of a larger roadway project. However, stand-alone candidate projects may be developed and will be

prioritized and ranked based on the following criteria. The number of stand-alone projects completed each year is dependent on the allocated CIP budget for bikeways.

Parameter	Score
Function	**20**
Eliminates Gap in Network	*10*
Connection to Major Employment Center/Neighborhood	*10*
Feasibility	**20**
Existing ROW	*10*
Overcomes Barriers to Mobility	*10*
Funding	**30**
100% Federal, State or Local Funding	*30*
80% Federal, State or Local Funding	*20*
50% Federal, State or Local Funding	*10*
Maintenance and Local Partnerships, Support	**30**
Existing Agreement with PRD or other local sponsor	*15*
Local Partner providing maintenance and/or funding	*10*
Local Support for Project	*5*

Function:

Eliminating a gap in the network (10% of ranking) is a score based on the ability of the project to complete a missing portion of bikeway in the Master Plan that currently inhibits bicyclist transportation.

Connecting to a major employment center or neighborhood (10% of ranking) is a score based on the ability of the project to address a transportation need for bicyclists that is non-recreational in purpose and will yield significant increases in bicycle traffic to and from specific locations within the City.

Feasibility:

Existing ROW (10% of ranking) is a score based on the availability or need to acquire property to build the proposed project. The acquisition of property for bikeway projects has been difficult on certain past projects, priority should be given to projects that do not require significant legal action for acquisition.

Overcoming barriers to mobility (10% of ranking) is a score based on the ability of the project to address a transportation link that has been infeasible due to a highway, bayou or lack of bridge crossing that would be provided through the construction of the proposed bikeway.

Funding:
Federal, State or Local Funding (up to 30% of ranking) is a score based on the availability of federal, state, or local funding for the construction of the proposed project, with lower scores given to a candidate project when funding sources require increased percentages of a locally-funded match. No points would be allocated to projects that require greater than a 50% match to construct the project.

Maintenance and Partnerships, Support:
Existing agreement with Parks and Recreation Department (PRD) or local sponsor (15% of ranking) is a score based on the presence of a maintenance agreement for the proposed project. PWE maintains all on-street bikeways and has an existing agreement with PRD to maintain specific off-street bikeways. PRD is not currently assuming maintenance responsibilities on new bikeway projects. Potential local sponsors of maintenance activities could include management districts, TIRZ, neighborhood groups as well as non-profit organizations.

Local Partner providing funding match (10% of ranking) is a score based on the ability of a local partner to provide financial contributions towards the construction of the proposed project. Projects that rank high in other categories should receive higher prioritization when local sponsors contribute funding to reduce City expenditures to construct the proposed bikeway. Donated right-of-way may be counted toward a funding match.

Local Support for Project (5% of ranking) is a score based on the level of support for a particular project, with additional emphasis on local entities and property owners affected by, or adjacent to, the proposed bikeway. This is becoming increasingly important to the implementation of bikeways. Past project development experience has revealed that the lack of specific local support has negatively impacted the property acquisition and design stages.

3.6 Recommended 5 Capital Improvement Plan

Each year PWE will prepare a recommended plan for approval and adoption by City Council.

LIST OF TABLES

Table 2.1
Storm Drainage Need Prioritization Weighting Factors

Parameter	Percent
Capacity of Existing Storm Drainage System	**38%**
Design Event System Adequacy	40%
Extreme Event System Adequacy	20%
Reported “Non-Structural” Flooding	40%
Existence of Structural Flooding	**38%**
Reported “Structural” Flooding	65%
Flood Insurance Claims	35%
Drainage Impacts to Mobility	**24%**
Reported “Street Impassable” Flooding	100%

Table 2.2
Major Thoroughfare and Collector Need Prioritization Weighting Factors

Parameter	Percent
Pavement Condition	**80%**
Pavement Condition Rating	90%
Supplemental Information	10%
Street Capacity	**20%**
Level of Service	80%
Adequacy to MTFP	20%

Table 2.3
Un-Built Major Thoroughfare and Collector
Need Prioritization Weighting Factors

Parameter	Percent
Future Street Capacity	**100%**
Future volume from Travel Demand Model	100%

Table 2.4
Local Street Need Prioritization Weighting Factors

Parameter	Percent
Pavement Condition	**100%**
Pavement Condition Rating	80%
Supplemental Information	20%

Table 2.5
Intersection Need Prioritization Weighting Factors

Parameter	Percent
Equipment	**60%**
Electromechanical	60
NEMA or similar	30
Other	0
Level of Service	**40%**
A or B	0
C	10
D	20
E	30
F	40

Table 3.1
Area Drainage Candidate Project Priority Score Determination

$$\textbf{Candidate Project Priority Score} = \textbf{Service Area Benefit Factor} \times \frac{\textbf{Benefitted Population}}{\textbf{City ReBuild Houston Funds}}$$

Service Area Benefit Factor					
Infrastructure Category	**Weight**	**Criteria**	**Benefit**	**Point Range**	**Measurement or Calculation**
Drainage System	75%	Extreme Event Level of Service	Drainage System conveys within public right-of-way		No Improvement or conveys less than 10-year event = 0 Improved - conveys 10-year event = 25 Improved - conveys extreme event = 50
		Design Event Level of Service	Drainage System conveys Design Event	0-25	No Improvement or does not convey design event = 0 Improved - partially conveys design event = 10 Improved - conveys design event = 25
Streets	15%	Pavement Condition	Improved Pavement Condition (driving surface)	0-15	0.15 X (100 - comp. PCR)
Water	5%	WIRP Rank (Water main Investment Replacement)	Reduction in occurrence of breaks, color, odor, low pressure, etc.	0-5	Replaced since 2000 = 0 (Total WIPR Areas - WIRP Rank)/ Total WIRP Areas
Wastewater	5%	Sanitary Sewer Overflows or Agreed Order	Reduction in occurrence of stoppages and overflows	0-2	No Sanitary Sewer Overflows = 0 Sanitary Sewer Overflows = 1 Repeat Sanitary Sewer Overflows = 2
		Maintenance History (5-Years)	Reduction in occurrence of breaks, stoppages and overflows	0-2	Less than 5 Point Repairs = 0 5 to 10 Point Repairs = 1 More than 10 point repairs= 2
		Age of Pipe	Reduction in number of collapses/failures due to condition of older pipe	0-1	30 years or less = 0 More than 30 years = 1 Agreed Order = 1
Benefitted Population					
Number of benefitted properties as defined by Ordinance 2011-254 (Note: contiguous properties under a single use and owner with a consolidated drainage account will be considered one property)					
City Rebuild Houston Funds					
Total Candidate Project Costs including Land Acquisition, Design and Construction that are funded by: Ad valorem, drainage charge, 3rd Party (Metro) or Impact Fee contributions *Does not include funding contributed from the Combined Utility System (water and wastewater, grants such as Community Development Block Grants, project specific Federal funding such as TxDOT, etc*					

Table 3.2
Major Thoroughfare and Collectors (Change in Classification) Candidate Project Priority Score Determination
(Includes Un-Built segments in the Major Thoroughfare and Collector system)

$$\textbf{Candidate Project Priority Score} = \textbf{Service Area Benefit Factor} \times \frac{\textbf{Benefitted Population}}{\textbf{City ReBuild Houston Funds}}$$

Service Area Benefit Factor					
Infrastructure Category	**Weight**	**Criteria**	**Benefit**	**Point Range**	**Measurement or Calculation**
Streets	75%	Traffic Level of Service	Reduced Delay (congestion and wait time)	0-55	Ratio of reduced delay compared to maximum reduced delay
		Pavement Condition	Improved Pavement Condition (driving surface)	0-15	0.15 X (100 - comp. PCR)
		Presence of Fatal Crashes	Safety	0-5	None = 0 1 or More = 5
Drainage System	15%	Extreme Event Level of Service	Drainage System conveys within public right-of-way	0-5	No Improvement or does not convey extreme event = 0 Improved - partially conveys extreme event = 3 Improved - conveys extreme event = 5
		Design Event Level of Service	Drainage System conveys Design Event	0-10	No Improvement or does not convey design event = 0 Improved - partially conveys design event = 5 Improved - conveys design event = 10
Water	5%	WIRP Rank (Water main Investment Replacement)	Reduction in occurrence of breaks, color, odor, low pressure, etc.	0-5	Replaced since 2000 = 0 (Total WIPR Areas - WIRP Rank)/ Total WIRP Areas
Wastewater	5%	Sanitary Sewer Overflows or Agreed Order	Reduction in occurrence of stoppages and overflows	0-2	No Sanitary Sewer Overflows = 0 Sanitary Sewer Overflows = 1 Repeat Sanitary Sewer Overflows = 2
		Maintenance History (5-Years)	Reduction in occurrence of breaks, stoppages and overflows	0-2	Less than 5 Point Repairs = 0 5 to 10 Point Repairs = 1 More than 10 point repairs= 2
		Age of Pipe	Reduction in number of collapses/failures due to condition of older pipe	0-1	30 years or less = 0 More than 30 years = 1 Agreed Order = 1
Benefitted Population					
35% of Current Average Daily Traffic + 65% of Future Average Daily Traffic + Current Metro Ridership numbers					
City Rebuild Houston Funds					
Total Candidate Project Costs including Land Acquisition, Design and Construction that are funded by: Ad valorem, drainage charge, 3rd Party (Metro) or Impact Fee contributions *Does not include funding contributed from the Combined Utility System (water and wastewater, grants such as Community Development Block Grants, project specific Federal funding such as TxDOT, etc*					

Table 3.3
Major Thoroughfare and Collectors (No Change in Classification) Candidate Project Priority Score Determination

$$\textbf{Candidate Project Priority Score} = \textbf{Service Area Benefit Factor} \times \frac{\textbf{Benefitted Population}}{\textbf{City ReBuild Houston Funds}}$$

Service Area Benefit Factor					
Infrastructure Category	**Weight**	**Criteria**	**Benefit**	**Point Range**	**Measurement or Calculation**
Streets	75%	Pavement Condition	Improved Pavement Condition (driving surface)	0-60	0.6 X (100 - comp. PCR)
		Traffic Level of Service	Reduced wait time at intersections	0-15	Ratio of reduced delay compared to maximum reduced delay citywide
Drainage System	15%	Extreme Event Level of Service	Drainage System conveys within public right-of-way	0-5	No Improvements or does not convey extreme event = 0 Improved - partially conveys extreme event = 3 Improved - conveys extreme event = 5
		Design Event Level of Service	Drainage System conveys Design Event	0-10	No Improvement or does not convey design event = 0 Improved - partially conveys design event = 5 Improved - conveys design event = 10
Water	5%	WIRP Rank (Water main Investment Replacement)	Reduction in occurrence of breaks, color, odor, low pressure, etc.	0-5	Replaced since 2000 = 0 (Total WIPR Areas - WIRP Rank)/ Total WIRP Areas
Wastewater	5%	Sanitary Sewer Overflows or Agreed Order	Reduction in occurrence of stoppages and overflows	0-2	No Sanitary Sewer Overflows = 0 Sanitary Sewer Overflows = 1 Repeat Sanitary Sewer Overflows = 2
		Maintenance History (5-Years)	Reduction in occurrence of breaks, stoppages and overflows	0-2	Less than 5 Point Repairs = 0 5 to 10 Point Repairs = 1 More than 10 point repairs= 2
		Age of Pipe	Reduction in number of collapses/failures due to condition of older pipe	0-1	30 years or less = 0 More than 30 years = 1 Agreed Order = 1
Benefitted Population					
35% of Current Average Daily Traffic + 65% of Future Average Daily Traffic + Current Metro Ridership numbers					
City Rebuild Houston Funds					
Total Candidate Project Costs including Land Acquisition, Design and Construction that are funded by: Ad valorem, drainage charge, 3rd Party (Metro) or Impact Fee contributions *Does not include funding contributed from the Combined Utility System (water and wastewater, grants such as Community Development Block Grants, project specific Federal funding such as TxDOT, etc*					

Table 3.4
Local Streets (Non-Residential) Candidate Project Priority Score Determination

$$\textbf{Candidate Project Priority Score} = \textbf{Service Area Benefit Factor} \times \frac{\textbf{Benefitted Population}}{\textbf{City ReBuild Houston Funds}}$$

Service Area Benefit Factor					
Infrastructure Category	**Weight**	**Criteria**	**Benefit**	**Point Range**	**Measurement or Calculation**
Streets	60%	Pavement Condition	Improved Pavement Condition (driving surface)	0-50	0.5 X (100 - comp. PCR)
		Pavement Width	Street accommodates designated uses	0-10	Width < 28' = 0 Width 28' to 40' = 5 Width >40' = 10
Drainage System	20%	Extreme Event Level of Service	Drainage System conveys within public right-of-way	0-12	No improvement or Does not convey extreme event = 0 Improved – partially convey the extreme event = 6 Improved – conveys extreme event = 12
		Design Event Level of Service	Drainage System conveys Design Event	0-8	No improvement or does not convey design event = 0 Improved – partially conveys the design event = 4 Improved – conveys design event = 8
Water	10%	WIRP Rank (Water main Investment Replacement)	Reduction in occurrence of breaks, color, odor, low pressure, etc.	0-10	Replaced since 2000 = 0 (Total WIPR Areas - WIRP Rank)/ Total WIRP Areas
Wastewater	10%	Sanitary Sewer Overflows or Agreed Order	Reduction in occurrence of stoppages and overflows	0-3	No Sanitary Sewer Overflows = 0 Sanitary Sewer Overflows = 1 Repeat Sanitary Sewer Overflows = 2
		Maintenance History (5-Years	Reduction in occurrence of breaks, stoppages and overflows	0-4	Less than 5 Point Repairs = 0 5 to 10 Point Repairs = 1 More than 10 point repairs= 2
		Age of Pipe	Reduction in number of collapses/failures due to condition of older pipe	0-3	30 years or less = 0 More than 30 years = 2 Agreed Order = 3
Benefitted Population					
Average Daily Traffic Volume as field measured during pre-engineering					
City Rebuild Houston Funds					
Total Candidate Project Costs including Land Acquisition, Design and Construction that are funded by: Ad valorem, drainage charge, 3rd Party (Metro) or Impact Fee contributions *Does not include funding contributed from the Combined Utility System (water and wastewater, grants such as Community Development Block Grants, project specific Federal funding such as TxDOT, etc*					

Table 3.5
Local Streets (Residential) Candidate Project Priority Score Determination

$$\textbf{Candidate Project Priority Score} = \textbf{Service Area Benefit Factor} \times \frac{\textbf{Benefitted Population}}{\textbf{City ReBuild Houston Funds}}$$

Service Area Benefit Factor					
Infrastructure Category	**Weight**	**Criteria**	**Benefit**	**Point Range**	**Measurement or Calculation**
Streets	60%	Pavement Condition	Improved Pavement Condition (driving surface)	0-50	0.5 X (100 - comp. PCR)
		Pavement Width	Street accommodates typical residential uses	0-5	Proposed 1-way w/o parking = 0 Proposed 2-way w/o parking = 2 Proposed 1-way w/ parking = 3 Proposed 2-way w/Parking = 5
		Age of NSR Petition	Fulfillment of Prior Program Commitment	0-5	No Petition = 0, 1-5 years = 1 6-10 years = 3, 10 or more years = 5
Drainage System	20%	Design Event Level of Service	Conveyance of Design Event below road surface	0-8	No improvement or does not convey design event = 0 Improved – partially conveys the design event = 4 Improved – conveys design event = 8
		Extreme Event Level of Service	Conveyance of Extreme Event within public right-of-way	0-12	No improvement or Does not convey extreme event = 0 Improved – partially convey the extreme event = 6 Improved – conveys extreme event = 12
Water	10%	WIRP Rank (Water main Investment Replacement)	Reduction in occurrence of breaks, color, odor, low pressure, etc.	0-10	Replaced since 2000 = 0 (Total WIPR Areas - WIRP Rank)/ Total WIRP Areas
Wastewater	10%	Sanitary Sewer Overflows or Agreed Order	Reduction in occurrence of stoppages and overflows	0-3	No Sanitary Sewer Overflows = 0 Sanitary Sewer Overflows = 1 Repeat Sanitary Sewer Overflows = 2
		Maintenance History (5-Years)	Reduction in occurrence of breaks, stoppages and overflows	0-4	Less than 5 Point Repairs = 0 5 to 10 Point Repairs = 1 More than 10 point repairs= 2
		Age of Pipe	Reduction in number of collapses/failures due to condition of older pipe	0-3	30 years or less = 0 More than 30 years = 2 Agreed Order = 3
Benefitted Population					
Number of Parcels with frontage on local streets proposed to be replaced					
City Rebuild Houston Funds					
Total Candidate Project Costs including Land Acquisition, Design and Construction that are funded by: Ad valorem, drainage charge, 3rd Party (Metro) or Impact Fee contributions *Does not include funding contributed from the Combined Utility System (water and wastewater, grants such as Community Development Block Grants, project specific Federal funding such as TxDOT, etc*					

PROCESS INVENTORY

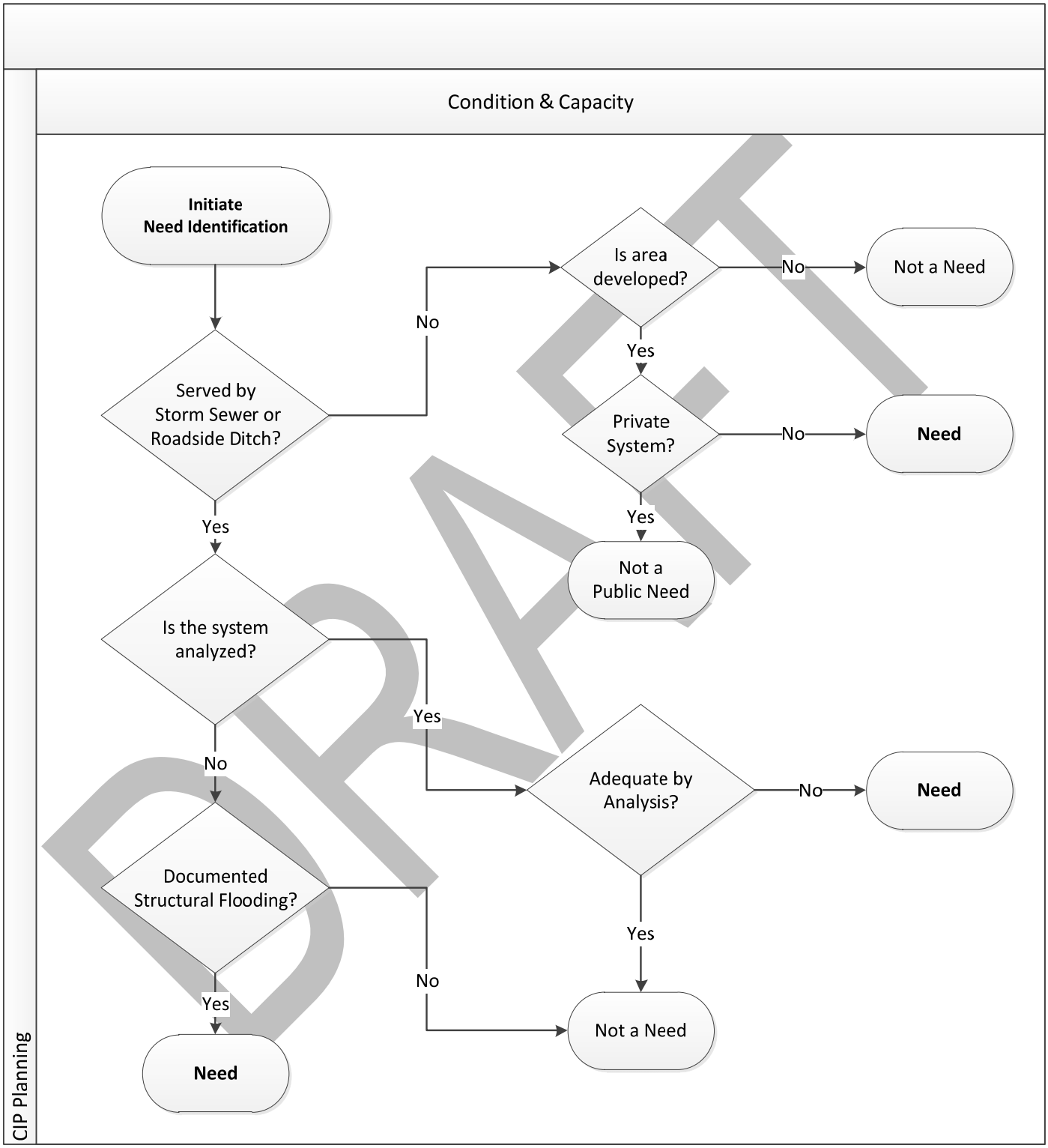
2.1 Need Identification for Storm Drainage Systems

2.2 Storm Drainage Need Prioritization

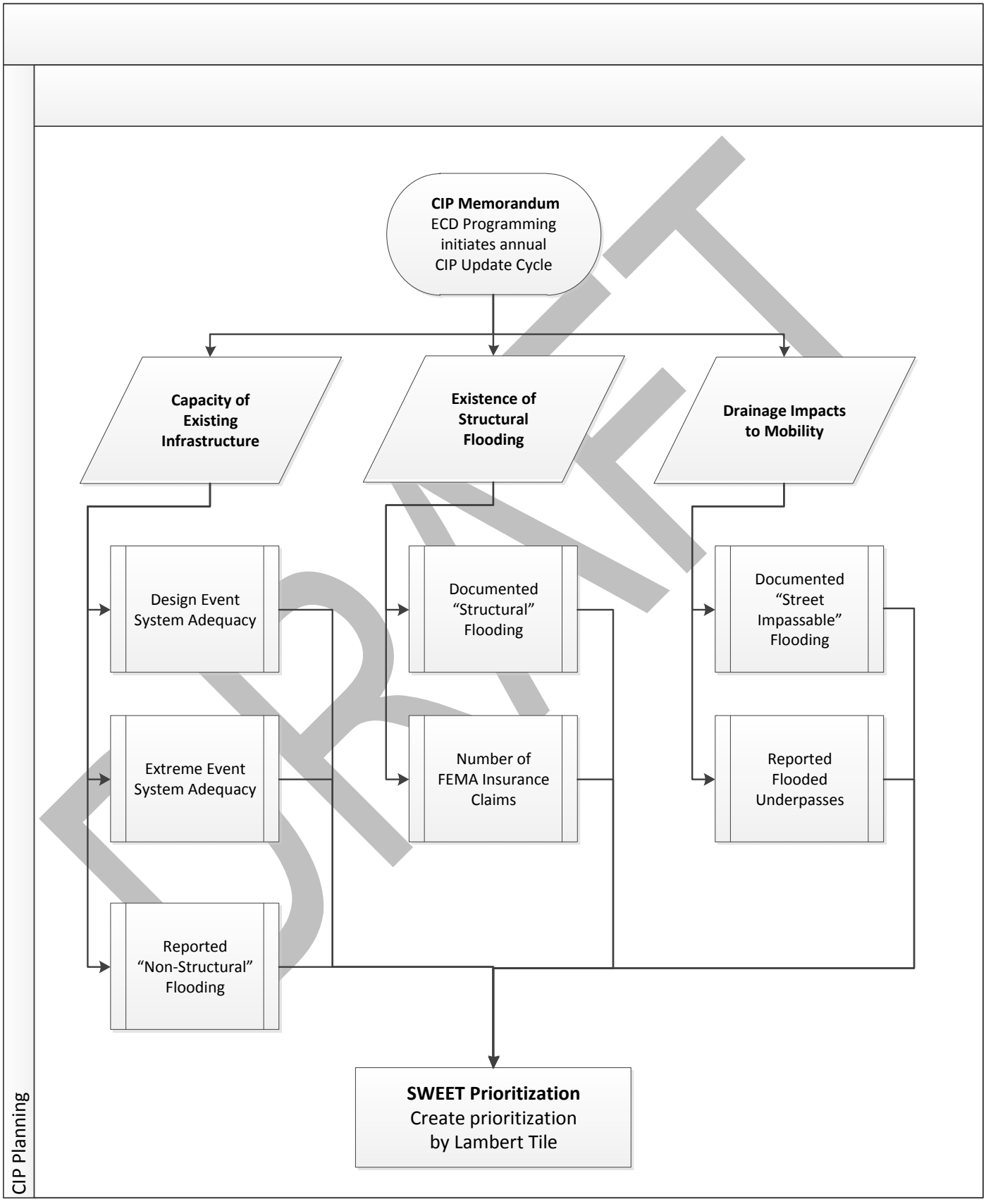
2.3 Major Thoroughfare and Collector Need Prioritization

2.4 Solution Development by Need Area

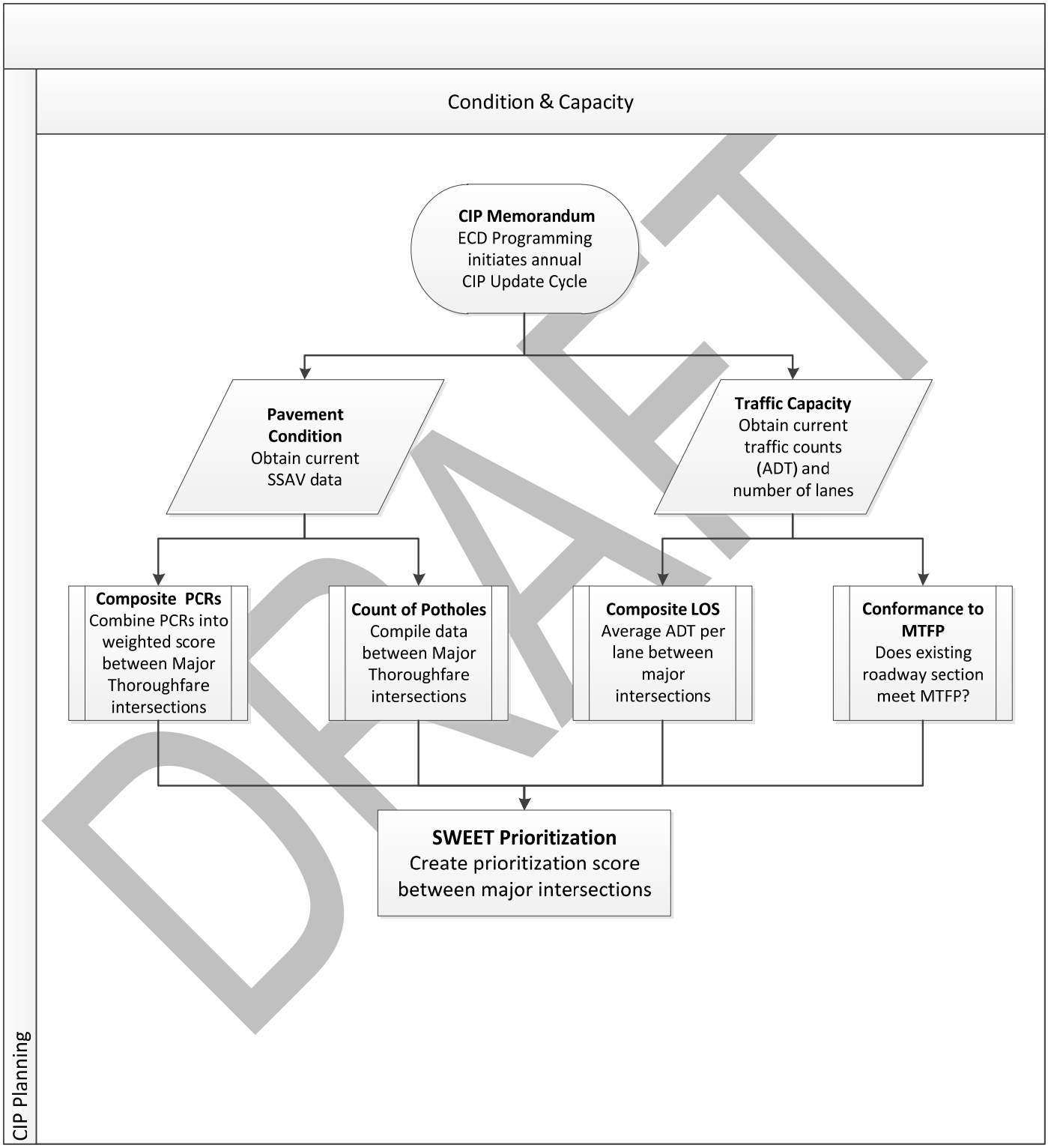
Process 2.1
Need Identification for Storm Drainage Systems



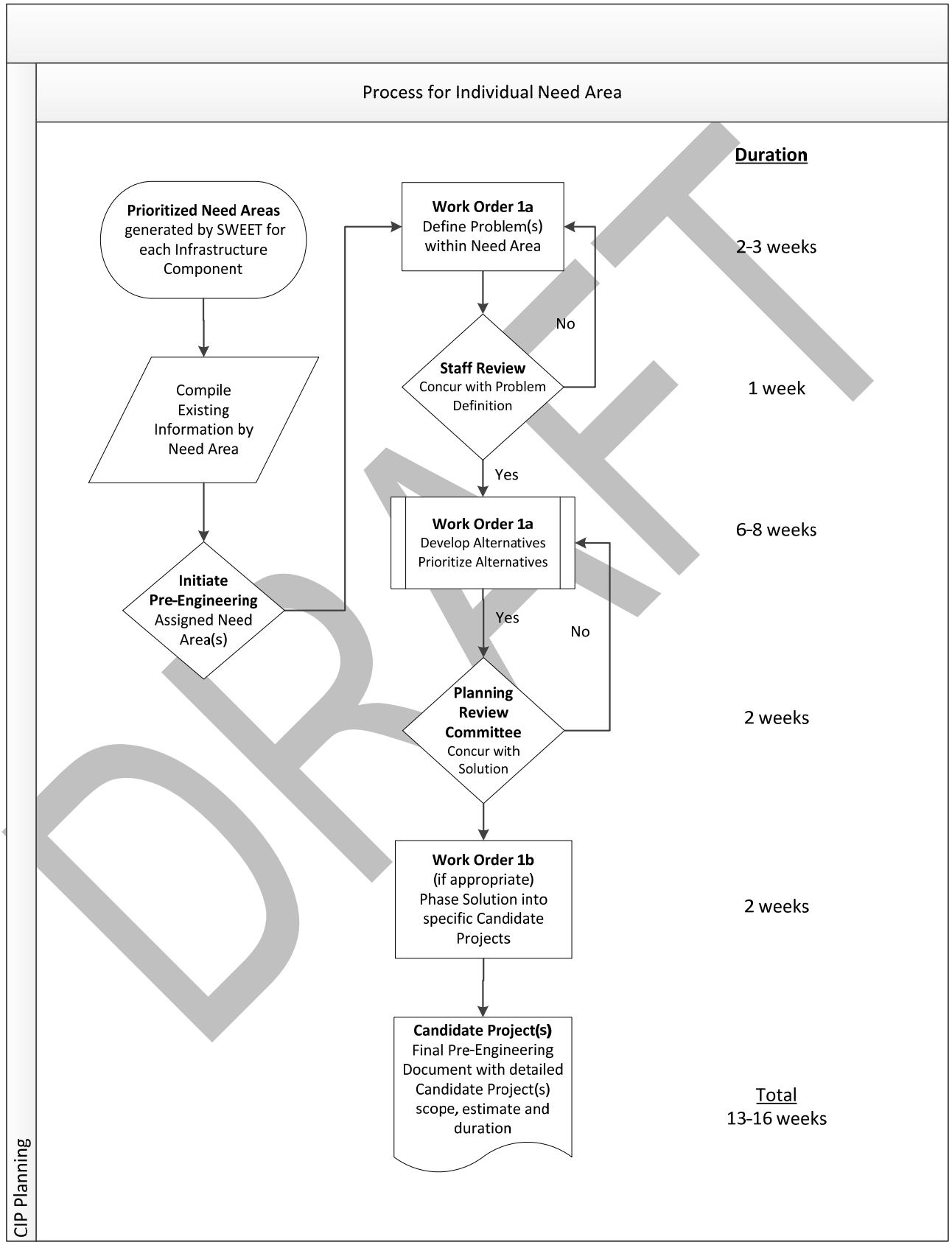
Process 2.2
Storm Drainage Need Prioritization



Process 2.3
Major Thoroughfare and Collector Need Prioritization



Process 2.4
Solution Development by Need Area



GLOSSARY OF TERMS AND ACRONYMS

Capital Improvement Plan: The capital improvement plan is a plan setting forth proposed capital projects and related expenditures to be incurred in the succeeding fiscal year, and each fiscal year following, over a rolling period of five (5) years, describing each project, its source of funding and the amounts allocated to the various stages, phases or aspects of the project.

Level of Service: Measure used to assess the effectiveness of infrastructure. Related to the accepted or desired performance goal for a particular infrastructure component.

Need: A need is identified for areas where existing infrastructure does not meet the desired or acceptable level of service.

Candidate Project: Proposed infrastructure project which has been approved by the Pre-Engineering Review Committee during the Checkpoint Review. Only approved Candidate Projects can be programmed to the CIP.

ADV – Average Daily Volume
CIP – Capital Improvement Plan
CDP – Comprehensive Drainage Plan
FEMA – Federal Emergency Management Agency
FY – Fiscal Year
GIS – Geographic Information Systems
HCFCD – Harris County Flood Control District
HGL – Hydraulic Grade Line
MPE – Maximum Ponding Elevation
MTFP – Major Thoroughfare and Freeway Plan
MUTCD – Manual on Uniform Traffic Control Devices
NRBS – Number of Residences and Businesses Served
NRS – Number of Residence Served
PRC – Planning Review Committee
PRD – Parks and Recreation Department
PWE – Public Works and Engineering
ROW – Right-of-way
SWEET – Storm Water Enhanced Evaluation Tool
TxDOT – Texas Department of Transportation
WIRP – Water Infrastructure Replacement Prioritization
WSE – Water Surface Elevation