

Executive Summary

In August of 2001, Mayor Wesely appointed the Mayor's Floodplain Task Force, representing a range of stakeholders from the community, to formulate recommendations regarding the development of new floodplain standards (see Charge Statement in Chapter 1 and Floodplain Task Force Membership in Appendix C). The City and the Lower Platte South NRD provided staff support for the Task Force and were funding partners in the development of technical studies completed by the Corps of Engineers (COE) and Camp Dresser, and McKee Inc. (CDM) to support the work of the Task Force. *(See Executive Summaries for Technical Studies in Appendix H).*

The Corps of Engineers study summarized various floodplain management strategies used in other communities, and modeled the impacts of alternative scenarios on Dead Man's Run and Beal Slough in Lincoln, which were selected as representative floodplain areas for Lincoln. The CDM study modeled the impact of a rise in flood heights on public infrastructure, studied the economic impact of alternative floodplain management scenarios on private development, and evaluated additional floodplain management strategies used by other communities. While the studies were being completed, the Task Force was presented with and considered a broad range of additional information which is summarized in Appendix E.

In December of 2002, the Task Force began a decision-making process and met twice a month through March of 2003 to formulate recommendations for floodplain standards. Policy recommendations were clearly separated into two areas: 1) New Growth Areas, and 2) the Existing Urban Area, and can be found in Chapter 2. The recommendations for both areas are summarized below:

1. Adopt No Adverse Impact Policy
2. Improve Accuracy of Floodplain Maps
3. Adopt New Floodplain Standard
4. Provide Flexibility for Stream Crossings
5. Apply Stream Buffers to Mapped Floodplains and Smaller Streams
6. Preserve Flood Storage on Surplus Property
7. Develop a Floodplain Buyout Program
8. Do **Not** Charge Floodplain Development Fee
9. Encourage Best Management Practices
10. Take Action Regarding Salt Creek Floodplain Through Lincoln
(N/A for New Growth Areas)
11. Encourage Higher Building Construction Standards
12. Protect Lateral Additions to Non-Residential Structures
13. Provide Incentives for Cluster Development
14. Use Best Available Floodplain Study Information
15. Improve Floodplain Disclosure in Real Estate Transactions
16. Improve Methods for Assessing Floodplain Properties

Chapter 1

Background Information



Mayor's Floodplain Task Force Charge Statement

August 21, 2001

The goal of the Mayor's Floodplain Task Force is to formulate recommendations regarding the development of permanent floodplain standards that address the natural functions of floodplains and reduction of future flooding hazards in Lincoln and Lancaster County, while being sensitive to business, environmental and neighborhood interests and recognizing the need to sustain long-term economic development opportunities. The Task Force is expected to:

- **Utilize the information from the Corps of Engineers (COE) floodplain study;**
- **Identify other floodplain management alternatives that should be considered that are not part of the COE technical study;**
- **Evaluate and make recommendations regarding policy issues relative to floodplains;**
- **Make recommendations for additional cost analysis or other evaluation needed relative to the impact of alternatives on private development costs, public infrastructure costs, or natural resources;**
- **Utilize all the information to make final recommendations to the Mayor, and, if applicable, to the Lancaster County Board regarding revised floodplain policies and standards for the City and County.**

The Task Force will work closely with staff from the City and the Lower Platte South Natural Resources District (NRD), who will provide support and guidance. Additional technical or facilitation resources from other sources or agencies will be sought by the City or NRD as needed. The Task Force is expected to utilize the information from the Corps of Engineers Study to formulate recommendations during May and June of 2002 in order that new standards could be drafted and adopted prior to the end of 2002 (see attached schedule).

Facilitation and Process for Developing Recommendations

The development of the recommendations by the Mayor's Floodplain Task Force was facilitated by the Heartland Center for Leadership Development. Several design considerations guided the development of an overall plan for Task Force management. Among these considerations, **participation was the priority**, with education regarding floodplain issues, information needs and attendance at meetings also prominent. Staff and consultants from the Heartland Center met for work sessions prior to each meeting of the Task Force to design an agenda and respond to requests from the Task Force Members. The role of Heartland Center staff also included the **facilitation of each Task Force meeting**.

Throughout the process, the **membership greatly influenced the design through requests for information and process suggestions**. This influence reflects the high degree of participation on the part of the membership. The need for information was, in fact, one reason that the timeline of the Task Force extended well past what was anticipated. Requests for new maps, studies and reports developed as the Task Force explored issues together and discovered personal and group needs for education about floodplains.

Attendance was a key concern. All Task Force members, having been appointed by Mayor Wesely, were vital to each meeting. While substitute representatives attended in place of one member, attendance records for all meetings are included in the appendices of this report. The City staff utilized a **web site** to encourage attendance, post notices and reports, and as an additional follow-up to email and regular mail communications and materials distribution. The Task Force always reviewed dates for meetings, and reminder phone calls were made prior to meetings. At several points, **additional meetings** were added, and the regular time and place adjusted, to offer an option for members that had difficulty with attendance.

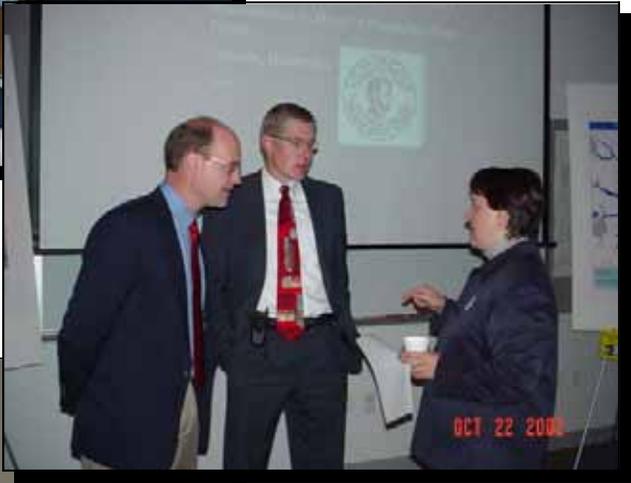
Meetings were designed to provide **both presentations and small group discussions**. The Task Force often worked in two or three small groups in order to maximize participation and balance discussion. A variety of guest speakers representing areas of technical expertise made presentations during meetings. A list of those individuals and topics is included in Appendix F.

As the policy recommendations developed the group decided to **consider “New Growth Areas” first** and then to consider parallel recommendations for the “Existing Urban Area.” This separation proved to be very useful since the issues and information regarding the New Growth Areas required extensive discussion. When the group turned their attention to the **“Existing Urban Area”, the length of discussion was reduced** because information and debate on many of the issues had already taken place in previous sessions. Recommendations were also broadened to address policies for both the City and County.

A **polling process** was developed that allowed each member present to **agree, disagree or offer specific word changes** to a draft policy. The results of these polling exercises are included in the appendices, but it should be noted that the procedure itself allowed for considerable discussion and evolution of draft statements as the group worked together. The conversations regarding specific statements proved very **useful in working toward consensus** or in clarifying positions outside the consensus. Some Task Force members chose to abstain from the polling process, left early or were absent from the room, so attendance and polling results may seem to conflict. The polling **results reflect**, however, those **members present during that particular discussion.**

The Task force acknowledged that there are **other significant stakeholders** who should be made aware of the recommendations and who will have opportunity for input as the decision-makers continue public participation and discussion.

Chapter 2 Policy Recommendations



Introduction to Mayor's Floodplain Task Force Recommendations

Floodplain Task Force **recommendations reflect the majority opinion** of those present at meetings where polling and decisions regarding policy recommendations took place. All policy items were discussed at multiple meetings. While significant efforts were made to schedule meetings in such a way as to include the majority of Task Force members, attendance varied from meeting to meeting due to members attending to other commitments. As described in the *Facilitation and Process* section the polling results from each decision-making session were recorded and are included in Appendix G.

Ultimately, the Floodplain Task Force's recommendations for New Growth Areas and the Existing Urban Area are very similar, differing in the administrative relief identified for Item 3, "No Net Rise/Compensatory Storage," and Item 12, "Substantial Improvement Threshold." There was a great deal of discussion about the **fairness of applying higher standards within New Growth Areas versus the Existing Urban Area**, which was presumed to affect existing homes and businesses in the floodplain and to have greater constraints for new development. For the purposes of this report, **the policy recommendations for New Growth Areas remain separate from the recommendations for the Existing Urban Area**, given that the Task Force made a clear distinction between these two areas throughout the process. Thus, there is a **significant degree of repetition between the two sections** with regard to both the policy recommendations and the accompanying discussion.

For context and understanding, Task Force recommendations are accompanied by information relating to issues raised and important facts considered by the group during the course of formulating each policy recommendation. Information relating to Item 3, **No Net Rise/Compensatory Storage, is the most lengthy** due to this recommendation being one of the most consequential, and the **substantial number of complex issues and technical pieces of information** assimilated by the Task Force in making decisions regarding this policy recommendation.

Floodplain Recommendations for New Growth Areas

For the purposes of these recommendations, 'New Growth Areas' are defined as those areas outside the City limits and zoned AG - Agricultural or AGR - Agricultural Residential at the time a new standard is adopted. (See Floodplain Policy Application Areas map in Appendix L).

1. No Adverse Impact

Adopt No Adverse Impact Policy

In New Growth Areas, the City of Lincoln and Lancaster County should have a policy of No Adverse Impact, with a goal of ensuring that the action of one property owner does not adversely impact the flooding risk for other properties, as measured by increased flood stages, flood velocity, flows or the increased potential for erosion and sedimentation.

No Adverse Impact is a managing principal and policy goal **developed by the Association of State Floodplain Managers (ASFPM)** in support of long-term, sustainable approaches to reducing the nation's flood losses. A "No Adverse Impact Floodplain" is defined as one where the action of one property owner does not adversely impact the flooding risk for other properties, as measured by increased flood stages, flood velocity, flows or the increased potential for erosion and sedimentation. The ASFPM recommends that the No Adverse Impact policy be **implemented nationwide at a local level** through a range of approaches based

upon what is most effective for a particular community.

2. Floodplain Mapping

Improve Accuracy of Floodplain Maps

The City and County should continue to develop and improve a comprehensive, watershed approach to floodplain mapping which recognizes the community interest and responsibility for the prevention of future flood damages. Accurate floodplain mapping should be a priority to which specific resources are dedicated, utilizing the latest technology and data available, and should be furthered through partnerships with other agencies.

The Task Force discussed the disadvantages of the **variable level of accuracy in mapping** and flood elevation information within the FEMA floodplain maps and flood insurance studies for the City and County. There was considerable discussion among Floodplain Task Force members regarding the **need to continue updating** the floodplain maps in order to have dependable information on which to base decisions and policies. While it was acknowledged that the 100-year floodplain boundary and flood elevation information is being developed for Lincoln and its future growth areas as watershed master plans are completed basin by basin (see Policy Item 14, 'Best Available Study Information'), there was concern about the period of time that it would take to develop this information using an incremental approach. The Task Force acknowledged that the floodplain map update process will be facilitated by the City having entered into the **Cooperating Technical Partners program** for floodplain mapping with

FEMA. However, the group expressed that mapping should be a priority to which specific resources are dedicated. Individual members felt that the role and responsibility of the Lower Platte South Natural Resources District and the Corps of Engineers should also be identified in the recommendation.

3. No Net Rise/Compensatory Storage Standard

Adopt New Floodplain Standard

A No Net Rise and Compensatory Storage standard should be adopted. This means that development within the 100-year floodplain in New Growth Areas should be required to demonstrate through an engineering study that it will cause no increase in the water surface elevation of the 100-year flood greater than five hundredths of a foot (0.05'). In addition, compensatory storage should be required at a ratio of 1 to 1 for volume of flood storage lost to fill or structures in the 100-year floodplain. Compensatory storage should be provided with the objective of being hydrologically similar to lost flood storage volume, but a hydrologic study should not be required to demonstrate that the storage is hydrologically equivalent.

The No Net Rise/Compensatory Storage standard recommended by the Task Force evolved out of discussion surrounding **two fundamental functions of the floodplain:**

- 1) **'No Net Rise,'** which relates to the conveyance properties of the floodplain, or "how the water flows"; and
- 2) **'Compensatory Storage,'** which relates to the volume, or "how much total water there is".

A **No Net Rise standard** by itself would preserve conveyance, but would not regulate 'non-conveyance' areas, backwater areas or the attenuating (flood reducing) characteristics of the floodplain. Also, technical information brought to the Task Force indicated that a community could preserve significant functions of the floodplain by adopting a 'No Net Rise' standard, but the No Net Rise standard by itself would not address increases in velocity or erosion.

Alternatively, if only a **Compensatory Storage standard** were adopted, hydraulic conveyance would not be preserved, and there could be a rise in flood heights. The purpose for coupling 'Compensatory Storage' with 'No Net Rise' was to identify a standard, which would address conveyance of floodwater and would also insure that the amount of water reaching the water course would remain the same. The two approaches were considered to complement one another and to meet the goal of No Adverse Impact outlined in the first policy recommendation.

Land Use Designation

An important consideration for **New Growth Areas** was the Lincoln/Lancaster County Land Use Plan (see Lincoln/Lancaster County Land Use Plan map in Appendix L) adopted as part of the **2025 Comprehensive Plan**, which **designates areas for future urban development outside of the floodplain** to avoid introducing new development to flood risks and to preserve the functions of the floodplain. The majority of floodplain within the New Growth Areas is designated as Green Space, Environmental Resources, or Agricultural Stream Corridors.

Hydraulic and Hydrologic Modeling

There was considerable discussion regarding what modeling should be required to demonstrate that the No Net Rise/Compensatory Storage standard was being met. Consideration was given to the fact that the

analysis to meet the ‘No Net Rise’ criteria is straightforward and utilized regularly today in the Floodway. However, it was acknowledged that determining the **hydrologic equivalent for Compensatory Storage** through modeling would be difficult and was not anticipated to be a practical requirement. Thus, it was agreed that compensatory storage should be provided with the objective of being hydrologically equivalent, without requiring a hydrologic model to demonstrate this fact.

Allowable Rise

Information was presented to the Task Force which indicated that allowing a very small rise could make a significant difference in the **flexibility of the No Net Rise** portion of the standard and would be easier to administer. It was pointed out that there are many actions that can be taken within the floodplain which would be unable to show No Rise, but would have an ‘infinitesimal’ impact. Thus, the Task Force included the provision to **allow for five hundredths of a foot (0.05’) rise** to account for these circumstances.

‘Mitigation’ Ratio for Lost Floodplain Storage

Early draft recommendations discussed by the Task Force identified that the ‘mitigation’ ratio for lost floodplain storage should be greater than 1 to 1. The discussion reflected a desire to base the standard for Lincoln and Lancaster County upon what was being done nationwide in this regard, however, the research showed that there is a **range of mitigation ratios utilized nationwide for flood storage**, with no overall consistency in the ratios. While there are examples of other communities where mitigation is required at greater than 1 to 1, these examples often were in communities where a Compensatory Storage standard was not coupled with a No Net Rise standard. Thus, it was determined that a **1 to 1 mitigation ratio would be sufficient** for Compensatory Storage as long as this was **coupled with a No Net Rise** standard.

Example Floodplain Developments

The Task Force was interested in examples of developments within the floodplain that met a similar standard. It was discussed that **Horizon Business Center/Southwest High School** site did meet a Compensatory Storage standard, and was likely close to meeting a No Net Rise standard as well, although this was not measured. It was also discussed that while **Haymarket Park** did not meet a No Net Rise/Compensatory Storage standard, it met the standards identified in the FEMA Flood Insurance Study to preserve Salt Creek flood storage outside of the levee system.

Additional Engineering Costs

Task Force members raised concerns about the additional engineering costs of meeting a No Net Rise/Compensatory Storage standard. To address this issue, engineering costs were researched and are provided (based upon discussions with various engineering firms) within this report in Appendix K. In general, there was found to be an **‘economy of scale’**, meaning that there was typically a base cost which did not vary with the size of the site, in addition to a cost per acre. Thus, the larger the site, the less of an increase would be expected in engineering costs to meet a No Net Rise/Compensatory Storage standard. In evaluating engineering as a percentage of total development costs, the **average estimated range in additional engineering costs to meet this standard would be 1.4 % to 0.3% of the development costs for sites in the range of 10 to 100 acres, respectively.**

Other Economic Impacts

The **projected costs of both adopting a higher standard and continuing with the present-day standard** are articulated by the Corps of Engineers (COE) and CDM studies (see Executive Summaries in Appendix H). Both studies utilized example floodplain reaches that are projected to be indicative of the

majority of floodplains in Lincoln and Lancaster County with regard to fill in the flood fringe.

The COE study summarized in Appendix H evaluated three scenarios on the Dead Man's Run and Beal Slough floodplains, from moderate to more extreme losses of flood storage. The study concluded that, within the study reaches, **increased flood damages** resulting from loss of flood storage had the potential to range from **\$2.6 to \$10.9 million on Dead Man's Run**, and from **\$0.1 to \$1.9 million on Beal Slough**. Economic analysis was not performed for **100% loss of flood storage**, which showed a substantially greater rise in flood heights (2.8 foot rise and 4.3 foot rise on Deadman's Run and Beal Slough, respectively) than the alternative scenarios where the economic analysis was performed.

The CDM study summarized in Appendix H projected the reduction in flood damage possible to public infrastructure if higher standards were adopted and the economic costs to private development of meeting a higher standard. Half-foot Rise and No Net Rise/Compensatory Storage standards were evaluated. Under the No Net Rise/Compensatory Storage standard, as compared to the current One-foot Rise standard, flood damage costs to public buildings, streets and stream crossings were projected to be reduced 27% and 44%, respectively. **Reduction in flood damage costs** based on a No-Rise/Compensatory Storage scenario were projected at **100%, 27% and 44%** for public buildings, streets, and stream crossing structures, respectively. **Increased costs to private development** to meet a No Rise/Compensatory Storage standard were projected at **14%, 21% and 10% for traditional** residential, commercial and industrial development configurations, respectively. **For cluster developments** allowed by the ordinance today through Community Unit Plans and Planned Unit Developments, the No Net Rise/Compensatory Storage standard was projected to increase costs to private development by 6% or less.

(See Policy Item 12 for discussion of this standard as it relates to substantial improvements and refer to Appendix K for additional information. Also see the No Net Rise and Compensatory Storage Fact Sheet included in Appendix I).

4. Stream Crossing Structures

Provide Flexibility for Stream Crossings

The City and County should adopt a practical standard for stream crossing structures, which takes into account that there are circumstances in which it is structurally or financially infeasible to construct stream crossings without causing any rise in flood heights in the flood fringe. Construction of stream crossing structures should be required to demonstrate a sequencing approach that seeks first to avoid, then to minimize, then mitigate for any impacts to flood storage or flood heights. The standards should be flexible and consider alternatives such as an allowable rise between 0'-1' in the flood fringe, allowable loss of flood storage, and/or purchase of property or easements where flood heights will increase and an amendment is made to the FEMA flood insurance rate map.

The Floodplain Task Force was presented with information indicating that there are circumstances in which it is **structurally or financially infeasible to construct stream crossings without causing any rise** in flood heights in the flood fringe.

Replacing Existing Structures

Where existing stream crossing structures exist and the grade of the road is not being raised, a No Net Rise/Compensatory Storage standard **would not be anticipated to have a significant impact on bridge and culvert replacements**, since most replacements meet a higher standard than the older structures being replaced.

New Stream Crossing Structures

Based upon anecdotal evidence from conversations with floodplain managers from other communities and other research supplied to the Task Force, it appears that adopting a No Net Rise/Compensatory Storage floodplain standard with no flexibility would be likely to **increase the cost of constructing new stream crossing structures by approximately 25%**. However, it was discussed that the ability to use compensatory storage, property rights acquisition, and increases in downstream conveyance capacity would make it more flexible and could offset many of these anticipated increases in cost.

While the Task Force agreed that flexibility with regard to stream crossing structures was important, it was emphasized that the flexibility outlined in this policy **should be provided for private as well as public stream crossing structures**. Individual Task Force members suggested the City and County ought to meet a higher standard than the private sector. Task Force members also expressed that any **impacts to flood storage or conveyance should have careful consideration**. The 'sequencing' approach identified in the recommendation is modeled upon the approach required by Section 404 of the Clean Water Act for impacts to wetlands, and was included in order to discourage an approach that would have adverse impacts. *(See Appendix K for additional information).*

5. Stream Buffers

Apply Stream Buffers to Mapped Floodplains and Smaller Streams

The Minimum Flood Corridor stream buffer or similar standard should be applied in the City and County within the FEMA-mapped floodplains and along smaller, unmapped streams that have a defined bed and bank. Encroachments should be permitted per the existing standards for Minimum Flood Corridors for operation, maintenance and repair, channel stabilization, stormwater storage facilities, utility crossings, public parks, pedestrian/bike trails and other recreational uses and public purposes. However, proposed encroachments should be required to demonstrate a sequencing approach that seeks first to avoid, then to minimize, then mitigate for any encroachments. Mitigation for loss of vegetation and flood storage should occur at a 1.5 to 1 ratio. Where land uses prior to development have an impact on the buffer width, the area should be replanted with vegetation compatible with the corridor and water quality benefits.

The Task Force discussed **City of Lincoln standards, which currently require a “minimum flood corridor”** buffer to be preserved along only those drainageways **outside the mapped floodplain** that drain greater than 150 acres. Thus, smaller tributaries draining less than 150 acres or larger streams that have a mapped floodplain require no buffer protection. The width of the minimum flood corridor is equal to the stream channel bottom width, plus 60 feet, plus 6 times the channel depth. It was determined that the Minimum Flood Corridor stream buffer or similar standard should be applied within the FEMA-mapped floodplains and along smaller, unmapped streams that have a defined bed and bank.

Mitigation

There was considerable discussion regarding **mitigation** that should be required **for impacts to buffers** along stream corridors. The majority of Task Force members felt that replacement of lost plant materials should occur at a ratio greater than 1 to 1 (1:1), due to the **plant mass lost when mature vegetation is replaced with new plantings**. Thus, a mitigation ratio of 1.5:1 was recommended. Information was provided to the Task Force showing a range of mitigation ratios nationwide for impacts to wetlands and stream buffers. The ratios generally ranged from 1:1 to 3:1, with greater ratios required for impacts to unique environmental areas. There was concern about the lack of a scientific basis for choosing any particular mitigation ratio, but the majority of Task Force members felt that 1.5:1 was an acceptable mitigation ratio given the available information. Individual members expressed some discomfort with the numbers but agreed in concept.

Buffer Width

Individual Task Force members also expressed concern about the **width of buffers that would be required along degraded, mainstem stream channels** like Salt Creek and Stevens Creek if the “minimum flood corridor” standard is applied. Examples were provided to the Task Force for a Stevens Creek tributary and the mainstem channel downstream in the basin. The buffer widths at each location were calculated and shown on a map for comparison with the existing FEMA-mapped 100 year floodplain and floodway. Both examples on the mainstem of Stevens Creek resulted in buffer widths much smaller than the existing 100 year floodway, and the floodway and buffer for the smaller Stevens Creek Tributary were nearly equal in width. The maps adequately addressed the concern of the Task Force and members agreed that the “minimum flood corridor” standard should be applied to areas within

the FEMA-mapped floodplain. Discussion also included **applying the standards in a reasonable way** that would, for example, not require a buffer area on a plateau outside of the floodplain. (*See Greenfield Approach Fact Sheet in Appendix I for additional information*).

6. Surplus/Vacated Floodplain Property Policy

Preserve Flood Storage on Surplus Property

The City and County should adopt a policy where, under normal circumstances, City or County property in the floodplain is viewed as serving a public purpose and not be proposed for surplus. If there are unusual circumstances that cause the consideration of declaring surplus property in the floodplain, the City or County should retain a permanent conservation easement that protects the flood storage capacity, or any flood storage impacts should be mitigated at a 1 to 1 ratio. Declaring surplus property should not be considered *under any circumstances* where floodplains contain environmental resources such as riparian areas or stream corridors that provide habitat and water infiltration benefits or serve as connectors to natural areas.

When other publicly-owned property in the floodplain is proposed for surplus, the City should consider purchasing the property fee simple, or alternatively, purchasing a permanent conservation easement where appropriate to preserve flood storage and other environmental resources.

When street or alley ROW in the floodplain is proposed for vacation, the City or County should retain a permanent conservation easement that protects the flood storage capacity. Consideration should be given to allowing for a conservation easement to be deeded over an alternate floodplain area having equal or greater flood storage volume.

Discussion on this policy item included consideration of the **amount of publicly owned property within the floodplain**. This information was provided in the form of a map to the Task Force. (See City of Lincoln/Lancaster County Publicly Owned Land in the Floodplain map, Appendix L).

Other Task Force dialogue on this policy item included:

- 1) Consideration of economic issues and the long-term costs and benefits;
- 2) The need to take into account the potential for multiple benefits, including opportunities to meet some of the recreational goals of the City and County.
- 3) Whether mitigation for flood storage impacts to surplus properties should be provided at greater than a 1:1 ratio to offset the loss of publicly owned floodplain areas.
- 4) Opportunities to partner with other agencies.

(*See Maintain Storage on Surplus Property Fact Sheet in Appendix I*).

7. Floodplain Buyout Program

Develop a Floodplain Buyout Program

The City and County should develop and implement a continuing floodplain buyout program, which is sensitive to the need to minimize impacts on neighborhoods and historic districts. Special emphasis should be placed upon sites that provide multiple benefits. These include opportunities to develop contiguous open space, preserve environmental resources, and to mitigate flood damage by providing additional detention for flood water during major storm events. An evaluation should be performed to identify potential funding sources, and where possible, the City and County should form partnerships and pool resources with other public agencies. Eminent domain should be used to acquire property only as a last resort.

While there was clear support on the Task Force for the creation of a floodplain buyout program, there was considerable discussion regarding **how such a program would be funded**. The Task Force recommendation was for a range of alternatives to be investigated through an evaluation of funding resources. Individual members felt that the policy recommendation should include specific reference to potential funding sources.

8. Floodplain Development Fee

Do Not Charge Floodplain Development Fee

At this time, it is not appropriate for the City or County to charge a floodplain development fee. Consideration of a floodplain development fee would require further evaluation regarding alternative fee structures and criteria for applying the fees in a logical and equitable manner. If a fee is established at some time in the future, consideration should be given to dedicating the revenue to advance the flood mapping program and to assist in the funding of floodplain buyouts.

Information regarding precedents for floodplain development fees was not available for evaluation by the Task Force. Research on this topic revealed examples of fees charged in other communities that related more to environmental impacts than to loss of flood storage or conveyance. There was concern on the part of Task Force members about **how a fee would be calculated and how the funds would be used**. Individual members also felt that a floodplain development fee would be a double burden when considering the increased engineering costs necessary for development within the floodplain to meet a No Net Rise/ Compensatory Storage standard.

9. Best Management Practices

Encourage Best Management Practices

‘Best Management Practices’ such as grassed swales, water quality wetlands, retention cells, etc. should be strongly *encouraged* in floodplain areas. Best Management Practices are identified in the City of Lincoln Drainage Criteria Manual and can offset impacts to the natural and beneficial functions of floodplains when they are developed.

The Task Force had considerable discussion regarding ‘Best Management Practices’ (BMP’s) as they relate to development in the floodplain. It was acknowledged that **preservation of stream buffers** is a BMP, which is **included as a separate policy** recommendation in Policy Item Five. Stream buffers are a BMP because they provide water quality and stream stability benefits, as well as assist in reducing the velocity of flood waters, and can be designated as a particular width and composition. The Task Force discussed the **difficulty of quantifying and prioritizing other BMP’s** in a way that could be

used for a required standard for floodplain management. Thus, the decision was to recommend a **policy which encourages** the implementation of BMP’s in floodplain areas. Individual members felt that BMP’s could be more easily integrated into residential areas than into commercial or industrial developments.

There are a number of BMP’s identified in the City of Lincoln Drainage Criteria Manual. The Task Force discussed the importance of continuing to update this reference as BMP’s evolve and improve.

(See Best Management Development Practices Fact Sheet in Appendix I for additional information as well as Supporting Information in Appendix K).

10. Salt Creek Flood Storage Areas

Take Action Regarding Salt Creek Floodplain Through Lincoln

Not Applicable in New Growth Areas.

11. Building Construction Standards

Encourage Higher Building Construction Standards

Buildings in New Growth Areas should continue to be protected to an elevation 1 foot above the 100-year flood elevation in accordance with the minimum requirements of the State of Nebraska. Should a No Net Rise/Compensatory Storage standard *not* be adopted in New Growth Areas, buildings should be protected to an elevation 1.5 feet above the 100-year flood elevation.

'Best Construction Practices' relating to site development and construction should be strongly encouraged. These include reducing impacts to flood storage by limiting fill to building pads in lieu of filling an entire site, floodproofing non-residential structures, and attention to the alignment of buildings relative to the flow of flood water. Development should be encouraged to demonstrate a sequencing approach that seeks first to avoid, then to minimize, then mitigate impacts to the floodplain.

The Task Force discussed **whether a higher level of floodplain protection should be required for structures in the floodplain.** The initial discussion was focused on the "freeboard," or elevation above the 100-year flood elevation to which buildings should be protected to serve as a buffer and to account for variances from predicted flood heights during flood events.

It was concluded that the proposed No Net Rise/Compensatory Storage standard (together with existing standards regarding stormwater runoff), should prevent significant increases in flood heights, and thus **the 1' minimum freeboard required by the State of Nebraska would be sufficient if the No Net Rise/Compensatory Storage standard is adopted.** However, the Task Force indicated that if such a standard was not adopted, buildings should be protected to an elevation 1.5 feet above the 100-year flood elevation. Furthermore, Task Force members also felt it was important to **encourage 'best construction practices'** that would minimum adverse impacts to the floodplain.

12. Substantial Improvement Threshold

Protect Lateral Additions to Non-Residential Structures

Where there are existing residential, commercial, or industrial structures within the floodplain, the substantial improvement threshold should continue to be implemented the same way that it is today (which reflects the minimum federal requirements). That is, when an improvement is made to a structure that is equal to or greater than 50% of its value, the entire structure must be brought into compliance with the floodplain regulations. Each separate improvement is considered individually relative to the 50% threshold.

In lieu of a new policy to cumulatively track substantial improvements, the City and County should implement a standard requiring *all* lateral additions to non-residential structures to be floodproofed or otherwise protected to 1' above the base flood elevation. (Should a No Net Rise/Compensatory Storage standard *not* be adopted in New Growth Areas, lateral additions should be protected to an elevation 1.5 feet above the 100-year flood elevation). Residential structures should be exempt from this requirement. (All structures will still have to meet the current 50% improvement/damage threshold to remain in compliance with minimum NFIP requirements).

To be consistent, the No Net Rise/Compensatory Storage standard should also be met when a substantial improvement ($\geq 50\%$ of the value) is made to a structure, or when a lateral addition is made to a non-residential structure.

The Task Force had considerable discussion regarding the ‘**substantial improvement threshold.**’ When an improvement is made to a structure in the floodplain that is equal to or greater than 50% of its value, *the entire structure must be brought into compliance* with the floodplain regulations. Today, each separate improvement is considered individually relative to the 50% threshold. Thus, improvements up to a value of 49% can repeatedly be made to a structure without bringing it into compliance with floodplain regulations.

The Task Force **considered whether to adopt a ‘cumulative’ standard** that would take into account multiple improvements made over a period of time. However, there was concern regarding the impact that a cumulative substantial improvement policy would have upon existing neighborhoods in the floodplain, and the ability of home or business owners to make investments in existing buildings in the floodplain. Individual members also expressed a concern that inaccurate data is being used to make floodplain determinations due to the need for revised floodplain studies.

In lieu of a new policy to cumulatively track substantial improvements, the Task Force recommended that the City and County implement a standard requiring ***all lateral additions to non-residential structures to be floodproofed or otherwise protected*** to 1' above the 100-year flood elevation. It was discussed that the option to floodproof rather than to elevate lateral additions to non-residential structures would provide flexibility and make the standard less burdensome to meet.

Individual members expressed concern about the No Net Rise/Compensatory Storage standard being applied when substantial improvements or lateral additions to buildings are made.

13. Cluster Development

Provide Incentives for Cluster Development

Additional incentives should be adopted for clustering development outside the floodplain by broadening the current language in the zoning ordinance regarding the protection of natural/environmentally sensitive areas that is currently included in the AG & AGR districts. Consideration should be given to appropriate density bonuses and more specific language regarding clustering outside of floodplain areas. Permanent conservation easements should be required as a method of protection to receive the bonus. Land areas left open by clustering development outside the floodplain should be utilized for open space, parks, trails, or natural areas as compatible with the site and the particular floodplain area.

The Task Force discussed and rejected the potential for mandatory cluster development requirements where a portion of a development was located in a floodplain area. Instead, the group expressed the importance of **providing incentives for clustering development outside the floodplain.**

The CDM Alternative Floodplain Management Strategies study (see Cluster-Open Space Development Fact Sheet, Appendix I) examined this strategy, and additional information was also provided to the Task Force relating to an evaluation of open space floodplain areas completed within the City of Lincoln. The latter evaluation looked at the effects of proximity to open space floodplain areas on property values in four different subdivisions in Lincoln. The **average sale price of lots adjacent to open floodplain areas**, accounting for differences in size, was approximately **20-35% higher** than those in the same subdivision not adjacent to open space floodplain areas. There was some discussion amongst Task Force members about whether a portion of that cost difference could be attributed to the **grades on lots abutting floodplain open space**. Individual members pointed out that the grade on lots adjacent to floodplain areas would be conducive to walk-out basements, which would bring a higher price for the lot. Some members also pointed out that cluster type development is not always feasible from the perspective of market demands.

14. Use Best Available Floodplain Study Information

Use Floodplain Information From Watershed Plans

100-year floodplain boundary and flood elevation information (existing conditions) developed for watershed master plans should be utilized as the ‘best available information’ for the purposes of administering the Floodplain Ordinance relative to requirements for proposed subdivisions and building permits. Until accurate information can be developed through the watershed master planning process, development and planning efforts should recognize the variable reliability of the FEMA floodplain maps and discourage building to the edge of the FEMA floodplain boundaries.

The acquisition and use of ‘**best available floodplain information**’ was an important topic for the Floodplain Task Force. Task Force members described this information as a ‘moving target’ and expressed the need to **anticipate future conditions** and to limit mistakes that would have an impact upon future generations. The Task Force stopped short of recommending regulation based upon a ‘future conditions’ floodplain, but did recommend that consideration be given to this approach in the future following further evaluation.

Individual members expressed concerns regarding the potential for an uneven playing field and uncertainty across the market if ‘best available information’ is developed through **watershed plans basin by basin**. However, other members felt that a lack of accurate mapping would put the community further behind. Other comments included the use of ‘best planning practices’ and the communication of floodplain information to encourage development to stay back from the floodplain boundary in case it changes in the future. *(For additional information, see Watershed Master Planning Fact Sheet included in Appendix I and Supporting Information regarding the 100-year storm limits in Appendix K).*

Apply ‘Stormwater’ Standards When Master Plan Information Unavailable

The stormwater standards should continue to apply to floodprone areas, or “100-year storm limits” which are required to be shown with new subdivision proposals along smaller tributaries. Floodplain standards should not be applied to these areas unless they are shown on the FEMA floodplain maps or have been identified through a watershed master plan.

Consider “Future Conditions” Floodplain Mapping

Consideration should be given to regulating based upon a “future conditions” floodplain when the information is available through watershed master planning. However, this topic needs further evaluation and discussion. The benefits of this approach need to be assessed relative to the benefits already provided by: 1) the protection of flood storage and conveyance following the adoption of new standards for floodplain areas, 2) the detention/retention standards already in place to address stormwater runoff throughout the basin, 3) watershed master planning and implementation addressing the timing of stormwater flow throughout the basin. The implementation of these three elements may or may not prevent significant increases in flood boundaries in the future.

15. Real Estate Transactions

Improve Floodplain Disclosure in Real Estate Transactions

Lincoln and Lancaster County floodplain policies should reinforce accountability and disclosure laws regarding real estate transactions with regard to notifying prospective buyers of properties in the 100-year floodplain of the flood hazard and the requirement for flood insurance, and should encourage the provision of information regarding the 100-year flood elevation. The City and County should enhance public education efforts regarding the floodplain and should consider revisions to the Land Subdivision Ordinance and Lincoln Housing Code to require the disclosure of floodplain information to the buyer prior to the sale of properties in the floodplain.

Individual Task Force members expressed an interest in this policy going a step further to recommend that real estate agents be required to disclose specific information about properties in the floodplain early in the sale process, including the location within the floodplain, the 100-year flood elevation, and an overview of the responsibilities for properties in the floodplain. Examples were provided of circumstances when floodplain **property buyers were not aware that the property was in the floodplain**, or were not aware of the implications of this fact. However, the Task Force was informed that **real estate agents are regulated by state law**, and local government cannot require a standard for real estate agents that exceeds state statutes. The Task Force discussed the **responsibility of the buyer to be informed versus the responsibility of the seller to inform** him or her, as well as the responsibility of local government to help educate potential buyers. The majority was satisfied with the language included in this policy recommendation.

16. Assessments for Floodplain Property

Improve Methods for Assessing Floodplain Properties

The County Assessor should re-examine the methodology for assessing and taxing land held in conservation easements to reflect through assessments the change in value of property held in such easements. In addition, if a No Net Rise/Compensatory Storage standard is adopted, valuations for floodplain properties as determined by the County Assessor should reflect the change in value.

Individual Task Force members expressed concern that **flood prone properties are not fairly assessed**. Discussion included recognition that only about 10% of properties in the floodplain have flood insurance, and that relief provided by a more fair assessment might be dedicated to additional flood insurance coverage. Other information provided to the Task Force suggested that a previous study on Dead Man's Run had shown that **homes within the floodplain were appraised at a value 10% less** than those in the same neighborhood outside of the floodplain. In addition, there is a provision regarding property tax under the Nebraska state **Conservation Easement Act**. Individual members also thought that, if assessed appropriately, the value of floodplain properties could decrease if a No Net Rise/Compensatory Storage standard were adopted, and there were questions regarding how this could **impact the City or County** relative to property taxes.

Floodplain Recommendations for Existing Urban Area

For the purposes of these recommendations, the 'Existing Urban Area' is defined as those areas inside the City limits at the time a new standard is adopted as well as those areas outside the City limits which have a zoning designation other than AG - Agricultural or AGR - Agricultural Residential at the time a new standard is adopted. (See Floodplain Policy Application Areas map in Appendix L).

1. No Adverse Impact

Adopt No Adverse Impact Policy

In the Existing Urban Area, the City of Lincoln and Lancaster County should have a policy of No Adverse Impact, with a goal of ensuring that the action of one property owner does not adversely impact the flooding risk for other properties, as measured by increased flood stages, flood velocity, flows or the increased potential for erosion and sedimentation.

No Adverse Impact is a managing principal and policy goal **developed by the Association of State Floodplain Managers (ASFPM)** in support of long-term, sustainable approaches to reducing the nation's flood losses. A "No Adverse Impact Floodplain" is defined as one where the action of one property owner does not adversely impact the flooding risk for other properties, as measured by increased flood stages, flood velocity, flows or the increased potential for erosion and sedimentation. The ASFPM recommends that the No Adverse Impact policy be **implemented nationwide at a local level** through a range of approaches based

upon what is most effective for a particular community.

While the majority was in support of this policy for the Existing Urban Area, the recommendation was not unanimous. There was a **greater level of concern expressed here than for the New Growth Areas** that No Adverse Impact was not a practical goal. Individual members stated that stringent requirements in New Growth Areas **should be balanced with flexibility** in the Existing Urban Area. The discussion included concerns about the cost of implementation and the risk of creating blight.

2. Floodplain Mapping

Improve Accuracy of Floodplain Maps

The City and County should continue to develop and improve a comprehensive, watershed approach to floodplain mapping which recognizes the community interest and responsibility for the prevention of future flood damages. Accurate floodplain mapping should be a priority to which specific resources are dedicated, utilizing the latest technology and data available, and should be furthered through partnerships with other agencies.

The Task Force discussed the disadvantages of the **variable level of accuracy in mapping** and flood elevation information within the FEMA floodplain maps and flood insurance studies for the City and County. There was considerable discussion among Floodplain Task Force members regarding the **need to continue updating this information** in order to have dependable information on which to base

decisions and policies. While it was acknowledged that 100-year floodplain boundary and flood elevation information is being developed for Lincoln and its future growth areas as watershed master plans are completed basin by basin (see Policy Item 14, 'Best Available Study Information'), there was concern about the period of time that it would take to develop this information using an incremental approach. The Task Force acknowledged that the floodplain map update process will be facilitated by the City having entered into the **Cooperating Technical Partners program** for floodplain mapping with FEMA. However, the group expressed that mapping should be a priority to which specific resources are dedicated. Individual members felt that the role and responsibility of the Lower Platte South Natural Resources District and the Corps of Engineers should also be identified in the recommendation.

3. No Net Rise/Compensatory Storage Standard

Adopt New Floodplain Standard

A No Net Rise and Compensatory Storage standard should be adopted. This means that development within the 100-year floodplain in the Existing Urban Area should be required to demonstrate through an engineering study that it will cause no increase in the water surface elevation of the 100-year flood greater than five hundredths of a foot (0.05'). In addition, compensatory storage should be required at a ratio of 1 to 1 for volume of flood storage lost to fill or structures in the 100-year floodplain. Compensatory storage should be provided with the objective of being hydrologically similar to lost flood storage volume, but a hydrologic study should not be required to demonstrate that the storage is hydrologically equivalent. Administrative relief from this standard should be considered for properties under one acre in size.

The No Net Rise/Compensatory Storage Standard recommended by the Task Force evolved out of discussion surrounding **two fundamental functions of the floodplain:**

- 1) '**No Net Rise,**' which relates to the conveyance properties of the floodplain, or "how the water flows"; and
- 2) '**Compensatory Storage,**' which relates to the volume, or "how much total water there is".

A **No Net Rise standard** by itself would preserve conveyance, but would not regulate 'non-conveyance' areas, backwater areas or the attenuating (flood reducing) characteristics of the floodplain. Also, technical information brought to the Task Force indicated that a community could preserve significant functions of the floodplain by adopting a 'No Net Rise' standard, but the No Net Rise standard by itself would not address increases in velocity or erosion.

Alternatively, if only a **Compensatory Storage standard** were adopted, hydraulic conveyance would not be preserved, and there could be a rise in flood heights. The purpose for coupling

'Compensatory Storage' with 'No Net Rise' was to identify a standard, which would address conveyance of floodwater and would also insure that the amount of water reaching the water course would remain the same. The two approaches were considered to complement one another and to meet the goal of No Adverse Impact outlined in the first policy recommendation.

Hydraulic and Hydrologic Modeling

There was considerable discussion regarding what modeling should be required to demonstrate that the No Net Rise/Compensatory Storage standard was being met. Consideration was given to the fact that the **analysis to meet the 'No Net Rise'** criteria is straightforward and utilized regularly today in the Floodway. However, it was acknowledged that determining the **hydrologic equivalent for**

Compensatory Storage through modeling would be difficult and was not anticipated to be a practical requirement. Thus, it was agreed that compensatory storage should be provided with the objective of being hydrologically equivalent, without requiring a hydrologic model to demonstrate this fact.

Allowable Rise

Information was presented to the Task Force which indicated that allowing a very small rise could make a significant difference in the **flexibility of the No Net Rise** portion of the standard and would be easier to administer. It was pointed out that there are many actions that can be taken within the floodplain which would be unable to show No Rise, but would have an ‘infinitesimal’ impact. Thus, the Task Force included the provision to **allow for five hundredths of a foot (0.05') rise** to account for these circumstances.

‘Mitigation’ Ratio for Lost Floodplain Storage

Early draft recommendations discussed by the Task Force identified that the ‘mitigation’ ratio for lost floodplain storage should be greater than 1 to 1. The discussion reflected a desire to base the standard for Lincoln and Lancaster County upon what was being done nationwide in this regard, however, the research showed that there is a **range of mitigation ratios utilized nationwide for flood storage**, with no overall consistency in the ratios. While there are examples of other communities where mitigation is required at greater than 1 to 1, these examples often were in communities where a Compensatory Storage standard was not coupled with a No Net Rise standard. Thus, it was determined that a **1 to 1 mitigation ratio would be sufficient** for Compensatory Storage as long as this was **coupled with a No Net Rise** standard.

Example Floodplain Developments

The Task Force was interested in examples of developments within the floodplain that met a similar standard. It was discussed that **Horizon Business Center/Southwest High School** site did meet a Compensatory Storage standard, and was likely close to meeting a No Net Rise standard as well, although this was not measured. It was also discussed that while **Haymarket Park** did not meet a No Net Rise/Compensatory Storage standard, it met the standards identified in the FEMA Flood Insurance Study to preserve Salt Creek flood storage outside of the levee system.

Additional Engineering Costs

Task Force members raised concerns about the additional engineering costs of meeting a No Net Rise/Compensatory Storage standard. To address this issue, engineering costs were researched and are provided (based upon discussions with various engineering firms) within this report in Appendix K. In general, there was found to be an ‘**economy of scale**’, meaning that there was typically a base cost which did not vary with the size of the site, in addition to a cost per acre. Thus, the larger the site, the less of an increase would be expected in engineering costs to meet a No Net Rise/Compensatory Storage standard. In evaluating engineering as a percentage of total development costs, the **average estimated range in additional engineering costs to meet this standard would be 1.4% to 0.3% of the development costs for sites in the range of 10 to 100 acres, respectively.**

Other Economic Impacts

The **projected costs of both adopting a higher standard and continuing with the present-day standard** are articulated by the Corps of Engineers (COE) and CDM studies (see Executive Summaries in Appendix H). Both studies utilized example floodplain reaches that are projected to be indicative of the majority of floodplains in Lincoln and Lancaster County with regard to fill in the flood fringe.

The COE study summarized in Appendix H evaluated three scenarios on the Dead Man’s Run and Beal Slough floodplains, from moderate to more extreme losses of flood storage. The study concluded that,

within the study reaches, **increased flood damages** resulting from loss of flood storage had the potential to range from **\$2.6 to \$10.9 million on Dead Man's Run**, and from **\$0.1 to \$1.9 million on Beal Slough**. Economic analysis was not performed for **100% loss of flood storage**, which showed a substantially greater rise in flood heights (2.8 foot rise and 4.3 foot rise on Dead Man's Run and Beal Slough, respectively), than the alternative scenarios where the economic analysis was performed.

The CDM study summarized in Appendix H projected the reduction in flood damage possible to public infrastructure if higher standards were adopted, and the economic costs to private development of meeting a higher standard. Half-foot Rise and No Net Rise/Compensatory Storage standards were evaluated. Under the No Net Rise/Compensatory Storage standard, as compared to the current One-foot Rise standard, flood damage costs to public buildings, streets and stream crossings were projected to be reduced 100%, 27% and 44%, respectively. **Reduction in flood damage costs** based on a No-Rise/Compensatory Storage scenario were projected at **100%, 27% and 44%** for public buildings, streets, and stream crossing structures, respectively. **Increased costs to private development** to meet a No Rise/Compensatory Storage standard were projected at **14%, 21% and 10% for traditional residential, commercial and industrial development configurations, respectively**. **For cluster developments** allowed by the ordinance today through Community Unit Plans and Planned Unit Developments, the No Net Rise/Compensatory Storage standard was projected to increase costs to private development by 6% or less.

Application to the Existing Urban Area

While this recommendation reflects the majority opinion expressed by the Task Force, several members voiced discomfort with applying this standard to the Existing Urban Area. In order to address some of these concerns, the Task Force recommended that within the Existing Urban Area, **administrative relief should be considered for properties under one acre in size**. There was general agreement that this would relieve some of the impact of the standard, however individual members continued to express **concerns that existing development and investments make the Existing Urban Area more constrained** in the ability to meet this standard independent of the size of the particular property. Considerations were similar to those given to the application of the No Adverse Impact policy to the Existing Urban Area, relating to the cost of implementation and the risk of creating blight.

(See Policy Item 12 for discussion of this standard as it relates to substantial improvements and refer to Appendix K for additional information. Also see the No Net Rise and Compensatory Storage Fact Sheet included in Appendix I).

4. Stream Crossing Structures

Provide Flexibility for Stream Crossings

The City and County should adopt a practical standard for stream crossing structures, which takes into account that there are circumstances in which it is structurally or financially infeasible to construct stream crossings without causing any rise in flood heights in the flood fringe.

Construction of stream crossing structures should be required to demonstrate a sequencing approach that seeks first to avoid, then to minimize, then mitigate for any impacts to flood storage or flood heights. The standards should be flexible and consider alternatives such as an allowable rise between 0'-1' in the flood fringe, allowable loss of flood storage, and/or purchase of property or easements where flood heights will increase and an amendment is made to the FEMA flood insurance rate map.

The Floodplain Task Force was presented with information indicating that there are circumstances in which it is **structurally or financially infeasible to construct stream crossings without causing any rise** in flood heights in the flood fringe.

Replacing Existing Structures

Where existing stream crossing structures exist and the grade of the road is not being raised, a No Net Rise/Compensatory Storage standard **would not be anticipated to have a significant impact on bridge and culvert replacements**, since most replacements meet a higher standard than the older structures being replaced.

New Stream Crossing Structures

Based upon anecdotal evidence from conversations with floodplain managers from other communities and other research supplied to the Task Force, it appears that adopting a No Net Rise/Compensatory Storage floodplain standard with no flexibility would be likely to **increase the cost of constructing new stream crossing structures by approximately 25%**. However, it was discussed that the ability to use compensatory storage, property rights acquisition, and increases in downstream conveyance capacity would make it more flexible and could offset many of these anticipated increases in cost.

While the Task Force agreed that flexibility with regard to stream crossing structures was important, it was emphasized that the flexibility outlined in this policy **should be provided for private as well as public stream crossing structures**. Individual Task Force members suggested the City and County ought to meet a higher standard than the private sector, and that special consideration should be given to construction within the Existing Urban Area and the potential risk for causing blight. Task Force members also expressed that any **impacts to flood storage or conveyance should have careful consideration**. The 'sequencing' approach identified in the recommendation is modeled upon the approach required by Section 404 of the Clean Water Act for impacts to wetlands, and was included in order to discourage an approach that would have adverse impacts. (*See Appendix K for additional information*).

5. Stream Buffers

Apply Stream Buffers to Mapped Floodplains and Smaller Streams

The Minimum Flood Corridor stream buffer or similar standard should be applied in the City and County within the FEMA-mapped floodplains and along smaller, unmapped streams that have a defined bed and bank. Encroachments should be permitted per the existing standards for Minimum Flood Corridors for operation, maintenance and repair, channel stabilization, stormwater storage facilities, utility crossings, public parks, pedestrian/bike trails and other recreational uses and public purposes. However, proposed encroachments should be required to demonstrate a sequencing approach that seeks first to avoid, then to minimize, then mitigate for any encroachments. Mitigation for loss of vegetation and flood storage should occur at a 1.5 to 1 ratio. Where land uses prior to development have an impact on the buffer width, the area should be replanted with vegetation compatible with the corridor and water quality benefits.

The Task Force discussed **City of Lincoln standards, which currently require a “minimum flood corridor”** buffer to be preserved along only those drainageways **outside the mapped floodplain** that drain greater than 150 acres. Thus, smaller tributaries draining less than 150 acres and larger streams that have a mapped floodplain require no buffer protection. The width of the minimum flood corridor is equal to the stream channel bottom width, plus 60 feet, plus 6 times the channel depth. It was determined that the Minimum Flood Corridor stream buffer or similar standard should be applied within the FEMA-mapped floodplains and along smaller, unmapped streams that have a defined bed and bank.

Mitigation

There was considerable discussion regarding **mitigation** that should be required **for impacts to buffers** along stream corridors. The majority of Task Force members felt that replacement of lost plant materials should occur at a ratio greater than 1 to 1 (1:1), due to the **plant mass lost when mature vegetation is replaced with new plantings**. Thus, a mitigation ratio of 1.5:1 was recommended. Information was provided to the Task Force showing a range of mitigation ratios nationwide for impacts to wetlands and stream buffers. The ratios generally ranged from 1:1 to 3:1, with greater ratios required for impacts to unique environmental areas. There was concern about the lack of a scientific basis for choosing any particular mitigation ratio, but the majority of Task Force members felt that 1.5:1 was an acceptable mitigation ratio given the available information. Individual members expressed some discomfort with the numbers but agreed in concept.

Buffer Width

Individual Task Force members also expressed concern about the **width of buffers that would be required along degraded, mainstem stream channels** like Salt Creek and Stevens Creek if the “minimum flood corridor” standard is applied. Examples were provided to the Task Force for a Stevens Creek tributary and the mainstem channel downstream in the basin. The buffer widths at each location were calculated and shown on a map for comparison with the existing FEMA-mapped 100 year floodplain and floodway. Both examples on the mainstem of Stevens Creek resulted in buffer widths much smaller than the existing 100 year floodway, and the floodway and buffer for the smaller Stevens Creek Tributary were nearly equal in width. The maps adequately addressed the concern of the Task Force and members agreed that the “minimum flood corridor” standard should be applied to areas within the FEMA-mapped floodplain. Discussion also included **applying the standards in a reasonable way**

that would, for example, not require a buffer area on a plateau outside of the floodplain. (See *Greenfield Approach Fact Sheet in Appendix I for additional information*).

6. Surplus/Vacated Floodplain Property Policy

Preserve Flood Storage on Surplus Property

The City and County should adopt a policy where, under normal circumstances, City or County property in the floodplain is viewed as serving a public purpose and not be proposed for surplus. If there are unusual circumstances that cause the consideration of declaring surplus property in the floodplain, the City or County should retain a permanent conservation easement that protects the flood storage capacity, or any flood storage impacts should be mitigated at a 1 to 1 ratio. Declaring surplus property should not be considered *under any circumstances* where floodplains contain environmental resources such as riparian areas or stream corridors that provide habitat and water infiltration benefits or serve as connectors to natural areas.

When other publicly-owned property in the floodplain is proposed for surplus, the City should consider purchasing the property fee simple, or alternatively, purchasing a permanent conservation easement where appropriate to preserve flood storage and other environmental resources.

When street or alley ROW in the floodplain is proposed for vacation, the City or County should retain a permanent conservation easement that protects the flood storage capacity. Consideration should be given to allowing for a conservation easement to be deeded over an alternate floodplain area having equal or greater flood storage volume.

Discussion on this policy item included consideration of the **amount of publicly owned property within the floodplain**. This information was provided in the form of a map to the Task Force. (See City of Lincoln/Lancaster County Publicly Owned Land in the Floodplain map, Appendix L).

Other Task Force dialogue on this policy item included:

- 1) Consideration of economic issues and the long-term costs and benefits;
- 2) The need to take into account the potential for multiple benefits, including opportunities to meet some of the recreational goals of the City and County.
- 3) Whether mitigation for flood storage impacts to surplus properties should be provided at greater than a 1:1 ratio to offset the loss of publicly owned floodplain areas.
- 4) Opportunities to partner with other agencies.
- 5) Concern regarding the flexibility for projects like Haymarket Park and the City Mission. (See *Maintain Storage on Surplus/Vacated Property Fact Sheet in Appendix I*).

7. Floodplain Buyout Program

Develop a Floodplain Buyout Program

The City and County should develop and implement a continuing floodplain buyout program, which is sensitive to the need to minimize impacts on neighborhoods and historic districts. Special emphasis should be placed upon sites that provide multiple benefits. These include opportunities to develop contiguous open space, preserve environmental resources, and to mitigate flood damage by providing additional detention for flood water during major storm events. An evaluation should be performed to identify potential funding sources, and where possible, the City and County should form partnerships and pool resources with other public agencies. Eminent domain should be used to acquire property only as a last resort.

While there was clear support on the Task Force for the creation of a floodplain buyout program, there was considerable discussion regarding **how such a program would be funded**. The Task Force recommendation was for a range of alternatives to be investigated through an evaluation of funding resources. Individual members felt that the policy recommendation should include specific reference to potential funding sources.

8. Floodplain Development Fee

Do Not Charge Floodplain Development Fee

At this time, it is not appropriate for the City or County to charge a floodplain development fee. Consideration of a floodplain development fee would require further evaluation regarding alternative fee structures and criteria for applying the fees in a logical and equitable manner. If a fee is established at some time in the future, consideration should be given to dedicating the revenue to advance the flood mapping program and to assist in the funding of floodplain buyouts.

Information regarding precedents for floodplain development fees was not available for evaluation by the Task Force. Research on this topic revealed examples of fees charged in other communities that related more to environmental impacts than to loss of flood storage or conveyance. There was concern on the part of Task Force members about **how a fee would be calculated and how the funds would be used**. Individual members also felt that a floodplain development fee would be a double burden when considering the increased engineering costs necessary for development within the floodplain to meet a No Net Rise/Compensatory Storage standard.

9. Best Management Practices

Encourage Best Management Practices

'Best Management Practices' such as grassed swales, water quality wetlands, retention cells, etc. should be strongly *encouraged* in floodplain areas. Best Management Practices are identified in the City of Lincoln Drainage Criteria Manual and can offset impacts to the natural and beneficial functions of floodplains when they are developed.

The Task Force had considerable discussion regarding 'Best Management Practices' (BMP's) as they relate to development in the floodplain. It was acknowledged that **preservation of stream buffers** is a BMP, which is **included as a separate policy** recommendation in Policy Item Five. Stream buffers are a BMP because they provide water quality and stream stability benefits, as well as assist in reducing the velocity of flood waters, and can be designated as a particular width and composition. The Task Force discussed the **difficulty of quantifying and prioritizing other BMP's** in a way that could be used for a required standard for floodplain

management. Thus, the decision was to recommend a **policy which encourages** the implementation of BMP's in floodplain areas. Individual members felt that BMP's could be more easily integrated into residential areas than into commercial or industrial developments.

There are a number of BMP's identified in the City of Lincoln Drainage Criteria Manual. The Task Force discussed the importance of continuing to update this reference as BMP's evolve and improve.

(See Best Management Development Practices Fact Sheet in Appendix I for additional information as well as Supporting Information in Appendix K).

10. Salt Creek Flood Storage Areas

Take Action Regarding Salt Creek Floodplain Through Lincoln

The City and County should pursue the following actions regarding the Salt Creek floodplain in Lincoln and in the upstream basins:

- a. A new, comprehensive floodplain study and FEMA floodplain mapping effort;
- b. Investigation and preservation of detention in upstream basins and implementation of previously identified detention cells on Oak Creek and Middle Creek;
- c. Acquisition of fee title or conservation easements to protect existing overbank flood storage capacity along Salt Creek through Lincoln; and
- d. Design and construction of new and replacement bridges to reduce backwater and other flooding impacts.

Salt Creek from Pioneers Boulevard to “O” Street was **originally selected as one of the three stream reaches** to be modeled in the COE floodplain study. However, Salt Creek turned out to be an unfortunate choice for this study. As described in the Salt Creek Floodplain Study Fact Sheet in Appendix I, due to the **complexity of the Salt Creek channel and levee system**, incompatibility of data and modeling techniques, and the limited scope of the study, the alternative scenarios were not able to be modeled and evaluated in a meaningful way. However, the Task Force was provided with information indicating that the No Net Rise/Compensatory Storage and other **alternative floodplain management standards** evaluated for Dead Mans Run’s and Beal Slough **could be applied in the Salt Creek floodplain and the results would be a greater level of protection** than the current regulations.

The Floodplain Task Force acknowledged that to accurately and completely address the impacts of alternative floodplain management concepts specifically on Salt Creek would require an **extensive study of the entire basin**, with new mapping, new hydrology, and new hydraulics, and this was included in their recommendations.

Other information important to the Task Force was a previously completed COE study, which identified the potential **benefits of upstream storage basins**. Construction of these basins was evaluated and did not meet the benefit/cost requirements of greater than 1:1 for a federal cost-share. Nonetheless, the COE did identify downstream benefits in flood reduction that would be realized by these projects.

11. Building Construction Standards

Encourage Higher Building Construction Standards

Buildings in the Existing Urban Area should continue to be protected to an elevation 1 foot above the 100-year flood elevation in accordance with the minimum requirements of the State of Nebraska. Should a No Net Rise/Compensatory Storage standard *not* be adopted in the Existing Urban Area, buildings should be protected to an elevation 1.5 feet above the 100-year flood elevation.

‘Best Construction Practices’ relating to site development and construction should be strongly encouraged. These include reducing impacts to flood storage by limiting fill to building pads in lieu of filling an entire site, floodproofing non-residential structures, and attention to the alignment of buildings relative to the flow of flood water. Development should be encouraged to demonstrate a sequencing approach that seeks first to avoid, then to minimize, then mitigate impacts to the floodplain.

The Task Force discussed **whether a higher level of floodplain protection should be required for structures in the floodplain**. The initial discussion was focused on the “freeboard,” or elevation above the 100-year flood elevation to which buildings should be protected to serve as a buffer and to account for variances from predicted flood heights during flood events.

It was concluded that the proposed No Net Rise/Compensatory Storage standard (together with existing standards regarding stormwater runoff), should prevent significant increases in flood heights, and thus **the 1' minimum freeboard** required by the State of Nebraska would be **sufficient if the No Net Rise/Compensatory Storage standard is adopted**. However, the Task Force indicated that if such a standard was not adopted, buildings should be protected to an elevation 1.5 feet above the 100-year flood elevation. Furthermore, Task Force members also felt it was important to **encourage ‘best construction practices’** that would minimum adverse impacts to the floodplain.

12. Substantial Improvement Threshold

Protect Lateral Additions to Non-Residential Structures

Where there are existing residential, commercial, or industrial structures within the floodplain, the substantial improvement threshold should continue to be implemented the same way that it is today (which reflects the minimum federal requirements). That is, when an improvement is made to a structure that is equal to or greater than 50% of its value, the entire structure must be brought into compliance with the floodplain regulations. Each separate improvement is considered individually relative to the 50% threshold.

In lieu of a new policy to cumulatively track substantial improvements, the City and County should implement a standard requiring *all* lateral additions to non-residential structures to be floodproofed or otherwise protected to 1' above the base flood elevation. (Should a No Net Rise/Compensatory Storage standard *not* be adopted in the Existing Urban Area, lateral additions should be protected to an elevation 1.5 feet above the 100-year flood elevation). Residential structures should be exempt from this requirement. (All structures will still have to meet the current 50% improvement/damage threshold to remain in compliance with minimum NFIP requirements).

To be consistent, the No Net Rise/Compensatory Storage standard should also be met when a substantial improvement ($\geq 50\%$ of the value) is made to a structure, or when a lateral addition is made to a non-residential structure. Administrative relief from this standard should be considered for properties under one acre in size.

The Task Force had considerable discussion regarding the '**substantial improvement threshold**'. When an improvement is made to a structure in the floodplain that is equal to or greater than 50% of its value, *the entire structure must be brought into compliance* with the floodplain regulations. Today, each separate improvement is considered individually relative to the 50% threshold. Thus, improvements up to a value of 49% can repeatedly be made to a structure without bringing it into compliance with floodplain regulations.

The Task Force **considered whether to adopt a 'cumulative' standard** that would take into account multiple improvements made over a period of time. However, there was concern regarding the impact that a cumulative substantial improvement policy would have upon existing neighborhoods in the floodplain, and the ability of home or business owners to make investments in existing buildings in the floodplain. Individual members also expressed a concern that inaccurate data is being used to make floodplain determinations due to the need for revised floodplain studies.

In lieu of a new policy to cumulatively track substantial improvements, the Task Force recommended that the City and County implement a standard requiring ***all lateral additions to non-residential structures to be floodproofed or otherwise protected*** to 1' above the 100-year flood elevation. It was discussed that the option to floodproof rather than to elevate lateral additions to non-residential structures would provide flexibility and make the standard less burdensome to meet.

Individual members expressed concern about the No Net Rise/Compensatory Storage standard being applied when substantial improvements or lateral additions to buildings are made.

13. Cluster Development

Provide Incentives for Cluster Development

Additional incentives should be adopted for clustering development outside the floodplain by broadening the current language in the zoning ordinance regarding the protection of natural/environmentally sensitive areas that is currently included in the AG & AGR districts. Consideration should be given to appropriate density bonuses and more specific language regarding clustering outside of floodplain areas. Permanent conservation easements should be required as a method of protection to receive the bonus. Land areas left open by clustering development outside the floodplain should be utilized for open space, parks, trails, or natural areas as compatible with the site and the particular floodplain area.

The Task Force discussed and rejected the potential for mandatory cluster development requirements where a portion of a development was located in a floodplain area. Instead, the group expressed the importance of **providing incentives for clustering development outside the floodplain.**

The CDM Alternative Floodplain Management Strategies study (see Cluster-Open Space Development Fact Sheet) examined this strategy, and additional information was also provided to the Task Force relating to an evaluation of open space floodplain areas completed within the City of Lincoln. The latter evaluation looked at the effects of proximity to open space floodplain areas on property values in four different subdivisions in Lincoln. **The average sale price of lots adjacent to open floodplain areas, accounting for differences in size, was approximately 20-35% higher** than those in the same subdivision not adjacent to open space floodplain areas. There was some discussion amongst Task Force members about whether a portion of that cost difference could be attributed to the **grades on lots abutting floodplain open space.** Individual members pointed out that the grade on lots adjacent to floodplain areas would be conducive to walk-out basements, which would bring a higher price for the lot. Some members also pointed out that cluster-type development is not always feasible from the perspective of market demands.

14. Use Best Available Floodplain Study Information

Use Floodplain Information From Watershed Plans

100- year floodplain boundary and flood elevation information (existing conditions) developed for watershed master plans should be utilized as the ‘best available information’ for the purposes of administering the Floodplain Ordinance relative to requirements for proposed subdivisions and building permits. Until accurate information can be developed through the watershed master planning process, development and planning efforts should recognize the variable reliability of the FEMA floodplain maps and discourage building to the edge of the FEMA floodplain boundaries.

The acquisition and use of ‘**best available floodplain information**’ was an important topic for the Floodplain Task Force. Task Force members described this information as a ‘moving target’, and expressed the need to **anticipate future conditions** and to limit mistakes that would have an impact upon future generations. The Task Force stopped short of recommending regulation based upon a ‘future conditions’ floodplain, but did recommend that consideration be given to this approach in the future following further evaluation.

Apply ‘Stormwater’ Standards When Master Plan Information Unavailable

The stormwater standards should continue to apply to floodprone areas, or “100-year storm limits” which are required to be shown with new subdivision proposals along smaller tributaries. Floodplain standards should not be applied to these areas unless they are shown on the FEMA floodplain maps or have been identified through a watershed master plan.

Individual members expressed concerns regarding the potential for an uneven playing field and uncertainty across the market if ‘best available information’ is developed through **watershed plans basin by basin**. However, other members felt that a lack of accurate mapping would put the community further behind. Other comments included the use of ‘best planning practices’ and the communication of floodplain information to encourage development to stay back from the floodplain boundary in case it changes in the future.

(For additional information, see Watershed Master Planning Fact Sheet in Appendix I, and Supporting Information regarding 100-year storm limits in Appendix K).

15. Real Estate Transactions

Consider “Future Conditions” Floodplain Mapping

Consideration should be given to regulating based upon a “future conditions” floodplain when the information is available through watershed master planning. However, this topic needs further evaluation and discussion. The benefits of this approach need to be assessed relative to the benefits already provided by: 1) the protection of flood storage and conveyance following the adoption of new standards for floodplain areas, 2) the detention/retention standards already in place to address stormwater runoff throughout the basin, 3) watershed master planning and implementation addressing the timing of stormwater flow throughout the basin. The implementation of these three elements may or may not prevent significant increases in flood boundaries in the future.

Improve Floodplain Disclosure in Real Estate Transactions

Lincoln and Lancaster County floodplain policies should reinforce accountability and disclosure laws regarding real estate transactions with regard to notifying prospective buyers of properties in the 100-year floodplain of the flood hazard and the requirement for flood insurance, and should encourage the provision of information regarding the 100-year flood elevation. The City and County should enhance public education efforts regarding the floodplain and should consider revisions to the Land Subdivision Ordinance and Lincoln Housing Code to require the disclosure of floodplain information to the buyer prior to the sale of properties in the floodplain.

Individual Task Force members expressed an interest in this policy going a step further to recommend that Real Estate agents be required to disclose specific information about properties in the floodplain early in the sale process, including the location within the floodplain, the 100-year flood elevation, and an overview of the responsibilities for properties in the floodplain. Examples were provided of circumstances when floodplain **property buyers were not aware that the property was in the floodplain**, or were not aware of the implications of this fact. However, the Task Force was informed that **real estate agents are regulated by state law**, and local government cannot require a standard for real estate agents that exceeds state statutes. The Task Force discussed the **responsibility of the buyer to be informed versus the responsibility of the seller to inform** him or her, as well as the responsibility of local government to help educate potential buyers. The majority of Task Force members were satisfied with the language included in this policy recommendation.

16. Assessments for Floodplain Property

Improve Methods for Assessing Floodplain Properties

The County Assessor should re-examine the methodology for assessing and taxing land held in conservation easements to reflect through assessments the change in value of property held in such easements. In addition, if a No Net Rise/Compensatory Storage standard is adopted, valuations for floodplain properties as determined by the County Assessor should reflect the change in value.

Individual Task Force members expressed concern that **flood prone properties are not fairly assessed**. Discussion included recognition that only about 10% of properties in the floodplain have flood insurance, and that relief provided by a more fair assessment might be dedicated to additional flood insurance coverage. Other information provided to the Task Force suggested that a previous study on Dead Man's Run had shown that **homes within the floodplain were appraised at a value 10% less** than those in the same neighborhood outside of the floodplain. In addition, there is a provision regarding property tax under the Nebraska state **Conservation Easement Act**. Individual members also thought that, if assessed appropriately, the value of

floodplain properties could decrease if a No Net Rise/Compensatory Storage standard were adopted, and there were questions regarding how this could **impact the City or County** relative to property taxes.

Chapter 3 Appendices



*April 2003
Mayor's Floodplain Task Force Recommendations*

A. Proposed Interim Standard and Formation of Floodplain Task Force

During the Winter of 2000-2001, the City of Lincoln began to assess the impacts of the **increasing number of floodplain development permits** being issued. A number of neighborhood and environmental groups had expressed concerns regarding the potential for greater flood heights resulting from increasing volumes of floodplain fill. Evaluation of the number of permits issued for commercial buildings and fill in the floodplain revealed that there was a **substantial increase from 1995 to 2000**. The most significant increase had occurred over the 2-year period from 1998 to 2000: the number of permits tripled during that time frame.

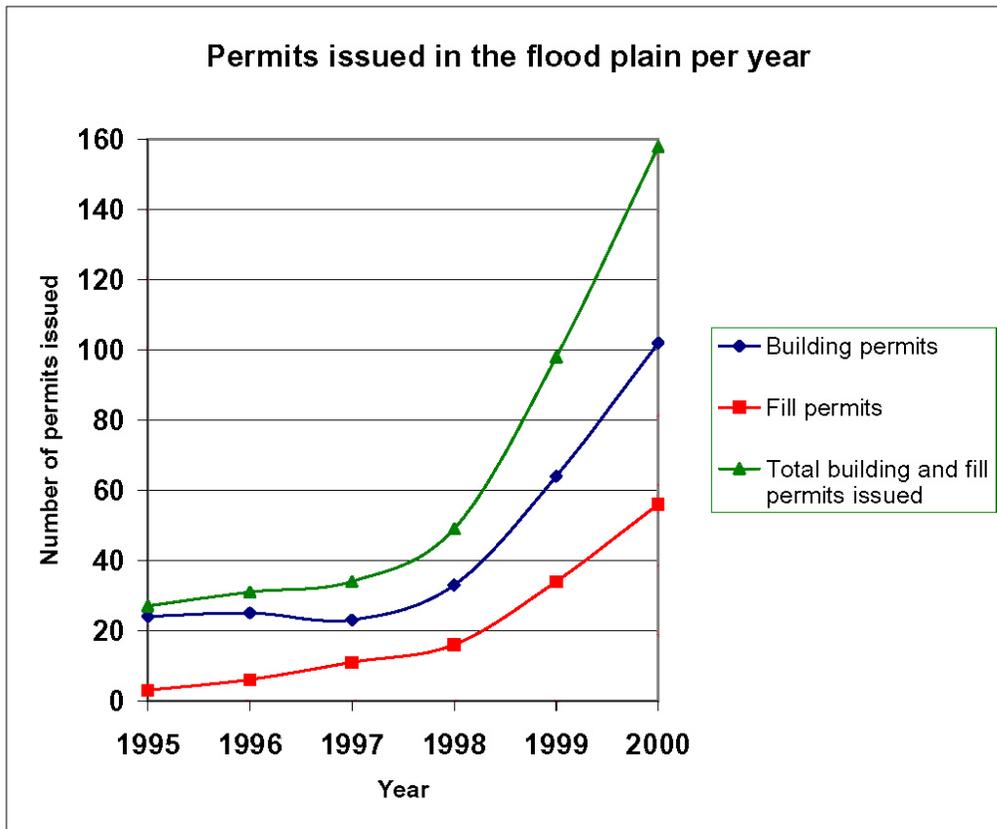
In response to these concerns, the Lower Platte South NRD, working in partnership with the City of Lincoln, entered into a contract with the **Corps of Engineers for a study to analyze the effects of filling in the floodplain** and to evaluate a range of alternatives for new floodplain regulations to address the issue. Based upon the increased rate of fill and building in the floodplain, there were concerns related to the potential impacts of continuing with the present standard until a study could be completed. To allow time for the completion of the study, public input, and the adoption of permanent standards, the City administration **proposed an 18-month Interim 'No Net Rise' standard**. The County Board requested that similar standards be brought forward for the County.

During the **winter and spring of 2001**, a public open house was held regarding the proposed Interim Standard, and the City and NRD met with a number of business, neighborhood, and environmental **interest groups**. During these meetings, **valid concerns were voiced** by a number of different groups that there was important information that would be unavailable until the floodplain studies were complete. As an alternative to the proposed Interim Standard, the **business community pledged to support a study** and to participate with other interest groups in the process of review and recommendations based upon the study results.

Mayor Wesely appointed a 16-member Floodplain Task Force representing a broad cross-section of interests throughout the community. The Task Force was charged with formulating recommendations regarding the development of permanent floodplain standards and held its first meeting in August of 2001.

B. FLOODPLAIN DEVELOPMENT PERMITS ISSUED 1995-2000

Year	Building Permits Issued in the flood plain	Fill permits issued in the flood plain	Total(Building and Fill) permits issued in the flood plain
1995	24	3	27
1996	25	6	31
1997	23	11	34
1998	33	16	49
1999	64	34	98
2000	102	56	158



C. Floodplain Task Force Membership and Staff

Members:

Bruce Bohrer, Lincoln Chamber of Commerce
Mark Brohman, NE Game & Parks Commission
Foster Collins, Mayor's Environmental Advisory Committee
Jim Cook, Homeowner
Bob Hampton, Hampton Development Services
Bernie Heier, Lancaster County Commissioner
John Janovy, Jr. Comprehensive Plan Committee
Candiss Kleen, Lincoln Plating Company
Ms. Kleen attended on behalf of Marc LeBaron
Marilyn McNabb, Mayor's Environmental Advisory Committee
Russell Miller, LP Services/Nebraska Recycling
Patte Newman, Lincoln-Lancaster County Planning Commission
Coleen Seng, Lincoln City Council
Roger Severin, Olsson Associates
Clay Smith, Speedway Motors
Art Thompson, Cooper Foundation
Kent Thompson, Thompson Realty Group

Staff:

Glenn Johnson, Lower Platte South NRD
Nicole Fleck-Tooze, Ben Higgins, Devin Biesecker, Sara Hartzell and Rock Krzycki, Public Works and Utilities Department
Mike Merwick Dale Stertz, Building & Safety Department
Rick Peo - City Law Department
Mike DeKalb, Lincoln-Lancaster County Planning Department
Doug Pillard, Lancaster County Engineering

Facilitation: Heartland Center for Leadership Development
Milan Wall, Vicki Luther, Reggi Carlson and Mary Emory

D. Task Force Attendance

Meeting Date	FLOODPLAIN TASK FORCE ATTENDANCE															
	Bruce Bohrer	Mark Brohman	Foster Collins	Jim Cook	Bob Hampton	Bernie Heier	John Janovy, Jr.	*Candiss Kleen	Marilyn McNabb	Russell Miller	Patte Newman	Coleen Seng	Roger Seventh	Clay Smith	Art Thompson	Kent Thompson
August 21, 2001	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
October 25, 2001	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
February 5, 2002	X	X	X	X	X			X	X	X	X	X	X	X	X	X
March 19, 2002	X	X	X	X	X	X			X	X	X	X	X	X	X	X
April 16, 2002	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
May 21, 2002	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
July 23, 2002	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
August 20, 2002	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
September 24, 2002	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
October 22, 2002	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
November 5, 2002	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
November 19, 2002	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
December 3, 2002	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
December 17, 2002	X	X	X	X	X			X	X	X	X	X	X	X	X	X
January 7, 2003	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
January 21, 2003	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
February 4, 2003	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
February 20, 2002	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
February 27, 2003	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
March 11, 2003	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
March 20, 2003	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
March 25, 2003	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
Total Meetings Attended	10	21	19	21	10	10	15	15	21	22	21	19	6	17	16	11

*Candiss Kleen attended for Marc LeBaron as the representative for Lincoln Plating

E. Summary of Information Received

2003

March 25, 2003

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.

Location: Lower Platte South Natural Resources District

Table of Contents Draft

Draft Floodplain Recommendations for Existing Urban Areas

Draft Floodplain Recommendations for New Growth Area

March 20, 2003

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.

Location: Wastewater Treatment Plant, 2400 Theresa Street

Map of Floodplain Development

Draft Floodplain Recommendations for Built Environment

March 11, 2003

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.

Location: Wastewater Treatment Plant, 2400 Theresa Street

Draft/Work-in-Progress Floodplain Recommendations for New Growth Areas

Floodplain Recommendation Appendices

Effects of Greenspace Proximity on Property Values in Lincoln, NE

Mitigation Summary Resources

The Community Rating System

February 27, 2003

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.

Location: Wastewater Treatment Plant, 2400 Theresa Street

Accountability and Disclosure Regarding Floodplain Properties

-Revised Seller Property Condition Disclosure Statement, Effective
January 1, 2003

-Environmental Conditions

-Title 299, Chapter 5

Draft/Work-in-Progress Floodplain Recommendations for New Growth Areas

Maps

Appendix A: No Net Rise/Compensatory Storage Standard

Mitigation Ratios

April 2003

Mayor's Floodplain Task Force Recommendations

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February 20, 2003

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.

Location: Wastewater Treatment Plant, 2400 Theresa Street

Draft/Work in Progress Floodplain Recommendations for New Growth Areas
Draft/Work in Progress Floodplain Recommendations for the Built Environment
Appendices A-D for draft recommendations (for reference - unmodified)

February 4, 2003

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.

Location: Wastewater Treatment Plant, 2400 Theresa Street

Information Appendices A-D for Floodplain Recommendations
Draft Floodplain Recommendations for New Growth Areas
Stream Buffers, Minimum Flood Corridor - Example

January 21, 2003

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.

Location: Wastewater Treatment Plant, 2400 Theresa Street

Meeting Notes, polling results related to Recommendations for the Built Environment

January 7, 2003

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.

Location: Wastewater Treatment Plant, 2400 Theresa Street

Statements for Discussion

Meeting Notes, Polling Results Related to New Growth Areas

2002

December 17, 2002

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.

Location: Wastewater Treatment Plant, 2400 Theresa Street

Map of Salt Creek Storage Areas
Minimum Flood Corridor
Greenfield Approach: Buffer Width Composition
Buyout Policy Examples
Statements for Discussion
Section 205 of the Salt Creek Feasibility Study
Strategies and Tools Survey Summary
Strategies and Tools Survey

December 3, 2002

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.
Location: Wastewater Treatment Plant, 2400 Theresa Street
Mayor's Floodplain Task Force Charge Statement
Floodplain Task Force Decision-Making Process Policy Issues and
Implementation Tools

November 19, 2002

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.
Location: Wastewater Treatment Plant, 2400 Theresa Street
Alternative Floodplain Management Strategies Study
Legal Parameters Handout
No Adverse Impact Presentation
Fact Sheets Handout

November 5, 2002

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.
Location: Wastewater Treatment Plant, 2400 Theresa Street
Comment, Question & Discussion - Help Sheet
CDM Alternative Floodplain Management Strategies Study

October 22, 2002

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.
Location: Wastewater Treatment Plant, 2400 Theresa Street
CDM Presentation for Dead Man's Run
- Economic Evaluation of Alternative Floodplain Regulations
(along Dead Man's Run)
- Sketched Conceptual Development

September 24, 2002

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.
Location: Wastewater Treatment Plant, 2400 Theresa Street
August 28th Flooding Handouts
- Flooding in Parking Garage at 52nd and "R" Streets
- 52nd and "R" Street
- Rainfall Intensity Map
- Public Awareness Slide Displayed at Local Theaters
Floodplain Studies Progress Overview
Strategies to Control Streambed Degradation - Salt Creek Basins (COE)
Streambed Degradation along Beal Slough (Olsson Associates)
Substantial Improvement Issue Discussion (Building and Safety)
Beal Slough Presentation (COE)

August 20, 2002

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.
Location: Wastewater Treatment Plant, 2400 Theresa Street
Corps of Engineers Dead Man's Run Study
No Adverse Impact Study Report
Policies pertaining to Street and Alley Vacations and Surplus Land in the Floodplain
Small Group Discussions
Dead Man's Run Map Provided by Corps of Engineers

July 23, 2002

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.
Location: Wastewater Treatment Plant, 2400 Theresa Street
Corps of Engineers, Dead Man's Run Study
Street and Alley Vacations, Handout No. 1
Street and Alley Vacations, Handout No. 2
Comprehensive Plan Overview
Land Use Plan

May 21, 2002

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.
Location: Wastewater Treatment Plant, 2400 Theresa Street
Overheads from the Corps of Engineers

April 16, 2002

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.
Location: Wastewater Treatment Plant, 2400 Theresa Street
Answers for Questions on Draft Scope of Work
Flood Insurance Study
Request for Proposals - Alternative Floodplain Management Strategies
- Technical Studies and Economic Impact
Floodplain Studies
Schedule for Corps of Engineers Floodplain Study
Floodplain 101 - Overheads by Glenn Johnson

March 19, 2002

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.
Location: Wastewater Treatment Plant, 2400 Theresa Street
Revised Corps of Engineers Study Schedule
Watershed Runoff and Floodplain Diagram
Floodplain True/False Quiz
Floodplain Quiz Answers
Floodplain Glossary of Terms
Common Floodplain Violations
Draft Floodplain Studies Outline

No Adverse Impact Summary
No Adverse Impact - Full Paper
Flood Hazard Areas Planning APA Article
"Floodplain Fliers" Floodplain Mapping Article
Comp Plan Open House/Public Hearing Schedule
Comp Plan Floodplain Development Assumptions
Key Assumptions of the Draft Comp Plan

February 5, 2002

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.
Location: Wastewater Treatment Plant, 2400 Theresa Street
History of Flooding in Lincoln
Floodplain Map
Summary of Issues/Additional Information Needed
Answers to Questions About the NFIP
Flood Insurance Coverage/Rates Summary
Storm & Flood Table
Community Rating System
Draft Economic/Environmental Impact Outline
Task Force Issues Update (Issues Addressed 1-29-01)
ASFPM No Adverse Impact Tabloid
Salt Creek Tiger Beetle Cabinet Report Update

2001

October 25, 2001

Floodplain Task Force Committee Meeting: 7:30 a.m. - 9:30 a.m.
Location: Wastewater Treatment Plant, 2400 Theresa Street
Corps of Engineers Report on Floodplain Management Strategies
Meeting Notes/Evaluation Results

August 21, 2001

Agenda
Comprehensive Plan Floodplain Assumptions

F. Speakers and Topics

Facilitators: Milan Wall, Vicki Luther, Reggi Carlson, Mary Emory

2003

March 25, 2003

Milan Wall-Heartland Center, *Polling re: the Existing urban Area, Table of Contents & Task Force Report*

March 20, 2003

Dale Stertz - Building & Safety, *Definition on "Built Environment"*
Milan Wall-Heartland Center, *Polling of the Built Environment*

March 11, 2003

Glenn Johnson - LPSNRD, *Salt Creek Storage Areas*
Brian Dunnigan - DNR, *Salt Creek Storage Areas*
Sara Hartzell - Public Works and Utilities, *Mitigation Ratios*
Rick Peo - City Law, *Accountability and Disclosure re: Floodplain Properties*
Sara Hartzell - City of Lincoln, *Areas Adjacent to Floodplain Areas*
Devin Biesecker - Public Works and Utilities, *CRS possible points for Adoption of Higher Standards*

February 27, 2003

Les Tyrrell - Director of NE Real-Estate Commission, *Accountability & Disclosure re: Floodplain Properties*
Devin Biesecker - Public Works and Utilities, *Property Specific information on the web*
Rock Krzycki - Public Works and Utilities, *Maps indicating Non-residential structures in the Floodplain*
Sara Hartzell - Public Works and Utilities, *Mitigation Ratios*

February 20, 2003

Nicole Fleck-Tooze - Public Works and Utilities, *Public Properties in the Floodplain*
Milan Wall-Heartland Center, *Applicability of the Task Force*
Dale Stertz - Building & Safety, *Applicability of F.P.T.F recommendations to the County*

February 4, 2002

Milan Wall-Heartland Center, *Polling on Draft Floodplain Recommendations for New Growth Areas*

January 21, 2003

Milan Wall-Heartland Center, *Polling of Groups, Regarding the Built Environment*

January 7, 2003

Milan Wall-Heartland Center, *Polling of Groups*

2002

December 17, 2002

Milan Wall-Heartland Center, *Presentation on Areas of Majority Agreement*

Glenn Johnson - LPSNRD, *Salt Creek Storage Areas*

Devin Biesecker, Sara Hartzell - Public Works and Utilities

Sara Hartzell - Public Works and Utilities, *Greenfield Approach & Buyout Policies*

December 3, 2002

Milan Wall-Heartland Center, *Review Task Force Charge Statement*

Vicki Luther-Heartland Center, *Proposed Strategy for Decision Making*

- *Development of Principals for Successful Floodplain Policy*
- *Draft Policy Issues & Implementation Tools*

November 19, 2002

Rick Peo - City Law, *Legal Parameters*

Nicole Fleck-Tooze - Public Works and Utilities, *No Adverse Impact*

Nicole Fleck-Tooze - Public Works and Utilities, *Fact Sheet Review*

November 5, 2002

Andrew Sauer - CDM, *Alternative Management Strategies Part II*

Patrick O'Neill - CDM, *Alternative Management Strategies Part II*

October 22, 2002

Patrick O'Neill - CDM *Economic Evaluation of Alternative Floodplain Regulations*

Andrew Sauer - CDM, *Conceptual Development Sketches*

September 24, 2002

Ben Higgins - Public Works and Utilities, *August 28th Flooding*

Jerome Tworek - Corps of Engineers, *Strategies to Control Stream Bank Degradation*

John Cambridge - Olsson Associates, *Stream Bank Degradation*

Jon Trombino, Building & Safety, *Substantial Improvement Issue*

Colleen Horihan - Corps of Engineers, *Beal Slough Presentation*

August 20, 2002

Gene Sturm - Corps of Engineers, *Economic Impacts*

Colleen Horihan - Corps of Engineers, *Deadman's Run Study Presentation*

Nicole Fleck-Tooze - Public Works and Utilities, *Policies pertaining to Street and Alley Vacations and Surplus Land in the Floodplain*

April 2003

July 23, 2002

Colleen Horihan - Corps of Engineers, *Deadman's Run Study*

Nicole Fleck-Tooze - Public Works and Utilities, *Street & Alley Vacations and Surplus Property*

Nicole Fleck-Tooze - Public Works and Utilities, *Comprehensive Plan Overview*

May 21, 2002

Colleen Horihan - Corps of Engineers, *Salt Creek Study Presentation Part 1*

Gene Sturm - Corps of Engineers, *Economic Overview*

April 16, 2002

Glenn Johnson - LPSNRD, *Floodplain 101*

John Cambridge - Olsson Associates, *Watershed Master Planning*

Jon Trombino, Building & Safety, *Floodplain Enforcement*

March 19, 2002

Nicole Fleck-Tooze - Public Works and Utilities, Glenn Johnson - LPSNRD, *Overview of Current Stormwater & Floodplain Management Activities*

Mike DeKalb Lincoln-Lancaster County Planning Department, *Overview of Floodplain Elements within proposed Comprehensive Plan*

February 5, 2002

John Palensky, Colleen Horihan, Corps of Engineers, *Corps of Engineers Study Update*

2001**October 25, 2001**

Colleen Horihan - Corps of Engineers, *Floodplain Management Strategies*

Milan Wall and Vicki Luther - Heartland Center, *Introduction & role in leadership development*

August 21, 2001

Mayor Wesely, *Introductions*

Glenn Johnson - LPSNRD, *Floodplain 101*

Nicole Fleck-Tooze - Public Works and Utilities, *Existing Floodplain Regulations Overview*

John Palensky, Colleen Horihan, Gene Sturm - Corps of Engineers, *Floodplain Study*

Kent Morgan - Lincoln-Lancaster County Planning Department, *Comprehensive Plan Processes & Floodplain Development Assumptions*

G. Task Force Polling Summaries

As discussed in the Facilitation and Process section of Chapter 1, a polling process was developed that allowed each member present to agree, disagree or offer specific word changes to each draft policy. Some Task Force members chose to abstain from the polling process, requested more information before voting, left early or were absent from the room, so **attendance and polling results may seem to conflict**. The polling results reflect, however, those members present during that particular discussion. Numbers **in parentheses** indicate, of those who agreed, the number of members who **agreed if specific text changes were made**.

For consistency, all of the final recommendations are listed in each table. Recommendations with an **asterisk are those which were not yet formulated at the time of the polling**. A copy of the specific comments from the polling meetings is available from the Public Works & Utilities Department upon request.

New Growth Areas: Draft

Date	Recommendation	Agree	Disagree
1/7/03	1. No Adverse Impact	11 (1)	0
	2. Floodplain Mapping *	N/A	N/A
1/7/03	3. No Net Rise/Compensatory Storage	10	0
1/7/03	4. Stream Crossing Structures	5 (4)	6
1/7/03	5. Stream Buffers	(10)	0
1/7/03	6. Surplus/Vacated Floodplain Property Policy	11 (4)	0
1/7/03	7. Floodplain Buyout Program	11 (5)	0
1/7/03	8. Charge Floodplain Development Fee	2	2
1/7/03	9. Best Management Practices	(9)	0
	10. Salt Creek Flood Storage Areas (Existing Urban Only)	N/A	N/A
1/7/03	11. Building Construction Standards (This standard was originally combined with #12 below, separated later)	7 (1) 1 abstain	2
1/7/03	12. Substantial Improvement Threshold		
1/7/03	13. Cluster Development	9 (6)	0
1/7/03	14. Best Available Study Information	9 (5)	0

	15. Real Estate Transactions*	N/A	N/A
	16. Assessments for Floodplain Property*	N/A	N/A

Existing Urban Area (Built Environment): Draft

Date	Recommendation	Agree	Disagree
1/21/03	1. No Adverse Impact	9 (2)	0
	2. Floodplain Mapping *	N/A	N/A
1/21/03	3. No Net Rise/Compensatory Storage	9 (2)	2
1/21/03	4. Stream Crossing Structures	(9)	0
1/21/03	5. Stream Buffers	8 (2)	1
1/21/03	6. Surplus/Vacated Floodplain Property Policy	9 (7)	0
1/21/03	7. Floodplain Buyout Program	9 (7)	0
1/21/03	8. Charge Floodplain Development Fee	8	2
1/21/03	9. Best Management Practices	9 (6)	0
1/21/03	10. Salt Creek Flood Storage Areas	8 (2)	0
1/21/03	11. Building Construction Standards (This standard was originally combined with #12 below, separated later)	7 (3)	2
1/21/03	12. Substantial Improvement Threshold		
1/21/03	13. Cluster Development	8 (7)	0
1/21/03	14. Best Available Study Information	8 (1)	0
	15. Real Estate Transactions*	N/A	N/A
	16. Assessments for Floodplain Property*	N/A	N/A

New Growth Areas: Final

Date	Recommendation	Agree	Disagree
2/4/03	1. No Adverse Impact	8	1
2/20/03	2. Floodplain Mapping	11	0
2/4/03	3. No Net Rise/Compensatory Storage	9	0

2/4/03	4. Stream Crossing Structures	(9)	0
2/4/03	5. Stream Buffers	9	0
2/4/03	6. Surplus/Vacated Floodplain Property Policy	9	0
2/4/03	7. Floodplain Buyout Program	9 (2)	0
2/4/03	8. Do Not Charge Floodplain Development Fee	9 (8)	0
2/4/03	9. Best Management Practices	9 (7)	0
	10. Salt Creek Flood Storage Areas (Existing Urban Only)	N/A	N/A
2/20/03	11. Building Construction Standards	(11)	0
2/20/03	12. Substantial Improvement Threshold	(11)	0
2/20/03	13. Cluster Development	11 (1)	0
2/20/03	14. Best Available Study Information	11	0
2/27/03	15. Real Estate Transactions	11	0
	16. Assessments for Floodplain Property	N/A	N/A

Existing Urban Area (Built Environment): Final

Date	Recommendation	Agree	Disagree
3/20/03	1. No Adverse Impact †	9	1
3/20/03	2. Floodplain Mapping	(10)	0
3/20/03	3. No Net Rise/Compensatory Storage †	7	2
3/20/03	4. Stream Crossing Structures	8	1
3/20/03	5. Stream Buffers	9	0
3/20/03	6. Surplus/Vacated Floodplain Property Policy	8	0
3/20/03	7. Floodplain Buyout Program	9	0
3/20/03	8. Do Not Charge Floodplain Development Fee	8	0
3/20/03	9. Best Management Practices	9	0
3/20/03	10. Salt Creek Flood Storage Areas	9	0
3/20/03	11. Building Construction Standards	9	0

3/20/03	12. Substantial Improvement Threshold	8	0
3/25/03	13. Cluster Development	14 (4)	0
3/25/03	14. Best Available Study Information	13	0
3/25/03	15. Real Estate Transactions	(14)	0
3/25/03	16. Assessments for Floodplain Property	11	0

† At the March 25th meeting, three members not present at the March 20th meeting when the second phase of polling was scheduled to begin for the Existing Urban Area expressed their opposition to the No Adverse Impact and No Net Rise/Compensatory Storage policy recommendations. A fourth member expressed opposition to the No Net Rise/Compensatory Storage recommendation as proposed for the Existing Urban Area via electronic mail following the March 25th meeting.

H. Executive Summaries for Technical Studies

COE Floodplain Study Results Summary

The Corps of Engineers Study results had two major components:

1. **Evaluation of alternative floodplain management strategies** utilized by other communities across the U.S. in adopting regulatory standards higher than the minimum federal requirements. Examples of other states and communities included:
 - a. Tulsa, Oklahoma. Tulsa regulates based upon a ‘future conditions’ floodplain assuming fully urbanized conditions and requires Compensatory Storage.
 - b. DuPage County, Illinois. DuPage regulates based upon a No Net Rise floodplain, assuming future conditions, with Compensatory Storage required at a 1.5:1 ratio
 - c. Charlotte-Mecklenburg, North Carolina. Charlotte-Mecklenburg regulates based upon a ½-Foot Rise floodway for Flood Insurance Program purposes, with a 0.1-Foot Rise floodway utilized for local regulation.
 - d. State of Montana. Montana regulates based upon a ½-Foot Rise Floodway, with residential structures required to be elevated 2 feet above 100-year flood elevation.
2. **Modeling of a ‘Do Nothing’ Alternative** to project the consequences of continuing to regulate based upon the current standards of the City and County (which reflect the minimum federal standards utilizing a 1-Foot Rise Floodway). Three scenarios were modeled: 1) 50% loss of flood storage; 2) 1-Foot Rise in flood heights (projected by flood insurance studies modeling flood conveyance); and 3) 100% loss of flood storage (worst-case scenario). Economic analysis was performed on the first two scenarios. Results are listed below:

COE Dead Man’s Run Study (33rd to 56th St.):

Existing Floodplain: 605 structures in 100-yr floodplain
\$31.9 million damage for 100-yr flood

Scenario A

50% Loss Flood Storage: 0.24' average increase in flood heights
0.48' maximum increase in flood heights
36 additional structures damaged
\$2.6 million additional damage

Scenario B

1' Rise in Flood Height: 1' increase in flood heights assumed per FEMA
151 additional structures damaged
\$10.9 million additional damage

Scenario C

100% Loss Flood Storage: 1.11' average increase in flood heights
2.82' maximum increase in flood heights

COE Beal Slough Study (Salt Creek to 40th St.):

Existing Floodplain: 74 structures in 100-yr floodplain
\$2.2 million damage for 100-yr flood

Scenario A

50% Loss Flood Storage: 0.45' average increase in flood heights
1.57' maximum increase in flood heights
2 additional structures damaged
\$0.1 million additional damage

Scenario B

1' Rise in Flood Height: 1' increase in flood heights assumed per FEMA
33 additional structures damaged
\$1.9 million additional damage

Scenario C

100% Loss Flood Storage: 2.09' average increase in flood heights
4.33' maximum increase in flood heights

CDM - Executive Summary

The City of Lincoln retained Camp Dresser & McKee Inc. (CDM), in association with Gould Evans Goodman, to provide professional engineering and planning services to evaluate various floodplain management alternatives. The project consisted of evaluating the economic impacts of floodplain management alternatives for existing public infrastructure along a portion of Dead Man's Run, and in newly developed areas. The purpose of the study was to provide the City with a comparative analysis of floodplain management alternatives that would not only be a useful management tool, but an informative study that could be used to help shape future floodplain management policy. The project consisted of three primary components as summarized below.

Economic Evaluation along Dead Man's Run

The economic evaluation along Dead Man's Run was focused on a channel reach extending from 33rd Street to 56th Street. The evaluation consisted of applying three floodplain management alternatives along this reach, and evaluating the economic consequences with regards to future flood damage to existing public buildings, public access streets, and stream crossing structures. The three floodplain management alternatives included:

- No Net Rise in the existing 100-year floodplain water surface elevation (WSE), combined with Compensatory Storage. Compensatory storage requires compensation for any flood storage volume lost to buildings or fill by providing a hydraulically equivalent volume of flood storage on the site.
- 1/2-Foot Rise in the 100-year floodplain WSE
- 1-Foot Rise in the 100-year floodplain WSE (Existing City Policy)

The economic analysis was based on existing GIS data, depth damage curves, HECRAS modeling results, and as-built drawings. A separate economic evaluation was conducted for public buildings, public access streets, and public stream crossing for each floodplain management alternative. The results of the evaluation are summarized below.

Table ES-1 Percent Reduction in Flood Damage

Type of Public Infrastructure	Percent Reduction in Annual Flood Damage		
	No Net Rise in Existing 100-yr WSE	1/2-ft Rise in 100-year WSE	1.0-ft Rise in 100-yr WSE (Existing Policy)
Public Building Annual Flood Damage Costs	100%	75%	Base
Public Access Street Annual Flood Damage Costs	27%	14%	Base
Public Stream Crossing Structure Improvement Costs	44%	6%	Base

As shown in the table, more restrictive floodplain management alternatives can significantly reduce costs associated with flood damage and capital improvements.

Economic Evaluation in New Development

An economic analysis was conducted to evaluate the impacts of four floodplain alternatives in a typical new development adjacent to a floodplain. Three land uses (residential, commercial, and industrial) and four floodplain management alternatives (1-ft Rise, 1/2-ft Rise, No Net Rise/Compensatory Storage, and CUP/PUD) were considered for a total of twelve conceptual development scenarios.

The economic evaluation was based on a hypothetical undeveloped parcel of land adjacent to a typical 1,000-foot reach of channel in Lincoln, Nebraska that had an established FEMA floodplain and floodway. The hypothetical development site area was 58 acres of undeveloped land. For each development scenario, Gould Evans Goodman developed a conceptual development layout sketch that was used to estimate the cost to develop the site.

The basis of the economic analysis was to determine the cost to develop the site, including the purchase of the property, and the cost to install streets, water and sewer mains, and electrical service. Building costs were not included in the economic analysis. The results of the evaluation are summarized in the three tables shown below.

Table ES-2 Residential Development Costs

Floodplain Management Alternative	Developable Land (ac)	Percent Cost Increase
1-ft Rise Floodway (existing policy)	40.5 ac	Base
1/2-ft Rise Floodway	19.2 ac	+8
No Net Rise/Compensatory Storage	35.7 ac	+14
CUP	10.0 ac	-1

Table ES-3 Commercial Development Costs

Floodplain Management Alternative	Developable Land (ac)	Percent Cost Increase
1-ft Rise Floodway (existing policy)	43.5 ac	Base
1/2-ft Rise Floodway	21.5 ac	+3
No Net Rise/Compensatory Storage	22.8 ac	+21
PUD	14.5 ac	+6

Table ES-4 Industrial Development Costs

Floodplain Management Alternative	Developable Land (ac)	Percent Cost Increase
1-ft Rise Floodway (existing policy)	38.1 ac	Base
1/2-ft Rise Floodway	17.9 ac	+4
No Net Rise/Compensatory Storage	25.5 ac	+10
CUP	14.0 ac	+3

In general, the economic impact analysis found that development costs increased with more restrictive floodplain management regulations. The increase in development costs, compared to the City's existing floodplain management policy, ranged from less than 0 percent for a residential CUP development to 21 percent for a commercial no net rise/compensatory storage alternative. However, more restrictive floodplain management alternatives will provide a proactive versus reactive approach to future flooding by:

- Maintaining channel storage to reduce downstream flow increases and corresponding increases in flood elevations
- Providing appropriate set-back distances to reduce future flood damage and avoid expensive retrofit projects
- Improving water quality and the environment by preserving the riparian zone adjacent to the stream
- Enhancing the quality of life of local residences by incorporating recreational amenities within the open green spaces
- Increasing property values of property adjacent to maintained open space

Floodplain Management Alternatives and Example Programs

A qualitative assessment of various floodplain management approaches that have been successfully implemented by other municipalities across the Country was conducted. The floodplain approaches that were reviewed included:

- No Net Rise and Compensatory Storage
- Property Buyouts
- Cluster (Open Space) Development
- Greenfield Approach
- Best Management Development Practices
- Floodplain Mitigation

A fact sheet was developed for each floodplain approach, which included a brief description of the concept, a list of advantages and disadvantages, implementation considerations, a list of communities that have implemented the concept, and a reference listing. In addition, the stormwater management programs for Tulsa, Oklahoma; Lake County, Illinois; and Johnson County, Kansas, were highlighted to provide examples of nearby communities that are currently implementing various proactive floodplain management strategies.

I. Fact Sheets

Fact Sheet - Table of Contents
April, 2003



Background Information

Current Floodplain Standards

Salt Creek Floodplain Study
No Adverse Impact

Standards Exceeding Minimum Federal Requirements

Floodplain Management Alternatives

No Net Rise and Compensatory Storage (CDM)

Property Buyout (CDM)

Cluster; Open Space Development (CDM)

Greenfield Approach (CDM)

Best Management Development Practices (CDM)

Floodplain Mitigation (CDM)

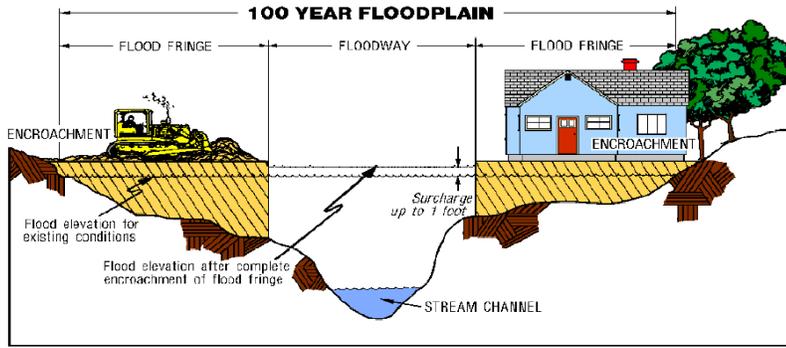
Cumulative Substantial Improvements

Maintain Storage on Surplus/Vacated Property
Watershed Master Planning

Floodplain Development Fee

Half Foot Rise Alternative

Floodplain Management: Current Floodplain Standards



Description

Mapped Floodplains:

Current floodplain standards apply to FEMA - mapped floodplains and allow for a one foot rise in the floodplain elevation. This is accomplished by allowing fill in the flood fringe area and keeping the floodway open for conveyance of flood water. However, the models used to develop the current standard do not account for the loss of overbank storage or upstream development, which can raise the base flood elevation significantly higher than one foot.

Unmapped Floodplains

City of Lincoln and Lancaster County floodplain standards currently apply only to streams that are large enough to have a FEMA-mapped floodplain. The Minimum Flood Corridor requirement that is part of the stormwater standards apply to some stream reaches outside the mapped floodplain. (Note: see Greenfield Approach fact sheet for information regarding the minimum corridor).

Advantages

- ★ No modifications to current floodplain regulations or City procedures are required.
- ★ There would be no increased up front cost for development in the floodplain.
- ★ There would be no increased up front cost for public infrastructure in the floodplain.

Floodplain Management: Current Floodplain Standards

Disadvantages

- ⊖ The City could expect significant increases in flood hazards and economic loss caused by loss of flood storage:

Floodplain Reach/Flood Height	# Structures Flooded	Damage in Millions of Dollars*
COE Dead Man's Run Study (33rd to 56th St):		
Existing FEMA-mapped floodplain:	605	\$31.9
Future floodplain assuming 1' rise:	756	\$42.8
<i>Predicted actual rise with 100% loss storage: 2.8 feet</i>	?	?
COE Beal Slough Study (Salt Creek to 40th St):		
Existing FEMA-mapped floodplain:	74	\$2.2
Future floodplain assuming 1' rise:	107	\$4.1
<i>Predicted actual rise with 100% loss storage: 4.33 feet</i>	?	?

Note: Additional costs are identified in the CDM report.

- ⊖ Long term costs would increase, since reactive flooding solutions in mitigation are more costly than proactive up-front solutions (e.g. \$15M for mitigation in Beal Slough).
- ⊖ Reduced opportunities for greenway corridors..
- ⊖ The loss of natural floodplain functions will continue to cause stream degradation and bank de-stabilization, loss of riparian and aquatic habitat, and reduction in water quality.

Implementation Considerations

- Requires no implementation considerations as this is the current policy.

References

- February 5, 2002 handout of existing floodplain regulations
- February 5, 2002 handout of History of Flooding
- April 16, 2002 handout of Flood Insurance Study
- August 20, 2002 US Army Corps of Engineers study on Dead Man's Run
- September 24, 2002 US Army Corps of Engineers presentation on Beal Slough
- September 24, 2002 Floodplain Studies Progress Overview from Public Works
- October 22, 2002 CDM presentation of Dead Man's Run
- November 5, 2002 CDM presentation of Fact Sheets

Floodplain Management: Salt Creek Floodplain Study



Description

Salt Creek, from Pioneers Boulevard to “O” Street, was selected as one of the three stream reaches to be modeled in the Corps of Engineers’ floodplain alternatives studies. The intent was to model the physical and economic impacts under the following three scenarios:

- 1’ Rise floodway (Do Nothing scenario causing 1’ rise)
- ½’ - Rise floodway
- 50% loss of flood fringe storage

Results

Salt Creek turned out to be an unfortunate choice for this study. Due to the complexity of the Salt Creek channel and levee system, to incompatibility of data and modeling techniques, and to the limited scope of this Corps study, the alternatives studies were not able to be meaningfully performed. Recall that the alternative scenarios were intended to be comparative to the existing situations and future conditions with no-change assumptions.

Reasons

The complexity and incompatible circumstances included:

- Salt Creek has a system of flood control levees that provide varying levels of flood protection (50-year to 100+year)
- The FEMA-mapped floodway is confined to the channel and levees, but this is based on a condition that only designated percentages of flood fringe storage are allowed to be filled, depending upon the location (0% to 100%).
- The earlier floodplain study was based upon 10-foot and 4-foot contour information, compared to 1-foot contours available with the new models
- Only limited records are available on flood fringe fills and developments since the earlier floodplain study.
- The flood fringe is compartmentalized into numerous flood storage cells, which are interdependent.
- Lack of data from the flood insurance study, much of which was done by hand calculations. This made it impractical to replicate the maps with the state of the art electronic models used for the alternative floodplain studies.

Floodplain Management: Salt Creek Floodplain Study

Conclusions

To accurately and completely address these alternative floodplain concepts and their impacts specifically on Salt Creek would require an extensive study of the entire basin, with new mapping, new hydrology, and new hydraulics. *Any of the proposed alternative floodplain regulation changes resulting from the analysis on Dead Mans Run and Beal Slough could be applied in the Salt Creek floodplain and the results would be a greater level of protection than the current regulations.*

References

Salt Creek Levees at Lincoln, NE, Reconnaissance Report, October 1990

Salt Creek in Lincoln, NE, Section 205 (1995-1997)

HUD, FIA, Flood Insurance Rate Map, City of Lincoln, NE, September 1976, revised November 1980

FEMA, FIA, Flood Insurance Study, City of Lincoln, NE, June 19, 1997

Floodplain Management: No Adverse Impact



Description

“No Adverse Impact” is a managing principal and policy goal developed by the Association of State Floodplain Managers (ASFPM) to support long-term, sustainable approaches to reducing the nation’s flood losses now and in the future. In essence, a **“No Adverse Impact Floodplain” is one where the action of one property owner does not adversely impact the flooding risk for other properties**, as measured by increased flood stages, flood velocity, flows, or the increased potential for erosion and sedimentation.

The No Adverse Impact policy is proposed to be implemented nationwide at a local level through a range of approaches based on what is most effective for any particular management area. The concept promotes local accountability for developing and implementing a comprehensive plan and strategy for the floodplain. Examples of implementation include enforcement of regulations and master plans, as well as delivery of programs and services.

Advantages

- ★ Sustainable flood policy
- ★ Reduces future flood damages
- ★ Manages floodplain for highest net social benefit
- ★ Promotes protection of the natural/beneficial functions of floodplains
- ★ Flexible concept open to a wide range of local approaches

Disadvantages

- ☹ Requires community to define what ‘No Adverse Impact’ means on a local level
- ☹ Initiatives of other communities may or may not be conducive to the local situation

Floodplain Management: No Adverse Impact

Implementation Considerations

- Community needs to determine implementation ‘tools’ (ordinances, design standards, master plans, etc.) and the function of each
- Consideration of individual property rights
- Public education
- Identification of range of hazard factors and incorporation of mitigation techniques to minimize impacts

Example Communities

- **DuPage County, IL**
 - ↳ Compensatory storage = 1.5 x volume floodplain displaced
 - ↳ 0' Rise in floodplain elevations for all developments
 - ↳ Floodplain mapping based on future development conditions
 - ↳ No net loss of wetlands - mitigation ratios of 1.5:1 to 3:1
 - ↳ Mitigation for any riparian function impacted by development
 - ↳ No variances for floodplain standards
 - ↳ 1' freeboard required, even for structures outside floodplain
 - ↳ Stormwater management plan and capital improvement projects
 - ↳ Buyouts of structures in flooded areas, including use of local funds
- **Maricopa County, AZ**
 - ↳ Required total retention of 100-year, 2-hour runoff (2.5-3" rain)
 - ↳ Adoption of erosion setback zones along watercourses
 - ↳ Area Drainage Master Study - ID floodprone areas and structural/non-structural solutions
 - ↳ Watercourse Master Plans (smaller-scale detailed evaluation/solutions) with emphasis on non-structural solutions and multi-use opportunities
- **Charlotte-Mecklenburg, NC**
 - ↳ New development must stay outside the 1/10'-rise floodway
 - ↳ Floodplain mapping/regulations based upon ultimate development in upstream watershed
 - ↳ 1' freeboard protection above ‘ultimate’ future flood elevation
 - ↳ Local adoption of water quality stream buffer regulations
 - ↳ Mecklenburg County Floodplain Management Guidance Document
 - ↳ Preparation of Flood Hazard Mitigation Plans based on watershed areas
 - ↳ Stormwater management program funded by stormwater fee

References

- No Adverse Impact: A Common Sense Strategy to Protect Your Property, February 2002 Task Force Materials.
- No Adverse Impact Floodplains: A White Paper, March 2002 Task Force Materials.
- No Adverse Impact, Status Report: Helping Communities Implement NAI, August 2002 Task Force Materials.
- No Adverse Impact Power Point Presentation, adapted from ASFPM presentation, November 19, 2002 Task Force Materials.

Floodplain Management: Standards Exceeding Minimum Federal Requirements



Description

The following counties, cities, and states have adopted floodplain regulations which go above and beyond those required by NFIP.

Southington, CT	<ul style="list-style-type: none"> - No net rise in floodway or floodway fringe. - Compensatory storage *, limit fill to 25% by volume of flood storage. - 2' Freeboard * residential; 1' freeboard commercial/industrial. - No encroachment on floodway.
Lake Forest, IL	<ul style="list-style-type: none"> - No development within floodplain.
Jefferson Co., KY	<ul style="list-style-type: none"> - No development in local regulatory conveyance zone *. - Natural maintenance of streams and channels w/ 25' vegetative buffer. - Use of a “fully developed scenario” in watershed planning models.
Hartford Co., MD	<ul style="list-style-type: none"> - 75' buffers along streams. - No net rise, compensatory storage*. - Restrictions on fill materials and slope.
Durham, NC	<ul style="list-style-type: none"> - Any alteration, to a structure currently in compliance must also be in compliance. Non-conforming buildings or uses may not be enlarged, replaced or rebuilt. - 2' freeboard for residential and non-residential. - For a development tract, up to 25% of parking may be in floodway fringe, but no more than 1/3 of floodway fringe may be used. - Density credits: 100% rate in floodway fringe 75% rate in floodway*. - Stream buffers: 30 ft for intermittent, 50 ft for perennial. - Wetland buffers: 25 ft.
Tulsa, OK	<ul style="list-style-type: none"> - No rise in floodplain, may use on-site or off-site storage. - Assume full development of watershed in delineation of regulatory floodplain.
King Co., WA.	<ul style="list-style-type: none"> - Program for purchase of property within high flood hazard area and for elevation of homes to above the 100 yr flood elevation.
Snohomish Co. WA	<ul style="list-style-type: none"> - Density Fringe concept; (2% of the surface area of the parcel) allowed to be developed in the floodplain. Intended to allow development of commercial farming operations.

* terms included under *Definitions*.

Floodplain Management: Standards Exceeding Minimum Federal Requirements

- | | |
|-------------------|---|
| Overland Park, KS | <ul style="list-style-type: none"> - 2' freeboard on residential in flood fringe - Stream corridors - from 30' to 120' either side of a stream's "ordinary high water mark". Natural vegetation to be maintained except in special circumstances |
| Lenexa, KS | <ul style="list-style-type: none"> - Stream Corridors - streams categorized into 5 types and 3 orders. - Mandatory corridor widths range from 100 ft. for highly impacted, order 1 streams to 300 ft. for sensitive order 3 streams. No mowing or clearing of streamside or middle zones. |
| State of Montana | <ul style="list-style-type: none"> - Fill in the flood fringe only in areas contiguous to areas naturally above the base flood elevation. - 2' freeboard |

FEMA defines the floodway as the stream channel plus that portion of the overbanks that must be kept free from encroachment in order to discharge a 100 year flood without raising the flood elevation by greater than 1 foot, assuming full development of the remainder of the floodplain. The following states have adopted definitions of floodway which allow for less than a 1 foot rise in the flood elevation, effectively increasing the portion of the floodplain designated as floodway.

Montana	0.5' rise	Wisconsin	0.01' rise
New Jersey	0.2' rise	Arizona	0.0' rise
Indiana	0.1' rise	Kentucky	0.0' rise
Illinois	0.1' rise	Massachusetts	0.0'rise

Definitions

Compensatory storage - Flood storage filled in a development is compensated for by excavation within the same site, including excavation to compensate for loss of infiltration caused by impervious surfaces. In some cases, this is allowed to be provided offsite.

Density credit - Development density from the flood fringe or floodway area may be utilized on areas outside the floodplain. For example, if a developer owns a 10-acre tract of land where 5 acres are outside the floodplain and the entire tract is zoned to allow 30 dwelling units (DU's), or 3 DU's/acre, a density credit would allow the developer to utilize the 15 DU's from the 5 acres of the floodplain land within the 5 acres outside the floodplain, for the total of 30 DU's allowed in the 5 acres outside the floodplain.

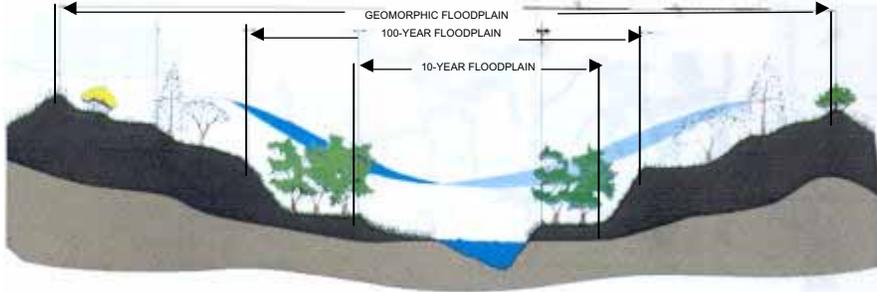
Density fringe - An alternate concept used when equal conveyance floodways can not be designated within a rather wide floodplain. Only 2% of any property may be developed, maximum obstruction allowed cannot exceed 15% of any line drawn across the property, all structures must be oriented parallel to the flood flow. Designed to achieve goals of protecting public health safety and welfare, and preserving prime farmlands in a productive agricultural capacity.

Freeboard - The freeboard is the height above the regulatory flood elevation to which the lowest floor of a structure must be raised or flood proofed (where allowed).

Ordinary high water mark - The elevation of the ordinary high flow of a stream channel, usually marked by visible bank cutting or debris that has been left by flowing water.

Regulatory conveyance zone - The channel of a river or stream and the adjacent land which if unobstructed will discharge a 100-year flood without cumulatively increasing the water surface elevation more than one tenth of one foot (e.g., 1/10'-rise floodway).

Floodplain Management: No-Net Rise and Compensatory Storage



Description

No-net rise floodplain management strategy requires developers to show that proposed improvements do not increase flood elevations at the site and/or downstream. Developments within the floodplain that increases the regulatory floodplain water surface elevations are prohibited. No-Net Rise is often combined with compensatory storage to provide some flexibility for the developer. Compensatory storage requires the developer to provide hydraulically equivalent storage volume at a ratio of 1 to 1 or greater for the fill volume proposed within the floodplain. A No-Net Rise/Compensatory storage policy would allow the developer to fill in the floodplain if it can be demonstrated that the fill will not increase the floodplain water surface elevations.

A no-net rise/compensatory storage floodplain management alternative should not be confused with “no net loss”. Often, a “no net loss” approach simply requires equal amount of fill and excavated volume, and does not require hydraulic simulations to verify a no-net rise in the floodwater elevations.

Advantages

- ★ Maintains floodplain storage volume.
- ★ Prevents downstream increase in peak flow rates by maintaining the floodplain storage.
- ★ Maintains existing flood elevations.
- ★ Reduces impact to riparian corridor.
- ★ Allows for development to occur within the floodplain as long as conditions are met.
- ★ Provides some water quality benefits by preserving floodplain storage.

Disadvantages

- ☹ May increase bridge design and construction costs for which backwater is a constraint.
- ☹ Requires more in depth technical review.
- ☹ Increases development costs.
- ☹ A Compensatory Storage (“no net loss) approach without requiring flood modeling would not be effective and could actually increase floodplain water surface elevations.

Floodplain Management: No-Net Rise and Compensatory Storage

☹ Requires identification and acquisition of compensatory storage areas.

☹ Requires developer to perform floodplain modeling.

Implementation Considerations

- Resources available for site plan review and enforcement
- Floodplain modeling methods are required to achieve greatest success
- Compensatory storage requirement for upstream storage areas such as wetlands
- Public outreach program
- Level of regulation

Example Communities

- Lake County, Illinois
- Fort Worth, Texas
- McHenry County, Illinois
- Milwaukee, Wisconsin
- King County, Washington

References

Comparison and Assessment of Zero-Rise Floodplain Ordinances, Wood, Andrew, et. al., Journal of Water Resources Planning and Management, July/August 1997.

No Adverse Impact Status Report: Helping Communities Implement NAI, June 2002, Association of State Flood Plain Managers

Floodplain Management: Property Buyout



Description Property buyout involves purchasing frequently flooded properties to demolish or relocate existing buildings and restoring the area to natural floodplains. The natural floodplain is then used as flood storage and to restore the natural environment.

- Advantages**
- ★ Reduces future flood damages.
 - ★ Reduces costs associated with frequent flood insurance payouts and rehabilitation
 - ★ Funds may be available to purchase property through the Federal Emergency Management Agency (FEMA) and National Flood Insurance Program (NFIP).
 - ★ Applicable for existing developed areas.
 - ★ Creates open spaces for flood storage and recreation amenities.
 - ★ Promotes wildlife habitat.
 - ★ Provides a riparian stream buffer with associated water quality benefits.

- Disadvantages**
- ☹ High initial cost to purchase property.
 - ☹ Difficult to obtain property owner's acceptance unless recent flood event has occurred.
 - ☹ Impacts historical districts.
 - ☹ Involves relocation of existing occupants.
 - ☹ Voluntary program may leave vacant lots that impact remaining residents.
 - ☹ Requires negotiations on market values.

- Implementation Considerations**
- Availability of Federal funding to support buyout programs.
 - Eligibility criteria to exercise buyout option.
 - Costs of relocation and demolition.

Floodplain Management: Property Buyout

- Willingness and ability of landowners to participate in buyout program.
- Assessing fair market values.
- Ownership and maintenance of newly created open space.

Example Communities

- Shawnee, Kansas
- Lake County, Illinois
- Fort Collins, Colorado
- Huntington, West Virginia
- Beatrice, Nebraska
- Napa County, California
- Sacramento County, California
- Omaha, Nebraska
- Sarpy County, Nebraska

References

No Adverse Impact Status Report: Helping Communities Implement NAI, Association of State Flood Plain Managers, June 2002.

Comparison and Assessment of Zero-Rise Floodplain Ordinances, Wood, Andrew, et. al., Journal of Water Resources Planning and Management, July/August 1997.

Mitigation Success Stories, Edition 4, Association of State Flood Plain Managers, January 2002.

Floodplain Management: Cluster (Open Space) Development



Description

A cluster development is a planning technique that concentrates residential living units in a compact area by minimizing lot sizes, setbacks and frontage distances to maximize open space. A cluster development reduces impervious area and grading activities compared to conventional developments, which decreases the runoff from the site. Cluster developments can be an effective floodplain management strategy by maximizing the number of housing units in the area located outside of the floodplain while preserving the area within the floodplain.

Advantages

- ★ Reduce impervious surfaces, thereby reducing runoff peaks and volumes. Impervious area can decline as much as 35% compared to traditional developments.
- ★ Allows for higher density development, which reduces the cost to develop the property.
- ★ Reduces sedimentation in streams which otherwise increases future flood stages.
- ★ Reduces pollutant loads to the stream.
- ★ Preserves open space that increase infiltration, which may be used for flood storage and recreation.
- ★ Preserves wildlife habitat.
- ★ In many areas, cluster developments appreciate at a higher rate than conventional subdivisions due to the amenities that are typically located in these areas.
- ★ Using cluster developments throughout the watershed will reduce future flooding impacts.
- ★ Lincoln code allows for cluster developments through a Community Unit Plan (CUP) and/or a Planned Unit Development (PUD), which is currently an optional development practice.

Disadvantages

- 🚫 May not be suitable for industrial developments that require larger buildings.

Floodplain Management: Cluster (Open Space) Development

☹️ Pa The general public may be reluctant to accept cluster development proposals; feeling that they may lead to more intense development, traffic or other local concerns.

☹️ Open space must be maintained to provide optimum benefits.

☹️ Additional resources may be required to maintain open space.

Implementation Considerations

- Local market factors
- Public Outreach Program
- Both mandatory and voluntary approaches can be used
- Existing cluster development code (CUP) may need to be revised to include other incentives for developers to use cluster design techniques

Example Communities

- City of Pittsburgh, Pennsylvania – Summerset Development
- City of Houston, Texas – The Woodlands New Community
- Montgomery County, Pennsylvania
- City of Grayslake, Illinois – Prairie Crossing
- Calvert County, Maryland – Mandatory Open Space Ordinance

References

Low Impact Development Center, Inc., www.lowimpactdevelopment.org

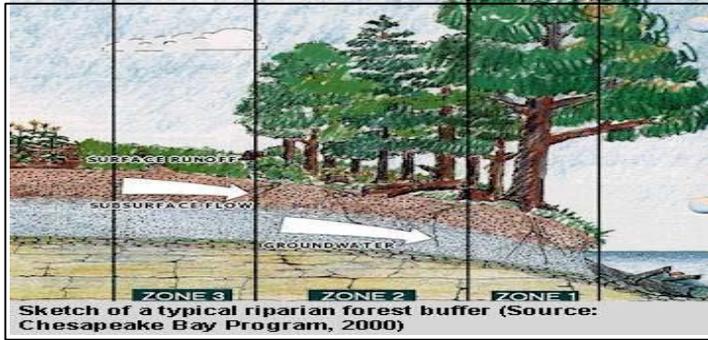
Low Impact Development Design Strategies, Prince Georges County, Maryland (EPA 841-B-00-003)

Open Space Development, United States Environmental Protection Agency, www.epa.gov/owow/nps/ordinance/openspace.htm

Post-Construction Storm Water Management in New Development & Redevelopment – Open Space Design, USEPA Fact Sheet, January 2002

Stormwater Manager's Resource Center, Center for Watershed Protection, www.stormwatercenter.net

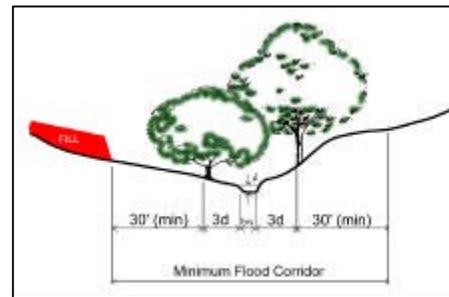
Floodplain Management: Greenfield Approach



Description

The Greenfield Approach uses stream buffers to reduce flood risks by preserving the floodplain storage along the stream corridor. Stream buffers are areas along a stream where development is restricted or prohibited. Buffers can be engineered to provide maximum water quality benefits, by planting with native grasses and vegetation or left in their natural state. To maximize the benefits of stream buffers, the buffer width should be a minimum of 100 feet on each side of the stream or more. Providing buffers along streams and around wetlands in upper portions of the watershed will provide natural flood control and water quality benefits downstream.

Lincoln currently requires a "minimum flood corridor" buffer to be preserved along only those drainage ways outside the mapped floodplain that drain greater than 150 acres. Thus, smaller tributaries draining less than 150 acres, or larger streams that have a mapped floodplain require no buffer protection. The formula to determine buffer width where it applies is the channel bottom width + 60 feet + 6 times the channel depth. Thus, a 6 feet wide, 3 feet deep channel would require an 84 foot flood corridor, or a 42 foot buffer on each side of the stream.



Advantages

- ★ Provides effective flood control by preserving floodplain storage volume.
- ★ Increases adjacent property values.
- ★ Preserves wildlife and terrestrial habitat.
- ★ Provides open space for passive recreation, water features, and other storm water management activities.
- ★ Improves water quality by filtering stormwater runoff from adjacent properties.
- ★ Removes areas of impervious cover from areas adjacent to streams. This helps to distribute peak flows and decreases flooding frequency downstream.
- ★ Provides a stream "right of way" which allows for lateral movement of the stream bed to dissipate energy and velocities.

Floodplain Management: Greenfield Approach

- ★ Protects the stream bank from erosion by maintaining the natural vegetation.
- ★ Can reduce watershed imperviousness by 5 percent, which reduces runoff volumes and peak flow rates.
- ★ Mitigates stream warming by preserving the shade provided by the riparian buffer, which supports aquatic habitats.
- ★ Proactive approach to reduce future flooding costs.
- ★ Increases the protection to adjacent properties.

Disadvantages

- ☹ Increases cost to developers by reducing developable land.
- ☹ Not applicable to developed areas and re-development.
- ☹ Requires planning and stakeholder “buy-in”.

Implementation Considerations

- May require adjustment in zoning ordinance
- Public Outreach Program
- Both mandatory and voluntary approaches can be used
- Provide incentives for developers to preserve floodplains such as allowing higher density development (see Cluster Development Fact Sheet)
- Decide which stream reaches will be regulated and to what degree
- Determine appropriate buffer width to provide desired flood protection and water quality benefits
- Increase flexibility by allowing riparian banking or buffer averaging.

Example Communities

- Lenexa, Kansas
- Johnson County, Kansas
- Arnold, Missouri
- Fort Collins, Colorado

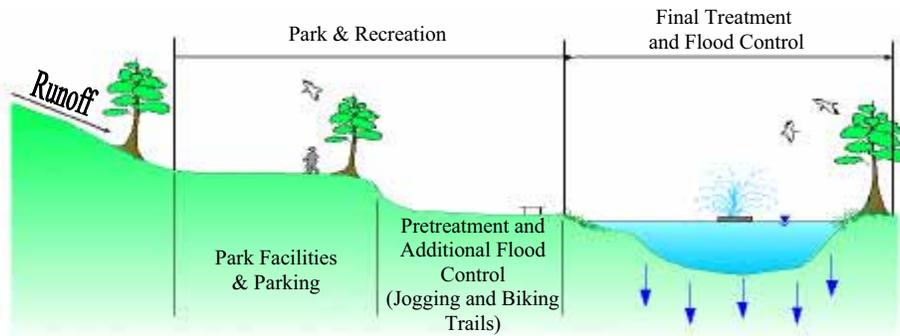
References

No Adverse Impact Status Report: Helping Communities Implement NAI, June 2002, Association of State Flood Plain Managers

Post Construction Storm Water Management in New Development & Redevelopment – Buffer Zones, January 2002, USEPA.

Stream Protection Guidelines, Draft Report, July 2001, Johnson County, Kansas.

Floodplain Management: Best Management Development Practices



Description

Best Management Development Practices can be implemented in floodplain areas to provide floodplain conveyance, and reduce runoff volumes and peak flows associated with development. Best Management Development Practices include swales, detention/retention ponds, and infiltration basins. These practices are also highly effective when used in upper portions of the watershed.

Swales are vegetated conveyance systems that reduce runoff volumes and peaks by providing infiltration and storage. Swales can be used in place of curb and gutter systems to provide floodplain conveyance, flood control and water quality benefits.

Detention/Retention ponds act to detain floodwaters and release it to the downstream conveyance system at a reduced rate (e.g. post development rate = pre development rate). Detention/Retention ponds also provide water quality benefits when they are designed to detain the frequent storm events (e.g. 1-inch rainfall event).

Infiltration basins detain runoff and slowly release it into the groundwater, providing runoff volume control and water quality treatment for non-soluble contaminants. The effectiveness of infiltration basins is dependent upon the permeability of the soils and the depth to groundwater and bedrock.

Advantages

- ★ Provide reductions in peak flow rates.
- ★ Minimizes erosion and flooding downstream.
- ★ Can be designed to provide water quality benefits.
- ★ Practices can be implemented on-site or as a regional facility.
- ★ Applicable for new and re-developments.
- ★ Infiltration practices replenish groundwater supplies, augmenting low flows and preserving base flows in streams.

Disadvantages

- ☹ Requires maintenance.
- ☹ Infiltration basins are not appropriate for areas with poorly drained soils or high water tables and may require more maintenance than other practices.

Floodplain Management: Best Management Development Practices

- ☹ On-site practices may increase downstream flooding potential if not designed with proper retention times.
- ☹ Difficult to incorporate into existing high density developments.
- ☹ Home associations may not have resources or knowledge to properly maintain the facilities.
- ☹ Site conditions determine infiltration capacity and limit flood reduction benefits.

Implementation Considerations

- Need to meet existing design standards to properly install facilities for flood control and may need updated standards to include water quality benefits.
- Need to consider cumulative impacts downstream.
- May require modifications of existing zoning ordinances.
- Maintenance responsibilities need to be specified and enforced.
- Public safety of wet detention facilities needs to be considered.
- Both mandatory and voluntary approaches can be used.
- Applicability to local topography and soil types.
- Lincoln's existing design standards may need to be strengthened to assist developers in designing practices that provide maximum benefit.

Example Communities

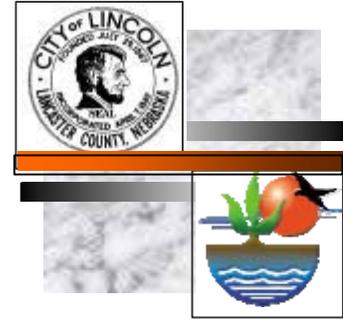
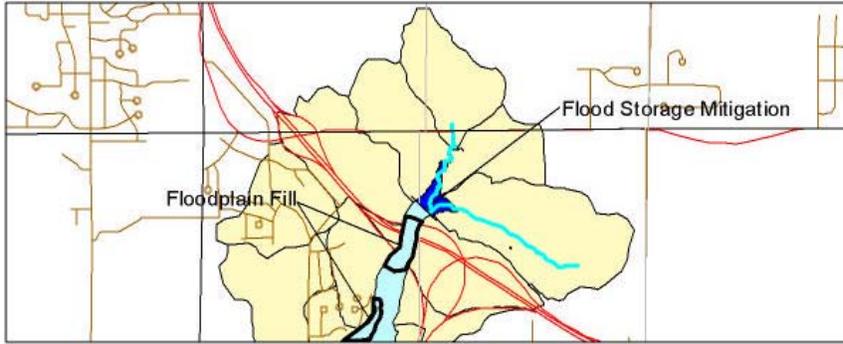
- Lake County, Illinois
- Overland Park, Kansas
- Fort Collins, Colorado
- Topeka, Kansas

References

The Wisconsin Storm Water Manual: Infiltration Basins and Trenches, University of Wisconsin – Extension, 2000.

City of Topeka Draft BMP Design Manual, Camp Dresser & McKee, Inc, December 2001.

Floodplain Management: Floodplain Mitigation



Description

Floodplain mitigation allows for development within the flood fringe, provided that the flood storage volume and environmental impacts are mitigated at a single designated off-site location to be used by multiple stakeholders along a given stream reach. This concept can be effective for mitigating the loss of riparian buffers, wetlands areas, and wildlife habitat by establishing a banking system. The banking system preserves an environmentally valuable tract of land as a means to maintain the balance of environmental assets as development occurs in a watershed. This concept has limited applicability for mitigating floodplain storage unless the tract of land is located in a proper location relative to the development. For example, it is not appropriate to mitigate floodplain storage loss in a separate watershed or at a location downstream from the development site.

Advantages

- ★ Can prevent the loss of environmentally sensitive areas such as wetlands, if environmental issues are considered as part of this floodplain management alternative.
- ★ May be appropriate for regional detention facilities within a watershed if hydraulic equivalency can be demonstrated.

Disadvantages

- ☹ Can increase flood elevations if not implemented properly.
- ☹ Limited applicability for flood storage mitigation.
- ☹ Difficult to locate and to obtain mitigation site.
- ☹ High construction costs.
- ☹ Requires detailed planning.
- ☹ Not always appropriate for developed watersheds.
- ☹ Requires a significant administrative effort to implement and manage.

Implementation Considerations

- Most effective with established watershed plan.
- May require more technical resources for review.
- Requires increase awareness and understanding of dynamic floodwater flow through a watershed.

Floodplain Management: Floodplain Mitigation

- Identification of mitigation sites within the watershed important for success.
- Ownership and maintenance of mitigation sites.

Example Communities

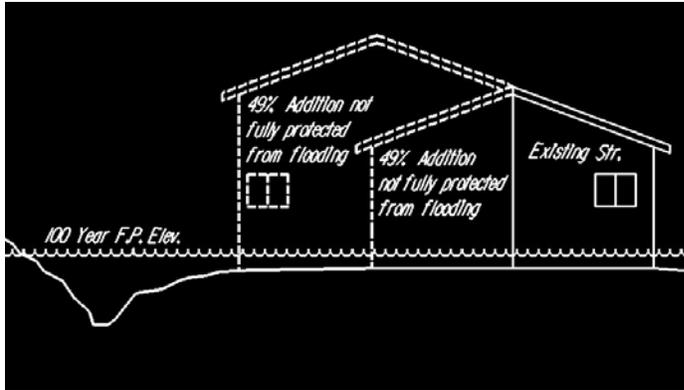
- Lake County, Illinois (Mitigation for “isolated” wetlands)
- Spaulding Township, Michigan

References

No Adverse Impact Status Report: Helping Communities Implement NAI, Association of State Flood Plain Managers, June 2002.

Mitigation Success Stories, Edition 4, Association of State Flood Plain Managers, January 2002.

Floodplain Management: Cumulative Substantial Improvements



Description

“Substantial Improvements” means any rehabilitation, addition or other improvement of a building when the cost of the improvement equals or exceeds 50% of the market value of the building before the start of construction of the improvement. This term includes any improvements made to a structure due to damage incurred by flood, fire, tornadoes, etc...

FEMA regulations require that any structure being “substantially improved” must be brought into compliance with floodplain regulations, including any additions that are part of the improvement.

Issue - Currently the City’s ordinances allow unlimited non-substantial improvements to structures. For example, a \$ 100,000 building could be improved to 49% of its’ value, when it would become an \$149,000 structure which could be improved to 49% of the new value... etc.. This is a problem because you can, substantially and repeatedly increase a buildings value without having to protect it from flooding.

Advantages

- ★ Seeks a balance between allowing future expansions and preserving flood storage.
- ★ Structures with multiple improvements are more likely to be protected from flood damage.
- ★ Provides flexibility to existing businesses in the older, developed areas of Lincoln where significant investments have already been made.
- ★ Prevents cost of repair/replacement falling to tax payers if the structure is flooded as part of a larger event that is declared an emergency.

Disadvantages

- ☹ Improvements beyond 49% of initial value would be a greater cost for existing homes and businesses in the floodplain, which would be required to bring the entire structure into compliance.
- ☹ Requires system tracking to be implemented and enforced.

Floodplain Management: Cumulative Substantial Improvements

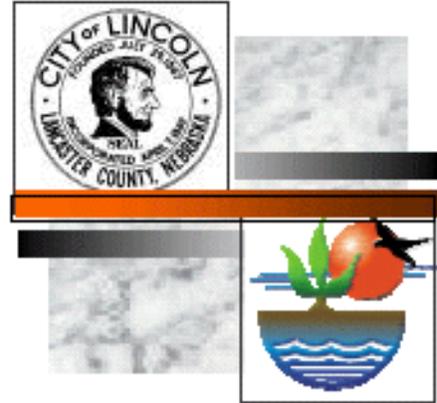
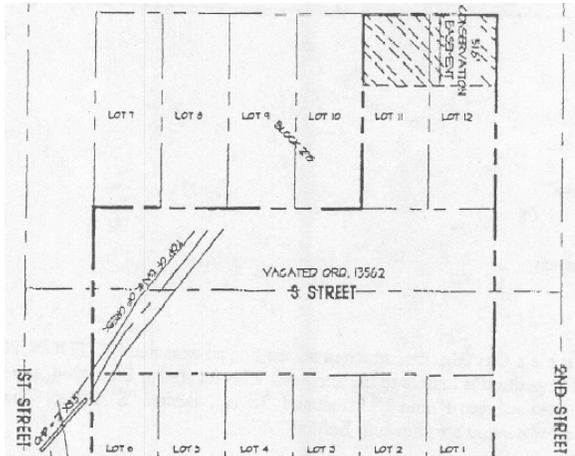
Implementation Considerations

- Provide start of construction date and begin tracking of all improvements after that date.
- An alternate standard would be to lower the 50% threshold to 25%, or another percentage.
- Improvements could also be limited to a certain percentage every 5 years, 10 years, etc..

References

- www.fema.gov/substantial

Floodplain Management: Maintain Storage on Surplus/Vacated Property



Description

Continuing this present-day policy would retain a permanent conservation easement over any City property within the floodplain that is declared surplus, or any street or alley ROW within the floodplain that is vacated. The conservation easement would protect the floodplain storage capacity (the area could not be filled or built upon, except for open space uses like a parking lot which preserve the flood storage).

As an alternative, the applicant may propose to deed a new conservation easement over a nearby area which would provide the same storage capacity. (e.g., 500 cubic yards of fill dirt and building volume could be compensated by the protection of 500 cubic yards of open flood storage volume elsewhere).

Advantages

- ★ Seeks a balance between allowing future expansions and preserving flood storage.
- ★ Provides flexibility to existing businesses in the older, developed areas of Lincoln where significant investments have already been made.

Disadvantages

- ☹ May encourage further development in the floodplain that would not otherwise occur due to space limitations.
- ☹ May lead to increased loss of flood storage, in spite of preserving a like volume of flood storage on the site, if conservation easement areas are not 'hydraulically equivalent.'
- ☹ May lead to a greater number of people/properties at risk of flooding.
- ☹ Encourages development of areas that might be considered for floodplain buyouts at some time in the future.

Implementation Considerations

- May not be an important consideration if a No Net Rise/Compensatory Storage or other 'No Adverse Impact' standard is adopted.
- Could be reviewed on case by case basis with review process and established criteria in place.
- For ROW vacations, acquisition of an easement over an alternate area takes significantly greater processing time/resources than retaining an easement over vacated ROW.

Floodplain Management: Maintain Storage on Surplus/Vacated Property

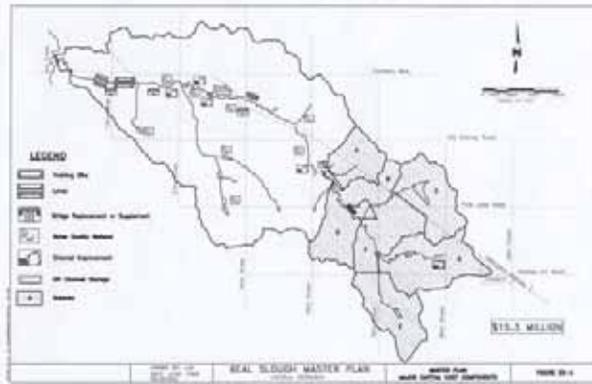
Implementation Considerations

- Policy could be one component of a larger program that places higher standards on undeveloped floodplains and allows greater flexibility in developed floodplains.
- Policy currently addresses only flood storage issues, but does not necessarily identify floodplain natural/beneficial functions (eg. impacts of constructing a parking lot in a previously undeveloped area).

References

- “Policies Pertaining to Street and Alley Vacations and Surplus Land in the Floodplain,” July 2002 FPTF handout (Handout No. 1 on website).
- Street and Alley Vacations, Handout No. 2 (ref. website).
- Small Group Discussions RE: Policies Pertaining to Street and Alley Vacations and Surplus Land in the Floodplain,” Aug 2002 handout and website reference.

Floodplain Management: Watershed Master Plan Standards



Description

The City and Lower Platte South NRD have commenced a process of master planning for each basin or watershed within the City of Lincoln and its future growth areas. The first master plan was completed for the Beal Slough basin in 2000, and the next area in process is the Southeast Upper Salt Creek Watershed. Eventually, all the master planned basins will be tied together in a comprehensive watershed master plan for the City of Lincoln and its environs.

The basin master plans provide a database of watershed information and a hydrologic/hydraulic computer modeling system which are used as analysis tools. The plans also include capital cost elements for floodplain management, water quality, and stream stability. The project components and computer model output are utilized by the City and NRD in evaluating and guiding future changes proposed within the basin.

Today, basin master plans are adopted by reference into the City-County Comprehensive Plan. Master plan components include:

- Better flood information: Existing and future 100-year floodplain and flood elevations along streams up to the uppermost 150 acre sub-basins. Depending on the basin, this may include areas previously mapped by FEMA, and/or previously unmapped tributaries.
- Structural project components - such as bridge/culvert improvements, stormwater retention basins, and constructed wetlands
- Non-structural project components - such as preservation of the 100-year floodplain.

Advantages

- ★ Floodplain standards are based upon the best available information and a comprehensive watershed approach to stormwater management
- ★ Provides an increased level of flood protection
- ★ Takes into account important natural functions of the floodplain beyond flood storage and conveyance, such as water quality and stream stability considerations.
- ★ There is an opportunity to consider regulating based upon future conditions for a higher level of proactive floodplain management.
- ★ Increased opportunities for multiple-use greenway corridors providing flood control and water quality benefits.

Floodplain Management: Watershed Master Plan Standards

Disadvantages	<ul style="list-style-type: none">☹ Challenges in implementing proposed capital project components due to timing of development relative to funding☹ Administrative challenges in regulating master plan floodplain in addition to FEMA-mapped floodplain areas (until FEMA maps are revised to reflect new floodplain information).☹ Consideration for impacts to private property if regulations were based upon a future conditions floodplain.
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Implementation Considerations	<ul style="list-style-type: none">● Better coordination between watershed model and information submitted with development proposals so that information is consistently provided on a sub-basin level that is compatible with the City/NRD model● Strengthen tie to master plan through zoning and subdivision ordinances to require impacts of individual developments to be compatible with the master plan● Regulate 100-year floodplain as identified in completed master plan until FEMA maps are revised to reflect the revised floodplain boundary● Regulate based upon future conditions as identified in master plan
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References	<ul style="list-style-type: none">• Watershed master planning discussion 4/16/04 (no handouts available)• Watershed master planning handout 9/24/02
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Floodplain Management: Floodplain Development Fee



Description

In 2000, an Infrastructure Financing Study was undertaken by the City of Lincoln to determine the impacts, capital costs, and financing alternatives for the provision of municipal utilities and other services to urban growth areas. A citizen Advisory Committee was appointed to assist the study team in the development of the study and to generate recommendations regarding financing alternatives.

The Committee's January 2001 Final Report included the following recommendation regarding floodplain development:

“Committee recommends in the future that, for those projects in the floodplain, an additional tax or special benefit district be created relating to the costs of the floodplain impact.” *(This proposed ‘fee’ was listed separately from, and in addition to, a recommendation for a city-wide stormwater utility service fee, for which enabling legislation is currently being pursued at the state level).*

It is important that the question regarding the need for a floodplain development fee be considered together with other floodplain policies currently being evaluated by the Mayor's Floodplain Task Force.

Advantages

- ★ Cost of impact to floodplain borne by those responsible for impact
- ★ Has the potential to deter development in the floodplain

Disadvantages

- ☹ Difficult to determine fee that would reflect actual costs of an individual development's impact.
- ☹ Potentially difficult to administer depending on the number of variables included
- ☹ Appear to be few communities with similar fees to use as a model

Floodplain Management: Floodplain Development Fee

Implementation Considerations

- Possibilities for basis of fee could include # cubic feet of flood storage lost, and/or number of square feet of disturbed riparian or stream buffer vegetation
- Could take into account impact to flood storage/conveyance attributes as well as natural/beneficial functions of floodplains
- May not be needed if floodplain resources are largely protected through new ordinances

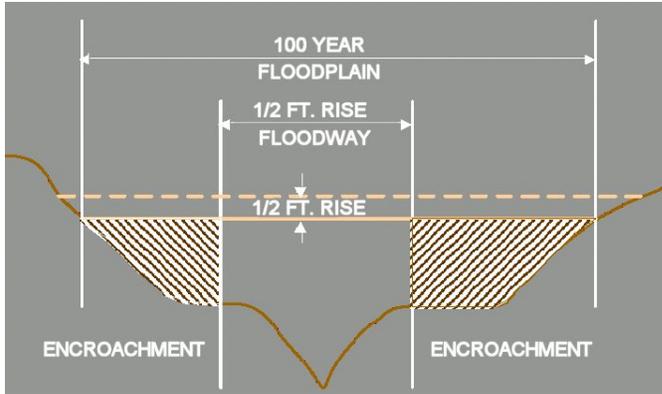
Example Communities

- ?? No *specific* examples of a floodplain development fee have been identified to date
- **Tallahassee, FL Environmental Impact Fees**
 - ↳ If a development includes land containing on or more of the conservation areas listed by Tallahassee, the applicant must propose measures to mitigate the adverse impacts of development on such areas
 - ↳ Environmental permit fees for individual residential building sites:
Short Form B - Low: \$510 for 1st 5,000 SF of disturbed area + \$0.01/SF > 5,000 SF
Short Form B -High: \$895 for 1st 5,000 SF of impervious area + \$0.025 > 5,000 SF
 - ↳ Environmental permit fees for larger development sites:
\$1,170 for 1st 5,000 SF of impervious area + \$0.04/SF > 5,000 SF & < 50,000 SF + a fee of \$0.04/SF for 50,000 SF & above.

References

- January 2001 Infrastructure Financing Study Advisory Committee Final Report, October 2001 Task Force Meeting Materials
- City of Tallahassee - Growth Management - Land Use and Environmental Services website and Environmental Management Ordinance (EMO), <http://talgov.com/citytlh/growth/luesdesc.html>

Floodplain Management: Half-foot Rise Alternative



Description

The Half-Foot Rise Alternative would require proposed developments in the floodplain to cause no greater than a half-foot rise in the 100-year flood elevation. This could be administered by re-mapping the existing floodways to a wider width to ensure that less than a half-foot rise when filling or obstructions are placed in the revised and narrower flood fringe.

Advantages

- ★ Maintains some floodplain storage capacity.
- ★ Preserves some aquatic and riparian habitat and areas.
- ★ May provide open space for public multi-use facilities such as recreation.

Disadvantages

- ⊖ Still allows a 1/2' rise, increasing flood hazards.
- ⊖ Less area available for development. This can be offset by other associated alternatives such as cluster development.
- ⊖ Higher cost for public drainage infrastructure.

Implementation Considerations

- Requires re-mapping of existing floodway/floodplain maps.
- Potentially greater number of proposed structures requiring hydraulic analysis.
- Developer/ Consultant/General Public outreach program.
- Use of cluster development would be compatible with this alternative.
- Use of compensatory storage alternative could be considered for remaining flood fringe area.

Example Communities

- State of Montana (10/25/01, USACE report)

References

- 10/25/01 USACE report on Floodplain Management Strategies
- 8/20/02 USACE handout of Deadman's Run Economic Analysis
- 9/24/02 USACE handout of Beal Slough Economic Analysis
- 10/22/02 CDM handout of presentation in binder

J. Glossary of Terms

Definitions:

100 - Year Floodplain - the limits of flooding having a 1% chance of occurring in any given year.

100 - Year Flood Elevation - the elevation of a flood having a 1% chance of occurring in any given year.

BMP - Best Management Practices include structural devices and/or non-structural stormwater activities designed to reduce the quantity or improve the quality of urban stormwater runoff.

Buffer - a vegetated zone adjacent to a stream where development is restricted or controlled to minimize the effects of development

CRS - Community Rating System is a program for recognizing and encouraging community floodplain management activities that exceed the minimum NFIP standards, where flood insurance premium rates are adjusted to reflect the reduced flood risk resulting from community activities.

Cluster (Open Space) Development - buildings and development concentrated in specific areas to minimize infrastructure and development costs and impacts to natural areas while achieving the allowable density.

Compensatory Storage - floodplain storage created by removing an equal or greater volume of fill from the flood fringe than the storage volume lost due to fill in the flood fringe.

CUP - Community Unit Plan. Lincoln Municipal Code, Chapter 27.65: Permits and encourages the creative design of new living areas that allow for increased dwellings per area in exchange for increased open space and common areas. The CUP enables cluster development.

Detention Basin - a stormwater facility that collects and temporarily stores runoff to reduce peak flow rates and alleviate downstream flooding and erosion problems.

Easement - a legal agreement to restrict the type and amount of development that may take place on a piece of property.

Existing Urban Area - For the purposes of this discussion, the Existing Urban Area is defined as those areas inside the city limits at the time a new standard is adopted *as well as* those areas outside the City limits which have zoning designation other than AG (Agricultural) or AGR (Agricultural Residential) at the time a new standard is adopted.

Eminent Domain - The government's power to acquire property without the consent of the owner.

FEMA - Federal Emergency Management Agency.

FIS - Flood Insurance Study

Floodplain - those lands which are subject to a one percent or greater chance of flooding in any given year. This is commonly referred to as the “100 year flood plain”.

Floodway - the channel of a river or other watercourses and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot. Floodways are mapped by FEMA and current regulations require development in floodways to meet a ‘No Net Rise’ standard.

Flood Fringe - area between the floodplain boundary and floodway boundary. Current regulations allow this area to be filled without regard to loss of flood storage.

Floodproofing- any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or structures.

Freeboard - A margin of safety added to the base flood elevation to account for waves, debris, miscalculations, or lack of data.

Green Space - defined in the Comprehensive Plan as areas predominantly used for active recreational uses, such as parks, golf courses, soccer or ball fields, and trails. Green space may also include areas of passive recreational uses as well as environmentally sensitive areas such as wetlands.

Habitat - an area or type of area that supports plant or animal life.

HEC-RAS - U.S. Army Corps of Engineers Hydrologic Engineering Center River Analysis System. Computer simulation software for open channel one-dimensional steady flow hydraulics.

Hydrology Analysis - the study of the amount and rate of flow arriving to conveyance systems from rainwater runoff.

Hydraulic Analysis - the study of stormwater flow through the conveyance system that includes underground pipelines, culverts, improved open channels, and natural creeks.

Impervious - the characteristic of a material that prevents the infiltration or passage of liquids through it. This may apply to roads, streets, parking lots, rooftops and sidewalks.

Lowest Finished Floor- the lowest floor of the lowest enclosed area (including a basement). FEMA requires that the lowest finished floor be protected to one foot above the 100 year flood elevation.

Minimum Flood Corridor - the existing channel bottom width plus 60 feet plus six times the channel depth, with the corridor centered on the channel.

NFIP - National Flood Insurance Program makes Federally-backed flood insurance available to communities that adopt and enforce floodplain management ordinances to reduce future flood damage.

New Growth Areas - For the purposes of these recommendations, New Growth Areas are defined as those areas outside the city limits and zoned AG or AGR at the time that a new standard is adopted.

No Adverse Impact - a managing principle and policy goal developed by the Association of State

Floodplain Managers to support long term, sustainable approaches to reducing the nation's flood losses now and in the future.

No Net Rise - term that indicates proposed land use revisions or changes in grade do not increase flood elevations at, upstream or downstream of the site.

Property Buyout - purchasing frequently flooded properties to demolish or relocate existing buildings and restoring the area to natural floodplains.

Public Infrastructure - areas of public land use, streets, and/or structures that serve the general public.

PUD - Planned Unit Development. Lincoln Municipal Code, Chapter 27.60. The PUD is an overlay zone permitting mixed land uses, and is intended to be used in combination with one or more of the City's existing zoning districts. The PUD also enables cluster development.

Retention Basin - a basin designed for the retention of stormwater, generally having a permanent water volume.

Riparian - the vegetated zone bordering a stream or river.

Runoff - the portion of precipitation that is discharged from a drainage area.

Substantial Improvement- Any reconstruction, rehabilitation, addition or other improvement to a structure, the total cost of which equals or exceeds 50 percent of the market value of the structure before the start of construction of the improvement. The definition of "substantial improvement" includes buildings that have been repaired after suffering substantial damage.

Surplus Property - property that has been found to be in excess of what is required.

Swale - an open drainage channel or depression explicitly designed to detain and promote the filtration of stormwater runoff.

Vacated Property - Property that has ceased to be occupied.

Watershed - a region of land that drains to a river, creek, or other body of water.

Wetland - areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

K. Supporting Information for Policy Recommendations

No Net Rise/Compensatory Storage Standard (Policy Item # 3)

1. It is estimated that the **hydrologic and hydraulic engineering costs** to develop in the flood fringe and meet the No Net Rise/Compensatory Storage standard will be similar to those that are incurred today for development or stream crossings within the floodway.
2. From discussions with engineering firms, the **costs to develop in the floodway** vary significantly, but typically **range between a few thousand dollars to greater than ten thousand dollars**. The replacement of stream crossing structures in the county where the replacement is going to have more flow capacity are on the low end, while more complicated stream crossings and developments with fill in the floodway can be on the high end of the range.
3. **Typical work involved for engineering** is surveying of cross sections, review of existing hydraulic models, review of hydrologic conditions, and the hydraulic modeling for the proposed structure.
4. **Examples** include hydraulic **engineering costs** of approximately \$12,000 for a recent ~60-acre development project and \$24,000 for the Lincoln Ballpark project (~90 acres), or about \$200/acre and \$300/acre respectively.
5. The table below depicts the **average estimated range in costs** for development in this area based upon discussions with engineering firms, and the **potential increase in engineering costs** for development in the floodplain that could be expected **if a No Net Rise/Compensatory Storage standard were adopted:**

Item	Cost	% of Development Cost
Total Development Costs	\$35,000-\$45,000/acre	100%
Existing Surveying/Engineering Costs*	\$3,500-\$4,500/acre	10%
Existing Land Planning Fees	\$1,750-2,250/acre	5%
Additional engineering costs anticipated to meet No Net Rise/Compensatory Storage standard	Mapped/Studied Areas: <u>Salt Creek Floodplain:</u> \$3,000 + \$200/acre <u>Other Floodplains:</u> \$3,000 + \$100/acre	<i>Additional Costs:</i> 100-acre site: 0.3%-0.7% 50-acre site: 0.4% -0.7% 10-acre site: 0.9%-1.4%

* Includes floodplain costs under present day standards.

Stream Crossing Structures (Policy Item 4)

1. There are circumstances in which it is **structurally or financially infeasible to construct stream crossings without causing any rise** in flood heights in the flood fringe. For example, on wide creeks it may be necessary to place piers within the flowage area. The piers act as an obstruction, and depending on their number and width will cause an increase in the water surface elevation.
2. Conversations with floodplain managers from other communities and other research indicates that **adopting a No Net Rise/Compensatory Storage floodplain standard will increase the cost of constructing new stream crossing structures**. Based on anecdotal evidence, it appears this increased cost **may approximate 25%**. However, the increase could be more for major structures, and also could be reduced if the standard is coupled with the ability to use compensatory storage, property rights acquisition, and increases in downstream conveyance capacity.
3. In areas where a No Net Rise floodplain standard is associated with other constraints such as in King County, Washington the **increased cost can be even more substantial**. King County has additional standards that require bridges to have a 6-foot freeboard above the 100-year flood level and do not allow any piers below the ‘ordinary high water mark.’ These are significant limitations, and the increase in bridge design and construction cost is estimated to be 40% for those bridges where backwater is a constraint.
4. When considering how this standard would be applied in Lincoln, it may be **fiscally impractical to construct a crossing that will not cause a rise** in flood heights in locations where no previous crossing has been built. For example, a bridge constructed to span the Salt Creek *Floodway* south of Lincoln would be 1,300 feet in length, whereas to **span the entire Salt Creek Floodplain** south of Lincoln would require a bridge 2,500 feet in length, and the **cost would increase** accordingly.
5. In some cases, stream crossings and utilities may cause an increase in flood stages but will not necessarily impact a significant flood storage area. Thus, one practical **alternative may be to allow a rise if property rights or flowage easements are acquired** in the area where flood heights are increased to offset the impacts of stream crossings. Compensatory storage could be required to offset any incidental loss in flood storage.
6. **Where existing stream crossing structures exist**, and the grade of the road is not being raised, a No Net Rise/Compensatory Storage standard **would not be anticipated to have a significant impact on bridge and culvert replacements**, since most replacements meet a higher standard than the older structures being replaced.

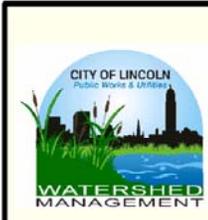
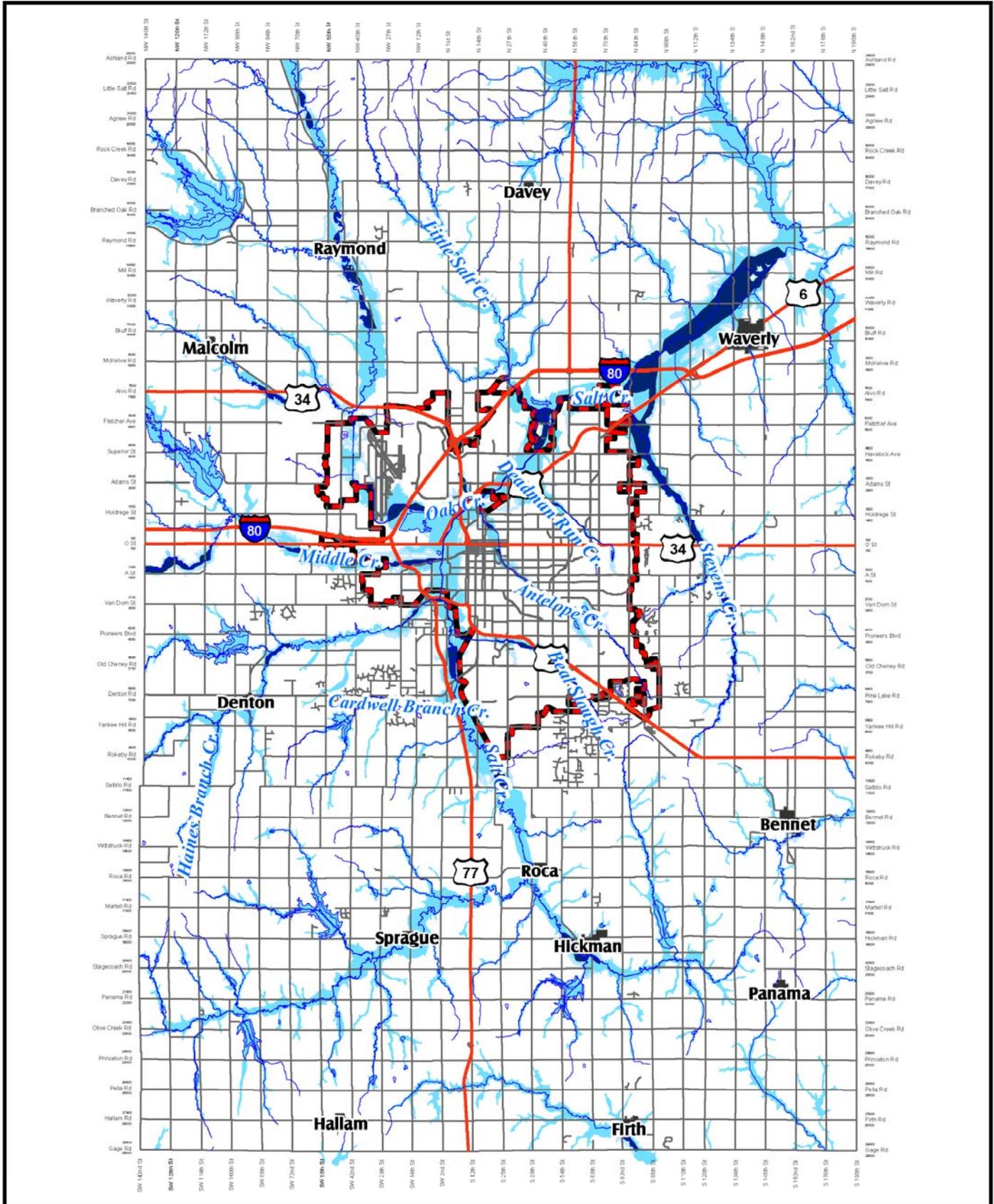
Best Management Practices (Policy Item 9)

Preservation of stream buffers is a ‘Best Management Practice’ which is included as a separate item (Item 4) proposed as a standard for floodplains. Stream buffers provide water quality and stream stability benefits, as well as assist in reducing the velocity of flood waters, and can be designated as a particular width and composition. **For this reason, buffers may be the most appropriate BMP to include as a required standard** in floodplain areas. **Other BMP’s** may be more difficult to quantify as a required standard for floodplain management and may be better implemented through a policy which **encourages and recommends their implementation**. Some relevant examples from Lincoln’s Drainage Criteria Manual are listed below:

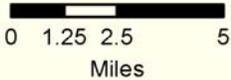
1. Extended Dry Detention Basins: require an area of 0.5 to 2.0% of drained area, no significant permanent water storage, approximately 40 hour drain time.
2. Retention (Wet) Ponds: Length to width ratio of 3:1 with inlet and outlet at maximum flow length, minimum depth 2 to 3 feet, maximum depth 9 to 10 feet, drainage area of 10 - 25 acres and larger.
3. Constructed Wetlands: Requires a perennial flow and near 0% slope, typically every 0.1 acres in size drains 10 acres, length to width ratio of 2:1, 50 % should have depth of 6" or less, 25% from 6 - 12", and 25% from 2-3'.
4. Grassed Swales: Used to collect overland runoff from impervious surfaces, ground slopes not over 6%, runoff velocities of no more than 1.5 to 2.5 ft/s with a maximum design flow depth of 3 ft.
5. Sand Filters: Used at outlet of detention basins and to treat parking lot runoff.
6. Check Dams: Where swales or other waterways need protection to reduce erosion.
7. Temporary Sediment Basins: Used below disturbed areas generally greater than 5 acres, usually used for less than 18 months unless designed as a permanent pond.
8. Infiltration Trenches: Use in drainage areas less than 15 acres, sandy and loamy soils, no less than 3 ft. between bottom of infiltration trench and top of ground water table.
9. Porous Pavement: Used in low traffic areas, walkways, and infrequently used parking areas, slopes of less than 5%, should not be constructed over fill.

100-Year Storm Limits Along Smaller Tributaries (Policy Item 14)

1. New subdivision proposals are required to show the ‘100-year storm’ limits along smaller tributaries outside of the FEMA-mapped floodplain. **Currently, the City applies the stormwater standards in these areas**, which require that the lowest minimum opening of a structure along a drainageway or overland flow route be at or above the 100-year storm elevation.
2. **Regulating these areas per the floodplain ordinance would pose administrative difficulties** unless these areas are master-planned, because information is submitted to the City in a piecemeal fashion, development by development.
3. The floodplain regulations require that the lowest finished floor of any structure within the mapped floodplain, including the basement, be elevated (or floodproofed) to 1' above the 100-year flood elevation. However, **structures that are outside of the mapped floodplain boundary may not receive adequate protection**, even if they are immediately adjacent to the floodplain. Because they are outside of the area ‘zoned’ as a floodplain, they may have doors or windows that are lower than the flood elevation.
4. The **stormwater standards are appropriate in these areas** because the smaller tributaries have a greater ratio of ‘edge’ to ‘floodprone area’. Structures along the edge are protected by insuring that the grading and elevation of the site keeps the minimum opening above the 100-year storm elevation. There are numerous smaller tributaries where structures might be protected to a lesser degree on the ‘edge’ if the floodplain standards are applied in lieu of the stormwater standards.

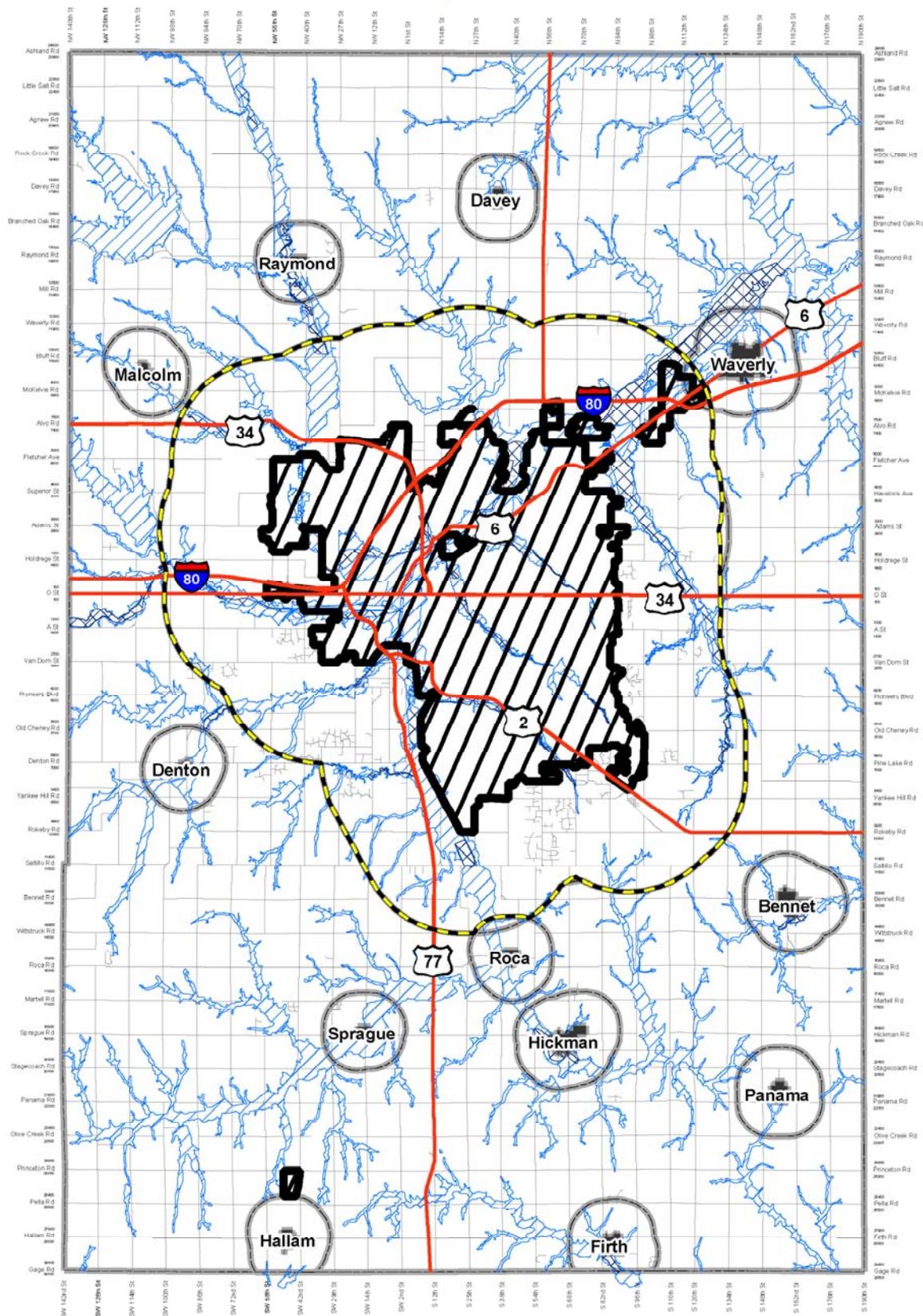


City of Lincoln / Lancaster County Floodplain Map



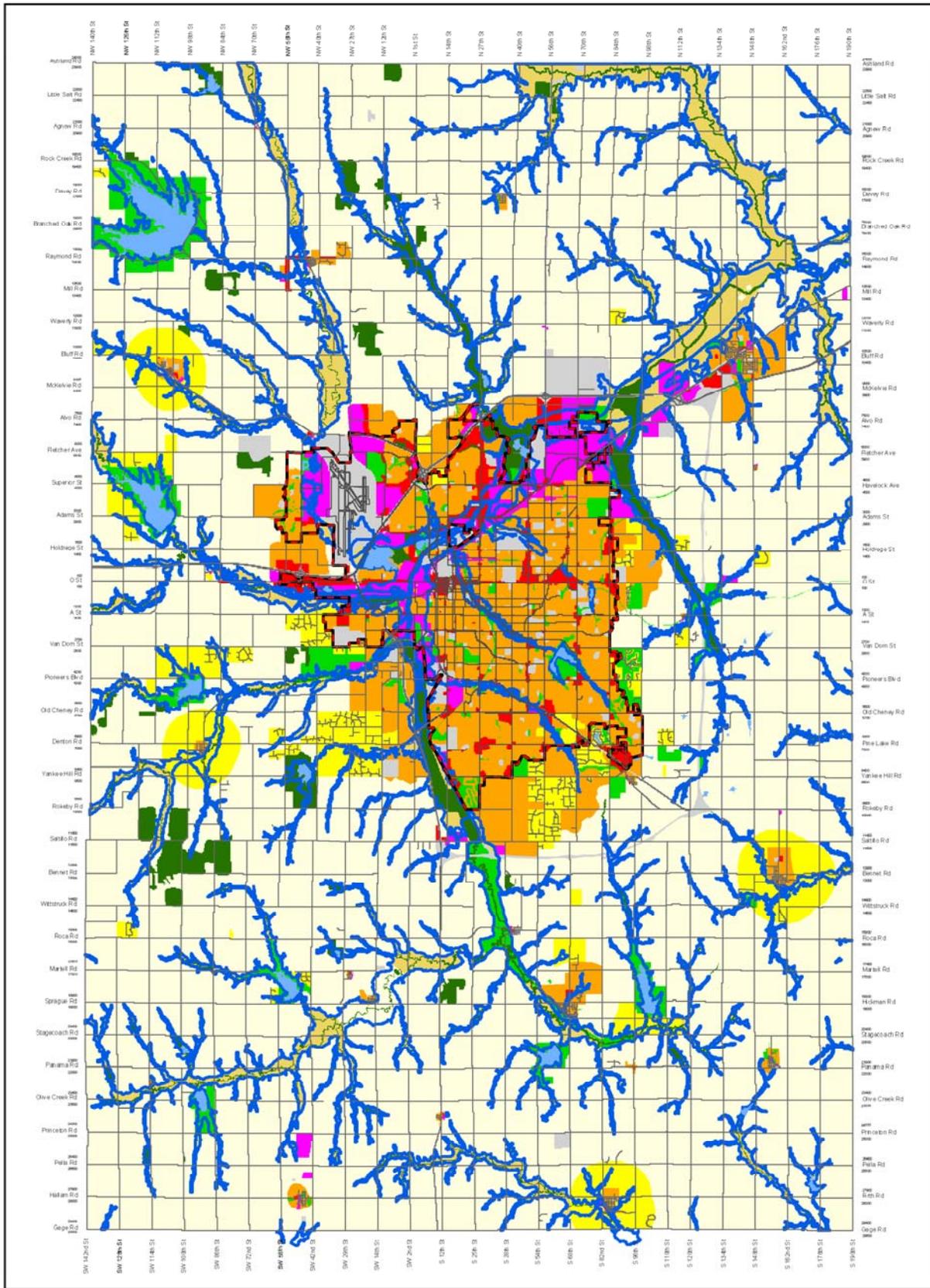
- | Legend | |
|--|---|
| — Streams | ■ Lancaster Co. Villages |
| — Highway | Floodplain Description |
| Major Street | ■ Floodway |
| Lancaster Co. Roads | ■ 100 Year Floodplain |
| City of Lincoln | ■ 500 Year Floodplain |

Floodplain Policy Application Areas

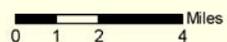


Legend		
Highway	Three Mile Zone	100 Year Floodplain
Lancaster Co. Roads	Lancaster Co. Villages	Floodway
Village Corporate Limits	Existing Urban Area	Future Growth Area



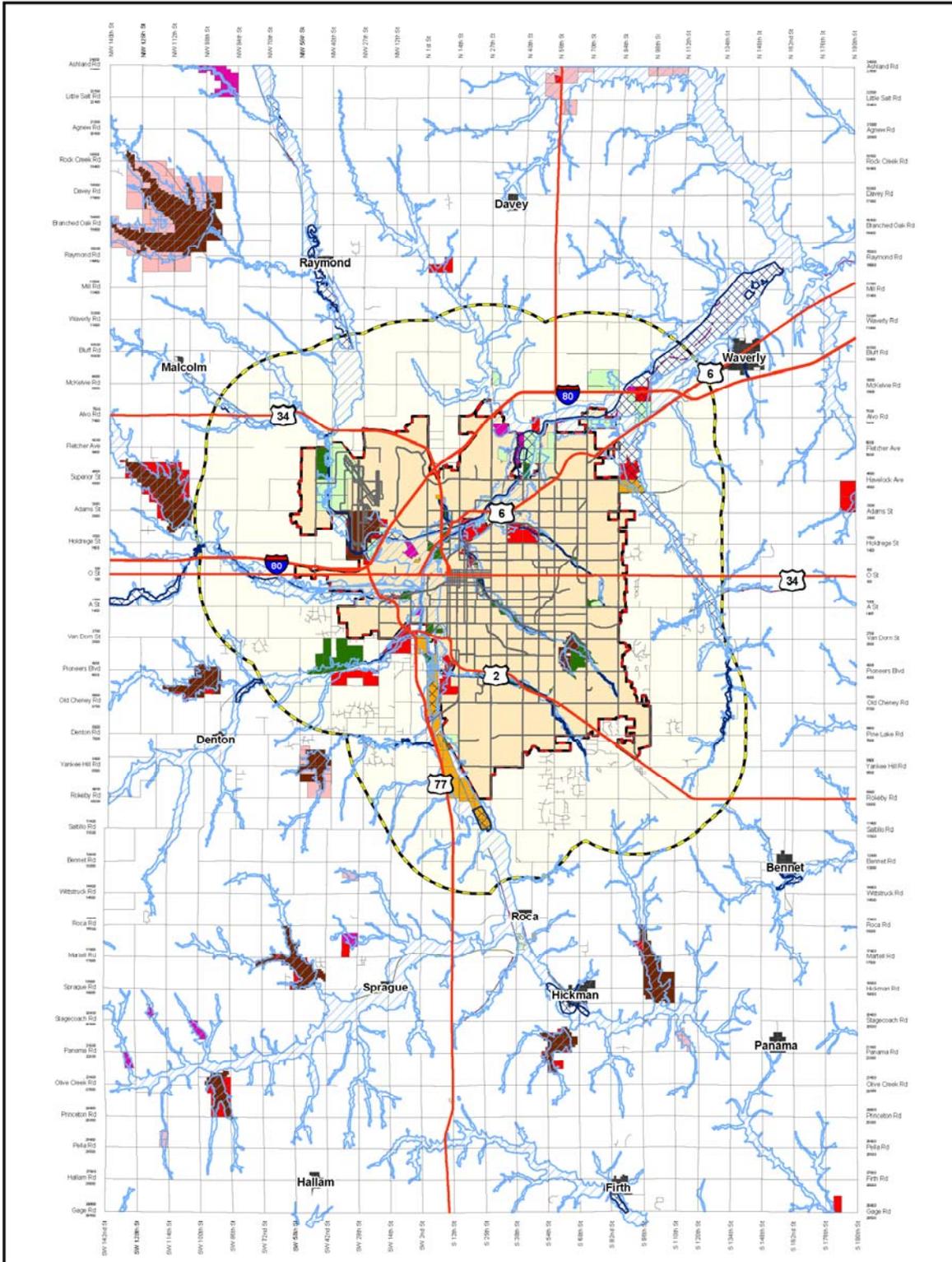


**Lincoln / Lancaster Co.
Land Use Plan
with Floodplain
April 2003**



Legend

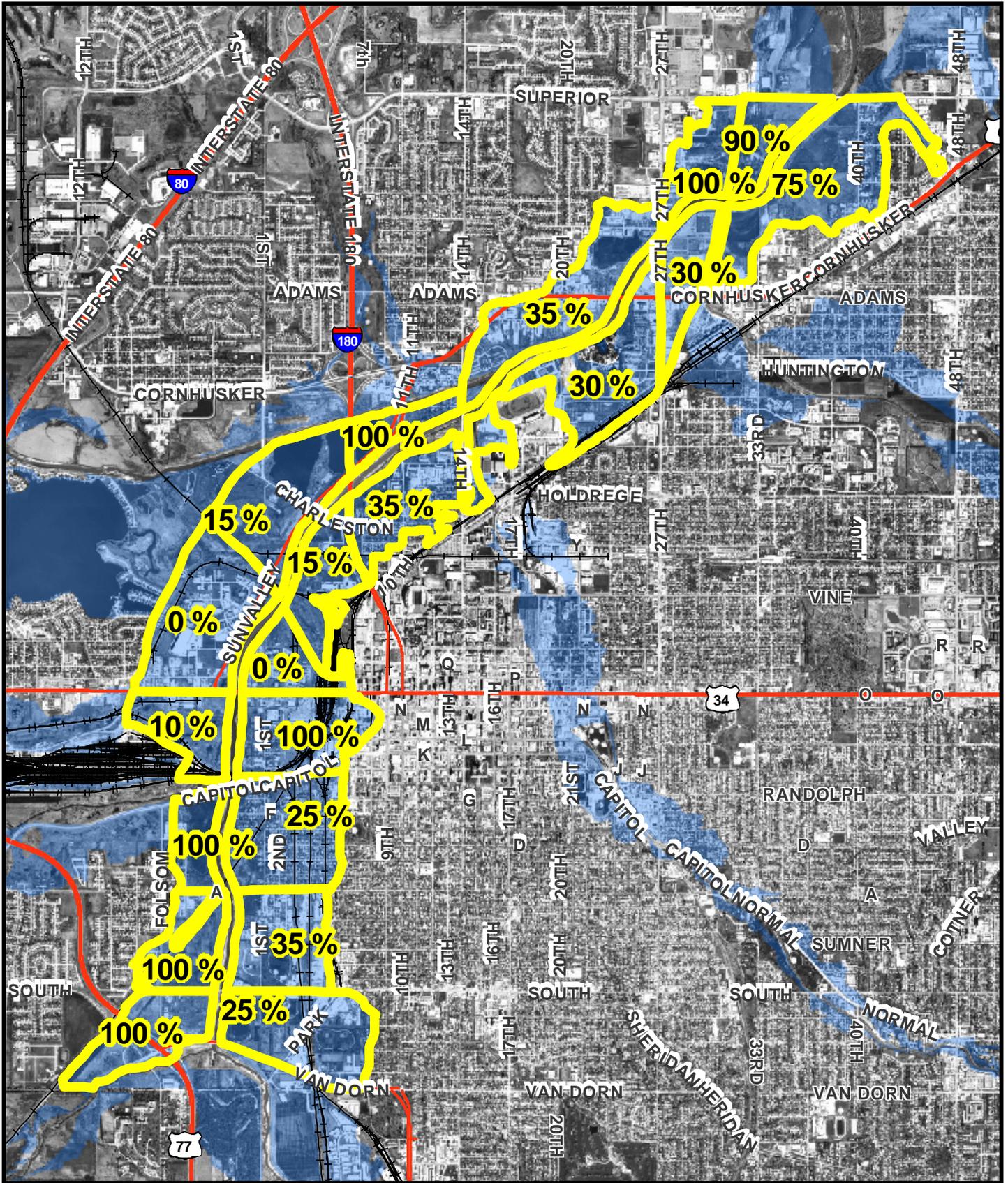
— Major Street	Public & Semi-Public	Residential, Low Density
— Lancaster Co. Roads	Lakes & Streams	Residential, Urban
▭ City Limit	Environmental Resources	Agricultural Stream Corridor
▭ Floodplain Description	Green Space	Commercial
▭ 100 Year Floodplain	Agricultural	Industrial



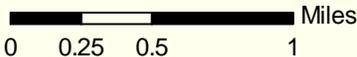
Legend			
— Major Street	Floodway	Public Agency	LES / NPPD (66 acres)
— Highway	100 Year Floodplain	CITY OF LINCOLN (1809 acres)	LANCASTER COUNTY (1482 acres)
City of Lincoln	3 Mile Zone	CITY OF LINCOLN / PARKS (988 acres)	LOWER PLATTE SOUTH NRD (1016 acres)
		NE GAME AND PARKS (2038 acres)	STATE OF NEBRASKA (1756 acres)
		FEDERAL (6374 acres)	

WATERSHED MANAGEMENT

City of Lincoln & Lancaster County Publicly Owned Land in Floodplain



**Percentage by Volume of Available Fill
for
Storage Areas
in
Salt Creek Flood Fringe**



Legend

- Railroad
- Highway
- Storage Area
- Flood Area Description**
- 100 Year Flood Area

