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Section 14 - Stormwater

The planning process for flood control and drainage related issues for new development differs dramatically from water and wastewater planning efforts. The primary difference is that water and wastewater distribution, collection and treatment systems must be sized according to expected future demand, and construction of the distribution and collection systems cannot usually be constructed incrementally to meet demand as it grows.

Drainage solutions however are forced to address stormwater that is delivered to the site from upstream and control discharge from the site in such a manor so as not to impact the lower watershed. One of the most significant goals of development with respect to drainage is to intercept water from upstream and to release stormwater to the downstream property in a manner that minimizes any departures from the existing conditions. Planners interpret this goal to mean that concentration of runoff sheet flow drainage is minimized, and no increase in flow rates are experienced downstream of the development. Recently development guidelines have begun including the concept of "no increase in volume of runoff" allowed from a proposed development. This concept is not universally accepted or applied throughout the country; however acceptance of this concept is gaining momentum. In short, the additional volume of stormwater generated on site must be retained on site and disposed of through ground interception, transpiration or some other method that prevents discharge to the network of streams. Detention facilities are used generally to control runoff flow rates while retention facilities function to control stormwater volume. Using these guideline concepts, impacts are minimized and development can proceed.

The development model proposed herein allows the network of streams and channels to remain in a natural state so all of the natural processes can continue. Floodplains are delineated for the major watersheds to assist developers when planning for placement of future structures. The maps at the end of this section include delineation of floodplains for all major watersheds within each service area.

Developed areas within the Truckee Meadows continue to have flooding and drainage problems. Many of these problems are a result of inadequate planning for facilities, or application of drainage design criteria that have since become outdated. The following list of projects is proposed for inclusion in this update of the WRC, 2005 Draft Regional Flood Control Master Plan (WRC plan). Some of the projects proposed in this section address problems which became evident during the flood event of 2005. Others are known problems not mentioned in the referenced plan. These projects are in addition to those projects identified in the WRC plan. The WRC plan was an update of the Washoe County Flood Control Master Plan, dated 1991 by Kennedy Jenks Chilton Consultants. Projects that were described in either of these planning efforts were not reviewed for adequacy, only observed to determine if the projects have been constructed and then only to remove them from the master plan project list if the conclusion was that the described project had been constructed. Costs for all facilities are included in Table 14.1.

14.1 FLOOD CONTROL PLANNING PROCESS

Flood master planning effort consists of a series of tasks that have been described in various publications and is further detailed in the most recent WRC plan. However lacking in that plan's discussion of this topic is the need to adequately describe the goal of the planning process (first task listed below). The following numbered items identify a brief summary of the planning process referenced in the WRC, 2005 Draft Master Plan with recommended modifications. This list identifies the planning process followed in this plan update:

1. Define the master plan objectives. Foremost among possible objectives for flood control includes protection against flooding, life and property. Inherent in this goal is the frequency of storm or level of flood protection, i.e. catastrophic flood damage, 100-year flood damage, or some lesser storm flooding. Drainage system channels, dams and other drainage/flood related infrastructure would all be designed to the agreed to level of service by the community to maintain a consistent design among all existing and proposed developments. Additional engineering complexity is involved in the Truckee Meadows when considering the playas (closed basins); unique strategies must be applied to these areas.

   Environmental considerations should also be included in master planning to maintain the natural geomorphic function and habitat. Finally, other non-flood considerations must be incorporated into the overall plan objective which may include groundwater infiltration for conjunctive water use, wastewater disposal and detention/retention facilities for use in potable water storage and delivery.

2. Based on the goals stated after step 1 above, gather and assemble available relevant information on the existing drainage facilities, previous master plans, land use plans, zoning maps, flood hazard area delineations, etc.

3. Identify existing and potential drainage problems with respect to the goals established in step 1 above.

4. Identify structural stormwater improvements and/or mitigation concepts to remedy problems identified in step 3 above.

5. Incorporate a stakeholder's process to solicit opinions of those most heavily impacted and to garner their support for the project. Stakeholder's typically include the public, but may also include impacted organizations and regulatory agencies as well.

6. Narrow all options into a few of the most appropriate alternatives and proceed with an analysis of these alternatives. Appropriateness may be determined by a combination of popular opinion and engineering judgement.

7. Continue with the stakeholder's process to select a "preferred alternative" to be included in the master plan.

A short form variation of the above process may be followed which eliminates the stakeholder's process. Items 5 through 7 are replaced with a short analysis based on engineering judgment of the best alternative adequate to include in the master plan. The short form was followed in this plan update due to the limited amount of time for performing this update. The short form is also typically followed by private land development companies when planning their improvements.

14.2 WATERSHED SPECIFIC MASTER PLANS

Watershed specific plans were reviewed for this update. Overall the Draft *Washoe County Regional Flood Control Master Plan* (WRC Plan) dated July 2005 by WRC is the basis for this master plan update. In WRC plan, the following watershed specific master plans were reviewed: Drainage Master Plan for Stead NV, Spanish Springs Valley Flood Control Master Plan, Washoe County, NV; Drainage Master Plan for Sun Valley, Washoe County, NV; ReTrac Drainage Report, Reno, NV; Storm Drain Master Plan East Washoe Valley Washoe County, NV; City of Sparks, NV Drainage Master Plan; Kiley Ranch Flood Control Master Plan, Spanish Springs Valley, NV.

Projects appropriate for inclusion into the regional master plan were included in the master plan by WRC; those projects are also made a part of this update. In addition, individual watershed specific master plans reviewed for this master plan update are discussed below:

North Valleys Flood Control Hydrologic Analysis and Mitigation Options

The Silver Lake and Swan (Lemmon) Lake playas are studied in this report. Focus of the report includes analysis of existing and proposed future conditions for both watersheds. Existing conditions in Silver Lake are above the existing FEMA regulatory 100-year base flood elevation. Furthermore, in the Silver Lake watershed, previous studies reduced the original regulatory 100-year base flood water surface and detailed hydrology developed in this report disagreed with the previous reduction. The result of that previous reduction is that the existing construction is based on a water surface in the lake that may have been estimated too low and facilities subsequently constructed will have a higher probability of flooding. In the Swan Lake watershed, only the future buildout conditions[1] water surface elevation is above the existing FEMA 100-year base flood elevation.

Due to the potential for damage to property adjacent to each playa lake in both basins, and a base flood water surface in Silver Lake that already may be too low, the above report details the estimated discharge from each of the watersheds and discussed mitigation options. In addition to the playa flooding potential, another goal of the study was to determine the potential for storing of wastewater effluent in either or both of these playa lakes. Mitigation options analyzed include the following:

[1] Buildout conditions and land use were assumed for the hydrology study in the report.

1. Removal of material from the playa lake bottoms,
2. Construction of levees to contain the current or projected increase in stormwater volume,
3. Use spreading basins or areas of enhanced infiltration,
4. Expand the lake holding capacity or develop additional storage areas within the watershed,
5. Inject excess stormwater into the Vadose Zone,
6. Incorporate Low Impact Development practices into the required building code for these areas,
7. Provide for evacuation of selected properties on the fringe areas of each playa lake,
8. Provide for draining excess water from Silver Lake to Swan Lake,
9. Pump excess stormwater from Swan Lake to a site in Hungry Valley, and
10. Construct an infiltration facility located on Stead Airport Property.

The recommended results of this study for existing conditions merely suggests application to FEMA for a LOMR which effectively would raise the regulated base flood elevation in Silver Lake. For future conditions, it was recommended to construct an infiltration facility on airport property as well as individual retention sites within the watershed. These projects are not shown on the master plan project list, but are incorporated by reference into the plan.

Somersett Development Storm Drainage Master Plan

The Somersett development including Somersett Wash and Mogul Wash are studied in this report by Manhard Consulting, dated 2004. Focus of the report includes analysis of existing and proposed future conditions. In both conditions, runoff from the south slopes of Peavine Mountain collects in the two washes and reports to the Mogul area, then under Interstate 80, and into the Truckee River. As part of the Somersett community, a total of 11 detention ponds were proposed and are in various stages of construction. According to the Somersett Development Storm Drainage Master Plan, these ponds will detain site runoff so that build-out peak flow is less than pre-construction peak flow. Additionally, "green belts" through the community were preserved to collect and convey runoff. While the reduction in peak flow will help reduce downstream flooding concerns in Mogul, the area is still very susceptible to localized flooding under events larger than a 5-year or 10-year storm.

According to an earlier 1998 Somersett Drainage Master Plan by WRC Nevada: "…the drainage structures in the Mogul area have sufficient capacity for the 5-year event. Flow rates in excess of the 5-year event may result in some localized overtopping of roadways as well as some of the

channel crossings and at the Interstate 80 frontage road and underpass. In a 100-year event, flows will exceed channel and culvert capacities in the Mogul area and cause flooding of private properties."

Field observations from site visits do indicate that this statement is accurate especially where Mogul Wash crosses under Silva Ranch Rd and W. 4th St, although a lack of photographical and specific anecdotal information persists.

Drainage Master Plan for Stead, Nevada

Stantec Consulting prepared this master plan for flood control facilities for the Stead area of Washoe County. A complete hydrology model was developed for the project area and six projects were proposed. All of the six projects have been constructed.

14.3 MISCELLANEOUS FACILITIES

The following section discusses projects and miscellaneous issues in addition to the projects identified in the two previous flood control master plans and those proposed in this plan update.

Irrigation Ditch and Stream Interactions

During the New Years Flood of 2005, the interaction between the irrigation ditches and streams that predominate on the city's west side (but also exist throughout the city) became more pronounced. The irrigation ditches have been a significant part of the city for more than 100 years, but few stories exist of flooding problems associated with these ditches. As mentioned above in 2005, the irrigation ditches intercepted flow at several locations. Prior to construction of the ditches the flow continued down the historical watershed flow path. Once runoff intercepted by the ditches exceeded the conveyance capacity of the ditch, overflow occurred at unpredictable locations. The previous master plans did identify some structures to alleviate the potential for flood damage but no mention was made on the overall problem.

For this plan update, each of the ditch crossings have been observed and a short section is included in this update; however, there is a deeper issue at hand and that is of liability. Because the ditches are privately owned, are the ditch companies liable when drainage water enters their systems then overtops and floods other properties? Is the city liable if natural drainage/creeks cross these ditches and is channeled into the ditch rather than the historical watershed? Most of the structures at the ditch crossings are manually operated. Who is responsible for failure to operate and are the operations at the various sites even recorded in writing so that the procedure can be followed by future operators? Finally, in most instances development has occurred downstream of the ditch crossings; what happens if stormwater is turned back into the historical watershed?

These and other arguments preclude the recommendation to upgrade these systems to full 100-year protection, unless of course the system downstream is fully improved to where the outfall discharges into the Steamboat Creek or Truckee River. These systems could be in the tens of millions of dollars in construction cost each and unlikely that they will ever be constructed. It is recommended in this update that the City develop a public policy or general guideline that could be followed for enhancement of each of the reported ditch crossings and bring the stakeholders into the process as appropriate.

NDOT Road Crossings at City Owned Drainage Facilities

The following culvert crossings have potential to result in flooding at various areas within the City of Reno. These areas are noted in this master plan for discussion and informational purposes and have not been included in the proposed project list for this plan update. The following system crossings are listed for future discussion with NDOT.

Evans Creek

Under the intersection of Hwy 395 and Neil Road, the conveyance for Evans Creek is through a pair of 11'x4' box culverts which are 1,600 ft long. The capacity of this system has been found to be between 900 and 1200 cfs. A detailed study of the 100-yr storm determined that flow rates in Evans Creek could be in the magnitude of 2,200 cfs. Historically, flow has broken out of the creek in numerous places between Lakeside Dr and Hwy 395, therefore reducing the amount of flow that the box has to convey. However, CIPs to fix these break-outs have been recommended. As the recommended CIPs are constructed, flow rates reaching the 2 – 11'x4' boxes will increase and could exceed capacity.

A detention basin has been proposed on Evans Creek in the Balardini Ranch area above Lakeridge. If this facility is constructed, many if not all of the concerns about the capacity of this box should vanish. Through proper design, the discharge of flows out of the basin could be reduced to allow for the accumulation of runoff below the basin, and combined still be less than the studied box capacity.

Thomas Creek North Split

The north branch (sometimes referenced as West Branch) of Thomas Creek passes under South Virginia and Hwy 395 just south of the "Pink Scolari's." The open channel approaches the intersection from the southwest (near the furniture stores) and enters the culvert system through a structure containing 2 - 30" RCP, and 1 - 24" RCP. Only 1 - 30" RCP exits inside the clover leaf/detention basin on the NE side of the intersection, and neither field research, NDOT research, or City of Reno Storm Drain research, has revealed the discharge location of the other 2 culverts. During field inspections, approximately 1/3 of the flow entering through the 3 culvert structure re-appeared inside the clover leaf and again at Huffaker Hills Park. During the 2005 event, water overtopped South Virginia by the intake structure, and the detention pond inside the Northbound onramp cloverleaf filled up and overtopped South Virginia and the on ramp.

A detention basin has been proposed on Thomas Creek near the Arrowcreek Subdivision. Additionally, a flow-split structure has been proposed where Thomas Creek splits into two branches east of Dixon Lane. If these facilities are constructed, flooding concerns in the vicinity of the Pink Scolari's will be reduced. However, the lack of information about the discharge location of the two culverts makes it extremely difficult to perform an accurate evaluation of the capacity of this reach and system modifications are still prudent.

Thomas Creek East Split

Due to the problematic nature of Thomas Creek West Split, CIPs mentioned in the previous section are intended to divert flow away from Thomas Creek West Split into the East Split. Currently an 11'x3.5' box culvert carries flow under South Virginia St., then the main channel passes through a detention basin and under Hwy 395 through a 12'x6' box. Overflow from the detention area drains into 2-12'x5' box culverts located approximately 200 yards north of the basin. Preliminary estimates indicate that this configuration has capacity for additional flow if the channel between the split and South Virginia St. and the box culvert under South Virginia (both are previously mentioned CIPs) are upsized.

A detention basin near the Arrowcreek development has been discussed for a number of years and is included in the WRC plan and this plan update. If constructed, this detention basin will have a significant impact on flow rates, and corresponding sizes, of the culvert under South Virginia. Additionally, depending on the flow the East Split will experience, the existing capacity under Hwy 395 may need to be increased.

Galena High Wash

Under Wedge Parkway, where Wedge Parkway crosses the Mt Rose Highway, there are 2 - 7'x3' boxes. Sixty feet upstream of these boxes is a pair of 36" CMPs. Due to the channel configuration (culverts are perpendicular to flow), the capacity of these culverts is not adequate. The channel continues east to where a single 36" CMP conveys some water north across the highway. About 100' east of this culvert, a pair of drop inlets exist. It is assumed that these were placed to catch excess flow that cannot not be conveyed by the CMPs. Any flow not captured by the CMP and the DI's continues down the historical path, which leads flow to pond between the south abutment and the jersey barrier for the north-bound clover leaf on ramp. During the 2005 event, this area impounded water and eventually flow spilled over the barrier and onto the on-ramp. Once the on ramp was filled, the other jersey barrier was overtopped and the flow continued down it's historical path which lead to water overtoping Hwy 395 south of the Geiger Grade interchange. The approximate runoff using the USGS peak flow regression equation indicates that the wash will receive 200-650 cfs during a 100-year storm event. The single 36" CMP at the bottom should have capacity for 40 cfs, and the pair of 36" CMPs above Wedge Pkwy are assumed to handle 15 cfs each (the culvert's outlet location is unknown therefore obtaining slope and length are not possible) when the channel is flowing full, and the pair of drainage inlets have an assumed capacity of 10 cfs total - bringing the total capacity to approximately 80 cfs.

Lemmon Drive Wash
The wash enters a 6'x7' box culvert on the south of Hwy 395, west of Lemmon Dr. At some location along the 1,800 ft length of the culvert, the size and material change to a 72" CMP. The approximate runoff using the USGS peak flow regression equation indicates that the wash will receive approximately 350-500 cfs. The box appears to have capacity for approximately 300 cfs, and the pipe only has capacity for approximately 200 cfs. Once the runoff exceeds the capacity of the culvert system, water will pond into the street and flow north along Lemmon Valley Drive. North of Buck Drive, some flow will leave the street and flow west/north (to Swan Lake via Military Drive) the remainder continues east/north (to Swan Lake via Lemmon Valley Drive).

Stead Wash
The Stead Wash flows under North Virginia Street heading in a northerly direction to Hwy 395 and eventually towards Stead. Upstream of Hwy 395, this channel is fed by a single 24" CMP coming from the west, and a pair of 36" CMPs under North Virginia. Just prior to crossing Hwy 395 the combined channel continues through a recently constructed (2 years old) 60" RCP beneath a mini storage road. Downstream from this culvert, is a 36" RCP under Hwy 395. The approximate runoff using the USGS regression peak flow equation indicates that the wash will receive 300-400 cfs. The culvert under Hwy 395 appears to have capacity for approximately 20 cfs.

14.4 PLANNED FACILITIES AND PROBABLE COSTS

This master plan update includes a combination of projects still awaiting construction as proposed in the WRC plan and new projects proposed specifically in this update. Project information is provided in Appendix B, which includes written description of each project as well as opinions of probable costs for each project. Each project is referenced by the CIP ID No and is labeled accordingly on each map. The ID number indicates the sheet number (see map index on each sheet) followed by the project number.

The map index on each sheet depicts a shaded indicator of map position in relation to the service area boundary. The maps are oriented from north to south by service area beginning with Spring Mountain, which is the furthest north, to the South Truckee Meadows which is furthest south. Each map figure number contains the number of this section (14) appended with the map index grid cell number.

The maps show the locations of each proposed master plan project included in this update. Table 14.1 on the following page includes a summary of general data for each project including costs. Costs for projects originally proposed in 1990 were not reworked; an inflationary factor was applied to bring those costs to present day. Those costs are recorded in the table; subtotals are provided for each service area.

Finally the maps show the delineation of floodplains for the undeveloped service areas. Utilization of the floodplain information and how the floodplains were developed is explained elsewhere in this plan update.