

CITY COUNCIL AGENDA ITEM
CITY OF SHORELINE, WASHINGTON

AGENDA TITLE: Thornton Creek Basin Plan Update
DEPARTMENT: Public Works Department
PRESENTED BY: Mark Relph, Director of Public Works
Jesus Sanchez, Operations Manager
Brian Landau, Surface Water and Environmental Services
Supervisor

PROBLEM/ISSUE STATEMENT:

The residential area south of Ronald Bog has historically flooded during significant rain events greater than a 50-year storm. Most recently, this neighborhood was severely flooded during the December 3, 2007 rainstorm, which was greater than a 100-year storm. Early in 2008, staff presented to Council proposed solutions to this issue since the flooding of many homes during a large rain-on-snow storm that occurred in early 1997. This report and presentation to Council will be an update on the progress made in the Thornton Creek drainage basin and specifically, the area adjacent to and South of Ronald Bog.

This update will cover the following topics:

1. Development of the Thornton Creek Basin Plan (TCBP) including floodplain mapping
2. Completion of CIP projects to date
3. The development of future CIP and the pursuit of Federal Emergency Management Agency (FEMA) grants: options, discussions with property owners and schedule.
4. Interim flood management plan

FINANCIAL IMPACT:

The completed drainage projects with respect to the Thornton Creek Basin Plan and the Flood Plain Designation Project totaled approximately \$2.3 million. Public Works Trust Fund Loans provided the revenue source to complete this phase of the project.

RECOMMENDATION

No action is required by the City Council at this time. This report is to provide the City Council with an update of the Thornton Creek Basin Plan.

Approved By: City Manager  City Attorney ____

INTRODUCTION

On December 3, 2007, a storm dropped more than four inches of rainfall in about 21 hours on the City. Public Works crews responded to hundreds of calls from residents. This rainfall amount exceeded the 100-year event, and thereby exceeded the design capacity of the stormwater infrastructure. The volume of runoff from this storm entering Ronald Bog was more than 20 acre-feet above flood stage. Consequently, flooding occurred in the residential area south of Ronald Bog. These homes were flooded with up to three feet of water for a second time in 11 years.

In 2008, City staff pursued several CIP solutions to mitigate flooding in the Ronald Bog area. The City, through contracted work, completed the replacement of the street drainage on the west side of Corliss Avenue N, between 171st and 172nd Streets, and removed the three restrictive culverts along Corliss Place, replacing them with fish passable boxes. In addition, the Cromwell Park Surface Water Enhancement Project currently under construction will also provide some flood reduction relief to the north branch of the Thornton Creek basin. Though these changes assist in mitigating some degree of flooding, it was not intended to be the panacea for alleviating flooding in the Ronald Bog area.

BACKGROUND

The neighborhood to the south of present day Ronald Bog Park was originally part of the bog. The area was platted for residential use by King County in 1955 and homes were built on fill not long afterwards. Construction of Interstate 5 began in the area in the early 1960's and the fill from the construction was used to reduce the open water portion of the bog (see Attachment A). Sometime after it began being used as a regional stormwater facility, the bog was directly connected to Thornton Creek. (bogs are usually isolated and are only connected to other surface waters through groundwater flow.)

Currently, Ronald Bog does not provide adequate storage volume to prevent downstream flooding during higher than normal severe storms (i.e. 25-100+ year events). The Ronald Bog outflow pipe and downstream channel have inadequate capacity and gradient. As a result, the Bog overtops its banks during these severe storms. In the past, as many as 20 homes have been significantly flooded. Some homes have been inundated with up to two feet of water above their finished flood elevations, causing significant damage. The four most recent floods include January 18, 1986, January 1, 1997, October 2, 2003, and December 3, 2007.

1. Thornton Creek Basin Plan:

A long-term solution to mitigate flooding to the fullest extent practicable required an understanding of the entire Thornton Creek basin from the headwaters up to and beyond the City's legal boundary. Based on the historical nature of Ronald Bog as a bog, groundwater/surface water interactions had to be considered when analyzing

potential flood reduction projects and developing long-term solutions. Thus, staff completed a preliminary Thornton Creek Basin Plan (TCBP), which included a detailed survey analysis to ascertain and delineate the floodplain area, affecting residents immediately south of Ronald Bog.

Additionally, in 2008, the City contracted with Northwest Hydraulic Consultants (NHC) to perform a floodplain mapping study of the north branch of Thornton Creek from Ronald Bog south to the City boundary. The purpose of the study was to delineate the flood hazard boundaries of the creek, thereby providing neighboring residents with the most current information available regarding their flooding risk. The creek was surveyed where rights-of-entry were available, and the stream geometry was coded into a HEC-RAS hydraulic computer model. The model was simulated with the standard FEMA discharge quantities of the 10-, 50-, 100-, and 500-year events. These flows were determined using a detailed hydraulic model of the Thornton Creek basin within the city limits.

A preliminary 100-year floodplain map has been prepared (See Attachment B). The floodplain mapping study will be completed in fall 2009. Once NHC completes the project, the final study products will be submitted to the City for review. At that time, the City will determine how the floodplain delineation will be used. Options include the likely submittal of the study to FEMA for incorporation in the national flood insurance database, regulation of the floodplain through the development code and building permits, or the distribution of the floodplain map to residents to educate and prepare the neighbors of the North Branch Thornton Creek. In addition, this study provides information necessary to seek grant funding from FEMA. The floodplain mapping may be modified in the future, depending upon the flood reduction projects implemented in this area.

The completed TCBP will provide a comprehensive examination of the surface water system within the watershed, including tributaries and storm drain trunk lines. The TCBP is intended to be a guide for future management of the basin. The objectives of the TCBP are to use a combination of regulatory measures, programmatic measures, and capital projects to:

- Reduce flooding,
- Improve water quality, and
- Protect and enhance existing habitat.

The TCBP also identifies potential funding scenarios to implement the solutions through the City's Capital Improvement Program.

Additionally, floodplain mapping work was undertaken due to the recurrence of extensive flooding downstream of Ronald Bog. The floodplain mapping study includes determining the existing floodplain south of the Bog. The hydraulic modeling developed as part of the floodplain mapping effort was also used to evaluate alternative solutions in this area.

In addition to the modeling of Ronald Bog and the downstream creek, separate hydraulic models were developed to analyze the complex drainage problems near 10th Avenue NE and NE 175th Street, as well as the Serpentine drainage system.

2. Completion of CIP projects to date:

Utilizing Public Works Trust Fund Loans (PWTF), staff developed a CIP Flood Improvement Project in the summer of 2008. This construction project at a cost of \$1.3 million replaced the street drainage on the west side of Corliss Avenue N, between N 171st and 172nd Streets, and removed the three restrictive culverts along Corliss Place N, replacing them with fish-passable boxes (See Attachment C). Though these changes assist in mitigating to some degree of flooding, it was not intended to alleviate 100-year flooding in the Ronald Bog area.

3. The development of future CIP and the pursuit of Federal Emergency Management Agency (FEMA) grants:

Much of floodplain analysis was given to the Ronald Bog area simply because it is by far the most significant flooding problem in the basin. The completion of the TCBP is critical in understanding the hydrologic behavior of the Thornton Creek basin. Before more major flood-related CIP work could be designed and completed, it is important to understand how the entire drainage system behaves within this basin. By mapping, surveying, and studying historical flooding and drainage issues, City staff worked with consultants and identified nearly 30 potential alternative solutions to address the Ronald Bog flooding problem. The list of potential solutions was developed by the following process:

- Reviewed prior studies.
- Obtained input from City staff.
- Obtained input from the public.
- Performed hydrologic and hydraulic modeling of the system.
- Evaluated field conditions.

Alternative solutions were grouped into four types of capital solutions that could be evaluated at a conceptual level, to ensure they were feasible prior to investing in more detailed analysis. These included:

1. Constructing a flood barrier, such as an earthen berm or a wall, to hold back floodwaters along the south edge of the Bog.
2. Expanding Ronald Bog to provide more flood storage capacity.
3. Increasing downstream flow capacity (e.g., by replacing the downstream pipe system with a larger system or by using a pump station).
4. Floodproofing homes and acquiring property.

In addition, several regulatory and programmatic options were also explored. The regulatory options included a wide range of floodplain management options, greater

development standards (e.g., building regulations, fill in the floodplain, etc.) and adopting the updated floodplain map and managing it as a regulatory floodplain. Programmatic measures include maintenance of the downstream channel, as well as enacting a monitoring and emergency response program.

Because this is a neighborhood problem, community meetings as well as one-on-one meetings with affected residents were held to get input from the public regarding the problems and the potential solutions.

Due to the sensitive nature of this problem and potential high cost of an alternative solution, specific evaluation criteria were developed to help identify a recommended solution. Based on these evaluation criteria, a practical and affordable floodplain management strategy that seeks the highest practicable flood protection is recommended.

The floodplain management strategy includes advancing an approach that involves alternative solutions 1 and 4 noted previously, plus the replacement of the outfall line. More specifically:

- A combination of a constructed flood barrier (such as a flood wall or berm)
- Dry floodproofing/ home elevations/ property acquisition. Examples of dry floodproofing measures include installing backflow preventers on exterior and interior drains, and installing floodgate/dams at garage doors. Home elevations would involve vacating lower basement areas and replacing these living spaces with added floor space on the main level.
- Replacement of the Ronald Bog Outfall line with a fish-passable piped system of largely the same capacity. Design of this system is scheduled to be completed by December 2009/January 2010. The estimated construction cost is approximately \$300,000.

The location, type, and extent of a flood barrier (i.e flood wall/berm), as well as which properties may receive floodproofing, will be determined considering both input from individual property owners and a cost/benefit analysis. The cost/benefit analysis is being done to both ensure that the ultimate project benefit outweighs the cost and to provide supporting data for FEMA grants. The cost benefit analysis is a requirement to submit and receive FEMA grants. In addition, the City is implementing other measures to reduce the potential for flood damage, including enhanced maintenance of the outlet system, an early warning system to notify property owners when water levels in the bog reach an early flood stage, and installation/operation of a street pump system.

The cost for the three projects to reduce flood impacts ranges from \$650,000 to \$1.7 million. The City is currently looking into FEMA grant opportunities to fund a portion of the Ronald Bog projects.

Alternative solutions 2 and 4 noted previously were not considered in the management strategy because they were ultimately not cost effective. Alternative 2 – increasing Ronald Bog storage capacity would not provide the highest level of flood protection practicable due to limited area and the cost to achieve even a 50-year protection would

be roughly 3 times the cost of other alternatives. Alternative 3 – larger outfall line would increase downstream peak flows and thereby send larger volumes of flood waters currently stored at the bog and create flooding and erosion at other locations downstream, specifically in Seattle. In addition, increased downstream flows could create new flooding problems where currently little or none exist.

Interim flood management plan:

A flood management plan is in development for the Ronald Bog neighborhood. The plan includes the existing early warning system (installed in 2008), reverse 911, a new pump system to remove surface street drainage, and the city response plan in the event of a major flood. A neighborhood meeting to discuss this plan is scheduled for October 15, 2009.

Next Steps

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|---|----------------|
| • Clean existing outlet pipe and remove downstream channel obstructions | September 2009 |
| • Complete Benefit/Cost Analysis for FEMA grants | October 2009 |
| • Begin design of outlet pipe replacement | November 2009 |
| • FEMA Pre-disaster Mitigation Grant Submittal | December 2009 |
| • Response from FEMA on our grant request | March 2009 |
| • Replacement of Outfall Line | Summer 2010 |

Funding

The following shows the current funding that is available based on the 2010-2015 Capital Improvement Plan (CIP) for the Ronald Bog Basin.

2010: \$ 315,000

2011: \$1,315,000

The projected CIP budget will provide the funding necessary to implement the flood reduction strategy outlined above. In addition, FEMA grant applications will likely be submitted to provide additional or supplemental funding for the proposed projects.

RECOMMENDATION

No action is required by the City Council at this time. This report is to provide the City Council with an update of the Thornton Creek Basin Plan.

ATTACHMENTS:

Attachment A – 1953 Ronald Bog Aerial Photo with Current Street Configuration

Attachment B – Draft of 100-year Thornton Creek Floodplain

Attachment C – 2008 Ronald Bog CIP Project

Attachment A – 1953 Ronald Bog Aerial Photo with Current Street Configuration



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FLOODPLAIN



