CHEHALIS RIVER BASIN FLOOD AUTHORITY

July 8, 2015

TO: Ron Averill, Projects Committee Chair

FROM: Vickie Raines, Flood Authority Chair

SUBJECT: Executive Committee Request

Over the past several months there have been a number of questions raised regarding the Mill Creek Dam and Wishkah Road projects. I asked for an independent evaluation of the projects to address the issues that have been raised. The evaluation was completed recently by Watershed Science and Engineering (see attached).

One conclusion of the evaluation common to both projects is that there is not sufficient information to determine if the projects can achieve their objectives for reducing flood impacts to their respective communities. The Executive Committee met by conference call on 7/07/2015 to discuss the evaluation. The Executive Committee would like the Project Committee to consider the following recommendations as it develops its recommendation for how to allocate project funds from the recently approved biennial budget.

1. A technical feasibility analysis should be conducted as soon as possible for both projects to determine if they can achieve the flood damage reduction benefits desired by the respective communities. If current project designs cannot achieve the desired benefits then alternatives to provide flood protection for the people of Cosmopolis and along the Wishkah Road should be identified that can.

2. For all new projects, a feasibility analysis should be funded in the initial stages of project design to ensure the desired benefits can be achieved.

Thank you for your consideration of the Executive Committee recommendations.

Please contact me if you have any questions.

CHEHALIS RIVER BASIN FLOOD AUTHORITY

Attachment

Watershed Science and Engineering Evaluation

Memorandum

To: Jim Kramer

From: Larry Karpack & Mark Indrebo, Watershed Science & Engineering

Date: July 7, 2015

Re: Wishkah Road and Mill Creek Dam projects

INTORDUCTION

Watershed Science & Engineering (WSE) was retained to provide a third party review of the Kersh-Wishkah Flood Levee Project and the Mill Creek Dam Improvement Project. The goal of the review is to evaluate the anticipated benefits, uncertainties, implementation issues, and costs of the projects by reviewing available design documents and background information, discussing the projects with key stakeholders, and visiting each site to make observations and collect any necessary field information.

At a high level, the most significant finding of our review, common to both projects, is that an engineering alternatives analysis including a detailed cost benefit analysis does not appear to have been conducted. For both projects it appears that a decision was made to fund the projects and an engineering consultant was selected to design the projects. While the engineering design documentation includes information regarding the projects costs, the absence of specific quantitative information on the benefits provided by the projects makes it impossible to say whether they make effective use of limited flood damage reduction funds or not. Specific issues and questions related to each of the proposed projects are outlined below.

We should note that it was suggested by some project proponents that WSE could collect additional data and perform analyses to quantify the potential benefits of the projects. That effort is beyond the scope of WSE's work but below we provide suggestions for analyses that could be completed to quantify benefits.

WISHKAH ROAD

1. Improving access for emergency response is a primary justification for this project. The report should provide a clear and succinct analysis of the water surface elevation that precludes emergency vehicle access past Baretich Road, as well as how frequently, and for what duration, the water level exceeds this critical elevation at that location.
2. In section 1.3, the AMEC report indicates that Wishkah Road is overtopped two to three times per year, and "shallow flooding" occurs up to 20 times per year. However, section 8.1.2 states that Wishkah Road is only closed due to water over the roadway once every year or two, for between 1 and 5 hours at a time. It is not clear if road closures near Baretich Road are due to flooding in the area of Baretich Road or further upstream. According to the County Roads staff, the County closes Wishkah Road at Baretich Road because it is the best spot for vehicles to turn around, not necessarily because the road is impassable at that location.
3. While it is clear that flooding in the vicinity of Baretich Road has made it difficult or impossible to pass that point, we did not find any documentation as to the frequency or duration of these

closures, and therefore cannot assess how much benefit the proposed Kersh-Wishkah Flood Levee Project is likely to have.

4. The analysis should be expanded to include a comprehensive evaluation of all of the low spots on Wishkah Road (Figure 1), and should include a way to prioritize road improvements to maximize benefits and optimize expenditures. It is apparent that more frequent and more severe flooding of Wishkah Road occurs at several upstream locations; fixing those problems may provide significantly greater benefit to homeowners who are isolated from emergency services during more frequent flood events (Figures 2, 3). In any case the benefits of simply improving the section of Wishkah Road near Baretich Road cannot be presumed to provide access to upstream residences unless other low lying sections of the road are also improved. A benefit-cost analysis that characterizes current impacts and evaluates and prioritizes improvements along the entire stretch of Wishkah Road from Baretich Road to the Wishkah Bridge would facilitate a comprehensive solution for improving emergency vehicle access.
5. The engineering design report noted that the project stakeholders determined that flood protection should be built to an elevation of 16' NAVD, to protect against current flooding and potential sea level rise due to global climate change. Given that there is probably little difference in cost between a floodwall with a top elevation of 15' versus one with a top elevation of 16', it makes sense that a floodwall would be proposed to the higher elevation to accommodate potential future climate change. However, when assessing other options such as raising the road grade, where the additional cost of another foot of fill is significant, a different design elevation may be more appropriate. It is quite possible that a lower design elevation such as the 100 year flood elevation of 14.4 feet to 14.9 feet (CHE 2014) or even lower might be more cost effective. A lower height might not totally eliminate flooding in all future conditions (including under climate change scenarios) but it may reduce flooding to acceptable frequencies and durations at far less cost. Furthermore, if future climate change does drive flood elevations higher, the road height could be raised again in the future.
6. When considering the alternative of raising the road, three challenges were identified that made it infeasible. However, these challenges would likely also apply, at least to some extent, to the preferred alternative.
    a. Road closures & traffic disruptions – It may be possible to raise the road by closing one lane of traffic at a time. This would cause disruptions, but would prevent the full closure of the road. Constructing the floodwall will likely require the closure of the northbound lane in some areas (the AMEC plan indicates that road closure details will be developed as part of the 60% design). Constructing the floodwall will likely involve less traffic disruption than raising the road, but it is not clear that the extra disruption makes raising the road infeasible.
    b. Installing new tide gates – Most of the culverts in the vicinity of Baretich Road do not currently have tidegates. In order to reduce flooding to local residences, both the road-raising alternative and the floodwall alternative would require installing tidegates on the presently unregulated culverts, and tidegates are included in the 30% plans for the floodwall. Permitting new tidegates will likely be difficult, but it will be equally difficult for either alternative.

c. More rapid rise in floodwaters behind the road – According to the AMEC report, if the road is raised, "residents would likely experience a more rapid rise in water levels than they are accustomed to, which could increase the risk that people would become trapped by flood waters". It is not clear why the rise in floodwater would be more rapid, nor how the rise with the floodwall would be any different than with a raised road.

7. The engineering design report notes that the soils under Wishkah Road are unstable, and if the road is built up to a higher elevation it will likely subside and need to be raised again in the future. The alternative analysis should investigate the cost of periodically raising the road, and compare it to the cost of the proposed floodwall over its effective lifespan.
8. The analysis should consider whether there are other options to provide emergency access during a flood event that would be equally effective, but at a lower cost. Examples might include providing helicopter landing areas or purchasing all-terrain vehicles (truck with over-size tires or a hovercraft similar to the one operated by Snohomish County) to access areas beyond the road closure. Such alternate modes of access may be cheaper, and could be used in other areas of the County that might be subject to stranding during flood events.
9. The report should include a discussion of whether there is an acceptable level of disruption (frequency and duration) to emergency services due to flooding. While life safety is paramount, flood reduction funding is limited and there are numerous locations throughout the County (including several further up Wishkah Road) that are subject to similar issues. The cost of the proposed floodwall project is significant. The County should consider if there are other projects that would provide a greater benefit, or address more severe life safety hazards than the proposed Wishkah Road project.

MILL CREEK DAM

1. The dimensions and storage volume of the original dam should be clearly detailed. There is conflicting information on its size, the area it inundated, and the volume of water that it impounded. The potential flow reduction benefit of the dam is thus uncertain. The dam length is reported variously as 100 feet, 50 feet and 35 feet, and the height as 20 feet or 12 feet. The ponding area behind the dam has been reported as 2 acres and as 3-4 acres, with a storage volume of 10 or 20 acre feet. Our field observations indicate that the concrete portion of the dam is about 35 feet long and 12 feet high, with an unregulated spillway at a height of about 9 feet. We estimate that less than 2.5 acre feet would have been stored before water began discharging via the unregulated spillway, and just over 8 acre feet would have been stored before the entire length of the concrete dam would have been overtopped. It is not clear that this volume of storage could have provided much flood reduction benefit.
2. According to the Hydrology and Hydraulics Technical Memorandum published as part of the Engineers Report (HDR, 2015), the proposed dam will impound 20.8 acre feet with flow approximately 2 feet deep over the dam crest, assuming the 100-year long-duration event which is estimated to have an inflow peak of 499 cubic feet per second (cfs). That event is estimated to have a total runoff volume of 654 acre feet. Therefore the dam can capture approximately 3% of

the total runoff during the 100-year event. It is difficult to imagine any scenario in which this limited amount of storage can provide a significant flood reduction benefit.

3. The mouth of Mill Creek is tidally influenced, and has a self-regulating (e.g. fish-passable) tidegate. In theory, active operations at the dam could store Mill Creek flows during periods of high tide to help reduce ponding elevations when the tidegate is closed. When the tide drops and the tidegate reopens, water could be released from the dam without raising water surface elevations in the ponding area. In this manner it is possible that flood reduction in the ponding area could be achieved while only storing water behind the dam for several hours coincident with the peak tides. However, considering the volume of water that can be impounded at the dam, we estimate that it would be filled to overflow in approximately 20 minutes during a 25-year event, and even faster during a 100-year event. The benefit of this limited potential storage is unclear. Furthermore, any potential benefit from storing water during high tides and releasing it during the subsequent low tides requires active operation of the dam's hydraulic controls. We have not seen any discussion about an operating plan to achieve this level of control.
4. Recent flooding reported in Cosmopolis appears to be the result of exceptional events; i.e. the dam break flood in 2008 and the flooding in January of 2015 which resulted from record rainfall. It is unclear if damage along Mill Creek occurs during smaller, more frequent flood events – i.e. 5-year or 10-year events or less. Since the dam appears to only have enough storage to provide any significant flow control during small flood events it is unclear whether flooding in the channelized portions of Mill Creek will be reduced at all. An analysis of this should be provided if the dam is being proposed to reduce potential flood damages.
5. It has been suggested that the flood benefit of this project can be shown by comparing the FEMA floodplain (Figure 4), which was mapped when the dam was in place, with recent flooding events on Mill Creek. However, the FEMA mapping did not consider the dam, and therefore represents the present system more accurately than the system with a dam in place.
6. A detailed hydraulic analysis should be completed as the next step in the project, to determine how effective the dam will be at reducing flood impacts to downstream landowners. According to the Multi-Objective Plan for Mill Creek (2014), the purpose for seeking funding form the Chehalis River Basin Flood Authority for a new dam was "to provide flood damage reduction, fish passage, and recreation". To date, there has not been an engineering analysis of the flood reduction benefit of either the old dam or the proposed dam. The Engineer's Report (2015) says that such an analysis will be completed as part of the final design, but we recommend that it be completed before other design work is undertaken in order to better understand the benefits of the project in relation to its costs.

SUMMARY

After reviewing the information about these projects, we believe that more information is needed to better quantify their benefit. Both offer potential flood reduction benefits, but without a more accurate and quantifiable assessment of the benefits, it is difficult to judge whether the projects represent an effective use of limited flood reduction funds available to the Chehalis River Basin Flood Authority.

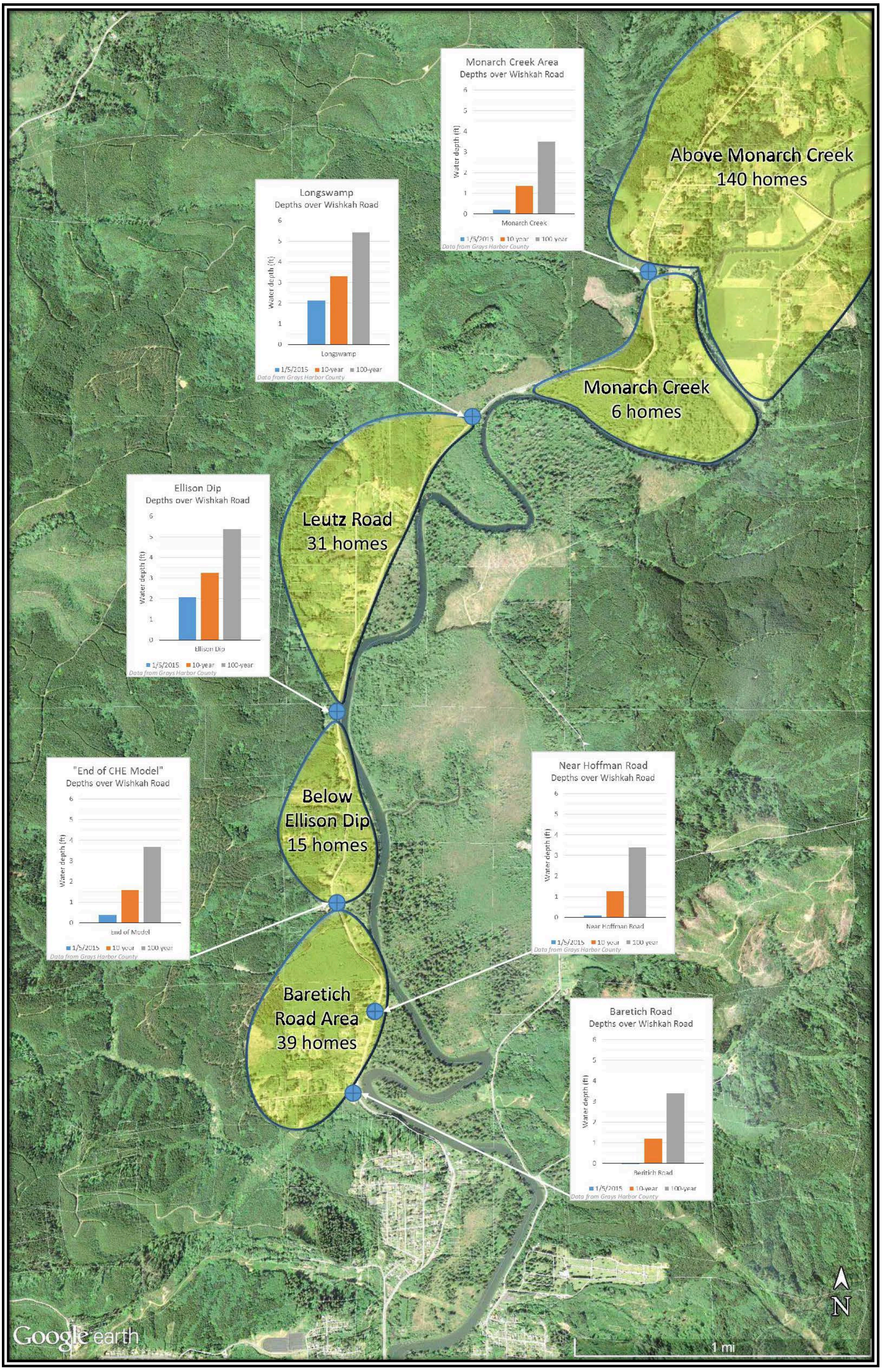

Figure 1 - Flood-prone areas of Wishkah Road

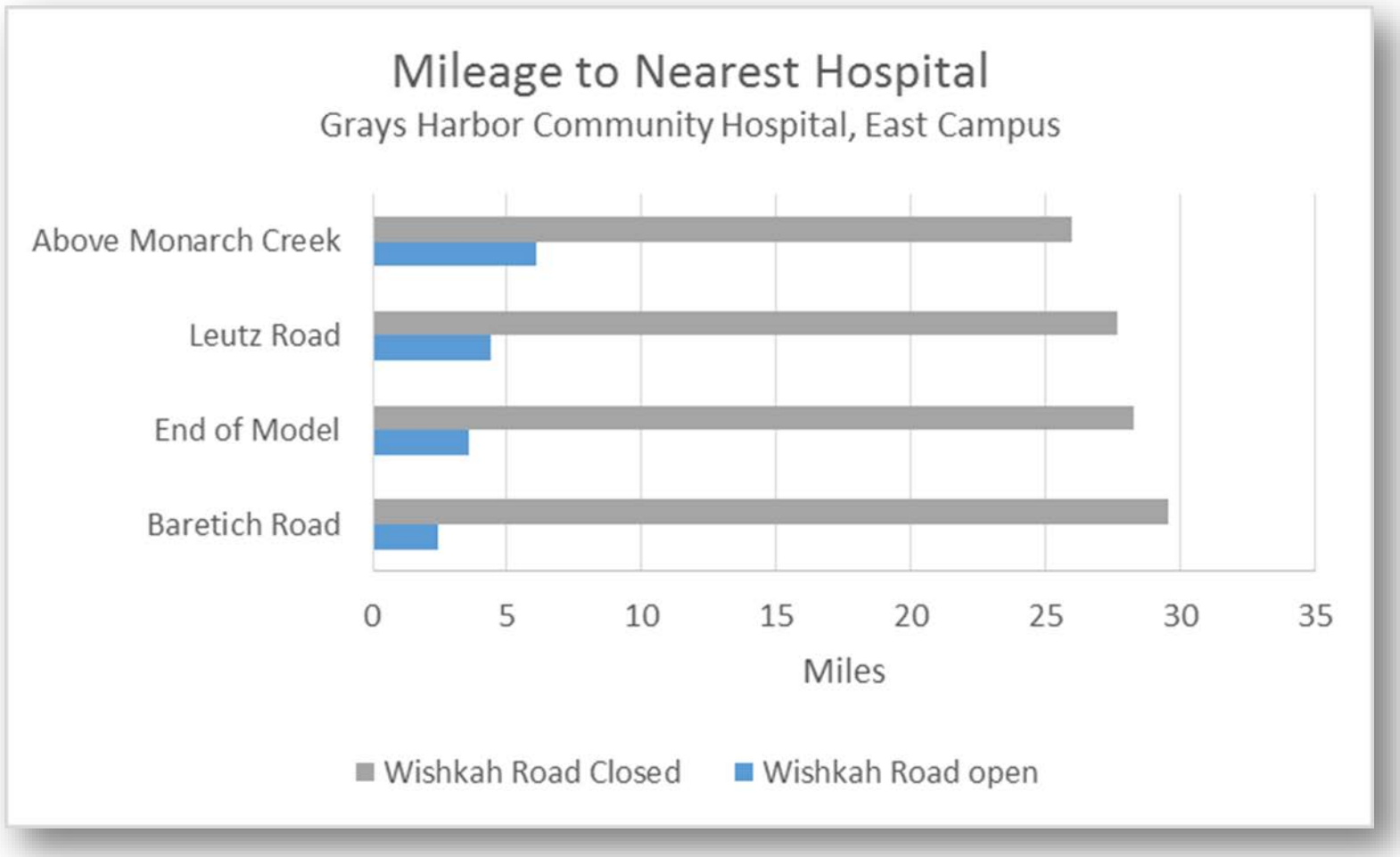

Figure 2 - Mileage to Nearest Hospital With & Without Road Closures on Wishkah Road

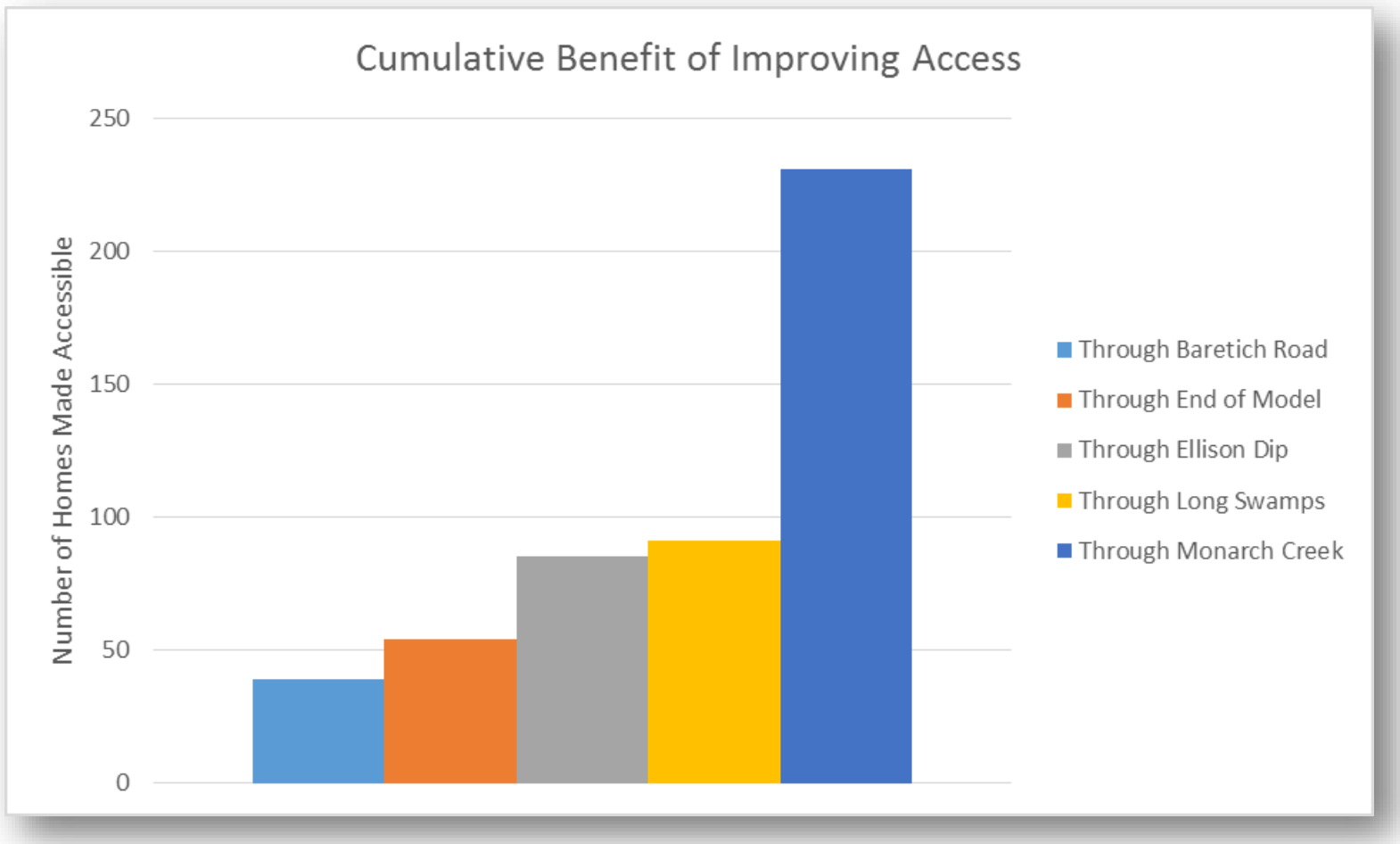

Figure 3 - Homes Made Accessible by Correcting Flood-Prone Areas of Wishkah Road (Working Downstream to Upstream)

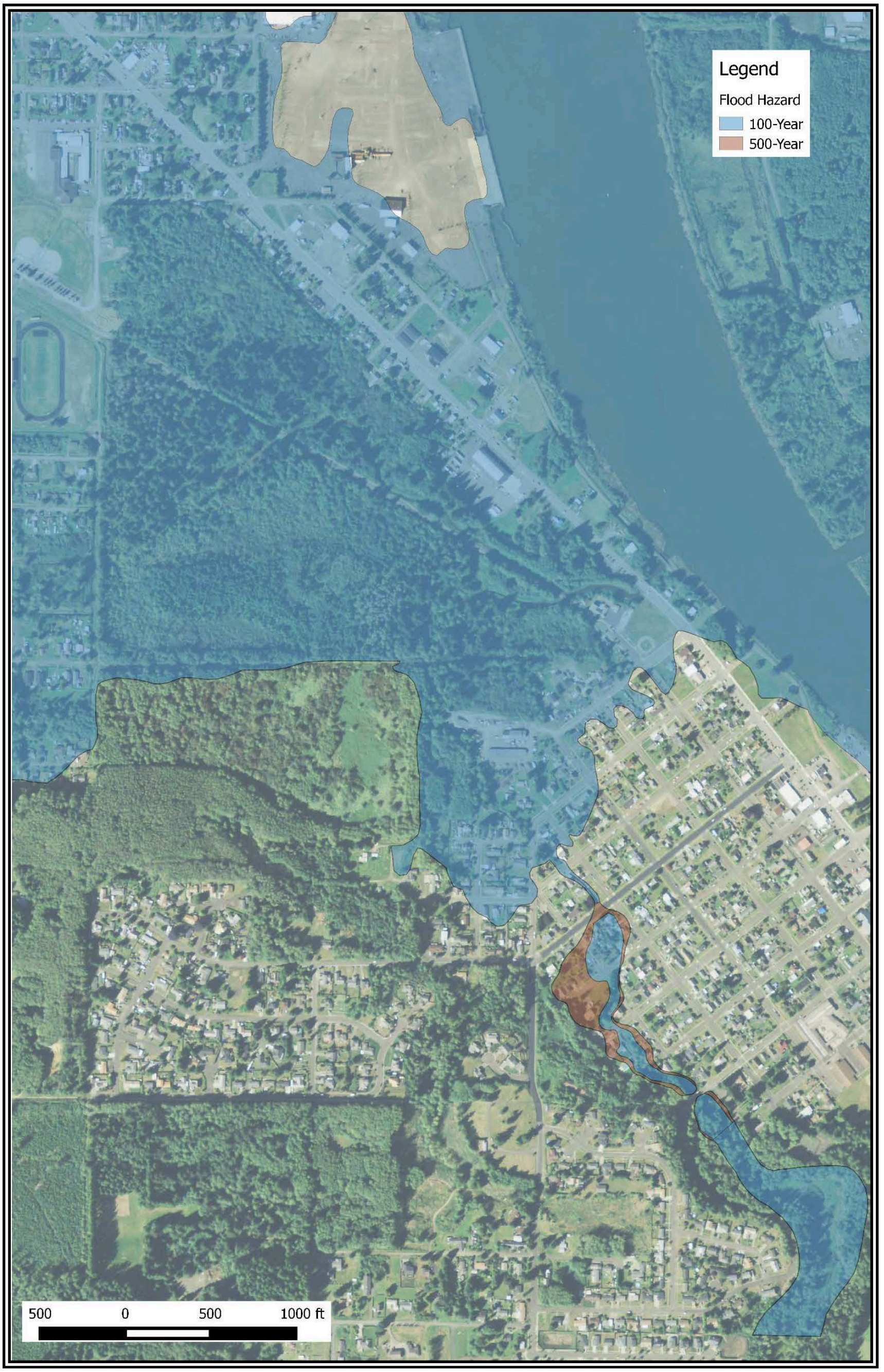

Figure 4 - FEMA Floodmapping, Cosmopolis and South Aberdeen. Digital version may differ somewhat from effective mapping.