5.4 Upstream Storm Drain Improvements

5.4.1 Overview of Storm Drain Improvements

The watershed approach to solving flooding in the Vista Grande drainage area outlined in this Study will require a combination of upstream and downstream solutions and improvements. Downstream improvements included in the Vista Grande Watershed Study's preliminary program recommendations include a new Tunnel South of County Line and Vista Grande Constructed Wetland (as described in Sections 5.2 and 5.3, respectively.) Upstream improvements include improvements to the storm drain conveyance system to alleviate flooding for the 10-year design storm event. It is important to note that before undertaking any upstream storm drain flow capacity improvements, downstream infrastructure improvements must be completed, as increased flow capacity upstream would require adequate flow capacity downstream. Additionally, in order to specifically identify the required improvements in the Vista Grande storm drain system, a storm drain master planning process should be undertaken, which would involve flow monitoring, model calibration, and the development of a capital improvement program.

This section describes the existing Vista Grande storm drain collection system, discusses general types of improvements that would be implemented to address storm drain system deficiencies, outlines the steps necessary to complete a storm drain master plan, and provides information on costs and the implementation schedule for storm drain improvements.

5.4.2 Existing System Description and Constraints

The Vista Grande storm drain collection system collects stormwater runoff from an approximately 2.5 square mile area of Daly City. The area includes a portion of unincorporated San Mateo County, and is bordered by San Francisco County to the north, Colma Creek to the south and east, and the Pacific Ocean to the west, as shown in Figure 1-1. During the wet weather season, rainfall runoff generated within this drainage area is captured in the existing Vista Grande storm drain collection system. This underground collection system routes storm flows northwest to Vista Grande canal and tunnel for discharge to an outfall structure at the beach below Fort Funston. The existing Vista Grande storm drain system is comprised of storm sewers, box culverts, manholes, catch basins, and flow equalizations facilities, with approximately 30 miles of pipe, ranging in size from 6 to 72 inches diameter, plus some box culverts (CH2MHill, 2002.) Pipe materials include reinforced concrete, vitrified clay, corrugated metal, and plastic.

The watershed area drained by the Vista Grande stormwater conveyance system periodically experiences localized flooding during the wet weather season due to capacity constraints throughout the system. Previous studies have shown that many parts of the storm drain system do not have adequate capacity to accommodate rainfall runoff from the 10-year design storm event (Kennedy/Jenks, 1983; CH2MHill, 2002.) Flooding is a public safety concern that causes traffic issues, and can potentially cause road and property damage as shown in Figure 5-29.

The 10-year storm event was used to evaluate the current performance of the storm drain system and to evaluate storm drain improvement options because 10-year level protection has become a typical storm drain design level because it provides a balance between level of service and affordability. The actual level of protection provided by storm drain improvements would be determined as part of future analyses associated with storm drain master planning.

Figure 5-29 Localized Flooding near Daly City's City Hall

5.4.3 Improvements to Address Storm Drain Capacity Issues

The Vista Grande stormwater conveyance system is in need of capacity improvements to alleviate localized flooding in the upstream areas of Daly City. Although downstream improvements are necessary to solve backwater and overflow issues, subsequent upstream solutions must be implemented to ensure a 10-year level of protection watershed-wide. Upstream improvement options may include conveyance solutions or local detention. Any conveyance improvements to the upstream storm drain system will increase flows downstream, and therefore, must be implemented after downstream improvements are constructed.

Conveyance Improvements

Structural improvements may include pipe or box replacement or new storm drains and pump stations. All options have their benefits and limitations and applicability to the upstream Vista Grande storm drain system, as discussed below.

Pipe Replacement or New Storm Drain Placement

Storm drain infrastructure improvements may involve enlarging the storm drain system through a series of pipe (and/or box) improvements and/or new storm drain construction. The standard practice for most Bay Area communities is to provide a 10–year level of protection for stormwater conveyance systems. The 10-year event has become the standard because it provides a balance between level of service and affordability. The Vista Grande Watershed Study assumes that the 10-year storm event will be selected as the design criteria for any upstream conveyance improvements, and preliminary cost estimates and sizing of downstream facilities has been done based on this assumption. However, the final design storm for storm drain improvements would be determined as part of future analyses associated with the development of upstream conveyance alternatives.

Pipe replacement is an option utilized when the capacity of an existing pipe is inadequate or when a pipe is in poor condition. Flow modeling of an existing storm drain system under specified design conditions identifies specific pipe sections where flow capacity is inadequate, and also demonstrates areas of localized flooding. Often, flooding results in a stormwater model can be substantiated with observations made in the field by City staff. For the assessment of a solution, new pipe diameters can be utilized in stormwater modeling to investigate the hydraulic performance of the system with the proposed improvement(s).

The placement of new storm drains, where pipes do not already exist, may be necessary in certain situations. Some of these instances follow:

- Pipe replacement is prohibitive due to soil/geologic conditions at existing location;
- Pipe replacement is cost prohibitive, so a parallel pipe is installed;
- Redevelopment of a site changes stormwater flow paths and a new flow route is established;
- Diversion of flow from one storm drain with capacity issues to another with capacity available; and,
- Consolidation of flows from multiple storm drains into a single new pipe.

Pump Stations

Pump stations can aid in the management of stormwater by facilitating the movement and timing of stormwater conveyance through a system. Pump stations are used in many ways to mechanically control flow through a storm drain system and alleviate localized flooding. Some stormwater uses for a pump station follow:

- To lift flow within the drainage system or from the storm drain system to an open channel or other structure;
- To force flow through a specific low-lying area or through an outfall where backwater issues may occur; and,
- To remove stormwater from an off-line detention structure and place it back into a storm drain after peak flows have passed.

Local Storage

Detention basin storage can be constructed on a local scale in lieu of conveyance improvements where cost effective. Local detention storage is often designed to store increased runoff from new developments or redevelopments, and is designed to handle storage of local overflows for smaller drainage areas.

Some benefits of local detention storage include the following:

- Most applicable to new development standards that require no net increase in stormwater from a site
- Reduces localized flooding in small developments or neighborhoods
- May provide groundwater recharge and water quality improvements
- Reduces size upgrades to local storm drains

Limitations exist to the use of local detention storage within Daly City. Some of these limitations are listed below:

- Does not solve watershed-wide flooding;
- Difficult to site storage facilities in developed areas; and,
- Large volumes of stormwater are very costly to store in an urbanized setting.

Local detention storage was included in the evaluation of alternatives for the Watershed Study as discussed in Section 4.1.3. Because of the limitations described above, and its inability to solve watershed-wide flooding, it was dropped as an alternative for flood protection. However, its applicability and cost effectiveness to solve local flooding issues can be evaluated as part of a storm drain master planning effort. Additionally, phasing requirements for local detention storage are different that those of conveyance improvements. Because detention storage does not increase conveyance of stormwater flows downstream, it does not require that downstream flood protection improvements be completed before it is implementation.

5.4.4 Runoff Reduction Practices

From a larger watershed perspective, runoff to storm drains can be reduced community-wide through innovative re/development planning and implementation of structural best management practices (BMPs). Utilizing runoff reduction practices maximizes stormwater locally by managing its movement with structures which allow more stormwater to be captured on-site. Structures that off-set the stormwater impacts from impervious surfaces include strategically-placed vegetated buffers, grassy strips and swales, and permeable pavement. The implementation runoff reduction structures can have additional benefit of slowing and reducing the volume runoff to storm drains, and allowing water infiltrated into the ground, promoting groundwater recharge. However, implementation of structural BMPs in an already developed area such as Daly City can be expensive and is generally done over a long period of time as redevelopment occurs. The ongoing implementation of both structural and nonstructural BMPs in Daly City is guided by compliance with Daly City's NPDES permit, as discussed in Section 5.5.

5.4.5 Storm Drain Master Planning

In order to implement storm drain improvements as recommended in the Vista Grande Watershed Study, Daly City will need to conduct a formal storm drain master planning process. This process will ultimately identify and prioritize capital improvements projects necessary to provide capacity to convey the design storm event throughout the Vista Grande storm drain system. This preliminary analysis was based on the 10-year storm event however, the actual level of protection to be used in the development of a storm drain master plan would be determined as part of future analyses associated with storm drain master planning.

Depending on a community's specific needs, storm drain master planning steps and tasks may vary. Daly City has already begun a key component of the master planning process by developing a model of the Vista Grande storm drain system that includes all major pipes within the drainage basin (CH2MHill, 2002.) However, further data collection and calibration of this model are required. The primary phases of a storm drain master planning process include data collection and verification, modeling and conceptual alternatives development, alternatives analysis and development of a capital improvement program. The phases, and a description of the steps required in each phase for the Vista Grande storm drain system are described below.

Phase I – Data Collection and Verification

1. <u>Infrastructure review and field verification</u>: Previous studies conducted using the existing Vista Grande storm drain system model recommended that existing infrastructure data, such as manhole and pipe attribute data, be reviewed to identify where data validation is warranted (CH2MHill, 2002.) This step would include review of the infrastructure data within the model and required field surveying to verify structure locations and elevations within the system. CCTV can also be used for existing condition assessment.
2. <u>Design standards</u>: The City's design standards for system improvements is the 10-year design storm event and will be used to evaluate the storm drain facilities.
3. <u>Rainfall and flow monitoring</u>: Previous studies conducted using the existing Vista Grande storm drain system model recommended that additional rainfall and flows data be collected to calibrate the model (CH2MHill, 2002.) As such, this step requires collection of data for multiple storm events at multiple locations throughout the storm drain system. Based on the size of the storm drain system, flow monitoring should be conducted at approximately 12 locations in the system. Daly City initiated a rainfall and flow monitoring program in December 2005. This program will be complete in 2006.

4. Runoff estimation: This step would result in runoff estimations based on land area, land use, percent pervious surfaces, slope, and other watershed characteristics.

Phase II – Modeling and Conceptual Alternatives Development

1. Model calibration: The flow and rainfall data collected as part of Phase 1 would be used to calibrate the existing model to a selected storm event.
2. Design flow simulation: Stormwater modeling will then be conducted for a number of design events to identify system deficiencies and correlate them with areas of known flooding.
3. Improvements analysis and alternatives development: This step will include modeling conceptual improvements to assess potential benefits to the system and developing a suite of conceptual alternatives.

Phase III – Detailed Alternative Analyses

1. Evaluate alternative feasibility: Once alternatives are a developed in Phase 2, a feasibility analyses will be conducted based on evaluation criteria such as performance criteria, preliminary cost estimates, contractility assessment, community impacts and maintenance issues.
2. Recommendations: This step includes developing improvement recommendations based on cost, feasibility, and potential impacts.

Phase IV – Development of Capital Improvement Program

1. Prioritization of recommendations: This step includes prioritizing and phasing recommended improvements against a set of evaluation criteria.
2. Capital Improvement Program Development: This step includes preliminary cost estimating of the recommended improvements and development of a schedule for program implementation. Additionally, funding options for the recommended program improvements should be identified.

Conducting a storm drain master planning process, as outlined above would identify deficient infrastructure and provide solutions to alleviate localized flooding and overflows for a 10-year flow event, assess the validity of proposed recommendations, prioritize the most feasible recommendations, and provide a capital improvement program for storm drain improvements. Ultimately, storm drain improvements identified through this process will aid in the greater watershed goal to resolve flooding issues for the 10-year design storm event.

5.4.6 Preliminary Planning Level Cost Estimate

A storm drain master planning process will identify required capital improvements, from which capital cost estimate can be developed. Until this process is complete it is difficult to develop an accurate capital cost estimate for storm drain upgrades. Previous studies have estimated that capacity deficiencies occur throughout the storm drain system (Kennedy/Jenks, 1983; CH2MHill, 2002.) This information, combined with a review of other recent storm drain capital improvement programs in the Bay Area, was used to develop preliminary planning level cost estimate of $25,000,000 to $35,000,000 for storm drain improvements in the Vista Grande watershed based on December 2005 dollars. Escalating these costs to the estimated midpoint of construction at a rate of 5% per year yields a cost range of $35,200,000 to $49,200,000[1]. See Appendix G for more information on cost escalation.

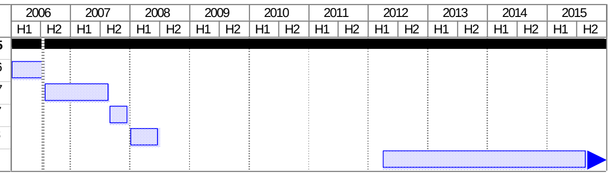
[1] Note that this escalation does not include financing costs associated with obtaining a bond measure, such as a debt service reserve fund.

5.4.7 Planning and Implementation Schedule

Like development of cost estimates, a detailed implementation schedule for storm drain improvements cannot be fully developed until the storm drain master planning process is completed. A key consideration for planning of upstream conveyance improvements is that they cannot be implemented until after downstream infrastructure improvements occur. A schedule which includes the timing of the key phases of the master planning processes and the potential timing of storm drain improvement implementation, which considers the timing of downstream flood protection improvements, is presented in Figure 5-30. This schedule assumes that downstream improvements are implemented by 2012 and that adequate funding is available.

Figure 5-30 Implementation Schedule for Storm Drain Improvements [a]

ID	Task Name	Duration	Start	Finish
1	**Vista Grande Storm Drain Master Plan**	**2604 days**	**Mon 1/9/06**	**Thu 12/31/15**
2	Data Collection/Verification	147 days	Mon 1/9/06	Tue 8/1/06
3	Modeling & Conceptual Alternatives Analysis	284 days	Tue 8/1/06	Fri 8/31/07
4	Detailed Alternatives Analyses	85 days	Mon 9/3/07	Fri 12/28/07
5	CIP Development	126 days	Mon 1/7/08	Mon 6/30/08
6	Implementation of Improvements	979 days	Mon 4/2/12	Thu 12/31/15



a. Assumes that downstream improvements are implemented by 2012.