Master Drainage Plan

--Review of Project Prioritization Procedure
--Discussion of Project Prioritization Criteria
--Preliminary Prioritization Results

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City of BROOKINGS South Dakota

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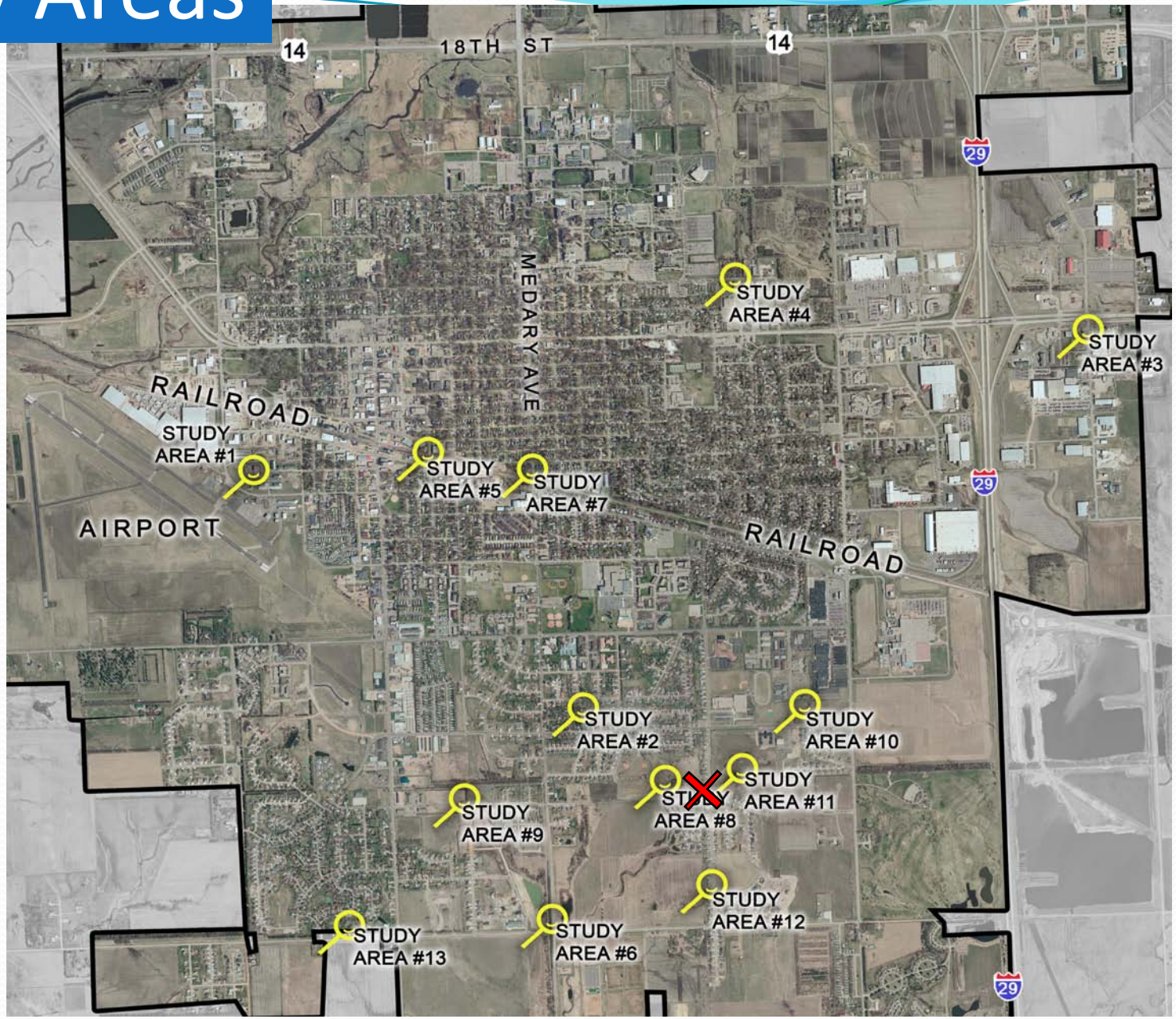
Prioritization Process Development

- Define the problem areas, determine potential solutions, estimate the costs (Master Drainage Plan)
- Categorize the criteria to be used when assessing the pros and cons of each project (last meeting and this meeting)
- Determine a 'weight' that each category will carry.
- Score each project on a scale of 0 to 5 in each of the categories.
- Multiply the individual scores by the weight of each category.
- Total the scores for each project.
- Rank the projects by the total score.

12 Study Areas



Eight ranking criteria categories were presented at the last meeting. After public discussion, one new category was added and one category was split into two.

10 Project Ranking Categories…

- Potential Environmental Impact
- Number of Buildings Affected
- Occupant Evacuation
- Property Damage (new)
- Traffic Impacts
- Location in Basin
- Cost versus Budget
- Reduced Maintenance Issues
- Infrastructure Age/Condition
- Citizen Safety

Basis of the Criteria Weighting System…

- Method of "ranking the ranking categories"
  - Does the category pose an immediate threat to life and safety?
  - To what extent is the threat?
  - How immediate is the threat?

Criteria Scoring System…

- Assign scores of 0 to 5 in each category for each project's goal.
- A score of zero (0) typically means the project's goal has no impact on that category.
  - Also assigned when the project does not provide a benefit in that particular category
- A score of five (5) means the project's goal is most consistent with the category definition or key points of the category

Terminology established…

- **Weight:**
  - A factor assigned to a CATEGORY.
  - 0.1 to 1.0 or greater.
  - Related to life & safety.
  - Independent of the project.
  - Each category's weight is the same for ALL projects.
- **Score:**
  - A number assigned to a PROJECT.
  - 0 to 5 scale.
  - Related to the project's GOAL and its applicability to the category being scored.
  - Assigned in each category for each project.
    - Each project will have 10 scores because there are 10 categories.

Project Prioritization Spreadsheet

	Drainage Improvement Project Ranking Date: 2/19/2009																			
	Enviro Impact Wt = 0.40		Buildings Wt = 0.70		Occupants Wt = 0.90		Property Damage Wt = 0.50		Traffic Impact Wt = 0.70		Location in Basin Wt = 0.90		Cost vs. Budget Wt = 1.00		Reduced Maint Wt = 0.40		Infrastructure Wt = 0.50		Citizen Safety Wt = 1.20	
Drainage Improvements	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result
West 2nd Street & West Folsom Street: Xtra Space Storage*																				
Hammond Avenue & Horner Avenue, North of Squire Court																				
LeFevre Drive																				
Garden Square Apartment & Garden Village Townhouse Area																				
6th Avenue Viaduct under DM&E Railroad																				
Medary Avenue South & 20th Street South*																				
Medary Avenue & Intersections of 1st Street and 2nd Street																				
15th Street South & 7th Avenue South (Detention Pond)*																				
Southland Lane & 12th Street South Detention*																				
17th Avenue South and Sawgrass Drive																				
17th Avenue South and Pebble Beach Drive																				
West 20th Street South and Main Avenue South																				

Category Definitions…

Summary

Weight:
Based on Safety

Score:
Based on applicability of project's goal

Potential Environmental Impact (review)

- Weighting Considerations
  - No immediate effects on life & safety
  - Could have long-term effects
  - Recommendation: **0.4**
- Scoring Considerations
  - What are the potential environmental impacts of the project?
  - 'No Change' would receive the **highest** scores. 'Improvement' may also score fairly high, but be cautious.
  - Highest potential for environmental impact would score lowest.

Buildings Affected*

- Weighting Considerations
  - Minimal flash flood effects in Brookings. Threat is generally predictable during a flood.
  - Mid to long term effects on building safety
  - Recommendation: **0.7**
- Scoring Considerations
  - Number of buildings potentially in contact with flood waters.
  - A score of zero (0) would be assigned to projects that do not change the number of buildings affected.

*Split out of “Buildings Affected” category

Occupant Evacuation*

- Weighting Considerations
  - Predictability of the need for evacuations, night vs day.
  - Evacuation is a response to an immediate threat.
  - Recommendation: **0.9**
- Scoring Considerations
  - Number of occupants that would require evacuation.
    - Residents
    - Employees
  - Evacuation logistics (accessibility & population density)

*Split out of “Buildings Affected” category

Property Damage*

- Weighting Considerations
  - Not an immediate threat to life & safety
  - Potential health effects due to water damage
  - Recommendation: **0.5**
- Scoring Considerations
  - Personal property & valuables
  - Parked vehicles
  - Property value
  - Potential lost revenue

*New category

Traffic Impact

- Weighting Considerations
  - Not an immediate threat to life & safety
    - The danger is typically observable and avoidable
  - Flooded streets can hamper emergency response efforts.
  - Recommendation: **0.7**
- Scoring Considerations
  - Are there alternate routes available?
  - Does the flooded street isolate people?

Location in Basin

- Weighting Considerations
  - Incorrect sequencing can create new safety hazards either upstream or downstream of the project
  - Recommendation: **0.9**
- Scoring Considerations
  - Detention projects should be constructed before increasing downstream flow capacity (upstream first)
  - Projects which increase flow capacity should begin at the downstream end
  - Detention projects towards the populous center of the City will benefit more residents

Cost vs. Budget

- One-dimensional criterion (no safety issue)
  - Since money is the driving force for the whole prioritization process, category weight is high
  - Recommendation: **1.0**
- Scoring Considerations
  - The City should strive to accomplish as much as possible within a given budget…
    - Inexpensive projects with lower priority could be moved up in the prioritization list
    - Lowest scores assigned to projects with the highest costs.
    - Highest scores assigned to projects with the lowest costs.
  - Project construction that can be 'phased' will score higher
    - Each construction phase must provide a standalone benefit.

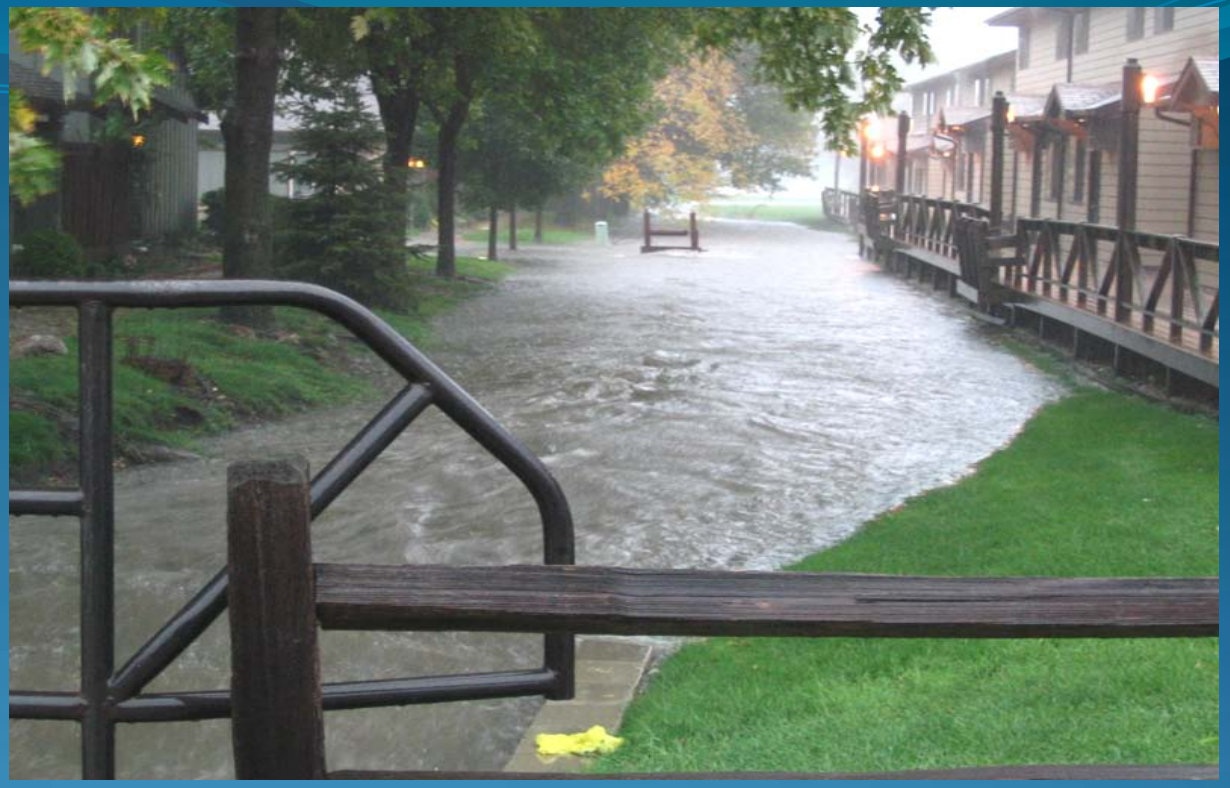
Reduced Maintenance Issues

- Weighting Considerations
  - No immediate threat to life & safety
  - Unmaintained features can create a hazard
  - Recommendation: **0.4**
- Scoring Considerations
  - Does the project reduce the maintenance that is required right now?
  - A score of zero (0) means 'no change'

Infrastructure Age

- Weighting Considerations
  - Aging drainage structures could have failure potential, but not likely to cause an immediate threat to life & safety.
  - Recommendation: **0.5**
- Scoring Considerations
  - Only consider the structures that would be replaced by the project
  - What is the structure's remaining useful life?
  - Is there imminent danger of structural failure?

Citizen Safety



- Weighting
  - Category directly deals with life & safety of pedestrians, bystanders, etc.
  - Recommendation: **1.2***
- Scoring Considerations
  - How quickly does the threat develop?
  - Is there ample warning for citizens to avoid the threat?
  - Will the project actually reduce the threat potential?

*Updated

Future Re-evaluation of Project Ranking

1. Some projects can dramatically change the City's hydrology
2. Some projects can affect other projects either upstream or downstream
3. New storm management techniques and technologies are always being developed

- For these reasons, the project prioritization list will tend to shuffle when re-evaluation takes place.
- The list should be re-evaluated on an annual basis.

Draft Summary of Category Weighting…

Citizen Safety……..	1.2
Buildings Affected……..	0.7
Occupant Evacuation……..	0.9
Property Damage……..	0.5
Traffic Impacts……..	0.7
Location in Basin……..	0.9
Cost vs. Budget……..	1.0
Reduced Maintenance Issues……..	0.4
Infrastructure Age……..	0.5
Potential Environmental Impacts……	0.4

- Discussion / Public Input
- Vote on acceptance of the drainage categories and their assigned weights.

Drainage Improvement Prioritization Guidelines for the Brookings Master Drainage Plan

February 24, 2009

City Engineer's Office

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Drainage Project Ranking Guide for the Brookings Master Drainage Plan

Abstract:

In an effort to reduce flooding in various areas of the city, the City of Brookings has implemented a 'Master Drainage Plan'. This plan pinpoints observable problem areas within the City, targets the source of the problem, and recommends one or more solutions for either a 5 year or 100 year storm event. These areas of study are listed in the Master Drainage Plan along with estimates of the cost of remediation for each area. In order to prioritize the drainage projects, a prioritization system was developed which assigns a ranking score to each project based on its overall benefit to the City in various categories. This document serves as a guide to assign these scores. As a rule of thumb, projects which minimize the immediate threat to life and safety receive the highest scores throughout the prioritization system. Each project will be individually scored on a scale of zero (0) to five (5) in a series of ten (10) different categories. The summation of the project scores in each of the categories determines the overall rank of the project.

Introduction:

A series of thirteen (13) drainage improvement projects have been set forth in the City of Brookings, and defined in the Master Drainage Plan in 2008. The Master Drainage Plan defined the problem areas which were selected on the basis of previous citizen input and engineering observation. Each area was analyzed for its adequacy to accommodate both a 5 year and 100 year storm event. Improvements for each of the 13 areas were recommended, as well as an approximate cost of each improvement.

The total cost of all the combined projects is beyond the short term budgeting capabilities of the City; therefore, a system of drainage project prioritization needs to be developed. The purpose of this document is to provide a technical basis for ranking each of the 13 projects. This prioritization system can also be used for future drainage concerns as they arise.

Ranking Procedure:

The ranking of the projects will be based on a series of different criteria. The criteria are as follows (in no particular order):

1. Potential Environmental Impact
2. Number of Buildings Affected
3. Occupant Evacuation
4. Property Damage

5. Traffic Impact
6. Location in Basin
7. Cost Versus Budget
8. Reduced Maintenance Issues
9. Infrastructure Age
10. Citizen Safety

Each criterion will be discussed herein. Every project will be scored in each of the criteria items above. The score will be based on a 0 to 5 scale with no fractional numbers.

Each of the criteria will also have a certain 'weight' assigned to it. The weighting of each criterion is like ranking the importance of the ranking criteria itself. Some criteria are more important than others. For instance, it would not make sense to budget moneys to improve a specific area if the problem is actually the result of another problem upstream. Therefore, location of the project within the basin has a higher weight than the cost of the project.

Determining the weight of each criterion is purely qualitative versus quantitative. In general, the safety of the public should be the determining factor for rating each criterion. Even though any amount of flooding is considered unsafe, the flooding which poses the most immediate threat to public safety is weighted the highest with a 1.0. The exception is the cost/budget criterion, which is also 1.0. It should be the City's goal to accomplish as much protection as possible with the limited amount of funds available.

The weighting of each criterion will be on a scale from 0.1 to 1.0. The only exception is the weight for 'Citizen Safety', which has been raised to 1.2 at the request of City Council in order to stress the importance of that criterion. The score of each project is then multiplied by the weight for that particular criterion.

Recent Changes to the Project Ranking System

The "complaint basis" criterion, which was originally proposed, has been removed from the list. This is because most complaints have a legitimate basis that already falls into one or more of the criteria categories. When a drainage complaint is brought to the City, we investigate the problem area and try to determine the cause. The cause can be infrastructure sizing, maintenance, etc. Therefore, the "complaint" itself is not the basis for ranking the project; rather, the "reason" for the complaint is the actual basis.

A new criterion was added to the project prioritization system called "Potential Environmental Impact". This was added to include potential environmental effects that a particular drainage project may have within or downstream of the City of Brookings.

The "15th Street South and Christine Avenue Extension" project was removed from the list of drainage projects to be ranked. This is because the project is already in the works as of 2008. Since this is new construction, the developers typically must comply with the requirements of the City's Storm Drainage Criteria Manual. In this particular situation, the developer and the City of Brookings have reached an assurance agreement to combine the storm drainage improvements of the 15th Street South, Camelot Drive, Christine Avenue project; the Camelot Intermediate School

project; and the adjacent developer's platted lots and construction of Pactola and Sylvan Drives into one project. The developer will cost share in the project and the City's portion of the cost has already been budgeted for 2009; therefore, there is no need to rank the project for future funding.

After presenting the first draft of the drainage criterion weighting system to the City Council, several suggestions were made to help improve the prioritization system. The first suggestion was to add a 'property damage' criterion which would take into consideration the potential value of property damage as a result of a flood. It was pointed out that the weight of this category would need to reflect its relation to life and safety issues; therefore the weight would be fairly low. It was also pointed out that; while property values would be taken into consideration, the City maintains that 1) life and safety concerns come first; and 2) the City does not intend to prioritize drainage projects based on the financial and social status of those affected.

Another suggestion was to break up the 'Buildings Affected' category into two separate categories for 'Number of Buildings Affected' and 'Occupant Evacuation'. This is because evacuation is generally a more immediate response to a flooding situation and is more closely related to 'life and safety' than is the longer-term affects of structural damage to buildings. The previous single category had a weight of 0.9 because it considered evacuation. Now that the category has been subdivided, the evacuation category carries a 0.9 weighting; while the building category carries a 0.7 weighting. The philosophy is explained later in this document.

Finally, it was suggested that the weight of the 'Citizen Safety' category should be raised to 1.2 in order to emphasize the City's commitment to protecting the life and safety of its citizens. Council indicated a consensus that the weighting values for the other categories were acceptable.

The possibility of considering 'project phasing' as a means to rank projects is discussed in the 'Cost vs Budget' category. Project phasing is the ability to break a project down into various construction phases in order to spread out the cost over a longer period of time.

Further discussion is presented at the end of this document regarding the need for flexibility of the project prioritization list, as well as future utilization of this prioritization system.

Potential Environmental Impact

This ranking criterion takes into consideration potential environmental impacts as a result of a drainage project; particularly its effect on wetlands. While wetlands are typically undesirable for developers, they serve an important purpose in nature, not only because they provide habitat for many species of plants and animals, but also because they can provide natural stormwater detention. Since this category poses no immediate threat to human life and safety, the weighting factor can be fairly low.

An important consideration when making any change in topography as a result of a drainage project is its effect on ecology and the environment. While the proposed projects in Brookings are on a relatively small scale, some consideration should be made as to how they will impact the established ecology, regardless of whether the ecology was natural or manmade to begin with. Even though past development within the City of Brookings created an excess amount of runoff

that would otherwise not have occurred, the downstream ecology has naturally adapted to these changes over time. Some of these adaptations have taken several decades or a century to occur, and could even be considered an asset to the community. When scoring this category, it will be important to remember that 'correcting' what humans have already done may not always be correct.

While a full environmental impact study might not be necessary for this purpose; at minimum a quick assessment of potential impact should be made based on observable, existing wetland, habitat, and vegetation conditions.

Scoring for this category will be on a scale of 1 to 5. Those projects which would 'appear' to have little or no potential environmental impact would receive a score of five (5), meaning projects with less impact are preferred. Projects which have the potential for major impact would receive a score of one (1). The premise for this is projects with a high potential environmental impact could possibly drop down on the prioritization list; thereby allowing for more time to complete a detailed environmental assessment, change the design or scope of the project, and account any possible changes in the cost of the project.

Number of Buildings Affected

This criterion refers to all buildings and structures directly affected by flooding which have the potential to be improved by undertaking a specific project. This includes existing structures and potential future structures based on the City's Vision 2020 zoning plan. The number of structures affected is highly dependent on the actual storm event (5yr, 10yr, 100yr storm, etc).

Due to the lack of recorded flood elevations after significant rainfall events in Brookings, it is important to note that the physical extent of flooding can only be predicted by theoretical methods and hypothetical circumstances. On the other hand, history has shown that a 50 year flood can occur from only a 2 year storm event if the conditions are right. Therefore, reasonable assumptions need to be made before estimating the number of structures affected.

As previously described, the weight of a particular criterion is based on the immediate threat to life and safety. Weighting of this criterion should be mid to high ranged, but less than 1.0 because the threat to life and safety is less than immediate. For example, a 100 yr flood event may take a period of several minutes to several hours to occur from the time that a threat is imminent. A catastrophic structural failure of the building is likely to take even longer. In such events, it is most likely that occupants will have had some warning to evacuate a building prior to the structure becoming an immediate threat to life and safety. This is in contrast to some cities with rivers and streams running through the town center; where structural flood damage can occur at a more rapid and dangerous rate. Nonetheless, a weight of at least 0.70 should be assigned to this category.

The ranking score is based on the number of structures affected as the result of a flood event. A score of zero (0) can either mean that no structures would be expected to be affected in the study area or that the project does not change the number of structures affected. The recommended scores in Table 1 are designed to quickly raise the rank

Table 1: Scoring Table for the 'Number Buildings Affected' Category.

Number of Buildings Affected	Score
0 (or no change)	0
1 to 2	1
3 to 5	2
6 to 9	3
10 to 14	4
15 or More	5

It is important to understand that these numbers are nothing more than estimates. A more extensive, hydrological modeling analysis and survey would need to be performed to determine the actual number of buildings and occupants affected. This was beyond the scope of the Master Drainage Plan. Even then, an extensive hydrological analysis is still just an estimate.

Occupant Evacuation:

In the event of a flood, certain structures may need to be evacuated either during or after the event for safety reasons. The number of occupants will be the primary consideration. As with the 'Number of Buildings Affected' category, a reasonable estimate of occupants affected will be made without performing an extensive hydrological study.

Since evacuation is generally an emergency response to an immediate threat, the weight of this category would be fairly high. Consideration of the Brookings' topography and hydrology should be used when deciding a weighting factor. Again, the potential for rapid washouts in Brookings is far less than other cities located along rivers or in canyons. A weight of 0.8 to 0.9 is recommended.

For these purposes, an occupant will be anyone in a structure who would need to be evacuated in the event of a flood emergency. For the most part, this would be equal to the estimated number of people living in a structure. Where a place of business is concerned, the number of occupants would be the approximate number of employees and a reasonable approximation of the number of customers. The term 'reasonable approximation' of the number of customers is stressed because people tend to stay at their homes during periods of bad weather versus going out to run various errands.

A score for the evacuation category will be assigned based on the number potential evacuations as described in the previous paragraphs. Projects which would reduce the number of evacuees would receive a higher score. Projects which do not change the number of people who would need to be evacuated would receive a score of zero (0), as the category is not applicable to the project. A suggested scale for scoring evacuation potential is given in Table 2.

Table 2: Scoring Table for the 'Occupant Evacuation' Category.

Occupants Evacuated	Score
0	0
1 to 10	1
11 to 20	2
21 to 30	3
13 to 40	4
41 or more	5

Property Damage:

In general, this category relates to the monetary damage of personal property. Personal property could include anything from family photos, electronics, furniture, vehicles, to an entire building. Although buildings are already addressed in their own category, this category mainly pertains to the value of the building, which is not a consideration in the other category.

By default, this category would seem to have very little pertinence in regards to life and safety. However, water damage to personal property can pose a certain level of health risk. With public education on the proper treatment of water damaged items, the potential health risks can be minimized. This category is quite far from being an immediate threat to life and safety. To caveat that statement, while such health effects are generally not immediate, the delayed onset of illness can make it difficult to ascertain the source of the illness. Therefore, a midrange weight of 0.5 would be recommended for this category.

The scoring of this category should be purely qualitative, not quantitative. One thing the City wanted to avoid was to rank drainage projects based on the socio-economic status of its citizens. In some ways, this category does exactly that. Some of the data used to score this category can be obtained from the Brookings County assessment values. Personal property is extremely difficult, if not impossible, to quantify without blatant invasion of privacy. Some people would be happy to talk about the value of their possessions, while others would rather not. However, some of the subjectivity in scoring this category can be overcome by using readily available data such as the county system.

This category is the most controversial to score because the concept of 'loss' is very dependent on the individual. Some personal property could be considered priceless because it can never be replaced. As is the case with the 'citizen safety' category, it would not be unreasonable to assign a score of five (5) to every project. However, this would nullify the purpose of having the category, as it would not change the overall ranking results. It is important to have a starting point to distinguish one project from another.

A common form of personal property damage is the damage to vehicles parked on flooded streets. In many cases, this damage is unavoidable, even with drainage improvement. This is because many streets in Brookings are actually designed to carry excess stormwater once the storm sewer capacity has been exceeded.

It is also important to look at areas where a high number of personal items can be reasonably assumed, as with storage units and high population density areas. Another consideration is the 'loss of use' or the temporary 'loss of revenue' as it relates to businesses affected by flooding. Projects will be scored on a scale of 0 to 5 as they relate to 'perceived potential loss'. A score of zero (0) will be assigned to projects which do not change the potential for loss. Higher scores will be assigned to projects which have the most potential to minimize the most amount of property damage or loss.

Traffic Impact:

Traffic impact refers to blockage of streets due to localized flooding as a result of minor storm events such as the 5 year storm and other more frequent events. There is a limitation to this criterion. In extreme cases such as the 100 year storm event, certain streets in the City have actually been designed to carry peak stormwater water flows within the roadway and boulevard, making travel on these streets impossible.

For the most part, the storm sewer piping and inlets in the City are designed to handle a 5 year storm event. At this time very few, if any, cities in South Dakota design streets with storm sewer piping beyond that capacity. The cost of augmenting storm sewer pipe capacity increases exponentially with the size and type of storm event. Therefore, it is very common to assume that the street will need to carry at least part of a storm surge. This will not change. Vehicular traffic in anything greater than a 5 year storm is considered risky regardless of the street design.

The weighting of the traffic impact criterion is also less than 1.0 because the flooding of streets in Brookings generally occurs over a period of hours in minor storms and several minutes in major storms. Motorists have ample time to decide whether or not to negotiate a certain street and should already understand that they should never attempt to drive through a flooded street. Safety becomes critical when emergency vehicles need to access an area isolated by flooding. A mid to high range weight is suggested.

The score of traffic impact will mostly be relative to the 'inconvenience factor' of flooded streets. Considerations will be made to the traffic counts of the affected streets and the availability of alternate routes. For example, a low traffic street will receive a lower score than a high traffic street. However a low traffic street or streets which isolate residents or occupants when flooded, could receive a higher score than a high traffic street that does not isolate. Table 3 provides some guidance criteria for scoring traffic impact.

Table 3: Scoring Table for the 'Traffic Impact' Category.

Traffic Situation:	Score
No traffic impact	0
Low traffic, no isolation, more than 1 alternate route	1
Low traffic, no isolation, 1 alternate route	2
Medium traffic, no isolation, 1 alternate route	3
High traffic, no isolation, more than 1 alternate route	4
High traffic with 1 alternate route, or any traffic with total isolation	5

Location in Basin:

The location within the basin refers to the logical progression of drainage improvements in a local minor watershed (basin). In some cases, a drainage improvement can create additional problems either upstream or downstream. In other cases, a drainage improvement can completely eliminate the need for certain other improvements. An understanding of such hydrological interactions is required to make these determinations.

The location of the drainage improvement within the basin can directly affect public safety during a flood event. Some areas are more critical than others, especially if there is a potential for increased flooding downstream. Therefore, the weighting of this criterion should be at or near 1.0.

The scoring of the location of a project is based on the project's position within a hydrological basin. Detention ponds will score higher the closer they are to the populous center of the City; and drainage conduit improvements (storm sewers, ditches, channels, etc) will score higher the further away from the center of the City. Scoring will be on a scale of 0 to 5. A score of zero (0) means the location of the project has no bearing on upstream or downstream hydrology.

With respect to downstream drainage conduit improvement projects taking priority over upstream improvements; it must be established that the downstream improvements will be sized properly in order to handle all future upstream improvements. With respect to detention ponds taking preference over downstream improvements; it is assumed that the discharge from these ponds will reduce the peak flows in the existing downstream systems. Even though the existing downstream system may still be undersized after the construction of a detention pond, the alternative of upsizing the downstream system without the pond can be more costly and risky.

Cost vs Budget:

Certain projects may be important from an engineering standpoint; but also may be well beyond the City's budgeting capabilities. Spending large sums of money on these projects up front could jeopardize the ability to make other improvements in a timely manner. Careful budget planning must be used. It should be the City's goal to accomplish as many improvements as possible in the least amount of time. This is why "cost vs budget" should have a weighting of 1.0.

In some cases, one large, expensive project may actually improve a vast area of the City and reduce the urgency for other improvements. This could then receive a higher score. Therefore it becomes a cost-versus-benefit analysis. On the other hand, a certain project may cost very little and take very little time to accomplish. This would also receive a high score because it can easily fit into the budget along with larger projects. This is the cost-versus-budget analysis. Both budget and benefit are considered in scoring. The purpose of this criterion is to move less expensive projects higher in rank because they are easy to budget simultaneously with more expensive, high ranking projects. In other words, the City may choose the number one project to be completed the first year, but also may look at the ranking of less expensive projects to fill out any remaining budget left over in that year.

The 'Cost vs Budget' criterion also takes into consideration whether or not the construction of a certain project can be 'phased'. Construction phasing would allow one particular portion of the project to be built at a lesser cost than the total project. When construction phasing is a possibility, a cost estimate will be determined to build the first phase. This cost can then be used as a basis for determining the scoring in this category. Project phases will be eligible for consideration in this category only when each construction phase is capable of providing a 'stand-alone' benefit to the overall drainage improvement plan. In other words, a construction phase which does not effectively reduce peak flows or increase capacity without constructing the remaining phases would not be eligible for reduced cost consideration.

The scoring is on a scale of 1 to 5 and does not simply reflect the cost of the project. A score of one (1) means that the cost of the project is well beyond the City's funding scenario in the near future. A score of five (5) could either mean that the cost of the project is minimal with respect to the available budget, or that the cost of the project improves larger sections of the City and reduces the cost of other drainage improvements.

Reduced Maintenance Issues:

This criterion refers to the maintenance of drainage channels, gutters, inlets, ponds, storm sewer pipes, etc. Without continuous maintenance, the drainage capacity of these features can be greatly reduced. The most significant maintenance issue is the clearing of drainage ditches and swales. Some drainage swales are only carrying about 25% of their potential capacity because of vegetation overgrowth. In many situations, vegetation is very difficult to control because saturated soils make it nearly impossible to operate maintenance equipment. Concrete valley gutters, box culverts, and other drainage conveyance structures would greatly reduce the need and frequency of maintenance.

While unmaintained drainage features can exacerbate flooding issues, it is unlikely to cause an immediate threat to life and safety. Therefore, the weighting factor for this criterion should be fairly low.

Scoring (from 0 to 5) will be based upon whether or not the project will reduce any existing maintenance issues or create new issues. A score of zero (0) means there will be no reduction of maintenance. In some cases, an improvement may add certain new maintenance duties but reduce other maintenance duties, as with a detention pond. Higher scores will be assigned to projects which reduce the amount of maintenance that is currently required. Typically, higher scores would be associated with the reduction or elimination of vegetated ditches. Mid level scores would be assigned to projects that do not necessarily eliminate vegetated ditches, but make them easier to maintain as is the case with the addition of concrete valley gutters.

Infrastructure Age:

The "infrastructure age" criterion applies to drainage features that may be currently functioning adequately, but nearing the end of their useful life or in danger of failing in the near future. This could also apply to aging infrastructure that is adequate for smaller storms, but not larger ones.

The term 'infrastructure' generally refers to hard structures such as storm sewer pipes and inlets, but could also refer to other topographic features such as basins and drainage swales. However, the improvement of such topographic features could possibly fall under the maintenance category and even the environmental impact category. When ranking topographic features, consideration should be made as to what category the feature falls into.

In most cases, the age of the infrastructure does not pose an immediate threat to life and safety due to the nature of these drainage features. However, certain features such as inlet design and inlet protection may be obsolete. The weighting of the "infrastructure age" should be less than 1.0, but more than some of the other criteria used.

The scoring (0 to 5) of this criterion should be based primarily on the need to replace aging infrastructure. Consideration is given to structures that are obsolete in design and function. When practical, existing structures should be upgraded to the City's current design standard. A score of zero (0) means that no aging infrastructure will be replaced. A score of five (5) means there is imminent danger of structural failure.

Citizen Safety:

This ranking criterion is directly related to the personal safety of pedestrians and bystanders in the vicinity of the problem area. It refers to an immediate threat to life and safety; therefore, the weighting should be a full 1.0.

Generally, an immediate threat means large quantities of fast moving water, capable of sweeping a person downstream. In some cities, rivers and permanent streams constitute a greater threat to safety than any of the drainage features in Brookings because they can completely engulf and carry an entire vehicle downstream. Therefore, this criterion will be limited to non-vehicular safety of citizens. Vehicular safety should be assessed in the "traffic impact" scoring criterion.

Scoring will reflect how immediate the threat of flooding is to life and safety. Standing water and flowing water are unavoidable because they occur in nature. However, water that is standing or slow flowing in areas that are unnatural will increase the threat because people do not expect it to be there. These areas will have a lower score than areas that experience fast moving waters during periods of flood. Higher scores will also be given to projects that improve the safety of existing structures. For example, a project that replaces damaged or unprotected inlets and culverts with newer, safer products will receive a higher score.

Higher scores will also be given to areas that see more pedestrians than others. For example, a project that improves the safety near parks and walkways will receive a higher score than those in remote or unpopulated areas. A project which does not change the immediate threat to life and safety will receive a score of zero (0). This does not necessarily mean that a threat does not exist; it simply means that there will be no change as a result of the project.

Flexibility of Project Prioritization:

The project prioritization system presented herein should never be construed as a 'rigid' system for determining the long term strategy. This is because of the 'hydrological interaction' that can

occur between two or more study areas. For example, construction of a detention pond in one part of the city could reduce peak storm flows in another part of the city; which could then affect the scoring of related projects. Therefore, it is recommended that the prioritization list be reevaluated in each category every time a drainage project has been completed.

It is also possible that when a certain project requires construction phasing, that the project could be reevaluated after each phase is complete. Construction phases should be planned such that they are well-delineated and perform a stand-alone function that is beneficial to the overall drainage improvement goal. Once a project phase is complete, the remaining project requirements and costs can be reinserted into the prioritization process. The results could either move the remaining portion of the project either up or down in the project prioritization list. Doing this could give other projects a chance to move further up on the list if it truly is warranted.

Flexibility is also important as new technologies become available which could reduce costs or make certain projects operate more efficiently. The process of drainage improvement should always be open to new ideas as well. The City engineering department will work to stay informed on other drainage strategies and technologies utilized throughout the nation and find ways to incorporate ideas that may provide a better solution.

It is highly recommended that when a project prioritization list is adopted, the list should only be valid for no more than one (1) year. At minimum, the list of projects should be reevaluated on an annual basis as some of the drainage improvements begin to take place. By doing so, the City should be able to achieve the greatest benefit in the least amount of time.

Drainage Improvement Project Ranking (1st draft) Date: 2/23/2009

	Enviro Impact Wt = 0.40		Buildings Wt = 0.70		Occupants Wt = 0.90		Property Dmg Wt = 0.50		Traffic Impact Wt = 0.70		Location Wt = 0.90		Cost vs. Budget Wt = 1.00		Reduced Maint Wt = 0.40		Infrastructure Wt = 0.50		Citizen Safety Wt = 1.20	
Drainage Improvements	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result
West 2nd Street & West Folsom Street: Xtra Space Storage*																				
Hammond Avenue & Horner Avenue, North of Squire Court																				
LeFevre Drive																				
Garden Square Apartment & Garden Village Townhouse Area																				
6th Avenue Viaduct under DM&E Railroad																				
Medary Avenue South & 20th Street South*																				
Medary Avenue & Intersections of 1st Street and 2nd Street																				
15th Street South & 7th Avenue South (Detention Pond)*																				
Southland Lane & 12th Street South Detention*																				
17th Avenue South and Sawgrass Drive																				
17th Avenue South and Pebble Beach Drive																				
West 20th Street South and Main Avenue South																				

Drainage Improvement Project Ranking (1st draft)

Date: 2/24/2009

Drainage Improvements	Enviro Impact Wt = 0.40		Buildings Wt = 0.70		Occupants Wt = 0.90		Property Dmg Wt = 0.50		Traffic Impact Wt = 0.70		Location Wt = 0.90		Cost vs. Budget Wt = 1.00		Reduced Maint Wt = 0.40		Infrastructure Wt = 0.50		Citizen Safety Wt = 1.20		Total	Rank	Capital Cost 5 yr Storm	100 yr Storm
	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result	Rank	Result				
West 2nd Street & West Folsom Street: Xtra Space Storage*	3	1.20	1	0.70	1	0.90	4	2.00	1	0.70	4	3.60	3	3.00	3	1.20	5	2.50	2	2.40	18.20	8	$1,449,134	$1,956,624
Hammond Avenue & Horner Avenue, North of Squire Court	4	1.60	3	2.10	3	2.70	3	1.50	1	0.70	2	1.80	3	3.00	3	1.20	3	1.50	3	3.60	19.70	4	$240,000	
LeFevre Drive	5	2.00	0	0.00	1	0.90	1	0.50	5	3.50	2	1.80	4	4.00	3	1.20	3	1.50	3	3.60	19.00	7	$80,165	$100,787
Garden Square Apartment & Garden Village Townhouse Area	3	1.20	3	2.10	5	4.50	4	2.00	0	0.00	4	3.60	5	5.00	5	2.00	3	1.50	5	6.00	27.90	2	$38,003	$541,477
6th Avenue Viaduct under DM&E Railroad	5	2.00	0	0.00	0	0.00	1	0.50	1	0.70	0	0.00	5	5.00	4	1.60	0	0.00	4	4.80	14.60	12	$10,000	$10,000
Medary Avenue South & 20th Street South*	1	0.40	2	1.40	2	1.80	2	1.00	5	3.50	4	3.60	2	2.00	3	1.20	2	1.00	3	3.60	19.50	5	$1,129,641	
Medary Avenue & Intersections of 1st Street and 2nd Street	5	2.00	1	0.70	2	1.80	2	1.00	4	2.80	3	2.70	2	2.00	1	0.40	4	2.00	2	2.40	17.80	10	$553,553	$824,737
15th Street South & 7th Avenue South (Detention Pond)*	1	0.40	4	2.80	4	3.60	4	2.00	2	1.40	4	3.60	2	2.00	3	1.20	1	0.50	2	2.40	19.90	3	$2,243,431	$4,962,629
Southland Lane & 12th Street South Detention*	3	1.20	5	3.50	5	4.50	5	2.50	5	3.50	5	4.50	3	3.00	3	1.20	1	0.50	3	3.60	28.00	1	$1,789,304	$4,779,524
17th Avenue South and Sawgrass Drive	4	1.60	2	1.40	2	1.80	3	1.50	4	2.80	2	1.80	3	3.00	1	0.40	1	0.50	2	2.40	17.20	11	$445,004	$1,027,384
17th Avenue South and Pebble Beach Drive	4	1.60	2	1.40	2	1.80	3	1.50	4	2.80	2	1.80	5	5.00	1	0.40	1	0.50	2	2.40	19.20	6	$37,654	$51,023
West 20th Street South and Main Avenue South	4	1.60	1	0.70	1	0.90	2	1.00	0	0.00	4	3.60	5	5.00	5	2.00	4	2.00	1	1.20	18.00	9	$13,239	$30,761
																							$8,148,651	$14,523,992