Appendix A

Biological Resources Assessment

Butterfield Boulevard Extension Biological Resources Assessment

MORGAN HILL, SANTA CLARA COUNTY CALIFORNIA

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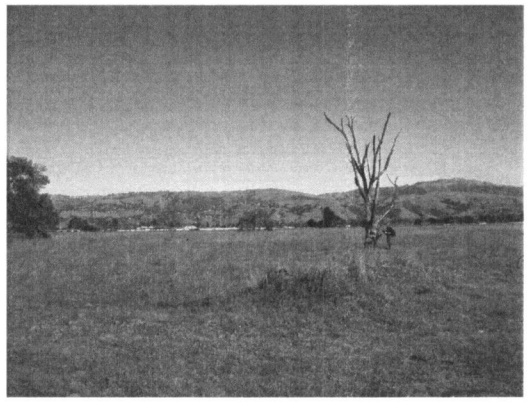

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1.0 INTRODUCTION

On November 24, 2009, WRA, Inc. conducted an assessment of biological resources within approximately 33 acres (Study Area) proposed for amendment to the Butterfield Boulevard Extension Project in Morgan Hill, Santa Clara County, California (Figure 1). Originally named the Sutter Boulevard Extension and Flood Protection Facilities, the project was reviewed in the Final Environmental Impact Report (FEIR; City of Morgan Hill 1992). Changes to the project in 2005 were covered in the Addendum to the FEIR (City of Morgan Hill 2005). Since the 2005 addendum, project plans have been modified to incorporate an improved design for the extended Butterfield Channel and a local detention basin near Monterey Road (Figure 2). The purpose of the assessment was to gather information necessary to complete a review of biological resources within new project areas under the California Environmental Quality Act (CEQA) for the City of Morgan Hill.

The Study Area is composed primarily of developed and agricultural lands located west of Highway 101; the site is accessible via the intersection of Butterfield Boulevard and Tennant Avenue. This report describes the results of the site visit, which assessed the Study Area for the (1) potential to support special status species; and (2) presence of other sensitive biological resources protected by local, state, and federal laws and regulations. If special status species were observed during the site visit, they were recorded. Specific findings on the habitat suitability or presence of special status species or sensitive habitats may require that protocol level surveys be conducted. This report also contains an evaluation of potential impacts to special status species and sensitive biological resources that may occur as a result of the proposed project and potential mitigation measures to compensate for those impacts.

A biological resources assessment provides general information on the potential presence of sensitive species and habitats. The biological assessment is not an official protocol level survey for listed species that may be required for project approval by local, state, or federal agencies. This assessment is based on information available at the time of the study and on site conditions that were observed on the date of the site visit.

2.0 REGULATORY BACKGROUND

The following sections explain the regulatory context of the biological resources assessment, including applicable laws and regulations that were applied to the field investigations and analysis of potential project impacts.

2.1 Special Status Species

Special status species include those plant and wildlife species that have been formally listed, are proposed as endangered or threatened, or are candidates for such listing under the federal Endangered Species Act (ESA) or California Endangered Species Act (CESA). These acts afford protection to both listed and proposed species. In addition, California Department of Fish and Game (CDFG) Species of Special Concern, which are species that face extirpation in California if current population and habitat trends continue, U.S. Fish and Wildlife Service (USFWS) Birds of Conservation Concern, sensitive species included in USFWS Recovery Plans, and CDFG special

Figure 1. Location Map

Butterfield Boulevard Extension
Santa Clara County, CA

0 1,000 2,000 4,000 Feet

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Date: January 2010
Aerial: 2005 NAIP
Map By: Michael Rochelle
Filepath: I:\Acad2000\19000\19127\gis\Arcmap\Location.mxd

Figure 2. 2010 Butterfield Boulevard Extension Amendment Study Area

Butterfield Boulevard Extension
Santa Clara County, CA

0 250 500 1,000 Feet

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Date: January 2010
Aerial: USGS, 2006
Map By: Michael Rochelle
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status invertebrates are all considered special status species. Although CDFG Species of Special Concern generally have no special legal status, they are given special consideration under the CEQA. In addition to regulations for special status species, most birds in the United States, including non-status species, are protected by the Migratory Bird Treaty Act of 1918. Under this legislation, destroying active nests, eggs, and young is illegal. Plant species on California Native Plant Society (CNPS) Lists 1 and 2 are also considered special status plant species and must be considered under CEQA. CNPS List 3 plants have little or no protection under CEQA, but are included in this analysis for completeness.

Critical Habitat

Critical habitat is a term defined and used in the Federal Endangered Species Act as a specific geographic area that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. The FESA requires federal agencies to consult with the USFWS to conserve listed species on their lands and to ensure that any activities or projects they fund, authorize, or carry out will not jeopardize the survival of a threatened or endangered species. In consultation for those species with critical habitat, federal agencies must also ensure that their activities or projects do not adversely modify critical habitat to the point that it will no longer aid in the species' recovery. In many cases, this level of protection is similar to that already provided to species by the FESA "jeopardy standard." However, areas that are currently unoccupied by the species but which are needed for the species' recovery, are protected by the prohibition against adverse modification of critical habitat.

2.2 Sensitive Biological Communities

Sensitive biological communities include habitats that fulfill special functions or have special values, such as wetlands, streams, and riparian habitat. These habitats are protected under federal regulations (such as the Clean Water Act), state regulations (such as the Porter-Cologne Act, the CDFG Streambed Alteration Program, and CEQA), or local ordinances or policies (City or County Tree Ordinances, Special Habitat Management Areas, and General Plan Elements).

Waters of the United States

The U.S. Army Corps of Engineers (Corps) regulates "Waters of the United States" under Section 404 of the Clean Water Act. "Waters of the U.S." are defined broadly as waters susceptible to use in commerce, including interstate waters and wetlands, all other waters (intrastate waterbodies, including wetlands), and their tributaries (33 CFR 328.3). Potential wetland areas, according to the three criteria used to delineate wetlands stated in the *U.S. Army Corps of Engineers Wetlands Delineation Manual* ("Corps Manual"; Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* ("Arid West Supplement"; Corps 2008), are identified by the presence of (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology. Areas that are inundated for sufficient duration and depth to exclude growth of hydrophytic vegetation are subject to Section 404 jurisdiction as "other waters" and are often characterized by an ordinary high water mark (OHWM). Other waters, for example, generally include lakes, rivers, and streams. The placement of fill material into "Waters of the U.S." (including wetlands) generally requires an individual or nationwide permit from the Corps under Section 404 of the Clean Water Act.

Waters of the State

The term "Waters of the State" is defined by the Porter-Cologne Act as "any surface water or groundwater, including saline waters, within the boundaries of the state." The Regional Water Quality Control Board (RWQCB) protects all waters in its regulatory scope, but has special responsibility for wetlands, riparian areas, and headwaters. These waterbodies have high resource value, are vulnerable to filling, and are not systematically protected by other programs. RWQCB jurisdiction includes "isolated" wetlands and waters that may not be regulated by the Corps under Section 404. "Waters of the State" are regulated by the RWQCB under the State Water Quality Certification Program which regulates discharges of fill and dredged material under Section 401 of the Clean Water Act and the Porter-Cologne Water Quality Control Act. Projects that require a Corps permit, or fall under other federal jurisdiction, and have the potential to impact "Waters of the State," are required to comply with the terms of the Water Quality Certification determination. If a proposed project does not require a federal permit, but does involve dredge or fill activities that may result in a discharge to "Waters of the State," the RWQCB has the option to regulate the dredge and fill activities under its state authority in the form of Waste Discharge Requirements.

Streams, Lakes, and Riparian Habitat

Streams and lakes, as habitat for fish and wildlife species, are subject to jurisdiction by CDFG under Sections 1600-1616 of California Fish and Game Code. Alterations to or work within or adjacent to streambeds or lakes generally require a 1602 Lake and Streambed Alteration Agreement. The term stream, which includes creeks and rivers, is defined in the California Code of Regulations (CCR) as follows: "a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having a surface or subsurface flow that supports or has supported riparian vegetation" (14 CCR 1.72). In addition, the term stream can include ephemeral streams, dry washes, watercourses with subsurface flows, canals, aqueducts, irrigation ditches, and other means of water conveyance if they support aquatic life, riparian vegetation, or stream-dependent terrestrial wildlife (CDFG ESD 1994). Riparian is defined as, "on, or pertaining to, the banks of a stream;" therefore, riparian vegetation is defined as, "vegetation which occurs in and/or adjacent to a stream and is dependent on, and occurs because of, the stream itself" (CDFG ESD 1994). Removal of riparian vegetation also requires a Section 1602 Lake and Streambed Alteration Agreement from CDFG.

Other Sensitive Biological Communities

Other sensitive biological communities not discussed above include habitats that fulfill special functions or have special values. Natural communities considered sensitive are those identified in local or regional plans, policies, regulations, or by the CDFG. CDFG ranks sensitive communities as "threatened" or "very threatened" and keeps records of their occurrences in its Natural Diversity Database. Sensitive plant communities are also identified by CDFG on their *List of California Natural Communities Recognized by the CNDDB*. Impacts to sensitive natural communities identified in local or regional plans, policies, regulations or by the CDFG or USFWS must be considered and evaluated under CEQA (California Code of Regulations: Title 14, Div. 6, Chap. 3, Appendix G). Specific habitats may also be identified as sensitive in City or County General Plans or ordinances.

Relevant Local Policies, Ordinances, Regulations

In 1999, the City of Morgan Hill (City) and the City of Morgan Hill Redevelopment Agency (Agency), in conjunction with CDFG, developed a citywide Burrowing Owl mitigation plan (Plan) to evaluate and mitigate impacts to owls that result from City development activities. The Plan regulates City lands below 600 feet elevation that support any grassland and/or mixed herbaceous vegetation upon which clearing and/or grading activities subject to CEQA would take place. On all such lands proposed for development within the City limits, pre-construction owl surveys will be required following the protocol outlined in the Plan. The Plan also includes limitations on weed abatement and ground squirrel control measures on City lands, as well as a goal to conserve and maintain 1,000 acre-points of occupied Burrowing Owl habitat in or near Morgan Hill (City of Morgan Hill 2003).

3.0 METHODS

On November 24, 2009, the Study Area was traversed on foot to determine (1) plant communities present within the Study Area, (2) if existing conditions provided suitable habitat for any special status plant or wildlife species, and (3) if sensitive habitats are present. All plant and wildlife species encountered were recorded and are summarized in Appendix A.

3.1 Biological Communities

Prior to the site visit, the Soil Survey of the Eastern Santa Clara Area, California [U.S. Department of Agriculture (USDA) 2007], the Final Environmental Impact Report (FEIR; City of Morgan Hill 1992), and the Addendum to the FEIR (City of Morgan Hill 2005) were examined to determine if any unique soil types that could support sensitive plant communities and/or aquatic features were present in the Study Area. Biological communities present in the Study Area were classified based on existing plant community descriptions described in the *Preliminary Descriptions of the Terrestrial Natural Communities of California* (Holland 1986). However, in some cases it is necessary to identify variants of community types or to describe non-vegetated areas that are not described in the literature. Biological communities were classified as sensitive or non-sensitive as defined by CEQA and other applicable laws and regulations.

3.1.1 Non-sensitive Biological Communities

Non-sensitive biological communities are those communities that are not afforded special protection under CEQA, and other state, federal, and local laws, regulations and ordinances. These communities may, however, provide suitable habitat for some special status plant or wildlife species and are identified or described in Section 4.1.1 below.

3.1.2 Sensitive Biological Communities

Sensitive biological communities are defined as those communities that are given special protection under CEQA and other applicable federal, state, and local laws, regulations and ordinances. Applicable laws and ordinances are discussed above in Section 2.0. Special methods used to identify sensitive biological communities are discussed below.

Wetlands and Waters

The Study Area was surveyed to determine if any wetlands and waters potentially subject to jurisdiction by the Corps, RWQCB, or CDFG were present. The assessment was based primarily on the presence of wetland plant indicators, but may also include any observed indicators of wetland hydrology or wetland soils. Any potential wetland areas were identified as areas dominated by plant species with a wetland indicator status[1] of OBL, FACW, or FAC as given on the U.S. Fish and Wildlife Service List of Plant Species that Occur in Wetlands (Reed 1988). Evidence of wetland hydrology can include direct evidence (primary indicators), such as visible inundation or saturation, surface sediment deposits, algal mats and drift lines, or indirect indicators (secondary indicators), such as oxidized root channels. Some indicators of wetland soils include dark colored soils, soils with a sulfidic odor, and soils that contain redoximorphic features as defined by the Corps Manual (Environmental Laboratory, 1987) and Field Indicators of Hydric Soils in the United States (NRCS, 2002).

The preliminary waters assessment was based primarily on the presence of unvegetated, ponded areas or flowing water, or evidence indicating their presence such as a high water mark or a defined drainage course. Additional wetlands and waters data were recorded and described in a separate delineation report which is intended for submission to the Corps.

Other Sensitive Biological Communities

The Study Area was evaluated for the presence of other sensitive biological communities, including riparian areas, and sensitive plant communities recognized by CDFG. If present in the Study Area, these sensitive biological communities were mapped and are described in Section 4.1.2 below.

3.2 Special Status Species

3.2.1 Literature Review

Potential occurrence of special status species in the Study Area was evaluated by first determining which special status species occur in the vicinity of the Study Area through a literature and database search. Database searches for known occurrences of special status species focused on the Mt. Madonna 7.5 minute USGS quadrangle and the eight surrounding USGS quadrangles. The following sources were reviewed to determine which special status plant and wildlife species have been documented to occur in the vicinity of the Study Area:

- California Natural Diversity Database records (CNDDB) (CDFG 2009)
- USFWS quadrangle species lists (USFWS 2009)
- CNPS Electronic Inventory records (CNPS 2009)
- CDFG publication "California's Wildlife, Volumes I-III" (Zeiner et al. 1990)
- CDFG publication "Amphibians and Reptile Species of Special Concern in California" (Jennings 1994)
- A Field Guide to Western Reptiles and Amphibians (Stebbins, R.C. 2003)
- National Marine Fisheries Service Distribution Maps for California Salmonid Species (2009)

[1] OBL = Obligate, always found in wetlands (> 99% frequency of occurrence); FACW = Facultative wetland, usually found in wetlands (67-99% frequency of occurrence); FAC = Facultative, equal occurrence in wetland or non-wetlands (34-66% frequency of occurrence).

3.2.2 Site Assessment

A site visit was made to the Study Area to search for suitable habitats for species identified in the literature review as occurring in the vicinity. The potential for each special status species to occur in the Study Area was then evaluated according to the following criteria:

1) No Potential. Habitat on and adjacent to the site is clearly unsuitable for the species requirements (foraging, breeding, cover, substrate, elevation, hydrology, plant community, site history, disturbance regime).

2) Unlikely. Few of the habitat components meeting the species requirements are present, and/or the majority of habitat on and adjacent to the site is unsuitable or of very poor quality. The species is not likely to be found on the site.

3) Moderate Potential. Some of the habitat components meeting the species requirements are present, and/or only some of the habitat on or adjacent to the site is unsuitable. The species has a moderate probability of being found on the site.

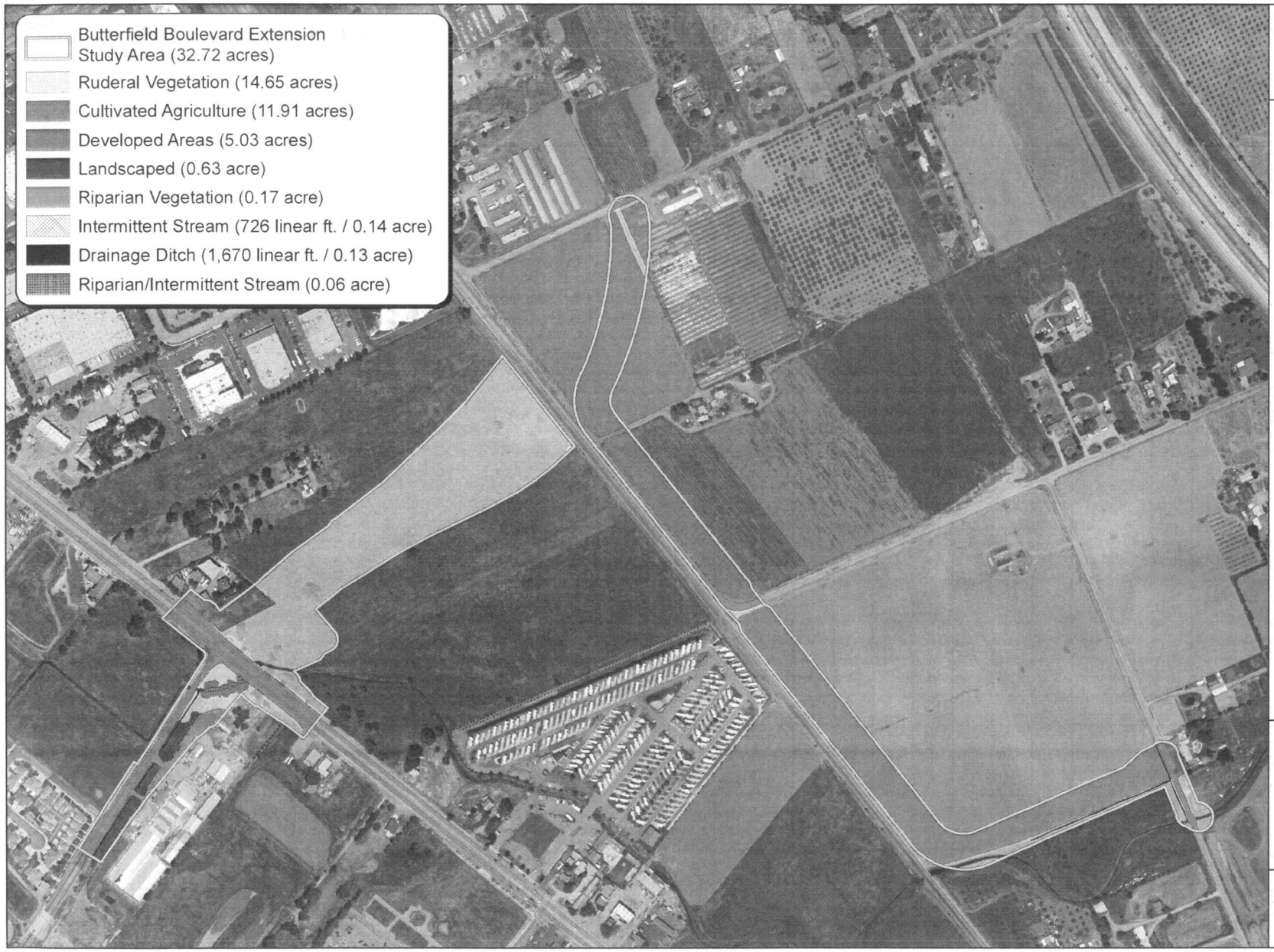
4) High Potential. All of the habitat components meeting the species requirements are present and/or most of the habitat on or adjacent to the site is highly suitable. The species has a high probability of being found on the site.

5) Present. Species is observed on the site or has been recorded (i.e. CNDDB, other reports) on the site recently.

The site assessment is intended to identify the presence or absence of suitable habitat for each special status species known to occur in the vicinity in order to determine its potential to occur in the Study Area. The site visit does not constitute a protocol-level survey and is not intended to determine the actual presence or absence of a species; however, if a special status species is observed during the site visit, its presence was recorded and discussed. Appendix B presents the evaluation of potential for occurrence of each special status plant and wildlife species known to occur in the vicinity of the Study Area with their habitat requirements, potential for occurrence, and rationale for the classification based on criteria listed above. Recommendations for further surveys are made in Section 5.0 below for species with a moderate or high potential to occur in the Study Area.

4.0 RESULTS

The Study Area is located in southern Morgan Hill surrounded by urban development and agricultural fields. On-site habitat has been significantly altered from its native state. The majority of the site is composed of fallow fields characterized by ruderal herbaceous grassland vegetation, including mustard (*Brassica rapa*), ripgut brome (*Bromus diandrus*), yellow star thistle (*Centaurea solstitialis*), and Italian thistle (*Carduus pycnocephalus*). Several walnut trees are present within the ruderal grassland, and landscape trees and shrubs occur along developed portions of the Study Area. A large portion of the site is composed of cultivated agricultural land, in which row crops were being cultivated at the time of the site visit. In addition, West Little Llagas Creek runs through the southern portion of the Study Area and supports a small area of coast live oak riparian habitat south of the Watsonville Road/Monterey Road intersection (Figure 3). Elevations of the Study Area range from 310 to 325 feet. The following sections present the results and discussion of the biological resources assessment within the Study Area.



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Butterfield Boulevard Extension

Santa Clara County, CA

Figure 3.

Biological Communities within the Study Area

0 150 300 600 Feet

Date: December 2009
Map by: Michael Rochelle
Aerial: USGS, 2006
File path: I:\acad2000\19000\19127\gis\arcmap\Habitat.mxd

4.1 Biological Communities

Table 1 summarizes the area of each biological community type observed in the Study Area. Non-sensitive biological communities in the Study Area include developed land, ruderal herbaceous grassland, and cultivated agricultural land. Two sensitive biological communities are found in the Study Area: riparian and other waters. Descriptions for each biological community are contained in the following sections.

Table 1. Biological Communities within the Study Area.

Community Type	Area
Developed land	5.03 acres
Ruderal herbaceous grassland	14.65 acres
Cultivated agricultural land	11.91 acres
Landscaped roadside	0.63 acre
Coast live oak riparian	0.17 acre
Intermittent stream	
Open	0.14 acre (726 linear feet)
Culverted	0.04 acre (139 linear feet)
Drainage ditch	
Open	0.13 acre (1,670 linear feet)
Culverted	0.01 acre (85 linear feet)
Combine riparian/intermittent stream habitat	0.06 acre
Total Study Area Size	32.77 acres

4.1.1 Non-sensitive biological communities

Developed land

Although not described in the literature, developed land includes areas where commercial, industrial, or recreational development is present. These areas generally include buildings, parking lots, streets, and vacant lots. Within the Study Area, approximately 5.03 acres of developed lands are present including several areas of commercial and industrial development, parking lots, and streets. Vegetation in these areas is predominantly landscaped, with species such as silver acacia (*Acacia decurrens*) and Monterey pine (*Pinus radiata*). Wildlife species observed in developed land within the Study Area include Western Scrub Jay (*Aphelocoma californica*) and Northern Mockingbird (*Mimus polyglottos*).

Landscaped Roadside

Although not described in the literature, landscaped roadsides within the Study Area consist of planted ornamental trees and herbaceous, occasionally ruderal, understory. This community

occurs along the southern edge of Watsonville Road. Dominant trees include silver acacia and olive (*Olea europaea*). Approximately 0.63 acre of landscaped roadside occurs within the Study Area.

Ruderal herbaceous grassland

Although not described in the literature, ruderal herbaceous grassland includes areas that have been partially developed or have been used in the past for agriculture. However, these areas are not currently used for agricultural activities, and have been allowed to revert to a semi-natural condition. Approximately 14.65 acres of this habitat are present in the Study Area, consisting of recently disced fields. Based on soil conditions, vegetation composition, and discussions with the property owner and the City of Morgan Hill, discing has occurred historically on the site for agricultural purposes. Plant species observed in ruderal herbaceous grassland in the Study Area include fiddleneck (*Amsinckia menziesii*), ripgut brome, Italian thistle, yellow star thistle, field mustard and black mustard (*Brassica nigra*). Wildlife species observed in this community in the Study Area include Western Meadowlark (*Sturnella neglecta*) and White-crowned Sparrow (*Zonotrichia leucophrys*).

Cultivated agricultural land

Cultivated agricultural land within the Study Area includes all lands currently being used to cultivate row crops such as tomato, corn, and flowers. Approximately 11.91 acres of this habitat are present in the Study Area. Row crops provide limited cover for wildlife species, and soil discing greatly reduces the habitat value for burrowing mammals and associated birds and reptiles. No wildlife species were observed within cultivated agricultural land during the site visit.

4.1.2 Sensitive Biological Communities

Two sensitive biological communities were observed within the Study Area: central coast live oak riparian forest and other waters. Riparian habitat was predominantly located along a small section of the West Little Llagas Creek channel in the southwestern Study Area, and other waters were observed throughout the site. These habitats are described in more detail below.

Central Coast Live Oak Riparian Forest

Central coast live oak riparian forest (Holland, 1986) is present south of the Watsonville Road/Monterey Road intersection. Dominated by coast live oak (*Quercus agrifolia*), this community has an understory of non-native annual grasses and both native and non-native shrubs. It is usually found on drier, outer floodplains along perennial streams. Approximately 0.17 acre of coast live oak riparian habitat was observed within the Study Area. This habitat supports additional species, such as olive, and flatsedge (*Cyperus eragrostis*). Several White-crowned Sparrows and nests of San Francisco Dusky-footed Woodrat (*Neotoma fuscipes annectens*) were observed within the riparian forest community.

Aquatic Features

Intermittent Stream

Approximately 726 linear feet (0.14 acre) of intermittent stream were observed in the Study Area. An additional 139 linear feet of intermittent stream are culverted under Monterey and Watsonville Boulevards. West Little Llagas Creek flows through the southern portions of the Study Area and is a blue-line stream which was dry at the time of the site visit. Ruderal vegetation dominated a

majority of the creek bed within the Study Area, composed predominantly of curly dock (*Rumex crispus)* and non-native grasses. A small area of riparian habitat occurs in association with the creek near the Watsonville Road/Monterey Road intersection. Although the creek is not considered suitable habitat for most special status wildlife species found in the region, it connects approximately three miles downstream to Llagas Creek, which has been designated critical habitat for South/Central California Steelhead. No wildlife species were observed within West Little Llagas Creek during the site visit.

Drainage Ditches

Approximately 1,670 linear feet (0.13 acre) of drainage ditches were observed bordering an agricultural field and along the southern side of Watsonville Road. An additional 85 linear feet of culverted ditch runs under Seymour Road. Vegetation along drainage ditches within the Study Area included California grape (*Vitis californica*), and redstem filaree *(Erodium cicutarium*), and non-native grasses.

4.2 Special Status Species

4.2.1 Plants

Based upon a review of the resources and databases given in Section 3.2.1, 36 special status plant species have been documented in the vicinity of the Study Area. Appendix B summarizes the potential for occurrence for each special status plant species occurring in the vicinity of the Study Area. All special status plant species documented to occur in the vicinity of the Study Area are unlikely or have no potential to occur; the Study Area does not have the potential to support any of these species due to the dominance of active agricultural areas, developed land, and ruderal habitat. Special status plant species were not observed in the Study Area during the assessment site visit.

4.2.2 Wildlife

Thirty-one special status species of wildlife have been recorded in the vicinity of the Study Area. Appendix B summarizes the potential for each of these species to occur in the Study Area. Two special status wildlife species were observed in the Study Area during the site assessment. Five special status wildlife species have a moderate or high potential to occur in the Study Area. Special status wildlife species that were observed, or have a moderate or high potential to occur in the Study Area are discussed below.

Pallid Bat (*Antrozous pallidus*), CDFG Species of Special Concern, WBWG High Priority. Pallid Bat is found in a variety of low elevation habitats throughout California. It selects a variety of day roosts including rock outcrops, mines, caves, hollow trees, buildings, and bridges. Night roosts are usually found under bridges, but also in caves, mines, and buildings. Pallid Bats are sensitive to roost disturbance. Unlike most bats, Pallid Bat primarily feeds on large ground-dwelling arthropods, and many prey are taken on the ground (Zeiner, et al. 1990). Livestock structures near Fisher Avenue may provide marginal roost habitat for this species. The large oak east of Monterey Road does not provide suitable roost cavities for this species. Only one tree with visible cavities was present in the Study Area, though cavities were shallow and no whitewash was observed; therefore, there is a moderate potential for this species to occur within the Study Area.

Yuma Myotis (*Myotis yumanensis*), WBWG Low Priority. Yuma Myotis is found throughout most of California at lower elevations in a wide variety of habitats. Day roosts are found in buildings,

trees, mines, caves, bridges, and rock crevices. Night roosts are usually associated with buildings, bridges or other man-made structures (Philpott 1996). Several livestock structures near Fisher Avenue may provide marginal roost habitat for this species. Only one tree with visible cavities was present in the Study Area, though cavities were shallow and no whitewash was observed; therefore, there is a moderate potential for this species to occur within the Study Area.

San Francisco Dusky-footed Woodrat (*Neotoma fuscipes annectens*), CDFG Species of Special Concern. This subspecies occurs in brushy habitat in chaparral and foothills of woodlands around San Francisco Bay and the adjacent range (Hafner et al. 1998). Woodrats often occupy habitats with both woodland and scrub components which provide cover and food sources, such as live oak, coffeeberry, blackberry, gooseberry, poison oak, and honeysuckle (Linsdale and Tevis 1951). Nests are typically over three feet in diameter and are constructed out of piled sticks, leaves and grasses. Several Dusky-footed Woodrat nests were observed on-site in the live oak riparian habitat south of the Watsonville Road/Monterey Road intersection.

White-tailed Kite (*Elanus leucurus*), CDFG Fully Protected Species. Kites occur in low elevation grassland, agricultural, wetland, oak woodland, and savannah habitats. Riparian zones adjacent to open areas are also used. Vegetative structure and prey availability seem to be more important than specific associations with plant species or vegetative communities. Lightly grazed or ungrazed fields generally support large prey populations and are often preferred to other habitats. Kites primarily feed on small mammals, although, birds, reptiles, amphibians, and insects are also taken. Nest trees range from single isolated trees to trees within large contiguous forests. Preferred nest trees are extremely variable, ranging from small shrubs (less than 10 feet. tall), to large trees (greater than 150 feet tall). (Dunk 1995). Fallow agricultural fields, orchards, and riparian habitat on-site may provide high quality foraging and nesting habitat for this species. Small mammal burrows and observations of other raptor species foraging in the Study Area indicate prey availability for White-tailed Kite. Also, riparian habitat and isolated walnut and oak trees and shrubs may provide high quality nesting habitat; therefore, there is a high potential for this species to occur within the Study Area.

Golden Eagle (*Aquila chrysaetos*), CDFG Fully Protected Species, CDFG Species of Special Concern. Golden Eagle is found in open and semi-open areas from sea level to 3600 m elevation, in habitats including tundra, shrublands, grasslands, mixed woodlands, and coniferous forests. Golden Eagle is usually found in mountainous areas, but it also nests in wetland, riparian and estuarine habitats (Kochert et al., 2002). This large raptor typically nests in large isolated trees or cliffs. Golden Eagle forages over large areas, feeding primarily on ground squirrels, rabbits, large birds, and carrion. No suitable nesting habitat was observed within the Project alignment, though marginal quality foraging habitat is present. An individual of this species was observed flying over the Study Area several times during the site visit.

Burrowing Owl (*Athene cunicularia*), CDFG Species of Special Concern; USFWS Bird of Conservation Concern. Burrowing Owl typically favors flat, open grassland or gentle slopes and sparse shrub land ecosystems. These owls prefer annual or perennial grasslands, typically with sparse or nonexistent tree or shrub canopies; however, they also colonize debris piles and old pipes. In California, burrowing owls are found in close association with California ground squirrels. Burrowing Owl exhibits high site fidelity and usually use the abandoned burrows of ground squirrels for shelter and nesting. Ground squirrel burrows have been observed during previous site visits (City of Morgan Hill 2005); however, no ground squirrel burrows, Burrowing Owls, or signs of Burrowing Owls were observed during the November 24, 2009 site visit. Potential habitat on-site includes untilled, open fallow fields with low-growing vegetation. Potential habitat in the Study Area

is limited, and the vegetation consists of low to moderately high, non-native, ruderal grassland species; therefore, there is a moderate potential for this species to occur within the Study Area.

Steelhead - South/Central California Coast ESU (*Oncorhynchus mykiss irideus*), Federal Threatened. The South/Central California Coast ESU includes all naturally spawned populations of steelhead (and their progeny) in California streams from the Pajaro River south to, but not including, the Santa Maria River. Steelhead typically migrate to marine waters after spending two years in fresh water, though they may stay up to seven. They then reside in marine waters for two or three years prior to returning to their natal stream to spawn as four-or five-year-olds. Steelhead adults typically spawn between December and June. In California, females typically spawn two times before they die. Preferred spawning habitat for steelhead is in perennial streams with cool to cold water temperatures, high dissolved oxygen levels and fast flowing water. Abundant riffle areas (shallow areas with gravel or cobble substrate) for spawning and deeper pools with sufficient riparian cover for rearing are necessary for successful breeding. West Little Llagas Creek does not provide suitable spawning habitat for this species, and riparian habitat within the Study Area is limited to the section of creek south of the Watsonville Road/Monterey Road intersection. However, West Little Llagas Creek is a tributary to Llagas Creek, which is designated critical habitat for steelhead. West Little Llagas Creek also passes through several culverts within the Study Area, though no impenetrable barriers to fish passage were observed on-site. Steelhead may occasionally utilize the low quality habitat in West Little Llagas Creek during the wet season; therefore, there is a moderate potential for this species to occur within the Study Area.

Other federally listed species that are documented to occur within the vicinity of the Study Area, but are unlikely to occur include: San Joaquin Kit Fox, California Tiger Salamander, and California Red-legged Frog. These species are discussed below.

San Joaquin Kit Fox (*Vulpes macrotis mutica*), Federal Endangered Species, State Threatened Species. San Joaquin Kit Fox is a small, slim canid with large ears and bushy tail, buffy- or tan-colored in summer, silver-gray in winter. This species is found in the San Joaquin Valley and in surrounding foothills, from Alameda County east to Stanislaus County. It occurs in mainly flat grasslands, scrublands, oak savannahs, alkali meadows, and agricultural areas, with loose-textured soils suitable for constructing dens. Kit fox prey consists primarily of rabbits and small rodents. The Study Area is surrounded by urban and agricultural development, and any open, untilled habitat on-site is fragmented and disturbed. It is also outside the known range for this species. Although an occurrence of two kit foxes near the town of Coyote was documented in 1992, Hwy 101 acts as a significant barrier to foxes from the east. No large mammal burrows or soils suitable for this species were observed on-site; therefore, there is a low potential for this species to occur within the Study Area.

California Tiger Salamander (*Ambystoma californiense*), Federal Threatened Species, State Candidate Endangered Species. California Tiger Salamander (CTS) is restricted to grasslands and low-elevation foothill regions in California (generally under 1500 feet) where it uses seasonal aquatic habitats for breeding. The salamanders breed in natural ephemeral pools, or ponds that mimic ephemeral pools (stock ponds that go dry), and occupy substantial areas surrounding the breeding pool as adults. CTS spend most of their time in the grasslands surrounding breeding pools. They survive hot, dry summers by estivating (going through a dormant period) in refugia (such as burrows created by ground squirrels and other mammals and deep cracks or holes in the ground) where the soil atmosphere remains near the water saturation point. During wet periods, the salamanders may emerge from refugia and feed in the surrounding grasslands.

Aquatic habitat within the Study Area includes West Little Llagas Creek, an intermittent drainage that forms a narrow, defined channel through the Study Area. Although the creek dries up annually, it is considered unsuitable because it does not appear to form pools, and it lacks barriers to predatory fish species that may enter the Study Area from Llagas Creek. As indicated by the channel topography and vegetation observed during the site visit, water likely moves through the creek in a rapid and ephemeral manner that is not considered suitable for CTS. In addition, a detention basin occurs along the Study Area's northern border and provides ephemeral aquatic habitat. This detention basin is designed to dewater through a gravity outlet within 48 hours; ponding of no longer than a two week period may occur during major storm events. CTS require a greater period of inundation to reproduce.

Though the Study Area does not contain breeding habitat, the upland habitat surrounding the creek is composed of cultivated agricultural land and ruderal herbaceous grassland that may provide limited areas of marginal upland habitat for this species. Upland habitat within the Study Area may be used by CTS as estivation and/or dispersal habitat if it occurs within the typical dispersal distance (0.7 mile) of aquatic breeding habitat (USFWS 2005). No known or potential breeding sites occur within 0.7 miles of the Study Area; therefore, it is unlikely that CTS occupy upland habitat on-site. One historic occurrence was documented within one mile of the Study Area, and several more recent occurrences were documented within three miles (CDFG 2009). Due to the lack of suitable breeding habitat within dispersal distance of the Study Area, there is a low potential for this species to occur on-site.

California Red-legged Frog (*Rana draytonii*), Federal Threatened Species, CDFG Species of Special Concern. The California Red-legged Frog is dependent on suitable aquatic, estivation, and upland habitat. During periods of wet weather, starting with the first rainfall in late fall, red-legged frogs disperse away from their estivation sites to seek suitable breeding habitat. Aquatic and breeding habitat are characterized by dense, shrubby, riparian vegetation and deep, still or slow-moving water. Breeding occurs between late November and late April. California Red-legged Frog estivates (period of inactivity) during the dry months in small mammal burrows, moist leaf litter, incised stream channels, and large cracks in the bottom of dried ponds. West Little Llagas Creek is the only potential aquatic habitat within the Study Area. The creek is an intermittent drainage that does not form pools or support aquatic vegetation suitable for this species. Though Red-legged Frog could feasibly use on-site aquatic habitat for dispersal between foraging and breeding habitats, the Study Area lacks breeding habitat and only provides low quality foraging habitat. In addition, the nearest documented occurrence of this species is approximately two miles away, which is beyond this frog's typical dispersal distance; therefore, there is a low potential for this species to occur within the Study Area.

Most of the wildlife observed in the Study Area are commonly found species, and many are adapted to occupying disturbed or urban areas. Two special status wildlife species were observed.

5.0 POTENTIAL IMPACTS AND MITIGATION

Two sensitive biological communities were identified within the Study Area. No special status plant species have potential to occur within the Study Area. Seven special status wildlife species have a moderate or high potential to occur within the Study Area. The following sections present recommendations for future studies and/or measures to avoid or reduce impacts to these species and sensitive habitats.

The proposed project involves the construction of a new road and a drainage channel that empties into a detention basin (Figure 4). Most of the Study Area is comprised of ruderal herbaceous grassland and cultivated agricultural land, which are not considered sensitive habitats under CEQA. In addition, the habitats observed on-site are considered unsuitable for local special status plant species. No impacts to special status plant species are anticipated as a result of the proposed project. Potentially significant impacts as a result of the project and their associated mitigation measures are discussed below.

5.1 Sensitive Biological Communities

Most of the Study Area is comprised of ruderal, agricultural and developed areas which are not sensitive biological communities. However, the Study Area does contain 0.23 acres of riparian habitat and 2,396 linear feet of intermittent stream and roadside drainage ditches. A jurisdictional wetland delineation has been conducted in the Study Area and has been recommended for submittal to the Corps for verification. Sensitive biological communities potentially impacted by project activities are described below.

5.1.1 Riparian Habitat

5.1.1.1 Impacts

The conversion of 0.1 acre of riparian habitat to developed land is a potentially significant impact under CEQA. The on-site riparian habitat may fall under the jurisdiction of the California Department of Fish and Game (CDFG) under the 1600 program.

5.1.1.2 Mitigation Measure

Approximately 0.10 acre of riparian habitat within the Study Area shall be replaced at a replacement-to-loss ratio of 3:1 (three acres of riparian habitat created for each acre disturbed). Mitigation would occur either through the purchase of mitigation credits from a local riparian mitigation bank or pursuant to a site-specific mitigation plan. At a minimum, this plan shall identify mitigation areas, a planting plan, and success criteria, along with remedial measures to compensate for lack of success.

Site-specific mitigation opportunities for riparian impacts include planting portions of West Little Llagas Creek and unlined sections of the extended Butterfield Channel. Riparian mitigation could also occur in the section of West Little Llagas Creek proposed for daylighting as part of project activities. Appropriate tree species for planting in these areas include coast live oak, big-leaf maple (Acer macrophyllum), valley oak (*Quercus lobata*), cottonwood (*Populus fremontii* ssp. *fremontii*), and various species of willow (*Salix* spp.).

As aforementioned, a Riparian Mitigation and Monitoring Plan shall specify the use of locally native, riparian plant species, quantities for planting, irrigation and maintenance requirements, performance criteria, and annual monitoring methods for a five-year monitoring period. Use of locally native plant species is important to maintain or improve the existing habitat structure and genetic integrity of restoration and mitigation areas.

Impacts to riparian habitat would require a Section 1602 Streambed Alteration Agreement from CDFG. Mitigation of impacts required by CDFG may include planting riparian species in suitable

habitat along West Little Llagas Creek and along the extended Butterfield Channel. Alternatively, mitigation requirements may be satisfied through the purchase of mitigation bank credits.

5.1.2 Other Waters: Intermittent Stream and Drainage Ditches

5.1.2.1 Impacts

Approximately 2,620 linear feet of other waters, including an intermittent stream and drainage ditches, occur within the Study Area. The proposed project would convert 263 linear feet of intermittent stream and 728 linear feet of drainage ditches to developed land, which constitutes a potentially significant impact under CEQA. The waterways on-site are potentially within the jurisdiction of the Corps under Section 404 of the Clean Water Act and RWQCB under the Porter Cologne Act and Section 401 of the Clean Water Act.

5.1.2.2 Mitigation Measure

Prior to initiating creek and drainage ditch modifications, the City shall apply for and be issued a Section 404 permit from the USACE, Section 401 certification from the Regional Water Quality Control Board, and Streambed Alteration Agreement from the CDFG. The City and contractors shall comply with the conditions of these regulatory permits.

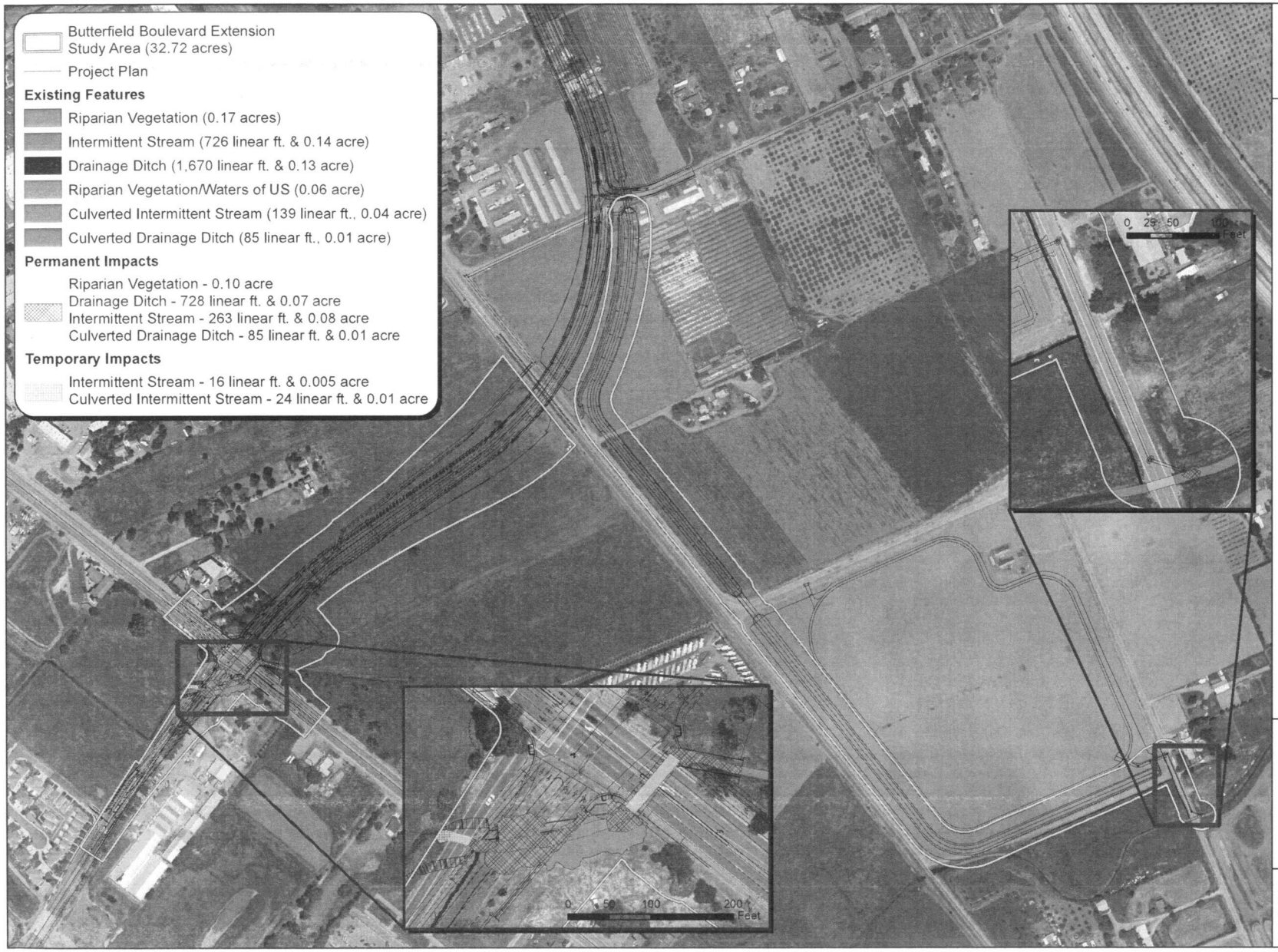
The Section 404 permit would require an alternatives analysis to determine if other, less environmentally damaging project alternatives are viable. A mitigation and monitoring plan would also be required for this permit to ensure environmental impacts are mitigated and the sensitive habitats are returned to a natural state after the project is complete. This mitigation and monitoring plan should satisfy the Section 401 and Section 1602 permit mitigation requirements as well. The Section 401 and Section 1602 permits also require a certified CEQA document prior to issuance.

Site-specific mitigation opportunities for stream and drainage ditch impacts within the Butterfield Project area include the following:

- Restoring portions of West Little Llagas occurring within the Project Area to natural conditions;
- Creating stream habitat (contouring, planting) within unlined sections of the proposed Butterfield Channel extension;
- Restoring the portion of West Little Llagas Creek currently culverted beneath Watsonville Road proposed for day-lighting;
- Creation of a drainage along the southern edge of the re-aligned Watsonville Road.

5.2 Special Status Plant Species

Of the 36 special status plant species known to occur in the vicinity of the Study Area, none have the potential to occur in the Study Area. Most of the species found in the review of background literature occur in high quality vernal pool habitat with low plant cover, or on special soil types such as serpentine often found in the foothills east of the Study Area. The agricultural, ruderal, and developed areas within the Study Area are highly disturbed or dominated by weedy species, and are therefore unlikely to support most of the special status plant species found in the literature review.



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ENVIRONMENTAL CONSULTANTS

Butterfield Boulevard Extension

Santa Clara County, CA

Figure 4.

Impacts Map

N W E S

0 150 300 600 Feet

Date: January 2010
Map by: Michael Rochelle
Aerial: USGS, 2006
File path: I:\acad2000\19000\19127\gis\arcmap\Impacts.mxd

5.2.1 Impacts

The Study Area is unlikely to support any special status plant species; therefore, no impacts to special status plants are anticipated.

5.2.2 Mitigation Measure

No additional surveys or mitigation measures are recommended to address sensitive plant issues within the Study Area.

5.3 Special Status Wildlife Species

Of the 31 special status wildlife species known to occur in the vicinity of the Study Area, seven were determined to have the potential to occur in the Study Area. Most of the species found in the review of background literature occur in habitats not found in the Study Area. Habitat suitability for grassland-associated species in the Study Area is reduced due to regular discing of large portions of the site, as well as the adjacent development. In addition, aquatic habitat on-site is intermittent, disturbed, and considered unsuitable for use as breeding habitat by special status reptiles, amphibians, and fish species found in the region. Special status wildlife species on-site may fall under the jurisdiction of USFWS under the Endangered Species Act and Migratory Bird Treaty Act, and/or the CDFG under the California Endangered Species Act and California Environmental Quality Act.

5.3.1 Pallid Bat and Yuma Myotis

5.3.1.1 Impacts

Two special status bat species have the potential to occur in the Study Area: Pallid Bat and Yuma Myotis. Only one large, mature tree with substantial cavities was observed within the Project alignment, and this tree may be inhabited by bats during the breeding and hibernation seasons (November through mid-August). In addition, bats may inhabit structures near Fisher Avenue that would be removed during Project construction. Removal of occupied trees and structures may impact one or both of these species.

5.3.1.2 Mitigation Measure

If tree and building removal is undertaken in late August through October, no additional measures are required.

For tree or building removal from November through mid-August, pre-construction surveys of trees within the Project Area and structures proposed for removal will be conducted by a qualified wildlife biologist. Surveys will occur no more than 30 days prior to the initiation of demolition or tree removal. The wildlife biologist will examine trees and structures for urine staining and fecal pellets. If signs of the presence of bats are detected, the wildlife biologist will determine whether the bats are presently occupying the tree or buildings and whether the colony is breeding. The wildlife biologist will then work with the contractor to exclude the colony from the trees at an appropriate time when the bats are not engaged in breeding or hibernation activities.

5.3.2 San Francisco Dusky-footed Woodrat

5.3.2.1 Impacts

Several San Francisco Dusky-footed Woodrat nests were observed within the Project footprint. The nests were found along West Little Llagas Creek at the edge of riparian woodland habitat. Conversion of riparian habitat into developed land would potentially impact active woodrat nests and reduce woodrat nesting habitat.

5.3.2.2 Mitigation Measure

A qualified biologist shall conduct a pre-construction survey to determine if active woodrat nests occur within a 10-foot buffer of areas to be cleared of vegetation. Pre-construction surveys will.be conducted not more than 30 days prior to the period of disturbance. If woodrat nests are determined to be occupied, each woodrat shall be relocated to suitable habitat in consultations with CDFG. If young are found within the nest, the nest material should be replaced until young have been weaned (up to six weeks from birth), at which point the nest should be dismantled and relocated.

5.3.3 Raptors and Common Avian Species

5.3.3.1 Impacts

This assessment determined that two raptor species may use the Study Area for breeding and foraging: Golden Eagle and White-tailed Kite. These species may forage in the ruderal and agricultural fields on-site, and the kite may find nesting habitat in trees and shrubs throughout the Study Area. Removal of trees, shrubs, cultivated agricultural land and ruderal herbaceous grassland within the Study Area may reduce nesting and foraging habitat for special status raptors as well as common avian species.

5.3.3.2 Mitigation Measure

It is recommended that pre-construction breeding bird surveys be conducted within 14 days of ground disturbance to avoid disturbance to active nests, eggs, and/or young of ground-nesting birds. It is also recommended that any trees and shrubs in or adjacent to the Study Area that are proposed for removal and that could be used as avian nesting sites be removed during the non-breeding season (September 1 through February 1). Surveys can be used to detect the nests of Golden Eagle and White-tailed Kite as well as non-special status birds such as Red-tailed Hawk and Northern Mockingbird, which are protected under the Migratory Bird Treaty Act. An exclusion zone should be established around any active nests of any avian species found in the Plan Area until a qualified biologist has determined that all young have fledged. Suggested buffer zone distances differ depending on species, location, and placement of nest.

5.3.4 Burrowing Owl

5.3.4.1 Impacts

Burrowing Owl may forage in open fields and nest in small mammal burrows within the Study Area. Therefore, the development of existing agricultural land and ruderal herbaceous grassland would potentially affect Burrowing Owl individuals and habitat within the Study Area.

5.3.4.2 Mitigation Measure

Project construction should conform to the requirements described in the Citywide Burrowing Owl Habitat Mitigation Plan (Plan) for the City of Morgan Hill (2003). Requirements include, but are not limited to, a pre-construction survey by a qualified biologist to determine the presence or absence of Burrowing Owl habitat within the Study Area. The pre-construction survey must be conducted within 30 days of ground disturbance within any potential owl habitat. If burrows are observed, a qualified biologist must conduct four surveys on different dates to census the owl population on-site. Locations of active burrows would be mapped, and Burrowing Owls inhabiting these burrows should be evicted within seven days of ground disturbance according to protocol described in the Plan. Eviction shall only take place during the non-breeding season (September 1 through January 31), and a written report of survey and eviction results would be submitted to the Department of Planning. If no burrows are observed on-site, or if owls are absent during all four census surveys, a written report describing survey results shall be submitted to the City Of Morgan Hill Department of Planning, and ground-breaking activities may commence no more than 30 days after the completion of Burrowing Owl surveys.

5.3.5 South/Central California Coast Steelhead

5.3.5.1 Impacts

The South/Central California Coast Steelhead is the only special status fish species with potential to occur within the Study Area. Though no steelhead spawning habitat is present, Project activities may impact individuals that occasionally move up West Little Llagas Creek from critical habitat in Llagas Creek.

5.3.5.2 Mitigation Measure

If in-channel work will occur, National Marine Fisheries Service (NMFS) should be consulted informally to determine the appropriate impact avoidance, minimization, and mitigation measures for the proposed Project. NMFS may require Project activities to be confined to a work window between June 15 and October 15, outside the steelhead spawning season; however, if this is not feasible, block nets and implementation of best management practices would likely be required for work in a live stream. Work in a stream channel would also need to be included in the 1602 Lake and Streambed Alteration Agreement with CDFG.

If Project activities are conducted only outside the creek channel, potential impacts to steelhead may be avoided with the implementation of best management practices, such as incorporating erosion control and sediment detention devices (e.g. well-anchored sandbag cofferdams, straw bales, or silt fences) into Project designs.

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APPENDIX A

LIST OF OBSERVED PLANT AND ANIMAL SPECIES

Appendix A. List of species observed during site visits conducted on November 24, 2009 at the Butterfield Boulevard Extension in Morgan Hill, California.

Scientific name	Common name	Status/Origin
Wildlife		
Agelaius phoeniceus	Red-winged Blackbird	common resident
Aphelocoma californica	Western Scrub Jay	common resident and migrant
Aquila chrysaetos	Golden Eagle	CDFG Fully Protected Species
Buteo jamaicensis	Red-tailed Hawk	common resident and migrant
Cathartes aura	Turkey Vulture	common resident
Charadrius vociferus	Killdeer	common resident
Corvus brachyrhynchos	American Crow	common resident
Mimus polyglottos	Northern Mockingbird	common resident
Neotoma fuscipes annectens	San Francisco Dusky-footed Woodrat	CDFG Species of Special Concern
Pseudacris regilla	Pacific Tree Frog	common resident
Sturnella neglecta	Western Meadowlark	common resident
Zenaida macroura	Mourning Dove	common resident and migrant
Zonotrichia leucophrys	White-crowned Sparrow	common resident
Plants		
Acacia melanoxylon	blackwood acacia	non-native; invasive (limited)
Amsinckia menziesii	small flowered fiddleneck	native
Baccharis pilularis	coyote brush	native
Brassica nigra	black mustard	non-native; invasive (moderate)
Brassica rapa	field mustard	non-native; invasive (limited)
Bromus diandrus	ripgut brome	non-native; invasive (moderate)
Calamagrostis sp.	reedgrass	native
Carduus pycnocephalus	Italian thistle	non-native; invasive (moderate)
Centaurea solstitialis	yellow star thistle	non-native; invasive (high)
Chenopodia album	lambs quarters	non-native
Cirsium vulgare	bull thistle	non-native; invasive (moderate)
Conyza bonariensis	horseweed	non-native
Cynodon dactylon	bermuda grass	non-native; invasive (moderate)
Cyperus eragrostis	flatsedge	native

Scientific name	Common name	Status/Origin
Erodium botrys	broad leaf filaree	non-native
Juglans hindsii	Northern California black walnut	native; rare
Lolium multiflorum	Italian ryegrass	non-native; invasive (moderate)
Malva nicaeensis	bull mallow	non-native
Olea europaea	olive	non-native; invasive (limited)
Opuntia ficus-indica	mission cactus	non-native
Phalaris aquatica	harding grass	non-native; invasive (moderate)
Phyla nodiflora	lippia	native
Pinus radiata	Monterey Pine	non-native (locally)
Plantago lanceolata	English plantain	non-native; invasive (limited)
Quercus agrifolia	coast live oak	native
Raphanus sativus	wild radish	non-native; invasive (limited)
Rumex crispus	curly dock	non-native; invasive (limited)
Senecio vulgaris	old man of Spring	non-native
Tropaeolum majus	nasturtium	non-native
Typha latifolia	tule	native
Vitis californica	California grape	native

APPENDIX B

POTENTIAL FOR SPECIAL STATUS PLANT AND WILDLIFE SPECIES TO OCCUR IN THE STUDY AREA

Appendix B. Potential for Special Status Plant and Wildlife Species to Occur in the Project Area. List compiled from the California Department of Fish and Game (CDFG) Natural Diversity Database (November 2009), U.S. Fish and Wildlife Service (USFWS) Species Lists, and California Native Plant Society (CNPS) Electronic Inventory search of the Mt. Madonna and eight surrounding USGS 7.5' quadrangles and a review of other CDFG lists and publications (Jennings and Hayes 1994, Zeiner et al. 1990).

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Mammals				
Pallid Bat *Antrozous pallidus*	SSC, WBWG: High	Found in deserts, grasslands, shrublands, woodlands, and forests. Most common in open, forages along river channels. Roost sites include old ranch buildings, rocky outcrops and caves within sandstone outcroppings. Roosts must protect bats from high temperatures. Very sensitive to disturbance of roosting sites.	**Moderate Potential.** Buildings may provide marginal roost sites within the Project Area. Cavities in the large walnut tree are shallow and no whitewash was observed.	Surveys of potential roosting sites in buildings and suitable tree habitat are recommended. If potential roosting sites are discovered, tree and building removal should be conducted in late August through October.
Hoary Bat *Lasiurus cinereus*	WBWG: Medium	Prefers open habitats or habitat mosaics, with access to trees for cover and open areas or habitat edges for feeding. Roosts in dense foliage of medium to large trees. Feeds primarily on moths. Requires water.	**Low Potential.** Oak trees onsite may provide marginal foliage for roosting habitat, though no whitewash was observed. Open water sources onsite appear to be ephemeral and do not provide suitable foraging habitat for most of the year.	No further surveys or avoidance measures are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Yuma Myotis *Myotis yumanensis*	WBWG: Low-Medium	Known for its ability to survive in urbanized environments. Also found in heavily forested settings. Day roosts in buildings, trees, mines, caves, bridges and rock crevices. Night roosts associated with man-made structures.	**Moderate Potential.** May forage over Project Area. Marginal roost habitat available in trees and buildings on site. Cavities in the large walnut tree are shallow and no whitewash was observed.	Surveys of potential roosting sites in buildings and suitable tree habitat are recommended. If potential roosting sites are discovered, tree and building removal should be conducted in late August through October.
San Francisco Dusky-footed Woodrat *Neotoma fuscipes annectens*	SSC	Forest habitats of moderate canopy and moderate to dense understory. Also in chaparral habitats. Constructs nests of shredded grass, leaves, and other material. May be limited by availability of nest-building materials.	**Present.** Nest found along Little Llagas Creek at Watsonville Road during biological resources assessment.	Avoidance of woodrat nests is recommended; otherwise, a qualified biologist should conduct a pre-construction survey and dismantle any nests that could be affected by Project construction.
American Badger *Taxidea taxus*	SSC	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. Requires friable soils and open, uncultivated ground. Preys on burrowing rodents.	**Low Potential.** Habitat for this species is fragmented, and the majority of open habitat is actively tilled. Also, no burrows were observed in the Project Area during the site visit.	No further surveys or avoidance measures are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
San Joaquin Kit Fox *Vulpes macrotis mutica*	FE, ST, RP	Annual grasslands or grassy open stages with scattered shrubby vegetation. Need loose-textured sandy soils for burrowing, and suitable prey base.	**Low Potential.** The Project Area outside of expected range and little suitable habitat is present. Although an occurrence of two kit foxes near the town of Coyote was documented in 1992, Hwy 101 acts as a significant barrier to foxes from the east.	No further surveys or avoidance measures are recommended.
Birds				
White-tailed Kite *Elanus leucurus*	CFP	Year-long resident of coastal and valley lowlands; rarely found away from agricultural areas. Preys on small diurnal mammals and occasional birds, insects, reptiles, and amphibians.	**High Potential.** Open agricultural fields onsite provide high quality foraging habitat. The few mature trees onsite may provide marginal nesting habitat.	Pre-construction breeding bird surveys are recommended for Project activities that occur between February 1 and August 31.
Golden Eagle *Aquila chrysaetos*	BCC, CFP	Rolling foothills mountain areas, sage-juniper flats, desert. Cliff-walled canyons provide nesting habitat in most parts of range; also, large trees in open areas.	**Present.** This species was observed flying overhead throughout the day of the site visit.	Pre-construction breeding bird surveys are recommended for Project activities that occur between February 1 and August 31.
Western Snowy Plover *Charadrius alexandrinus nivosus*	FT, SSC, BCC, RP	Federal listing applies only to the Pacific coastal population. Found on sandy beaches, salt pond levees and shores of large alkali lakes. Requires sandy, gravelly or friable soils for nesting.	**Not Present.** No suitable foraging or nesting habitat is present in or adjacent to the Study Area.	No further surveys or avoidance measures are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Burrowing Owl *Athene cunicularia*	BCC, SSC	Open, dry annual or perennial grasslands, deserts and scrublands characterized by low-growing vegetation. Subterranean nester, dependent upon burrowing mammals, most notably, the California ground squirrel.	**Moderate Potential.** Open habitat in the Study Area is either actively tilled or overgrown by tall, non-native vegetation. However, several small mammal burrows were observed onsite, and these burrows may provide marginal nesting habitat. The nearest CNDDB occurrence is less than five miles from the Study Area (CDFG 2009).	A qualified biologist should conduct pre-construction surveys prior to vegetation clearing and grading, as described in the Citywide Burrowing Owl Habitat Mitigation Plan of the City of Morgan Hill.
Black Swift *Cypseloides niger*	BCC, SSC	Coastal belt of Santa Cruz and Monterey County; central and southern Sierra Nevada; San Bernardino and San Jacinto Mountains. Breeds in small colonies on cliffs behind or adjacent to waterfalls in deep canyons and sea-bluffs above surf; forages widely.	**Not Present.** The Study Area is outside the known range for this species, and no suitable nesting habitat is present onsite.	No further surveys or avoidance measures are recommended.
Bank Swallow *Riparia riparia*	ST	Migrant in riparian and other lowland habitats in western California. Colonial nester in riparian areas with vertical cliffs and bands with fine-textured or fine-textured sandy soils near streams, rivers, lakes or the ocean.	**Low Potential.** No breeding habitat is present in or adjacent to the Study Area, though this species may occasionally use marginal onsite foraging habitat during migration.	No further surveys or avoidance measures are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Least Bell's Vireo *Vireo bellii pusillus*	FE, SE, BCC	Summer resident of southern California in low riparian in vicinity of water or in dry river bottoms; below 2000 feet. Nests placed along margins of bushes or on twigs projecting into pathways, usually willow, *Baccharis*, mesquite.	**Not Present.** The Study Area is outside the known range for this species, and no breeding sites have been identified in Santa Clara County.	No further surveys or avoidance measures are recommended.
Tricolored Blackbird *Agelaius tricolor*	BCC, SSC, RP	Highly colonial species, most numerous in Central Valley and vicinity. Largely endemic to California. Requires open water, protected nesting substrate, and foraging area with insect prey within a few kilometers of the colony.	**Low Potential.** Available aquatic habitat onsite is limited and the majority is highly ephemeral. The Study Area is also outside the known range for this species.	No further surveys or avoidance measures are recommended.
California Least Tern *Sterna antillarum browni*	FE, SE, CFP	Nests along the coast from San Francisco Bay south to northern Baja California. Breeding colonies in San Francisco Bay found in abandoned salt ponds and along estuarine shores. Colonial breeder on barren or sparsely vegetated, flat substrates near water.	**Not Present.** No suitable foraging or nesting habitat is present in or adjacent to the Study Area.	No further surveys or avoidance measures are recommended.
Marbled Murrelet *Brachyramphus marmoratus*	FT, SE	Feeds near shore; nests inland along the Pacific coast, from Eureka to Oregon border, and from Half Moon Bay to Santa Cruz. Nests in old-growth redwood-dominated forests, up to six miles inland. Nests often built in Douglas-fir or redwood stands containing platform-like branches.	**Not Present.** No suitable foraging or nesting habitat is present in or adjacent to the Study Area.	No further surveys or avoidance measures are recommended.
Reptiles and Amphibians				

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
California Tiger Salamander *Ambystoma californiense*	FT, SSC, SCE, RP	Inhabits grassland, oak woodland, ruderal and seasonal pool habitats. Seasonal ponds and vernal pools are crucial to breeding. Adults utilize mammal burrows as estivation habitat.	**Low Potential.** Although the nearest historic CNDDB historic occurrence is approximately one mile from the Study Area (CDFG 2009), no suitable aquatic breeding habitat is present onsite. No suitable breeding habitat occurs within dispersal distance of the Study Area, thus CTS are unlikely to occur in on-site upland habitat. The Study Area does not occur within designated critical habitat for this species.	No further surveys or avoidance measures are recommended.
Foothill Yellow-legged Frog *Rana boylii*	SSC	Found in or near rocky streams in a variety of habitats. Prefers partly-shaded, shallow streams and riffles with a rocky substrate; requires at least some cobble-sized substrate for egg-laying. Needs at least 15 weeks to attain metamorphosis. Feeds on both aquatic and terrestrial invertebrates.	**Not Present.** No aquatic habitat suitable for this species occurs onsite. The Study Area is outside the known range for this species.	No further surveys or avoidance measures are recommended.
California Red-legged Frog *Rana draytonii*	FT, SSC, RP	Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11 to 20 weeks of permanent water for larval development. Must have access to estivation habitat.	No CH. The nearest CNDDB occurrence is less than five miles from the Study Area (CDFG 2009).	No further surveys or avoidance measures are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Western Pond Turtle *Actinemys marmorata*	SSC	A thoroughly aquatic turtle of ponds, marshes, rivers, streams and irrigation ditches with aquatic vegetation. Require basking sites such as partially submerged logs, vegetation mats, or open mud banks, and suitable upland habitat (sandy banks or grassy open fields) for egg-laying.	**Low Potential.** Although the nearest CNDDB occurrence is less than five miles from the Study Area (CDFG 2009), no suitable aquatic habitat is present onsite.	No further surveys or avoidance measures are recommended.
Black Legless Lizard *Anniella pulchra nigra*	SSC	Sand dunes and sandy soils in the Monterey Bay and Morro Bay regions. Inhabit sandy soil/dune areas with bush lupine and mock heather as dominant plants. Moist soil is essential.	**Not Present.** No suitable soils or sandy dune habitat are present in or adjacent to the Study Area.	No further surveys or avoidance measures are recommended.
Coast (California) Horned Lizard *Phrynosoma coronatum (frontale)*	SSC	Frequents a wide variety of habitats, most common in lowlands along sandy washes with scattered low bushes. Open areas for sunning, bushes for cover, patches of loose soil for burial, and abundant supply of ants and other insects.	**Not Present.** No suitable sandy soils were observed within the Study Area, which is outside the known range for this species.	No further surveys or avoidance measures are recommended.
Fishes				
Tidewater Goby *Eucyclogobius newberryi*	FE, SSC	Brackish water habitats along the California coast from Agua Hedionda Lagoon, San Diego County to the mouth of the Smith River. Found in shallow lagoons and lower stream reaches, they need fairly still but not stagnant water and high oxygen levels.	**Not Present.** The Study Area contains only intermittent freshwater aquatic habitat; no suitable brackish water habitat is present.	No further surveys or avoidance measures are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Delta Smelt *Hypomesus transpacificus*	FT, ST, RP	Lives in the Sacramento-San Joaquin estuary in areas where salt and freshwater systems meet. Occurs seasonally in Suisun Bay, Carquinez Strait and San Pablo Bay. Seldom found at salinities > 10 ppt; most often at salinities < 2 ppt.	**Not Present.** The Study Area contains only intermittent freshwater aquatic habitat; no suitable estuarine habitat is present.	No further surveys or avoidance measures are recommended.
Steelhead - Central CA Coast ESU *Oncorhynchus mykiss*	FT	Occurs from the Russian River south to Soquel Creek and Pajaro River. Also in San Francisco and San Pablo Bay Basins. Adults migrate upstream to spawn in cool, clear, well-oxygenated streams. Juveniles remain in fresh water for 1 or more years before migrating downstream to the ocean.	**Not Present.** Little Llagas Creek drains into the Pajaro River, and this Steelhead ESU occurs north of the Study Area, outside of the Pajaro River watershed.	No further surveys or avoidance measures are recommended.
Steelhead - Central Valley ESU *Oncorhynchus mykiss irideus*	FT	Occurs from the Russian River south to Soquel Creek and Aptos Creek. Also in San Francisco and San Pablo Bay Basins. Populations in the Sacramento and San Joaquin Rivers and their tributaries. Adults migrate upstream to spawn in cool, clear, well-oxygenated streams. Juveniles remain in fresh water for 1 or more years before migrating downstream to the ocean .	**Not Present.** Little Llagas Creek drains into the Pajaro River, and this Steelhead ESU occurs east of the Study Area, outside of the Pajaro River watershed.	No further surveys or avoidance measures are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Steelhead - South/Central CA Coast ESU *Oncorhynchus mykiss irideus*	FT, SSC	Occurs in coastal basins from the Pajaro River south to, but not including, the Santa Maria River. Adults migrate upstream to spawn in cool, clear, well-oxygenated streams. Juveniles remain in fresh water for 1 or more years before migrating downstream to the ocean.	**Moderate Potential.** The Study Area does not contain critical habitat for this species, but Little Llagas Creek is a tributary to critical habitat in Llagas Creek. Steelhead may be present in Little Llagas Creek during winter migration.	If in-channel will occur, informal consultation with NMFS is recommended. If Project activities are conducted only outside the channel, implementation of erosion control and sediment detention devices is recommended.
Chinook Salmon - Spring-run ESU *Oncorhynchus tshawytscha*	FT, ST	Occurs in the Feather River and the Sacramento River and its tributaries, including Butte, Mill, Deer, Antelope and Beegum Creeks. Adults enter the Sacramento River from late March through September. Adults migrate upstream to spawn in cool, clear, well-oxygenated streams from mid-August through early October. Juveniles migrate soon after emergence as young-of-the-year, or remain in freshwater and migrate as yearlings.	**Not Present.** This species is not known to occur in the Pajaro River watershed.	No further surveys or avoidance measures are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Chinook Salmon - Winter-run ESU *Oncorhynchus tshawytscha*	FE, SE, RP	Occurs in the Sacramento River below Keswick Dam. Spawns in the Sacramento River but not in tributary streams. Requires clean, cold water over gravel beds with water temperatures between 6 and 14 degrees C for spawning. Adults migrate upstream to spawn in cool, clear, well-oxygenated streams. Juveniles typically migrate to the ocean soon after emergence from the gravel.	**Not Present.** This species is not known to occur in the Pajaro River watershed.	No further surveys or avoidance measures are recommended.
Invertebrates				
monarch butterfly *Danaus plexippus*	SSI	Winter roost sites extend along the coast from northern Mendocino to Baja California, Mexico. Roosts located in wind-protected tree groves (eucalyptus, Monterey pine, Monterey cypress), with nectar and water sources nearby.	**Not Present.** No suitable roosting habitat is present in or adjacent to the Study Area.	No further surveys or avoidance measures are recommended.
Bay checkerspot butterfly *Euphydryas editha bayensis*	FT, SSI, RP	Restricted to native grasslands on outcrops of serpentine soil in the vicinity of San Francisco Bay. *Plantago erecta* is the primary host plant; *Orthocarpus densiflorus* and *O. purpurscens* are the secondary host plants.	**Not Present.** Although the nearest CNDDB occurrence is less than five miles from the Study Area (CDFG 2009), no suitable soils or native grasslands are present onsite. No critical habitat is present within the Study Area.	No further surveys or avoidance measures are recommended.
Plants				

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Santa Cruz Manzanita *Arctostaphylos andersonii*	List 1B	Broadleaved upland forest, chaparral, openings and edges of north coast coniferous forest. 60-730 m. Blooms November-April.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
Hooker's manzanita *Arctostaphylos hookeri* ssp. *hookeri*	List 1B	Chaparral, coastal scrub/sandy, closed cone coniferous forest, cismontane woodland. 85-300 m. Blooms February-June.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
Pajaro Manzanita *Arctostaphylos pajaroensis*	List 1B	Chaparral on sandy soils. 30-760 m. Blooms December-March.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
Kings Mountain Manzanita *Arctostaphylos regismontana*	List 1B	Broadleaved upland forest, chaparral, north coast coniferous forest, on granitic or sandstone substrate. 305-730 m. Blooms January-April.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
big-scale balsamroot *Balsamorhiza macrolepsis var. macrolepsis*	List 1B	Chaparral, cismontane woodland, valley and foothill grassland/ sometimes serpentine; 90-1400 m elevation. Blooms March- June.	**Unlikely.** No suitable habitat for this species occurs within the Study Area. A documented occurrence occurs within five miles of the Study Area; potential grassland areas are disturbed by agricultural activities or dominated by ruderal species.	No further surveys or avoidance measures are recommended.
Santa Cruz Mountains pussypaws *Calyptridium parryi*	List 1B	Chaparral, cismontane woodland; 305-1115 m elevation. Blooms May-August. Bloomes May-July.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Tiburon Indian paintbrush *Castilleja affinis ssp. neglecta*	FE, ST, List 1B	Valley and foothill grassland (serpentine); 60-400 m elevation. Blooms April- June.	**Unlikely.** No suitable habitat for this species occurs within the Study Area. A documented occurrence occurs within five miles of the Study Area; potential grassland areas are disturbed by agricultural activities or dominated by ruderal species.	No further surveys or avoidance measures are recommended.
pink creamsacs *Castilleja rubicundula* ssp. *rubicundula*	List 1B	Chaparral openings, cismontane woodland, meadows and seeps, valley and foothill grassland on serpentinite. 20-900 m. Blooms April-June.	**No Potential.** No suitable habitat for this species or serpentine soils occur within the Study Area.	No further surveys or avoidance measures are recommended.
coyote ceanothus *Ceanothus ferrisae*	FE, List 1B	Chaparral, coastal scrub, valley and foothill grassland/ serpentine; 120-460 m elevation. Blooms January-May.	**Unlikely.** No suitable habitat for this species or serpentine soils occur within the Study Area. A documented occurrence occurs within five miles of the Study Area; potential grassland areas are disturbed by agricultural activities or dominated by ruderal species.	No further surveys or avoidance measures are recommended.
Congdon's tarplant *Centromadia parryi* ssp. *congdonii*	List 1B	Valley and foothill grassland (alkaline). 1-230 m. Blooms June-November.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
Monterey spineflower *Chorizanthe pungens var. pungens*	FT, List 1B	Chaparral (maritime), coastal dunes/scrub, valley and foothill grassland/ sandy; 3-450 m elevation. Blooms April- June.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
robust spineflower *Chorizanthe robusta var. robusta*	FE, List 1B	Coastal dunes/scrub, sandy terraces and bluffs in loose sand; 1-120 m elevation. Blooms April- September.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
Mt. Hamilton thistle *Cirsium fontinale var. campylon*	List 1B	Chaparral, cismontane woodland, valley and foothill grassland/ serpentine seeps; 100-890 m elevation. Blooms February-October.	**Unlikely.** No suitable habitat for this species or serpentine soils occur within the Study Area. A documented occurrence occurs within five miles of the Study Area; potential grassland areas are disturbed by agricultural activities or dominated by ruderal species.	No further surveys or avoidance measures are recommended.
Santa Clara Valley dudleya *Dudleya setchellii*	FE, List 1B	Cismontane woodland, valley and foothill grassland/ rocky serpentine outcrops; 60-455 m elevation. Blooms April- June.	**Unlikely.** No suitable habitat for this species or serpentine soils occur within the Study Area. A documented occurrence occurs within five miles of the Study Area; potential grassland areas are disturbed by agricultural activities or dominated by ruderal species.	No further surveys or avoidance measures are recommended.
sand-loving wallflower *Erysimum ammophilum*	List 1B	Chaparral, coastal dunes, coastal scrub in sandy soils and openings; 0-60 m elevation. Blooms February-June.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
Fragrant fritillary *Fritillaria liliacea*	List 1B	Cismontane woodland, coastal prairie and scrub, valley and foothill grassland/ often serpentine; 3-410 m elevation. Blooms February- April.	**No Potential.** No suitable habitat for this species, or serpentine soils, occur within the Study Area.	No further surveys or avoidance measures are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
sand gilia *Gilia tenuiflora* ssp. *arenaria*	FE, ST, 1B	Chaparral (maritime), cismontane woodland, coastal dunes, coastal scrub/sandy; openings. 0-45 m. Blooms April-June.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
Loma Prieta hoita *Hoita strobilina*	List 1B	Chaparral, cismontane woodland, riparian woodland/ usually serpentine; 30-600 m elevation. Blooms May- October.	**Unlikely.** No suitable habitat for this species or serpentine soils occur within the Study Area.	No further surveys or avoidance measures are recommended.
Santa Cruz tarplant *Holocarpha macradenia*	FT, SE, 1B	Coastal prairie, coastal scrub, valley and foothill grassland/often clay, sandy. 10-220 m. Blooms June-October.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
Kellogg's horkelia *Horkelia cuneata* ssp. *sericea*	List 1B	Closed -cone coniferous forest, chaparral (maritime), coastal scrub/sandy or gravelly, openings. 10-200 m. Blooms April-September.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
legenere *Legenere limosa*	List 1B	In beds of vernal pools; 1-880 m elevation. Blooms April- June.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
smooth lessingia *Lessingia micradenia var. glabrata*	List 1B	Chaparral, cismontane woodland/serpentine, often roadsides; 120-420 m elevation. Blooms July- November.	**Unlikely.** No suitable habitat for this species or serpentine soils occur within the Study Area. A documented occurrence occurs within five miles of the Study Area.	No further surveys or avoidance measures are recommended.
arcuate bush mallow *Malcothamnus arcuatus*	List 1B	Chaparral; 15-355 m elevation. Blooms April- September.	**Unlikely.** No suitable habitat for this species occurs within the Study Area. A documented occurrence occurs within five miles of the Study Area.	No further surveys or avoidance measures are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Hall's bush mallow *Malcothamnus hallii*	List 1B	Chaparral, coastal scrub; 10-550 m elevation. Blooms May- September.	**Unlikely.** No suitable habitat for this species occurs within the Study Area. A documented occurrence occurs within five miles of the Study Area.	No further surveys or avoidance measures are recommended.
robust monardella *Monardella villosa* ssp. *globosa*	List 1B	Broadleafed upland forest (openings), chaparral (openings), cismontane woodland, coastal scrub, and valley and foothill grassland; 100-915 m elevation. Blooms June-July.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
Dudley's lousewort *Pedicularis dudleyi*	SR, List 1B	Chaparral, cismontane woodland, north coast coniferous forest, valley and foothill grassland; 60-900 m elevation. Blooms April- June.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
Santa Cruz Mountains beardtongue *Penstemon rattanii var. kleei*	List 1B	Chaparral, lower montane coniferous forest, North Coast coniferous forest; 400-1100 m elevation. Blooms May- June.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
Plagiobothrys chorisianus var. chorisianus	List 1B	Coastal chaparral, coastal prairie, coastal scrub; 15-160 m elevation. Blooms March- June.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
hairless popcorn flower *Plagiobothrys glaber*	List 1A	Alkaline meadows, marshes and swamps (coastal salt), presumed extirpated from California; 15-180 m elevation. Blooms March- May.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
rock sanicle *Sanicula saxitalis*	SR, List 1B	Broadleaf upland forest, chaparral, valley and foothill grassland, bedrock outcrops and talus slopes; 615-1215 m elevations. Blooms April- May.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.

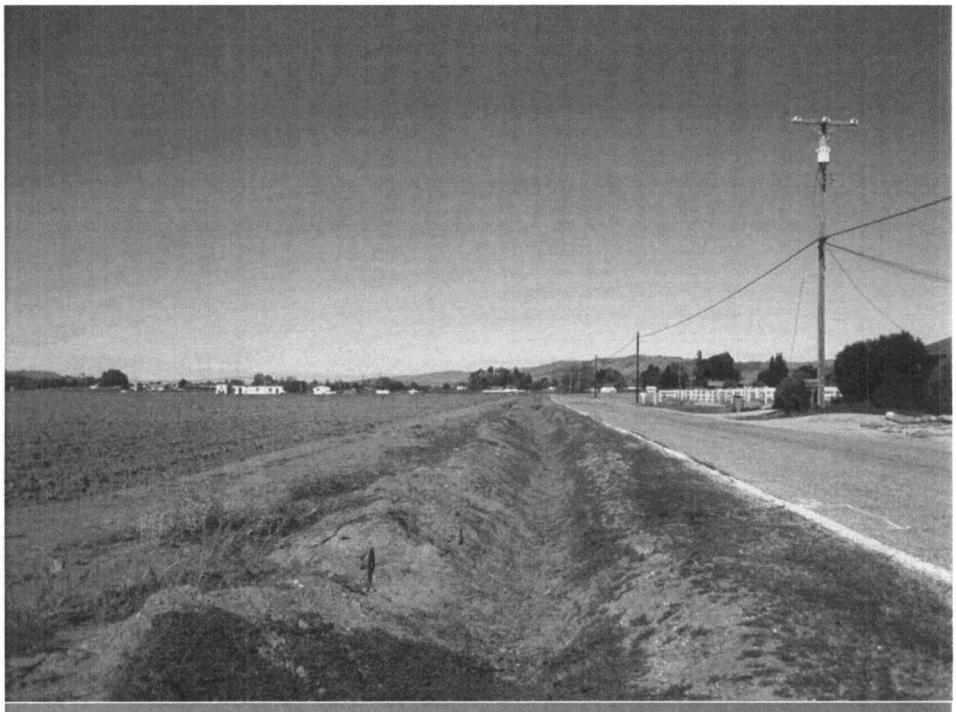
SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RECOMMENDATIONS
Metcalf Canyon jewelflower *Streptanthus albidus ssp. albidus*	FE, List 1B	Valley and foothill grassland, relatively open areas with serpentine soils; 45-800 m elevation. Blooms April- July.	**Unlikely.** No suitable habitat for this species or serpentine soils occur within the Study Area. A documented occurrence occurs within five miles of the Study Area.	No further surveys or avoidance measures are recommended.
most beautiful jewelflower *Streptanthus albidus ssp. peramoenus*	List 1B	Chaparral, cismontane woodland, valley and foothill grassland, serpentine soils; 110-1100 m elevation. Blooms April- June.	**Unlikely.** No suitable habitat for this species occurs within the Study Area. A documented occurrence occurs within five miles of the Study Area.	No further surveys or avoidance measures are recommended.
Mt. Hamilton jewelflower *Streptanthus callistus*	List 1B	Chaparral, cismontane woodland, open talus slopes with shale and/or black oak; 600-790 m elevation. Blooms April- May.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
showy Indian clover *Trifolium amoenum*	FE, List 1B	Coastal bluff scrub, valley and foothill grassland (sometimes serpentine); 5-415 m elevation. Blooms April- June.	**No Potential.** No suitable habitat for this species or serpentine soils occur within the Study Area.	No further surveys or avoidance measures are recommended.
Santa Cruz clover *Trifolium buckwestiorum*	List 1B	Coastal prairie, broadleaf upland forest, cismontane woodland, moist grassland endemic to Santa Cruz County; 105-610 m elevation. Blooms April- October.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.
saline clover *Trifolium depauperatum* var. *hydrophilum*	List 1B	Marshes and swamps, valley and foothill grassland (mesic, alkaline), vernal pools. 0-300 m. Blooms April-June.	**No Potential.** No suitable habitat for this species occurs within the Study Area.	No further surveys or avoidance measures are recommended.

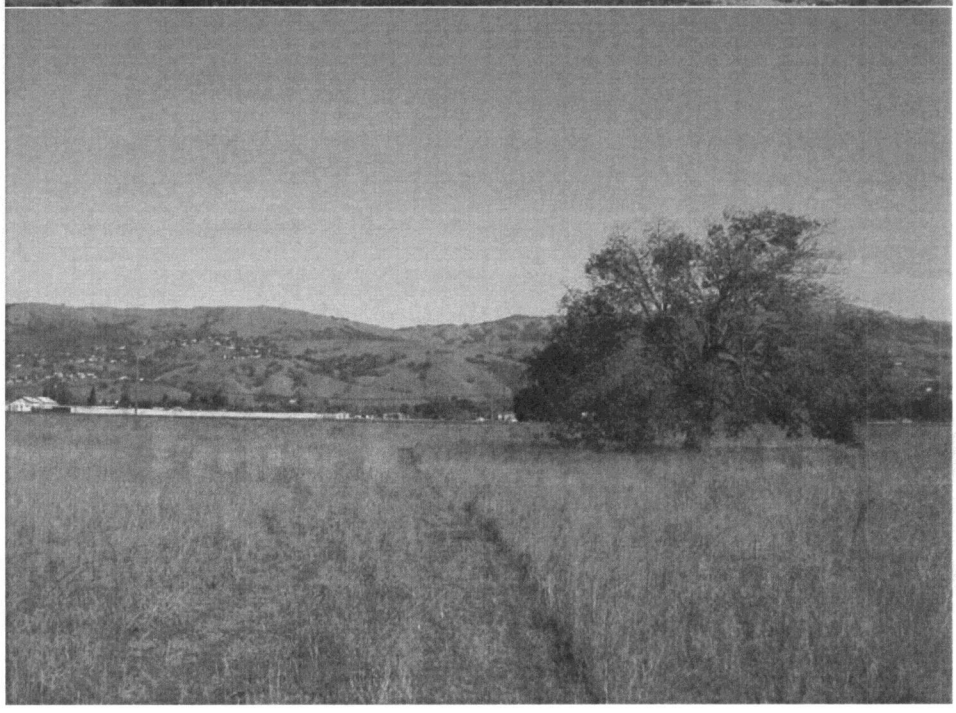
*** Key to status codes:**

FE	Federal Endangered
FT	Federal Threatened
FC	Federal Candidate
FD	Federal De-listed
FPD	Federal Proposed for De-listing
NMFS	Species under the Jurisdiction of the National Marine Fisheries Service
BCC	USFWS Birds of Conservation Concern
RP	Sensitive species included in a USFWS Recovery Plan or Draft Recovery Plan
SE	State Endangered
ST	State Threatened
SR	State Rare
CSC	CDFG Species of Special Concern
Draft CSC	4 April 2000 Draft CDFG Species of Special Concern
CFP	CDFG Fully Protected Animal
SSI	CDFG Special Status Invertebrates
WBWG	Western Bat Working Group High Priority species
List 1A	CNPS List 1A: Plants presumed extinct in California
List 1B	CNPS List 1B: Plants rare, threatened or endangered in California and elsewhere
List 2	CNPS List 2: Plants rare, threatened, or endangered in California, but more common elsewhere
List 3	CNPS List 3: Plants about which CNPS needs more information (a review list)

APPENDIX C

REPRESENTATIVE STUDY AREA PHOTOGRAPHS





Top: Cultivated agricultural land (left) occurs throughout the Study Area; drainage ditches (center) border some of these fields.

Bottom: Ruderal herbaceous grassland habitat dominates the Study Area; mature walnut trees are scattered throughout.

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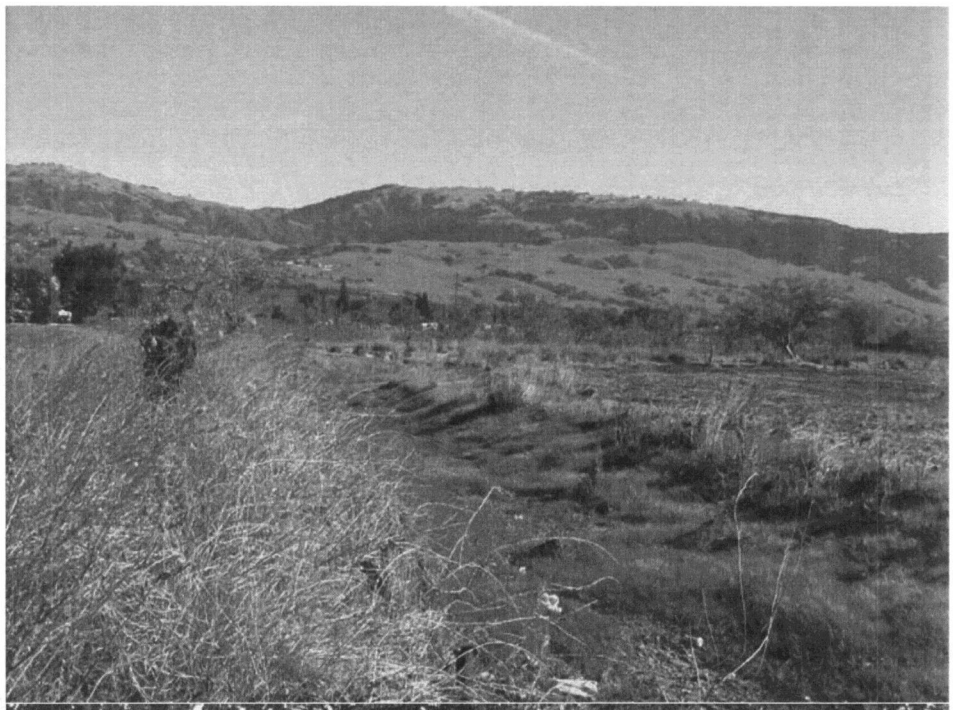

Top: West Little Llagas Creek flows seasonally through the southern portion of the Study Area.

Bottom: Coast live oak riparian habitat surrounding West Little Llagas Creek, with a woodrat nest on the right bank.

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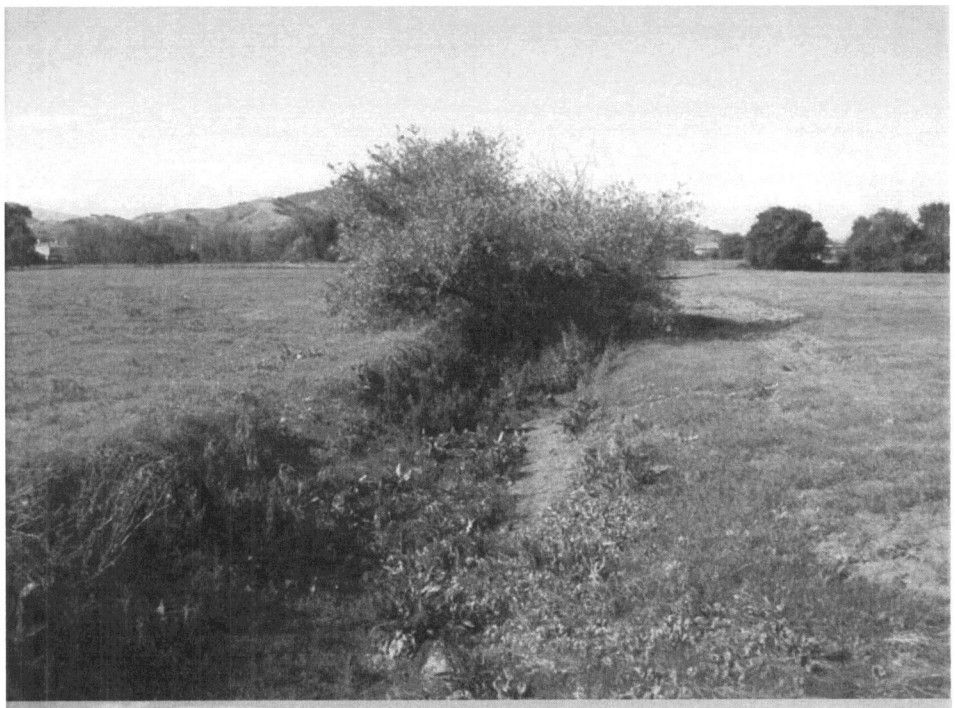

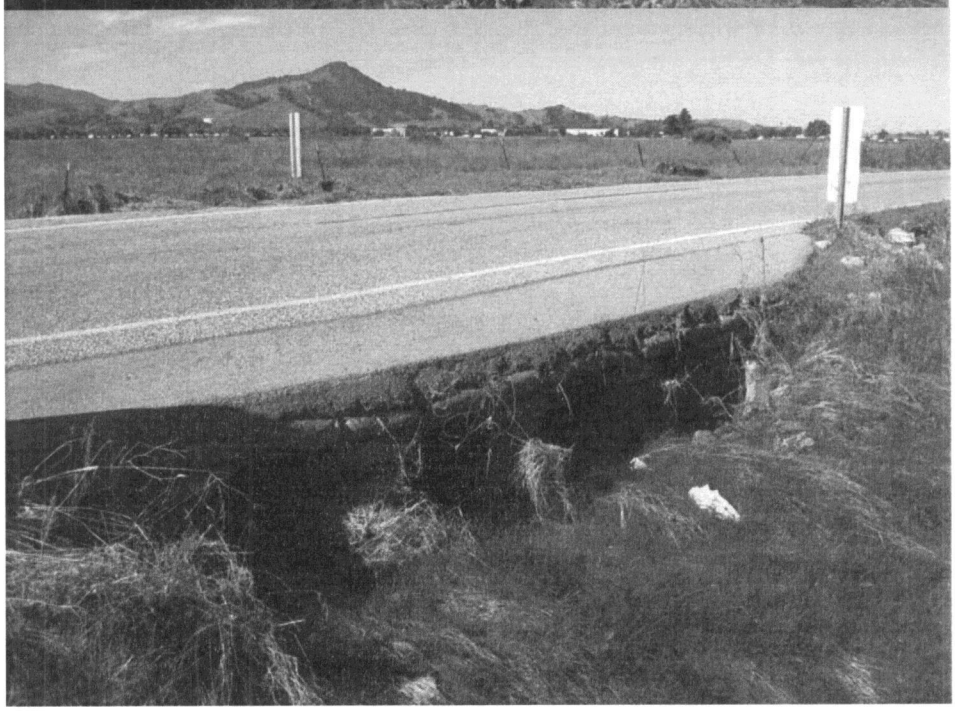

Top: West Little Llagas Creek in the southwestern portion of the Project Area.

Bottom: West Little Llagas Creek passes through culverts under Seymour Ave. in the southeastern Study Area.

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Appendix B

Preliminary Section 404 Determination

Butterfield Boulevard Extension
Preliminary Section 404 Determination

MORGAN HILL, SANTA CLARA COUNTY
CALIFORNIA

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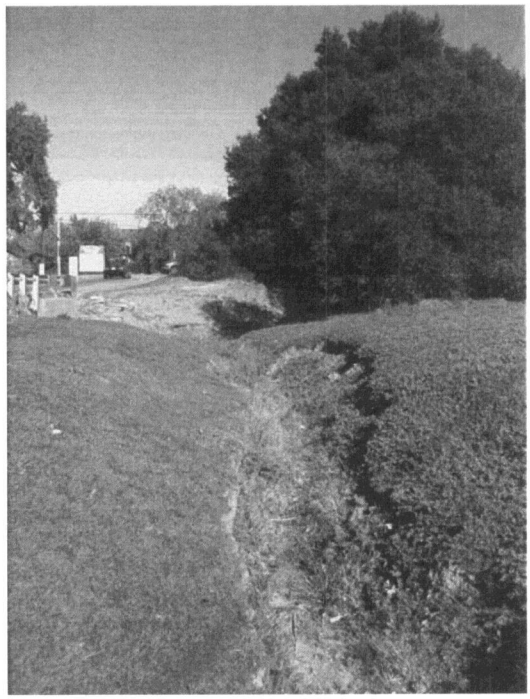

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February 2010

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1.0 INTRODUCTION

1.1 Study Background

On November 24, 2009, WRA, Inc. conducted a delineation within 33 acres (Study Area) proposed for amendment to the Butterfield Boulevard Extension Project in Morgan Hill, Santa Clara County, California (Figure 1). Originally named the Sutter Boulevard Extension and Flood Protection Facilities, the project was reviewed in the Final Environmental Impact Report (FEIR; City of Morgan Hill 1992). Changes to the project in 2005 were covered in the Addendum to the FEIR (City of Morgan Hill 2005). Since the 2005 addendum, project plans have been modified to incorporate an improved design for the extended Butterfield Channel and a local detention basin near Monterey Road.

On November 24, 2009, WRA conducted a routine wetland delineation in the Study Area to determine the presence of potential wetlands and waters subject to federal jurisdiction under Section 404 of the Clean Water Act. This report presents the results of this delineation.

1.2 Regulatory Background

Section 404 of the Clean Water Act

Section 404 of the Clean Water Act gives the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (Corps) regulatory and permitting authority regarding discharge of dredged or fill material into "navigable waters of the United States". Section 502(7) of the Clean Water Act defines navigable waters as "waters of the United States, including territorial seas." Section 328 of Chapter 33 in the Code of Federal Regulations defines the term "waters of the United States" as it applies to the jurisdictional limits of the authority of the Corps under the Clean Water Act. A summary of this definition of "waters of the U.S." in 33 CFR 328.3 includes (1) waters used for commerce; (2) interstate waters and wetlands; (3) "other waters" such as intrastate lakes, rivers, streams, and wetlands; (4) impoundments of waters; (5) tributaries to the above waters; (6) territorial seas; and (7) wetlands adjacent to waters. Therefore, for purposes of the determining Corps jurisdiction under the Clean Water Act, "navigable waters" as defined in the Clean Water Act are the same as "waters of the U.S." defined in the Code of Federal Regulations above.

The limits of Corps jurisdiction under Section 404 as given in 33 CFR Section 328.4 are as follows: (a) *Territorial seas:* three nautical miles in a seaward direction from the baseline; (b) *Tidal waters of the U.S.:* high tide line or to the limit of adjacent non-tidal waters; (c) *Non-tidal waters of the U.S.:* ordinary high water mark or to the limit of adjacent wetlands; (d) *Wetlands:* to the limit of the wetland.

Figure 1. Location Map

Butterfield Boulevard Extension
Santa Clara County, CA

0 1,000 2,000 4,000 Feet

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Date: January 2010
Aerial: 2005 NAIP
Map By: Michael Rochelle
Filepath: I:\Acad2000\19000\19127\gis\Arcmap\Location.mxd

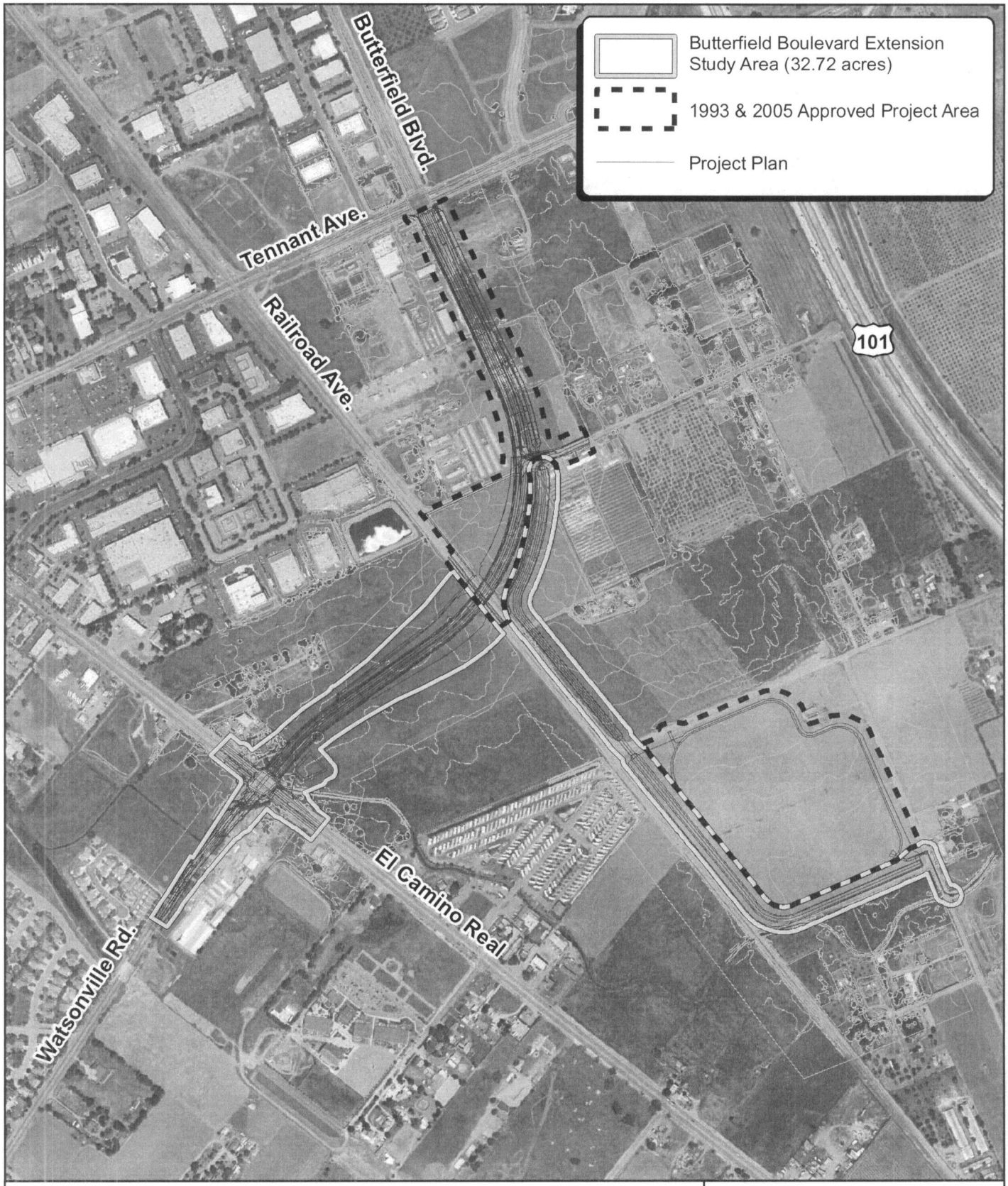

Figure 2. 2010 Butterfield Boulevard Extension Amendment Study Area

N
W E
S

0 250 500 1,000 Feet

Butterfield Boulevard Extension
Santa Clara County, CA

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Date: January 2010
Aerial: USGS, 2006
Map By: Michael Rochelle
Filepath: I:\Acad2000\19000\19127\gis\Arcmap\Project Plan.mxd

2.0 SUMMARY OF POTENTIAL JURISDICTIONAL AREAS

Appendix A depicts the extent of Corps jurisdiction within the Study Area based on a wetland delineation conducted by WRA on November 24, 2009. The acreage of potential Section 404 jurisdictional areas is summarized in Table 1 below.

Table 1. Summary of Potential Section 404 Jurisdictional Areas Within the Study Area

Habitat Type	Length (linear feet) [Size (acres)]	Culverted (Linear Feet)	**Potential Jurisdictional Waters of the U.S. (linear feet)**
Other Waters:			
Intermittent Streams	726 linear feet (0.2 acre)	139 linear feet	865 linear feet
Drainage Ditches	1,670 linear feet (0.13 acre)	85 linear feet	1,755 linear feet
TOTAL			**2,620 linear feet**

3.0 METHODS

Prior to conducting field surveys, reference materials were reviewed, including the Soil Survey of Eastern Santa Clara Area (USDA 1974), the Mt. Madonna USGS 7.5' quadrangle, and aerial photographs of the site.

A focused evaluation of indicators of wetlands and waters was conducted in the Study Area on November 24, 2009. The methods used in this study to delineate jurisdictional wetlands and waters are based on the *U.S. Army Corps of Engineers Wetlands Delineation Manual* ("Corps Manual"; Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* ("Arid West Supplement"; Corps 2008). The routine method for wetland delineation described in the Corps Manual was used to identify areas potentially subject to Corps Section 404 jurisdiction within the Study Area. A general description of the Study Area, including plant communities present, topography, and land use was also generated during the delineation visits. The methods for evaluating the presence of wetlands and Other Waters of the U.S. employed during the site visit are described in detail below.

3.1 Potential Section 404 Waters of the U.S.

3.1.1 Wetlands

The Study Area was evaluated for the presence or absence of indicators of the three wetland parameters described in the Corps Manual (Environmental Laboratory 1987) and Arid West Supplement (Corps 2008).

Section 328.3 of the Federal Code of Regulations defines wetlands as:

> *"Those areas that are inundated or saturated by surface or ground water 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. Wetlands generally include swamps, marshes, bogs, and similar areas."*
>
> EPA, 40 CFR 230.3 and CE, 33 CFR 328.3 (b)

The three parameters used to delineate wetlands are the presence of: (1) hydrophytic vegetation, (2) wetland hydrology, and (3) hydric soils. According to the Corps Manual, for areas not considered "problem areas" or "atypical situations":

> *"....[E]vidence of a minimum of one positive wetland indicator from each parameter (hydrology, soil, and vegetation) must be found in order to make a positive wetland determination."*

Data on vegetation, hydrology, and soils collected at sample points during the delineation site visit was recorded on Arid West Supplement data forms. Once an area was determined to be a potential jurisdictional wetland, its boundaries were delineated using GPS equipment and mapped on a topographic map. The areas of potential jurisdictional wetlands were measured digitally using ArcGIS software. Indicators described in the Arid West Supplement were used to make wetland determinations at each sample point in the Study Area and are summarized below.

Vegetation

Plant species identified on the Study Area were assigned a wetland status according to the U.S. Fish and Wildlife Service list of plant species that occur in wetlands (Reed 1988). This wetland classification system is based on the expected frequency of occurrence in wetlands as follows:

OBL	Always found in wetlands	>99% frequency
FACW(±)	Usually found in wetlands	67-99%
FAC	Equal in wetland or non-wetlands	34-66%
FACU	Usually found in non-wetlands	1-33%
UPL/NL	Upland/Not listed (upland)	<1%

The presence of hydrophytic vegetation was then determined based on indicator tests described in the Arid west Supplement. The Arid West Supplement requires that a three-step process be conducted to determine if hydrophytic vegetation is present. The procedure first requires the delineator to apply the "50/20 rule" (Indicator 1; Dominance Test) described in the manual. To apply the "50/20 rule", dominant species are chosen independently from each stratum of the community. Dominant species are determined for each vegetation stratum from a sampling plot of an appropriate size surrounding the sample point. Dominants are the most abundant species that individually or collectively account for more than 50 percent of the total vegetative cover in the stratum, plus any other species that, by itself, accounts for at least 20 percent of the total vegetative cover. If greater than 50 percent of the dominant species has an OBL, FACW, or FAC status, ignoring + and - qualifiers, the sample point meets the hydrophytic vegetation criterion.

If the sample point fails Indicator 1 and both hydric soils and wetland hydrology are not present, then the sample point does not meet the hydrophytic vegetation criterion, unless the site is a

problematic wetland situation. However, if the sample point fails Indicator 1 but hydric soils and wetland hydrology are both present, the delineator must apply Indicator 2.

Indicator 2 is known as the Prevalence Index. The prevalence index is a weighted average of the wetland indicator status for all plant species within the sampling plot. Each indicator status is given a numeric code (OBL = 1, FACW = 2, FAC = 3, FACU = 4, and UPL = 5). Indicator 2 requires the delineator to estimate the percent cover of each species in every stratum of the community and sum the cover estimates for any species that is present in more than one stratum. The delineator must then organize all species into groups according to their wetland indicator status and calculate the Prevalence Index using the following formula, where A equals total percent cover:

$$PI = \frac{A_{OBL} + 2A_{FACW} + 3A_{FAC} + 4A_{FACU} + 5A_{UPL}}{A_{OBL} + A_{FACW} + A_{FAC} + A_{FACU} + A_{UPL}}$$

The Prevalence Index will yield a number between 1 and 5. If the Prevalence Index is equal to or less than 3, the sample point meets the hydrophytic vegetation criterion. However, if the community fails Indicator 2, the delineator must proceed to Indicator 3.

Indicator 3 is known as Morphological Adaptations. If more than 50 percent of the individuals of a FACU species have morphological adaptations for life in wetlands, that species is considered to be a hydrophyte and its indicator status should be reassigned to FAC. If such observations are made, the delineator must recalculate Indicators 1 and 2 using a FAC indicator status for this species. The sample point meets the hydrophytic vegetation criterion if either test is satisfied.

Hydrology

The Corps jurisdictional wetland hydrology criterion is satisfied if an area is inundated or saturated for a period sufficient to create anoxic soil conditions during the growing season (a minimum of 14 consecutive days in the Arid West region). Evidence of wetland hydrology can include primary indicators, such as visible inundation or saturation, drift deposits, oxidized root channels, and salt crusts, or secondary indicators such as the FAC-neutral test, presence of a shallow aquitard, or crayfish burrows. The Arid West Supplement contains 16 primary hydrology indicators and 10 secondary hydrology indicators. Only one primary indicator is required to meet the wetland hydrology criterion; however, if secondary indicators are used, at least two secondary indicators must be present to conclude that an area has wetland hydrology.

The presence or absence of the primary or secondary indicators described in the Arid West Supplement was utilized to determine if sample points within the Study Area met the wetland hydrology criterion.

Soils

The Natural Resource Conservation Service (NRCS) defines a hydric soil as follows:

> *"A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part."*
>
> Federal Register July 13, 1994,
> U.S. Department of Agriculture, NRCS

Soils formed over long periods of time under wetland (anaerobic) conditions often possess characteristics that indicate they meet the definition of hydric soils. Hydric soils can have a hydrogen sulfide (rotten egg) odor, low chroma matrix color, generally designated 0, 1, or 2, used to identify them as hydric, presence of redox concentrations, gleyed or depleted matrix, or high organic matter content.

Specific indicators that can be used to determine whether a soil is hydric for the purposes of wetland delineation are provided in the NRCS *Field Indicators of Hydric Soils in the U.S.* (USDA 2006). The Arid West Supplement provides a list of 23 of these hydric soil indicators which are known to occur in the Arid West region. Soil samples were collected and described according to the methodology provided in the Arid West Supplement. Soil chroma and values were determined by utilizing a standard Munsell soil color chart (GretagMacbeth 2000).

Hydric soils were determined to be present if any of the soil samples met one or more of the 23 hydric soil indicators described in the Arid West Supplement.

3.1.2 Other Waters of the U.S.

This study also evaluated the presence of "Waters of the United States" other than wetlands potentially subject to U.S. Army Corps of Engineers jurisdiction under Section 404 of the Clean Water Act. Other areas, besides wetlands, subject to Corps jurisdiction include lakes, rivers and streams (including intermittent streams) in addition to all areas below the HTL in areas subject to tidal influence. Jurisdiction in non-tidal areas extends to the ordinary high water mark (OHW) defined as:

> *"...that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impresses on the bank, shelving, changes in the characteristics of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas."*
>
> Federal Register Vol. 51, No. 219,
> Part 328.3 (e). November 13, 1986

Identification of the ordinary high water mark followed the Corps Regulatory Guidance Letter No. 05-05, *Ordinary High Water Mark Identification* (Corps 2005).

3.2 Difficult Wetland Situations in the Arid West

The Arid West Supplement (Corps 2008) includes procedures for identifying wetlands that may lack indicators due to natural processes (problem areas) or recent disturbances (atypical situations). "Problem area" wetlands are defined as naturally occurring wetland types that periodically lack indicators of hydrophytic vegetation, hydric soil, or wetland hydrology due to normal seasonal or annual variability. Some problem area wetlands may permanently lack certain indicators due to the nature of the soils or plant species on the site. "Atypical situations" are defined as wetlands in which vegetation, soil, or hydrology indicators are absent due to recent human activities or natural events.

The list of difficult wetland situations provided in the Arid West Supplement includes wetlands with problematic hydrophytic vegetation, problematic hydric soils, and wetlands that periodically lack indicators of wetland hydrology. In addition, the problem area and atypical situation sections of the

Corps Manual (Environmental Laboratory 1987) were utilized to determine if any sample points taken within the Study Area met the criteria for a problem area or atypical situation. If any determination was based on less than three parameters, the rationale for the wetland determination was explained on the data sheets included in Appendix A. Although the Corps Manual and Arid West Supplement were utilized in the wetland determination, they do not provide exhaustive lists of the difficult situations that can arise during delineations in the Arid West. As a result, WRA interpreted the gathered data using best professional judgement and our knowledge of the ecology of the wetlands in the region.

3.3 Areas Exempt from Section 404 Jurisdiction

Some areas that meet the technical criteria for wetlands or waters may not be jurisdictional under the Clean Water Act. Included in this category are some man-induced wetlands, which are areas that have developed at least some characteristics of naturally occurring wetlands due to either intentional or incidental human activities. Examples of man-induced wetlands may include, but are not limited to, irrigated wetlands, impoundments, or drainage ditches excavated in uplands, wetlands resulting from filling of formerly deep water habitats, dredged material disposal areas, and depressions within construction areas.

In addition, some isolated wetlands and waters may also be considered outside of Corps jurisdiction as a result of the Supreme Court's decision in *Solid Waste Agency of Northern Cook County (SWANCC) v. United States Army Corps of Engineers* (531 U.S. 159 (2001)). Isolated wetlands and waters are those areas that do not have a surface or groundwater connection to, and are not adjacent to a navigable "Waters of the U.S.", and do not otherwise exhibit an interstate commerce connection.

4.0 STUDY AREA DESCRIPTION

The approximately 33-acre Study Area is located in Morgan Hill, Santa Clara County, California (Figure 1). The Study Area is located in southern Morgan Hill surrounded by urban development and agricultural fields; site elevations range from approximately 312 to 325 feet NGVD On-site habitat has been significantly altered from its native state. The majority of the site is composed of fallow fields covered by ruderal herbaceous grassland vegetation, including mustard (*Brassica rapa*), ripgut brome (*Bromus diandrus*), yellow star thistle (*Centaurea solstitialis*), and Italian thistle (*Carduus pycnocephalus*). Several walnut trees are present within the ruderal grassland, and landscape trees and shrubs occur along developed portions of the Study Area. Another large portion of the site is composed of cultivated agricultural land, in which row crops were being cultivated at the time of the site visit. In addition, West Little Llagas Creek runs through the southern portion of the Study Area and supports a small area of coast live oak riparian habitat south of the Watsonville Road/Monterey Road intersection.

<u>Vegetation</u>

Vegetated areas within the Study Area consisted primarily of ruderal, non-native grasses and herbaceous species. Dominant vegetation upland areas included fiddleneck (*Amsinckia menziesii*), ripgut brome (*Bromus diandrus*), Italian thistle (*Carduus pycnocephalus*), yellow star thistle (*Centaurea solstitialis*), field mustard (*Brassica rapa*) and black mustard (*Brassica nigra*).

Vegetation along drainage ditches within the Study Area included California grape (*Vitis californica*), redstem filaree *(Erodium cicutarium*), and non-native grasses. A small area of riparian habitat

dominated by coast live oak (*Quercus agrifolia*) occurs in association with West Little Llagas Creek near the Watsonville Road/Monterey Road intersection. This habitat supports additional species, such as olive, and flatsedge (*Cyperus eragrostis*).

Hydrology

Natural hydrological sources for the Study Area include precipitation, surface runoff from adjacent lands, and flows within West Little Llagas Creek from the upstream Llagas Creek watershed.

Soils

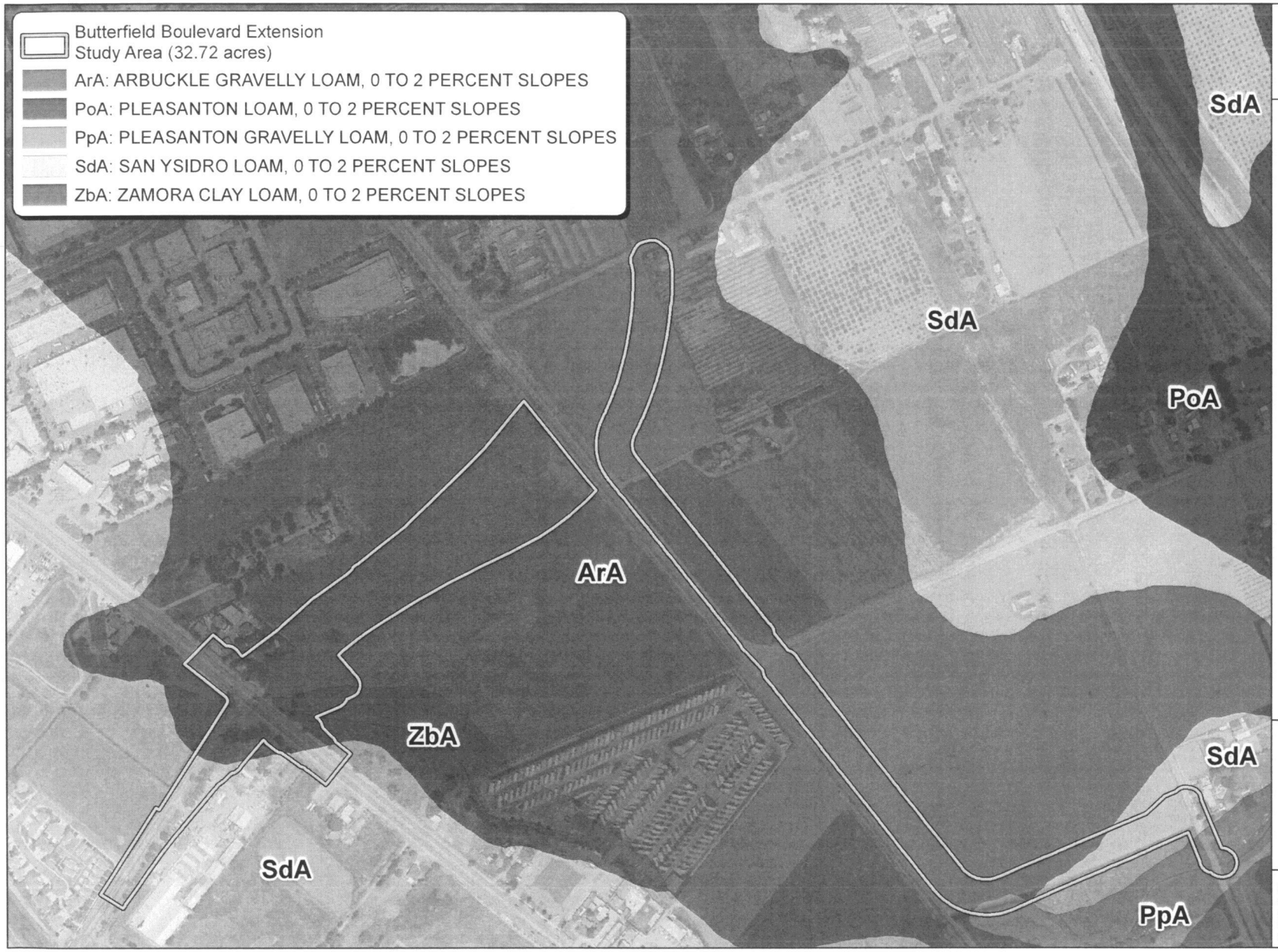
The Soil Survey of Eastern Santa Clara Area (USDA 1974) indicates that the Study Area has five native soil types: Arbuckle gravelly loam, 0 to 2 percent slopes; Pleasanton loam, 0 to 2 percent slopes; Pleasanton gravelly loam, 0 to 2 percent slopes; San Ysidro loam, 0 to 2 percent slopes; and Zamora clay loam, 0 to 2 percent slopes. These soil types are described in detail below and are shown in Figure 2:

Arbuckle gravelly loam, 0 to 2 percent slopes. The Arbuckle series consists of very deep, well-drained soils formed in alluvial materials. They typically occur on low terraces. Arbuckle soils have negligible to high runoff and moderately slow to slow permeability. Lands with this soil series are generally used for dryland and irrigated orchards, row and field crops and range. Annual grasses and forbs commonly grow in Arbuckle soils, sometimes as the understory of a blue oak woodland.

A representative profile for this series consists of a light yellowish-brown (10YR 6/4) gravelly sandy loam.clay surface layer 17 inches thick.

Pleasanton loam, 0 to 2 percent slopes and Pleasanton gravelly loam, 0 to 2 percent slopes. The Pleasanton series consists of well-drained soils with slow to medium runoff. They occur on nearly level to gently sloping alluvial fans and terraces. Pleasanton soils have moderately slow permeability and are used for dry farmed grain and grain hay, wine grapes, fruits, nuts and row crops. Naturally occurring vegetation commonly growing in Pleasanton soils includes annual grasses and forbs with scattered oaks.

A representative profile for this series consists of a grayish brown (10YR 5/2) gravelly fine sandy loam surface layer 21 inches thick.



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Butterfield Boulevard Extension

Santa Clara County, CA

Figure 3.

Soils Map

N
W E
S

0 150 300 600
Feet

Date: January 2010
Map by: Michael Rochelle
Aerial: USGS, 2006
File path: I:\acad2000\19000\19127\gis\arcmap\Soils.mxd

San Ysidro loam, 0 to 2 percent slopes. The San Ysidro series forms in alluvium from sedimentary rocks. These are old soils on low terraces with gradients of zero to nine percent. The San Ysidro series consist of deep, moderately well drained soils with slow to medium runoff and very slow permeability. Soils in this series are used for growing dryland grains, shallow rooted row crops and pasture. Annual grasses and forbs are naturally dominant in areas with San Ysidro soils.

A representative profile for this series consists of a light brownish gray (10YR 6/2) fine sandy loam surface layer 14 inches thick and a dark yellowish brown (10 YR 4/4) clay layer to 28 inches.

Zamora clay loam, 0 to 2 percent slopes. The Zamora series occurs on nearly level to strongly sloping fans and terraces. Zamora soils form in alluvium from material weathered from mixed sedimentary rocks. They are well drained with slow to medium runoff and moderately slow permeability. Lands with Zamora soils are used for growing orchards, row, field and truck crops. Naturally occurring vegetation commonly growing in this series includes annual grasses and forbs with scattered oaks.

A representative profile for this series consists of a grayish brown (2.5Y 5/2) silt loam surface layer 10 inches thick and a brown (10 YR 5/3) silty clay loam layer to 24 inches.

5.0 RESULTS

Vegetation, soils and hydrology data collected during delineation site visits are reported on standard Corps Arid West Region data forms in Appendix A. Potential Section 404 jurisdictional areas are described in the following sections and depicted on a map in Appendix A. Photographs of representative portions of the Study Area and sample points are shown in Appendix B. A list of plant species observed during the site visits is included in Appendix C.

5.1 Potential Section 404 Waters of the U.S.

5.1.1 Wetlands

No potentially jurisdictional wetland areas were observed within the Study Area. No evidence of hydrophytic vegetation, hydric soils, or wetland hydrology were observed during the delineation site visit.

5.1.2 Other Waters of the U.S.

Approximately 2,620 linear feet of potentially jurisdictional Waters of the US occur within the Study Area. West Little Llagas Creek and tributary drainage ditches were dry at the time of the site visit. Evidence of erosion was observed in both West Little Llagas Creek and in the drainage ditches; ordinary high water marks were also present. West Little Llagas Creek flows into Llagas Creek, which then flows into the Pajaro River, a navigable water.

5.2 Difficult Wetland Situations in the Arid West

No difficult wetland situations were encountered during the jurisdictional wetland delineation within the Study Area.

5.3 Areas Exempt from Section 404 Jurisdiction

There are no isolated wetlands or man-induced wetlands within the Study Area.

6.0 POTENTIAL CORPS OF ENGINEERS JURISDICTION

The Butterfield Boulevard Study Area has 2,620 linear feet of Other Waters that may be considered jurisdictional under Section 404 of the Clean Water Act (Appendix A). These waterways are tributary to a navigable "Waters of the U.S." and therefore meet the definition of jurisdictional wetlands and Other Waters for Section 404 of the Clean Water Act.

The conclusion reached in this delineation is based on conditions observed at the time of the field survey conducted on November 24, 2009.

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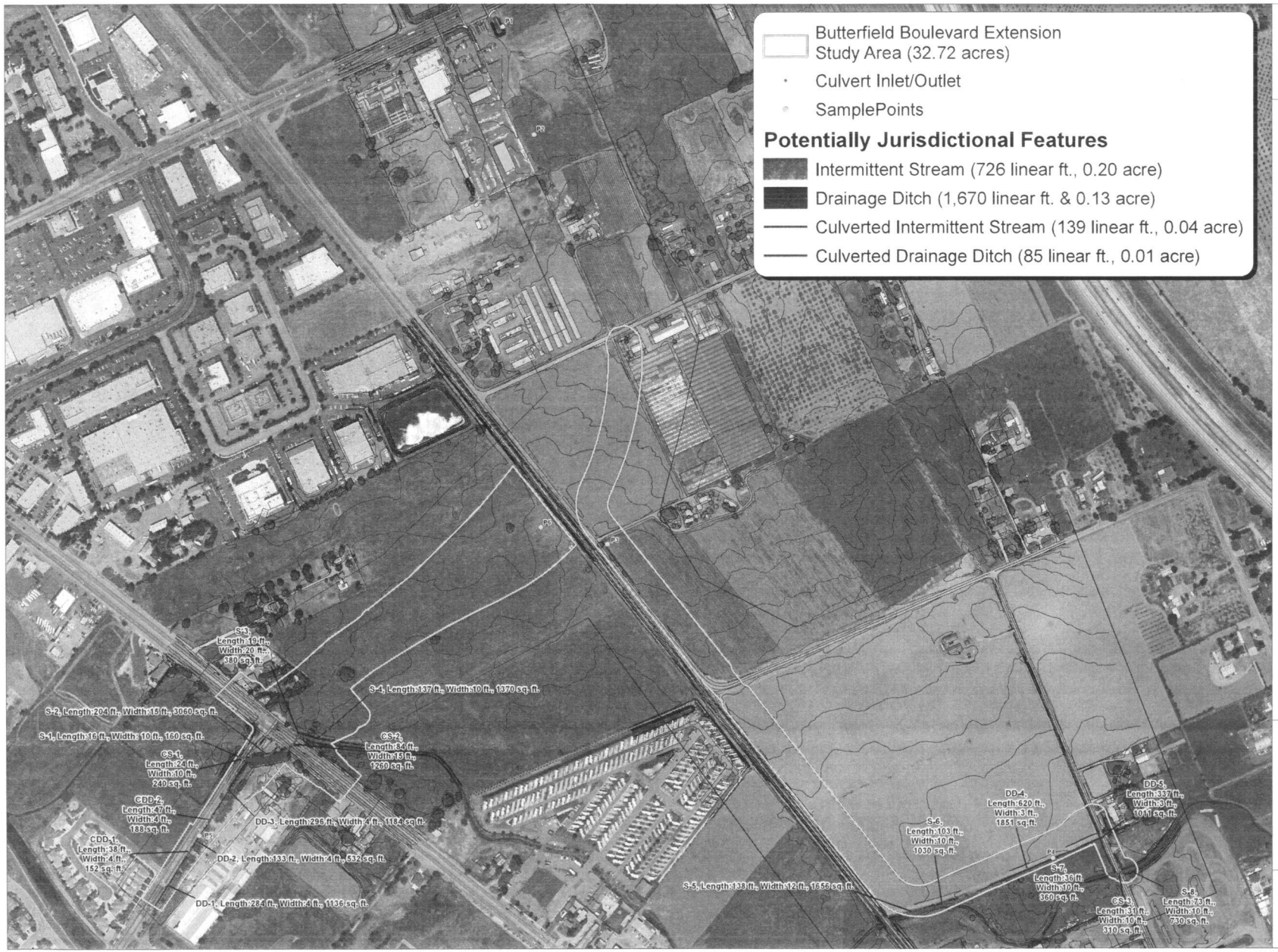
Appendix A - Preliminary Section 404 Jurisdictional Map and Data Sheets



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Butterfield Boulevard Extension

Santa Clara County, CA

Appendix A.

Section 404 Potentially Jurisdictional Features

N
W E
S

1 inch = 200 feet

0 150 300 600 Feet

Date: January 2010
Map by: Michael Rochelle
Aerial: USGS, 2006
File path: I:\acad2000\19000\19127\gis\arcmap\Corps Delineation.mxd

Wetland Determination Data Form - Arid West Region

Project/Site Butterfield Boulevard City Morgan Hill County Santa Clara Sampling Date 11/24/2009

Applicant/Owner City of Morgan Hil Extension State CA Sampling Point SP3

Investigator(s) L. Lazarotti, K. Allan Section,Township,Range T9S, R3E

Landform (hillslope, terrace, etc.) plain Local Relief (concave, convex, none) none Slope(%) 0

Subregion(LRR) LRR C (Medit. CA) Lat: 37.11012 Long: 121.63019 Datum:

Soil Map Unit Name Arbuckle gravelly loam, 0 to 2 percent slopes NWI classification

Are climatic/hydrologic conditions on-site typical for this time of year? ☐ Yes ☒ No (If no, explain in remarks)

Are any of the following significantly disturbed? ☐ Vegetation ☐ Soil ☐ Hydrology Are "Normal Circumstances" present? ☒ Yes ☐ No

Are any of the following naturally problematic? ☐ Vegetation ☐ Soil ☐ Hydrology (If needed, explain any answers in remarks)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	☐ Yes ☒ No	**Is the Sampled Area within a Wetland?** ☐ **Yes** ☒ **No**
Hydric Soil Present?	☐ Yes ☒ No	
Wetland Hydrology Present?	☐ Yes ☒ No	

Remarks: Sample point was located north of Railroad Avenue along the edge of an agricultural field. Wetland vegetation, soils and hydrology were not observed at the sample point; sample point does not occur within a wetland.

VEGETATION (use scientific names)

TREE STRATUM Plot Size:	Absolute % cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Tree Stratum Total Cover:			

SAPLING/SHRUB STRATUM Plot Size:			
1.			
2.			
3.			
4.			
Sapling/Shrub Stratum Total Cover:			

HERB STRATUM Plot Size:			
1. *Trifolium hirtum*	20	Y	NL
2. *Erodium botrys*	35	Y	NL
3. *Brassica nigra*	10		NL
4. *Bromus diandrus*	20	Y	NL
5.			
6.			
7.			
8.			
Herb Stratum Total Cover:	85		

WOODY VINE STRATUM Plot Size:			
1.			
2.			
Woody Vines Total Cover:			

% Bare ground in herb stratum 15 % cover of biotic crust

Dominance Test Worksheet

Number of Dominant Species that are OBL, FACW, or FAC?	0	(A)
Total number of dominant species across all strata?	3	(B)
% of dominant species that are OBL, FACW, or FAC?	0	(A/B)

Prevalence Index Worksheet

Total % cover of:		Multiply by:	
OBL species		x1	
FACW species		x2	
FAC species		x3	
FACU species		x4	
UPL species	85	x5	425
Column Totals	85 (A)		425 (B)

Prevalence Index = B/A = 5.0

Hydrophytic Vegetation Indicators

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is </= 3.0[1]
- ☐ Morphological adaptations (provide supporting data in remarks)
- ☐ Problematic hydrophytic vegetation[1] (explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present ? ☐ Yes ☒ No

Remarks: None of the plant species are hydrophytic. Wetland vegetation criterion is not met.

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[1]	Texture	Remarks
0-12	10YR 4/4	100						no redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)(LRR C)
- ☐ 1cm Muck (A9)(LRR D)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1cm Muck (A9) (LRR C)
- ☐ 2cm Muck (A10)(LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (explain in remarks)

[3]Indicators of hydric vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present ? ☐ Yes ☒ No

Remarks: No hydric soil indicators observed. Hydric soil criterion is not met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)(Nonriverine)
- ☐ Sediment Deposits (B2)(Nonriverine)
- ☐ Drift Deposits (B3)(Nonriverine)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in PLowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1)(Riverine)
- ☐ Sediment Deposits (B2)(Riverine)
- ☐ Drift Deposits (B3)(Riverine)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ Yes ☒ No Depth (inches): _____

Water table present? ☐ Yes ☒ No Depth (inches): _____

Saturation Present? (includes capillary fringe) ☐ Yes ☒ No Depth (inches): _____

Wetland Hydrology Present ? ☐ Yes ☒ No

Describe recorded data (stream guage, monitoring well, aerial photos, etc.) if available.

Remarks: No hydrology indicators observed. Hydrology criterion is not met.

Wetland Determination Data Form - Arid West Region

Project/Site Butterfield Boulevard City Morgan Hill County Santa Clara Sampling Date 11/24/2009

Applicant/Owner City of Morgan Hil Extension State CA Sampling Point SP4

Investigator(s) L. Lazarotti, K. Allan Section,Township,Range T9S, R3E

Landform (hillslope, terrace, etc.) drainage Local Relief (concave, convex, none) concave Slope(%) ____

Subregion(LRR) LRR C (Medit. CA) Lat: 37.10620 Long: 121.62295 Datum: ____

Soil Map Unit Name San Ysidro loam, 0 to 2 percent slopes NWI classification ____

Are climatic/hydrologic conditions on-site typical for this time of year? ☐ Yes ☒ No (If no, explain in remarks)

Are any of the following significantly disturbed? ☐ Vegetation ☐ Soil ☐ Hydrology Are "Normal Circumstances" present? ☒ Yes ☐ No

Are any of the following naturally problematic? ☐ Vegetation ☐ Soil ☐ Hydrology (If needed, explain any answers in remarks)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	☐ Yes ☒ No	**Is the Sampled Area within a Wetland?** ☐ **Yes** ☒ **No**
Hydric Soil Present?	☐ Yes ☒ No	
Wetland Hydrology Present?	☐ Yes ☒ No	

Remarks: Sample point is located within a drainage on south edge of an agricultural field. The un-maintained drainage was dominated by upland species and an ordinary high water mark was evident. Wetland vegetation, soils, and hydrology were not observed at the sample point; sp4 does not occur within a wetland.

VEGETATION (use scientific names)

TREE STRATUM Plot Size: ____	Absolute % cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Tree Stratum Total Cover:			

SAPLING/SHRUB STRATUM Plot Size: ____			
1.			
2.			
3.			
4.			
Sapling/Shrub Stratum Total Cover:			

HERB STRATUM Plot Size: ____			
1. *Brassica nigra*	25	Y	NL
2. *Epilobium ciliatum*	15	Y	FACW
3. *Chenopodia album*	10	N	FAC
4. *Vitis californica*	20	Y	NL
5.			
6.			
7.			
8.			
Herb Stratum Total Cover:	70		

WOODY VINE STRATUM Plot Size: ____			
1.			
2.			
Woody Vines Total Cover:			

% Bare ground in herb stratum 30 % cover of biotic crust ____

Dominance Test Worksheet

Number of Dominant Species that are OBL, FACW, or FAC?	1	(A)
Total number of dominant species across all strata?	3	(B)
% of dominant species that are OBL, FACW, or FAC?	33	(A/B)

Prevalence Index Worksheet

Total % cover of:			Multiply by:
OBL species		x1	
FACW species	15	x2	30
FAC species	10	x3	30
FACU species		x4	
UPL species	45	x5	225
Column Totals	85 (A)		285 (B)

Prevalence Index = B/A = 3

Hydrophytic Vegetation Indicators

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is </= 3.0[1]
- ☐ Morphological adaptations (provide supporting data in remarks)
- ☐ Problematic hydrophytic vegetation[1] (explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present ? ☐ Yes ☒ No

Remarks: Hydrophytic vegetation was not observed at the sample point. Wetland vegetation criteria not met.

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[1]	Texture	Remarks
0-12	10YR 3/4	100					clay loam	no redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)(LRR C)
- ☐ 1cm Muck (A9)(LRR D)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1cm Muck (A9) (LRR C)
- ☐ 2cm Muck (A10)(LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (explain in remarks)

[3]Indicators of hydric vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present ? ☐ Yes ☒ No

Remarks: No hydric soil indicators observed. Hydric soil criterion is not met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)(Nonriverine)
- ☐ Sediment Deposits (B2)(Nonriverine)
- ☐ Drift Deposits (B3)(Nonriverine)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in PLowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1)(Riverine)
- ☐ Sediment Deposits (B2)(Riverine)
- ☐ Drift Deposits (B3)(Riverine)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ Yes ☒ No Depth (inches): _____

Water table present? ☐ Yes ☒ No Depth (inches): _____

Saturation Present? (includes capillary fringe) ☐ Yes ☒ No Depth (inches): _____

Wetland Hydrology Present ? ☐ Yes ☒ No

Describe recorded data (stream guage, monitoring well, aerial photos, etc.) if available.

Remarks: No wetland hydrology indicators were observed at the sample point. Drainage ditch was dry at the time of the site visit. Wetland hydrology criteria not met.

Wetland Determination Data Form - Arid West Region

Project/Site Butterfield Boulevard City Morgan Hill County Santa Clara Sampling Date 11/24/2009

Applicant/Owner City of Morgan Hil Extension State CA Sampling Point SP5

Investigator(s) L. Lazarotti, K. Allan Section,Township,Range T9S, R3E

Landform (hillslope, terrace, etc.) plain Local Relief (concave, convex, none) none Slope(%) ____

Subregion(LRR) LRR C (Medit. CA) Lat: 37.10642 Long: 121.63663 Datum: ____

Soil Map Unit Name San Ysidro loam, 0 to 2 percent slopes NWI classification ____

Are climatic/hydrologic conditions on-site typical for this time of year? ☐ Yes ☒ No (If no, explain in remarks)

Are any of the following significantly disturbed? ☐ Vegetation ☐ Soil ☐ Hydrology Are "Normal Circumstances" present? ☒ Yes ☐ No

Are any of the following naturally problematic? ☐ Vegetation ☐ Soil ☐ Hydrology (If needed, explain any answers in remarks)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	☐ Yes ☒ No	**Is the Sampled Area within a Wetland?** ☐ **Yes** ☒ **No**
Hydric Soil Present?	☐ Yes ☒ No	
Wetland Hydrology Present?	☐ Yes ☒ No	

Remarks: Sample point occurs within a roadside ditch on the southern edge of Watsonville Road. Evidence of erosion is present. An ordinary high water mark was observed at the sample point. Hydrophytic, soil, and wetland hydrology were not met. Sample point does not occur within a wetland.

VEGETATION (use scientific names)

TREE STRATUM Plot Size: ____	Absolute % cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Tree Stratum Total Cover:			
SAPLING/SHRUB STRATUM Plot Size: ____			
1.			
2.			
3.			
4.			
Sapling/Shrub Stratum Total Cover:			
HERB STRATUM Plot Size: ____			
1. *Erodium cicutarium*	20	Y	NL
2. *Malva sp.*	25	Y	NL
3.			
4.			
5.			
6.			
7.			
8.			
Herb Stratum Total Cover:	45		
WOODY VINE STRATUM Plot Size: ____			
1.			
2.			
Woody Vines Total Cover:			

% Bare ground in herb stratum 55 % cover of biotic crust ____

Dominance Test Worksheet

Number of Dominant Species that are OBL, FACW, or FAC?	0	(A)
Total number of dominant species across all strata?	2	(B)
% of dominant species that are OBL, FACW, or FAC?	0	(A/B)

Prevalence Index Worksheet

Total % cover of:		Multiply by:	
OBL species		x1	
FACW species		x2	
FAC species		x3	
FACU species		x4	
UPL species	45	x5	225
Column Totals	45 (A)		225 (B)

Prevalence Index = B/A = 5

Hydrophytic Vegetation Indicators

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is </= 3.0[1]
- ☐ Morphological adaptations (provide supporting data in remarks)
- ☐ Problematic hydrophytic vegetation[1] (explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present ? ☐ Yes ☒ No

Remarks: Hydrophytic vegetation not observed at the sample point. Hydrophytic vegetation criteria not met.

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[1]	Texture	Remarks
0-12	10YR 3/4	100						no redox present

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)(LRR C)
- ☐ 1cm Muck (A9)(LRR D)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1cm Muck (A9) (LRR C)
- ☐ 2cm Muck (A10)(LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (explain in remarks)

[3]Indicators of hydric vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present ? ☐ Yes ☒ No

Remarks: Hydric soil indicators were not observed at the sample point. Hydric soil criteria not met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)(Nonriverine)
- ☐ Sediment Deposits (B2)(Nonriverine)
- ☐ Drift Deposits (B3)(Nonriverine)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in PLowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1)(Riverine)
- ☐ Sediment Deposits (B2)(Riverine)
- ☐ Drift Deposits (B3)(Riverine)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ Yes ☐ No Depth (inches): _____

Water table present? ☐ Yes ☐ No Depth (inches): _____

Saturation Present? (includes capillary fringe) ☐ Yes ☐ No Depth (inches): _____

Wetland Hydrology Present ? ☐ Yes ☒ No

Describe recorded data (stream guage, monitoring well, aerial photos, etc.) if available.

Remarks: The drainage ditch was dry at the time of the site visit. An ordinary high water mark was observed. Wetland hydrology was not observed at the sample point; wetland hydrology criteria not met.

Wetland Determination Data Form - Arid West Region

Project/Site Butterfield Boulevard City Morgan Hill County Santa Clara Sampling Date 11/24/2009

Applicant/Owner City of Morgan Hil Extension State CA Sampling Point SP6

Investigator(s) L. Lazarotti, K. Allan Section,Township,Range T9S, R3E

Landform (hillslope, terrace, etc.) plain Local Relief (concave, convex, none) none Slope(%) 0

Subregion(LRR) LRR C (Medit. CA) Lat: 37.11025 Long: 121.63122 Datum:

Soil Map Unit Name Arbuckle gravelly loam, 0 to 2 percent slopes NWI classification

Are climatic/hydrologic conditions on-site typical for this time of year? ☐ Yes ☒ No (If no, explain in remarks)

Are any of the following significantly disturbed? ☐ Vegetation ☐ Soil ☐ Hydrology Are "Normal Circumstances" present? ☒ Yes ☐ No

Are any of the following naturally problematic? ☐ Vegetation ☐ Soil ☐ Hydrology (If needed, explain any answers in remarks)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	☐ Yes ☒ No	**Is the Sampled Area within a Wetland?** ☐ **Yes** ☒ **No**
Hydric Soil Present?	☐ Yes ☒ No	
Wetland Hydrology Present?	☐ Yes ☒ No	

Remarks: The sample point occurred near the edge of a ruderal non-native field approximately 65 feet from railroad bed and track. Wetland vegetation, soils, and hydrology were not observed at the sample point. SP6 does not occur within a wetland.

VEGETATION (use scientific names)

TREE STRATUM Plot Size:	Absolute % cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Tree Stratum Total Cover:			
SAPLING/SHRUB STRATUM Plot Size:			
1.			
2.			
3.			
4.			
Sapling/Shrub Stratum Total Cover:			
HERB STRATUM Plot Size:			
1. *Brassica nigra*	35	Y	NL
2. *Lolium multiflorum*	50	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
Herb Stratum Total Cover:	85		
WOODY VINE STRATUM Plot Size:			
1.			
2.			
Woody Vines Total Cover:			

% Bare ground in herb stratum 15 % cover of biotic crust

Dominance Test Worksheet

Number of Dominant Species that are OBL, FACW, or FAC?	1	(A)
Total number of dominant species across all strata?	2	(B)
% of dominant species that are OBL, FACW, or FAC?	50	(A/B)

Prevalence Index Worksheet

Total % cover of:		Multiply by:	
OBL species		x1	
FACW species		x2	
FAC species	50	x3	150
FACU species		x4	
UPL species	35	x5	175
Column Totals	85 (A)		325 (B)

Prevalence Index = B/A = 3.8

Hydrophytic Vegetation Indicators

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is <= 3.0[1]
- ☐ Morphological adaptations (provide supporting data in remarks)
- ☐ Problematic hydrophytic vegetation[1] (explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present ? ☐ Yes ☒ No

Remarks: Only 50% of the dominant vegetation is hydrophytic. Wetland vegetation criterion not met.

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[1]	Texture	Remarks
0-8	10YR 3/3	100					gravelly loam	no redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)(LRR C)
- ☐ 1cm Muck (A9)(LRR D)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1cm Muck (A9) (LRR C)
- ☐ 2cm Muck (A10)(LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (explain in remarks)

[3]Indicators of hydric vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present ? ☐ Yes ☒ No

Remarks: Soil very rocky and soil refusal was met at 8 inches. No hydric soil indicators observed, hydic soil criterion not met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)(Nonriverine)
- ☐ Sediment Deposits (B2)(Nonriverine)
- ☐ Drift Deposits (B3)(Nonriverine)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in PLowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1)(Riverine)
- ☐ Sediment Deposits (B2)(Riverine)
- ☐ Drift Deposits (B3)(Riverine)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ Yes ☒ No Depth (inches): _____

Water table present? ☐ Yes ☒ No Depth (inches): _____

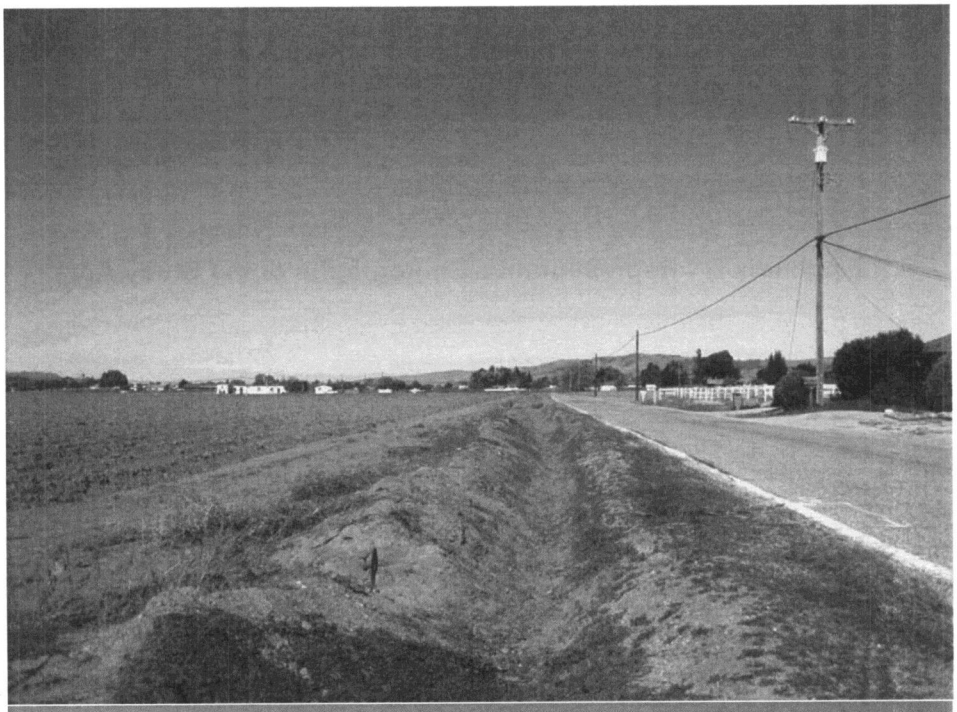
Saturation Present? (includes capillary fringe) ☐ Yes ☒ No Depth (inches): _____

Wetland Hydrology Present ? ☐ Yes ☒ No

Describe recorded data (stream guage, monitoring well, aerial photos, etc.) if available.

Remarks: No hydrology indicators observed. Hydrology criterion not met.

Appendix B - Representative Photographs of the Study Area

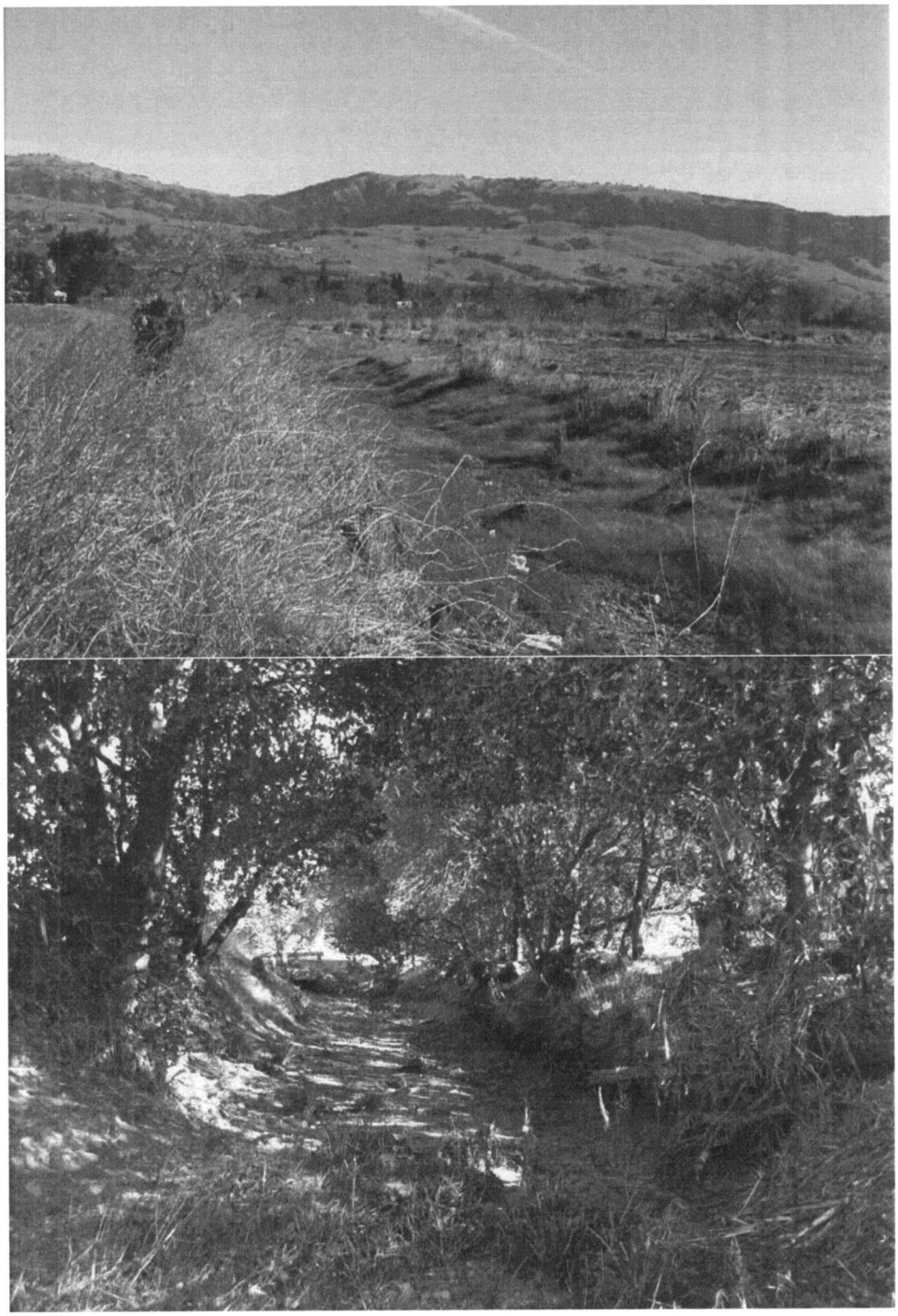


Top: Cultivated agricultural land (left) occurs throughout the Study Area; drainage ditches (center) border some of these fields.

Bottom: Ruderal herbaceous grassland habitat dominates the Study Area; mature walnut trees are scattered throughout.

wra

ENVIRONMENTAL CONSULTANTS

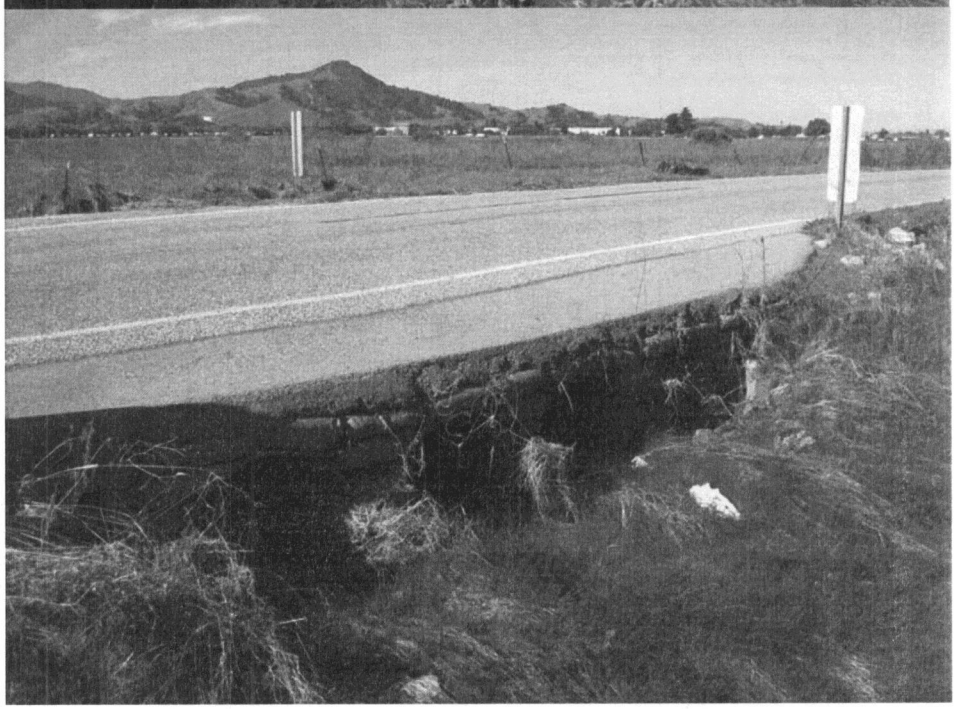


Top: West Little Llagas Creek flows seasonally through the southern portion of the Study Area.

Bottom: Coast live oak riparian habitat surrounding West Little Llagas Creek, with a woodrat nest on the right bank.

wra

ENVIRONMENTAL CONSULTANTS



Top: West Little Llagas Creek in the southwestern portion of the Project Area.

Bottom: West Little Llagas Creek passes through culverts under Seymour Ave. in the southeastern Study Area.

wra

ENVIRONMENTAL CONSULTANTS

Scientific name	Common name	Status/Origin
Erodium botrys	broad leaf filaree	non-native
Juglans hindsii	Northern California black walnut	native; rare
Lolium multiflorum	Italian ryegrass	non-native; invasive (moderate)
Malva nicaeensis	bull mallow	non-native
Olea europaea	olive	non-native; invasive (limited)
Opuntia ficus-indica	mission cactus	non-native
Phalaris aquatica	harding grass	non-native; invasive (moderate)
Phyla nodiflora	lippia	native
Pinus radiata	Monterey Pine	non-native (locally)
Plantago lanceolata	English plantain	non-native; invasive (limited)
Quercus agrifolia	coast live oak	native
Raphanus sativus	wild radish	non-native; invasive (limited)
Rumex crispus	curly dock	non-native; invasive (limited)
Senecio vulgaris	old man of Spring	non-native
Tropaeolum majus	nasturtium	non-native
Typha latifolia	tule	native
Vitis californica	California grape	native

Appendix C - Plant Species Observed in the Study Area

Appendix C

Cultural Resources Assessment

CULTURAL RESOURCES ASSESSMENT

BUTTERFIELD BOULEVARD EXTENSION PROJECT
MORGAN HILL, SANTA CLARA COUNTY, CALIFORNIA

FOR

DAVID J. POWERS AND ASSOCIATES
1885 The Alameda, Suite 204
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ATTN: Mr. Demetri Loukas

PREPARED BY

BASIN RESEARCH ASSOCIATES, INC.
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JUNE 2005

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ATTACHMENTS Attached

FIGURES

FIGURE 1	GENERAL PROJECT LOCATION
FIGURE 2	PROJECT LOCATION (USGS Morgan Hill, Calif. 1980; Mt. Sizer, Calif. 1978; Mt. Madonna, Calif. 1996; and Gilroy, Calif. 1993)
FIGURE 3	BUTTERFIELD AVENUE – PROPOSED ALIGNMENTS WITH PARCEL APNs
FIGURE 4	BUTTERFIELD AVENUE – BUILT ENVIRONMENT

ATTACHMENTS

FIGURES

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FIGURE 2	PROJECT LOCATION (USGS Morgan Hill, Calif. 1980; Mt. Sizer, Calif. 1978; Mt. Madonna, Calif. 1996; and Gilroy, Calif. 1993)
FIGURE 3	BUTTERFIELD AVENUE – PROPOSED ALIGNMENTS WITH PARCEL APNs
FIGURE 4	BUTTERFIELD AVENUE – BUILT ENVIRONMENT

1.0 INTRODUCTION

This *Cultural Resources Assessment Report* presents the archaeological identification and evaluation effort as well as a preliminary built environment review for the proposed Butterfield Boulevard Extension Project in Morgan Hill, Santa Clara County. This report seeks to fulfill the various mandates of the California Environmental Quality Act (CEQA) and other cultural resources and planning directives of the City of Morgan Hill and Santa Clara County. The report provides the results of an archival records search, a limited review of pertinent literature, the results of an archaeological field inventory of parcels available for inspection, a photographic review of the existing built environment by a qualified consulting architectural historian and management recommendations.

2.0 PROJECT LOCATION AND DESCRIPTION

The Butterfield Boulevard Extension Project consists of the construction of an extension of Butterfield Boulevard[1] and a related stormwater drainage system in a mostly agricultural area of the City of Morgan Hill and within the Morgan Hill Sphere of Influence (MHSI), Santa Clara County (USGS Mt. Madonna, Calif. 1996 and Gilroy, Calif. 1993, T 9S, R 3E, Unsectioned; topographic maps, 7.5' series) [Figs. 1-3].

The road alignment proceeds south of Tennant Avenue crossing and connecting with Fisher Avenue and then trending southwest crossing Railroad Avenue and the Union Pacific railroad tracks and continuing to its termination with the Watsonville Road at Monterey Road/Monterey Highway [see Fig. 3 with APNs].

The storm water drainage system includes a 55-foot wide channel and associated detention pond. The channel alignment proceeds along the east side of the extension of Butterfield Boulevard under the short connector to Fisher Avenue continuing south crossing under Maple Avenue and then a short distance south to its termination at a detention pond. The pond is within the area bounded by Maple Avenue on the north, the Union Pacific Railroad tracks on the west, Pollard Avenue on the south, and Seymour Avenue on the east [see Fig. 3 with APNs; David J. Powers 2005].

3.0 BACKGROUND OVERVIEW

3.1 ENVIRONMENTAL

The general study area is affiliated with the Santa Clara Valley with San Francisco Bay to the north, the Santa Cruz Mountains to the west, and the Diablo Range to the east. The southern end of the project is located just north of Little Llagas Creek. Little Llagas Creek, described as "a tiny ditch" ranging from about 18 inches to 6 feet deep, was excavated before the turn of the century to drain a swampy area along part of Llagas Avenue. It was later modified in the early 20th century. Reportedly, the creek/ditch was maintained by local landowners until ca. 1973 (King and Hickman 1973b:9/S-4286). The available USGS topographic map series for Morgan Hill indicates that this portion of the creek has retained the same configuration as shown on the earliest available USGS to date (e.g., USGS 1917, 1993, 1996; US War Department 1940

1. Butterfield Boulevard north of Tennant Avenue was constructed between December 1996 and January 1998.

[photography 1939]).

3.2 NATIVE AMERICAN

3.2A Prehistoric

The general project area is in a potentially sensitive archaeological area with Little Llagas Creek in the southwestern corner of the project and vicinity, Coyote Creek to the east, and the San Francisco Bay margin at some distance to the north. These watercourses were foci of prehistoric occupation in the Santa Clara Valley with Native American groups exploiting a variety of ecological niches on the alluvial plain, the foothills and bay margins.

Native American occupation and use of the general study area appears to extend over 5000-7000 years and maybe longer. Occupation sites appear to have been selected in the area for accessibility, protection from seasonal flooding, and the availability of resources. Archaeological information suggests an increase in the prehistoric population over time due to more efficient resource procurement, storage and increasing political complexity with an increasing focus on permanent settlements with large populations in later periods. This change from hunter-collectors to an increased sedentary lifestyle is due to more efficient resource procurement with a focus on staple food exploitation, the increased ability to store food at village locations, and the development of increasing complex social and political systems including long-distance trade networks. The information obtained from archaeological studies in the general area has played a key role in refining both the local and regional interpretations of Native American history for central California. Overviews and a perspective on regional prehistory are presented by Elsasser (1978, 1986) and Moratto (1984).

3.2B Ethnographic

The aboriginal inhabitants of the Santa Clara Valley belonged to a group known as the Costanoans (from Spanish *Costanos* or "coastal people") who occupied the central California coast as far east as the Diablo Range. The term Costanoan, as applied by anthropologists, does not imply the existence of a politically unified entity, but rather refers to different groups of people who shared similar cultural traits and belonged to the same linguistic family. An estimated 200+ persons of partial Costanoan descent currently reside in the greater San Francisco Bay Area; these individuals now generally prefer the term Ohlone to the anthropologists' Costanoan (See Galvan 1967/1968: 12; Levy 1978; A. Galvan, personal communication 1990).

Tribelet boundaries and village locations are inexact due to incomplete historic records, and they remain a subject of anthropological contention and debate. The proposed project appears to have been situated in the *Mutsun* tribelet/group territory of the Costanoan (Levy 1978:485, Fig. 1) or the *Matalan* of the Costanoan (C. King 1977; Milliken 1995:248, 229, Map 5). The *Matalan* appear to have held the Santa Valley corridor from the present town of Coyote south to Morgan Hill.

Based on Spanish Mission records and archaeological data, researchers have estimated a population of 1000 to 1200 individuals for this area in 1770. Within the subareas, a population was further subdivided into tribelets. These tribelets were politically autonomous groups containing some 50-500 individuals, with an average population of 200. The tribelet territories,

defined by physiographic features, usually had one or more permanent villages surrounded by a number of temporary camps. The camps were used to exploit seasonally available floral and faunal resources (Levy 1978:485, 487; C. King 1977:54).

No known village was located in the vicinity of the proposed alignment. The closest village, *Tomoi* or *San Carlos*, is located a considerable distance south and across Llagas Creek (after C. King 1978b:437-438). In fact, the *lamsin* (alternatively *Las Pulgas* or *Matalan*) of the *Tamyen* tribelet/group territory is located nearer to the north (after Kroeber 1925:465; C. King 1978b; Levy 1978:485). A major prehistoric/historic trail appears to have passed through the general project area (see Elsasser 1986:48, Table 4, #1; Figure 10).

In addition, historic accounts of the 1770s-1790s and archaeological data suggest that a number of tribelets may have had temporary camps within the vicinity of the study area throughout prehistoric period and into the Hispanic Period (Kroeber 1925:465; T. King 1973a; King and Hickman 1973).

Extensive ethnographic data for the San Francisco Bay Region are lacking, and the aboriginal lifeway apparently disappeared by approximately 1810 due to introduced diseases, a declining birthrate, the cataclysmic impact of the mission system and the later secularization[2] of the missions by the Mexican government. The Costanoan were transformed from hunters and gatherers into agricultural laborers [and in some cases, craft artisans] who lived at the missions and worked with former neighboring groups such as the Esselen, Yokuts, and Miwok (Levy 1978:486). Later, because of the secularization of the missions by Mexico in 1834, the majority of the aboriginal population gradually moved to ranchos to work as manual laborers (Levy 1978:486). Thus, multi-ethnic Indian communities grew up in and around Costanoan territory and it was these people who provided ethnological data in the period from 1878 to 1933.

For a more extensive review of the Costanoan see Kroeber (1925:462-473), Harrington (1942), Galvan (1967/1968), C. King (1974, 1977, 1978a-b), Levy (1978), T. King (1973), Bean (1994), and Milliken (1995).

3.3 HISTORIC ERA

3.3A Spanish and Mexican Period

The period of initial historic exploration of the Santa Clara Valley lasted from 1769 to 1776. Spanish explorers in the late 1760s and 1770s were the first Europeans to traverse the Santa Clara Valley and likely followed aboriginal trails.

The first party, consisting of Gaspar de Portola and Father Juan Crespi, traveled west of the project (west of the Santa Cruz Mountains) and arrived in the Alviso-San Jose area in the fall of 1769. The following year, Pedro Fages led another party and was the first European to enter the Santa Clara Valley. In 1772, Fages returned to the same vicinity with Crespi. They were

2. A program which replaced Franciscan clergy with "secular" (parish) clergy, released Native American neophytes from mission jurisdiction, and converted mission property into pueblos (towns). Decrees were issued in Spain in 1813 and 1920 and in California in 1826 and 1834 - ten missions were secularized in 1834, six in 1835, and five in 1836 (Hart 1987:464).

followed by Fernando Javier y Moncada Rivera and Father Francisco Palou in 1774, Bruno de Hezeta-Palou in 1775, and Juan Bautista de Anza and Father Pedro Font in 1776. Alferez Gabriel Moraga in 1806, and Jose Viader accompanied by Gabriel Moraga in 1810, and Jose Dolores Pico in 1815. Even though the routes of the early explorers cannot be determined with total accuracy, a number appear to have passed through the general vicinity of the project area (James and McMurry 1933:8; King and Hickman 1973a:25, Map 5; Beck and Haase 1974:#16-17; Levy 1978:486).

The Fages 1772 expedition route as mapped by Brown (1994:2, Fig. 1.1) was along the east side of the valley[3] while the USNPS, maps the Juan Bautista de Anza National Historic Trail [1776]" (USNPS 1995)[4] as west of the project. The latter camped on the east side of Santa Teresa Boulevard south of Watsonville Road alongside *Arroyo de las Llagas* on March 24, 1776 at about present day San Martin[5] (SClCoHH 1979:62, #19; CAL/OHP 1992a:66, #SCL-040; Arbuckle and Rambo 1968:30-31). The favorable reports of Anza and Font led to the establishment of both Mission Santa Clara and the Pueblo San Jose de Guadalupe in 1777 (Beck and Haase 1974:#17).

The Spanish philosophy of government in northwestern New Spain was directed at the founding of presidios, missions, and secular towns (pueblo) with the land held by the Crown (1769-1821), while the later Mexican policy stressed individual ownership of the land. After the secularization of the missions by Mexico in 1833, vast tracts of the mission lands were granted to individual citizens. Between 1769-1823, 21 missions were established by the Franciscan priests along the California coast between San Diego and Sonoma. Mission Santa Clara, the 8th of the 21 missions founded in California, was established on January 12, 1777, about 10 months before the founding of the Pueblo of San Jose. The *Pueblo San Jose de Guadalupe* was one of the three towns founded to administer and coordinate the missions and presidios of the province of Alta California. Until 1851, Mission Santa Clara provided for all the religious needs of the Pueblo San Jose de Guadalupe. Mission San Juan Bautista the 15th of 21 missions was founded in 1797. Either of these two of the seven missions located within Costanoan territory, may have had a major impact on the aboriginal population living in the vicinity of the project area (Hall 1871:84; Hendry and Bowman 1940:750, 918; Hart 1987:112-113, 324, 454).

---

3. The Captain Pedro Fages Trail 1772 is listed under the theme of exploration and settlement in *The California History Plan* and *California Inventory of Historic Resources* and is State of California Landmark #853 within Contra Costa County and #858 in San Diego County (CAL/OHP 1973, 1976, 1990).

4. The National Trails System Act (P.L. 90-543 (16 U.S.C. 1241 et. seq) as amended through P.L. 102-461, October 23, 1992 defines three types of national trails: National scenic trails, National recreation trails, and National historic trails. National historic trails are *extended trails which follow as closely as possible and practicable the original trails or routes of travel of national historical significance.* They are established to identify and protect a historic route, plus its historic remnants and artifacts, for public use and enjoyment. National scenic and historic trails can only be authorized by Congress, through amendment of the National Trails System Act. Non-federally owned trail sites, segments, and interpretation facilities are added to the national historic trail thorough certification agreements between the owner or managers and the National Park Service (US/NPS 1996:Appendix A).

5. Fages was the first at this "stopping place " and was responsible for the naming "*Las Llagas de Nuestro Padre San Francisco*" or Llagas Creek on March 22, 1772 (Hoover et al. 1966:442).

During the Mexican Period (1821 to 1846) and into the American Period, the project was within two ranchos, *Ojo de Agua de la Coche*, and *Rancho San Francisco de las Llagas*.[6] The far northern part of the project was within *Ojo de Agua de la Coche*, ("Pig Spring" or "Sow Spring"), a rancho granted by Governor Figueroa to Juan Maria Hernandez in 1835 (Arbuckle and Rambo 1968:24). Hernandez sold the *Ojo de Agua de la Coche* in 1845 to Charles M. Weber of San Jose, later of Stockton, who sold it in 1846 to Bernard Murphy. Martin J.C. Murphy, a grandson of pioneer Martin Murphy, Sr., received the patent to the *Ojo de Agua de la Coche* in 1860. At the time, most of the ranch was already in the possession of Daniel Murphy (Thompson 1857; USSG 1863; Thompson and West 1876:56; Hendry and Bowman 1940:958-959; Wyman 1982:18-28; Hoover et al. 1966:442, 448-449; Arbuckle and Rambo 1968:24; USGS 1980:Mt. Madonna, Calif).

Most of the project was within the boundaries of *Rancho San Francisco de las Llagas* ("St. Francis of the Wounds" or Sores, Ulcers, Stigmatas, etc) (United States Surveyor General 1863; Thompson and West 1876:56). This rancho of ca. 26,632 acres was granted by Governor Figueroa to Carlos Castro on February 3, 1834 and sold to Daniel and James Murphy on August 16, 1848, who sold it in 1851 to Martin and James Murphy. The latter two patented it on March 19, 1868. Carlos Antonio Castro was born ca. 1774 in Fuerte Sonora and came with his parents, Joaquin Isidro Castro and Maria Martina Botiller (Botillier), with the 1776 Anza expedition (Hendry and Bowman 1940:960-963; Arbuckle and Rambo 1968:30-31).

With the exception of the former *El Camino Real*/Monterey Road/US Route 101, no Hispanic Period roads, dwellings or other structures, features etc., have been reported in or adjacent to the proposed project. The southern end of the extension of Butterfield Boulevard terminates at the Monterey Road/US Route 101, formerly the "Old National Mexican Road from San Francisco to Monterey" (also known as *El Camino Real*). *El Camino Real* ran from Mission San Diego de Alcala in San Diego to Mission San Francisco de Asis (Mission Dolores) in San Francisco. *El Camino Real* is listed in *The California History Plan* (CAL/OHP 1973:150) and *California Inventory of Historic Resources* (CAL/OHP 1976:133) and is also a State of California landmark. As a landmark designated after #770, it is automatically on the California Register of Historical Resources (CRHR; CAL/OHP 1990:204-205, Landmark #784, ca. 1999).

3.3B American Period

The Early American Period in the Santa Clara Valley is characterized by an influx of Euro-Americans and rapid growth which overwhelmed the Hispanic residents and their economic/cultural traditions which centered on missions, presidios, and ranchos. In the mid-19th century, most of the rancho and pueblo lands in California were subdivided as the result of population growth, the American takeover, and the confirmation of property titles throughout the state. The initial explosion in population was associated with the Gold Rush (1848), followed later by the construction of the transcontinental railroad (1869). Still later, the development of the refrigerator railroad car (ca. 1880s), used for the transport of agricultural produce to distant markets, had a major impact on population growth (Broek 1932; Hart 1987).

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6. The boundary between ranchos is situated just south and parallel to Tennant Avenue.

Morgan Hill and Vicinity

During the 19th century, Morgan Hill was located about 20 miles south of the City of San Jose. During the late American Period, the project was located within a predominantly agricultural area with *El Camino Real*/Monterey Road to the west. As noted above, Martin J.C. Murphy, a grandson of pioneer Martin Murphy, Sr., received the patent to the *Ojo de Agua de la Coche* in 1860. Hiram Morgan Hill married Martin Murphy's granddaughter Diana. Their ranch was subdivided in 1892 and by 1896 this area around Burnett Station was known as the town of Morgan Hill. The town functioned as a small rural settlement providing goods and services for the surrounding farms/ranches. By 1893, Morgan Hill had a post office and by 1896 it had an extensive list of civic amenities and businesses including a church, two hotels, an express office and a passenger and freight depot, a telephone station, a restaurant, three livery stables, a lumberyard, several small shops, and a number of "very comfortable residences." The town incorporated in 1906 (Thompson 1857; *San Jose Mercury* 1896; USGS 1917; Sawyer 1922; Hoover et al. 1966; Arbuckle and Rambo 1968; Butler 1991; Patera 1991).

Transportation

The southern end of the project terminates at *El Camino Real*/Monterey Road and crosses the Union Pacific Railroad Company (the former Southern Pacific) railroad tracks. The corridor remained important throughout the American Period as the main stagecoach road from San Francisco to Los Angeles (Beck and Haase 1974:#51-53). The section between San Jose and Gilroy/Watsonville was originally a toll road and was declared a public highway in 1874 (Sawyer 1922:149).

In general, the corridor also became the alignment for the railroads. The Santa Clara and Pajaro Valley Railroad (SC&PV RR) officially commenced service from San Jose and reached Fifteen Mile House-Perry Station in Coyote Valley north of the project on January 11, 1869 and Gilroy, south of the project, about February 6, 1869. The SC&PV RR was consolidated into the original Southern Pacific Railroad Company (SPRR Co) October 12, 1870 (Fickewirth 1992:136; Robertson 1998:228). As a result of the arrival of the railroad, a "Tennant Station" was established south of Watsonville Road [the project], north of the *Arroyo de las Llagas*, and the near convergence of the tracks with *El Camino Real*/Monterey Road (e.g., Thompson and West 1876:56).

Project Specific Historic Map Review

The earliest available map of the general study area, Goddard's 1857 *Map of the State of California*, shows no roads other than the *El Camino Real* (not labeled) and Llagas in the study area.

Thompson's 1857 Map of the Survey of the *Rancho "Ojo de Agua de la Coche"* shows "Tennant's 21 Mile House" on the west side of the "San Jose Road" near the southern boundary of the rancho with a "Barn" on the east side of the road in the *Rancho San Francisco de las Llagas*. No other features are shown in the study area.

The United States Surveyor General's Office (USSG) 1863 *Plat of the Rancho San Francisco de las Llagas* shows only "Tennent's 21 Mile house" [*sic*] and a short segment of a "Stage Road"

crossing the rancho boundary.

Healey's 1866 *Official Map of the County of Santa Clara* illustrates Wm Tennent 21 Mile House[7] on the west side El Camino Real/Monterey Road of just north of the northern boundary of *Rancho San Francisco de las Llagas*. As shown on the Plat of the *Pueblo Lands of San Jose* by G. H. Thompson and A.T. Herrmann (1866/1879) the road splits into - the westernmost to the "Road from San Jose to Watsonville" and "Old National Mexican Road from San Francisco to Monterey" which conforms to the present-day Monterey Road in the project area. These two maps do not conform, possibly due to the difference in dates - the 1866/1879 map which labels the roads shows the third road to the east labeled "Stage from San Jose to San Juan [Bautista]" just north of the two shown on Healey's 1866 map. Present-day Monterey Road conforms to the alignment of the latter road in the study area, just west of the project terminus.[8]

By 1876, as shown in the *Historical Atlas of Santa Clara County, California*, the project area passed through parcels owned by Mrs. J. Dunne.[9] At the time only Monterey Road and the railroad tracks passed through the project area and no structures or features other than "21 Mile House", "Watsonville Road," and the Southern Pacific Railroad tracks were located in the area (Thompson and West 1876:56).

An Anonymous 1901/1907 *Street and Residence Map of Morgan Hill* Area shows Tennant, Fisher, Maple, and Seymour avenues. At this time, Railroad Avenue terminated at Tennant Avenue. The "Wheeler Nursery" was located along the south side of Tennant Avenue, west of the project while the residence/farmstead of "Brussard" was located north of Maple Avenue and west of the S.P. railroad tracks to the east of the project.

The 1917 USGS topographic map, surveyed in 1915, shows "Tennant" station (between Morgan Hill and San Martin stations) just south of Tennant Avenue[10] along the railroad tracks west of the project. Railroad Avenue appears to have been extended to Maple Avenue in order to provide southern access road to the station. At this time, no structures were located in the project area; one structure was located in the vicinity of Maple and Seymour avenues to the northeast of the proposed detention pond.

The 1940 USGS topographic map shows a region covered in orchards and no structures in or adjacent [near] to the project. Both "Tennant" and the single structure northeast of the detention

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7. Vasquez Tree/21-Mile House [Tennent's or Tennant's Station] (CA-SCl-468H) is listed in *The California History Plan* [tree site only] and the *California Inventory of Historic Resources* under the theme of economic and industrial. It is California State Landmark #259 (CAL/OHP 1973:178; CAL/OHP 1976:267; CAL/OHP 1990:231).

8. Point of reference - the northern border of the *Rancho San Francisco de las Llagas*. See also Hoover et al. (1966:431) for additional information including observations of the William Henry Brewer (1860-1864 Geological Survey of California) whose party camped at or near the tree (Hart 1987:59-60).

9. The available *MetroScan* sheets note four parcels within the former Catherine Dunne Ranch No. 7 and one parcel in Catherine Dunne Ranch No. 7 Parcel 2.

10. As compared to the 1876 location south of Watsonville Road (e.g., Thompson and West 1876:56).

pond shown on earlier maps were still present. In addition, a structure had been built since 1915 near the railroad tracks north of unpaved Fisher Avenue. At the time, an orchard covered the project between Tennant and Fisher and south of Maple Avenue and most of the area between the tracks and Monterey Road. Presumably the project area between Fisher and Maple avenues was used for row crops (USGS 1917; US War Dept 1940 [photography 1939]).

By 1980, a number of structures in/adjacent to the project had been built and are shown on the USGS topographic map(s). These structures are reviewed from north to south (USGS/US War Dept. v.d. with DJP 2005 [aerial with Metroscans]).

A cluster of three buildings/structures is mapped between Tennant and Fisher Avenues and corresponds to 515 Fisher Avenue (APN 817-08-009). Two of the buildings appear to have been constructed between 1955-1980 while the third, located within the proposed drainage channel, was constructed prior to 1955 (but after 1939). These buildings are identified by Banet (1991:List 1/S-13455; include *#14 trailer, #15 residence, #16 shed, and #17 work shed).*[11]

One building/structure is present just to the north of Fisher Avenue at 15750 Railroad Avenue (APN 817-08-017). This represents the easternmost of a series of elongated structures (probably light industrial or agricultural) built between 1955-1980. It will be impacted by the project road.

Two buildings/structures are visible between Fisher and Maple avenues and third may also be present within the drainage channel alignment at 15490 Railroad Avenue (APN 817-07-006). The third building appears to have been built between 1955-1980. Banet (1991:List 1) notes the presence of a trailer (#12) and a residence (#13) at this location.

The last cluster of building/structures is located at the southern end of the project at 15540 Monterey Road (APN 817-06-004). One building/structure in or in the vicinity was built between 1955-1980 and another to north was erected prior to 1955. The available aerial photograph shows larger, possibly residential, structure and a smaller building (USGS 1917, 1980, 1996; US War Dept 1940 [photography 1939]; DJP 2005 [aerial with Metroscans]). This cluster will be impacted by the road alignment.

The historic map review suggest that the built environment present within the road and channel alignments that may be impacted by the proposed project date to between 1939 and later.

4.0 RESEARCH/INVENTORY METHODOLOGY

The intent of the research and field studies were to identify cultural properties including prehistoric and historic archaeological sites, historic features and standing buildings/structures which may be potentially eligible for inclusion on the California Register of Historical Resources (CRHR).[12]

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11. S-# assigned by the CHRIS/NWIC.

12. A historical resource may be listed in the CRHR if it meets one or more of the following criteria: "(1) it is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States; (2) it is associated with the lives of persons important to local, California or national history; (3) it embodies the distinctive characteristics of a type,

4.1 RESEARCH SOURCES

A prehistoric and historic sites records search was completed by the California Historical Resources Information System, Northwest Information Center, CSU Sonoma, Rohnert Park (CHRIS/NWIC; File No. 04-906). In addition, a review of pertinent literature and archival records on file at Basin Research Associates and at other repositories including the Bancroft Library, University of California at Berkeley, were consulted.[13]

4.2 AGENCIES AND INDIVIDUALS CONSULTED

The Native American Heritage Commission (NAHC) was contacted in regard to resources listed on the NAHC *Sacred Lands Inventory* (Busby 2005). The review was negative (Pilas-Treadway 2005).

No groups (e.g., historical societies) or individuals were consulted in regard to the project.

4.3 FIELD INVENTORY

An archaeological field inventory was conducted by Mr. Christopher Canzonieri (M.A.) on May 24, 2005 of all parcels with rights-of-entry. Field photographs of all buildings and structures with the proposed road and drainage channel alignment were reviewed by Mr. Ward Hill, consulting architectural historian, to determine the need for further research and evaluation.

5.0 RESULTS

5.1 RECORDS SEARCH RESULTS (CHRIS/NWIC File No. 04-906)[14]

The majority of the archaeological data available for sites in the project area have been compiled as a result of cultural resource compliance programs undertaken for both public agencies and private entities.

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period, region, or method of construction, or represents the work of a master or possesses high artistic values; or (4) it has yielded or has the potential to yield information important in the prehistory or history of the local area, California or the nation." Automatic listings include properties listed in the National Register, determined eligible for the National Register either by the Keeper of the National Register or through a consensus determination on a project review, or State Historical Landmarks from number 770 onward. In addition Points of Interest nominated from January 1998 onward will be jointly listed as Points and in the California Register. Landmarks prior to 770 and Points of Historical Interest may be listed through an action of the State Historical Resources Commission (CAL/OHP ca. 1999, 2001a-b).

13. Specialized listings consulted include the *Historic Properties Directory* for Santa Clara County (CAL/OHP 2005a) with the most recent updates of the National Register of Historic Places, California Historical Landmarks, and California Points of Historical Interest as well as other evaluations of properties reviewed by the State of California Office of Historic Preservation. Other sources consulted *California Inventory of Historic Resources* (CAL/OHP 1976); *California Historical Landmarks* (CAL/OHP 1990); *California Points of Historical Interest* (CAL/OHP 1992); *Five Views: An Ethnic Sites Survey for California* (CAL/OHP 1988); and, *Historic Civil Engineering Landmarks of San Francisco and Northern California* (American Society of Civil Engineers 1977) and local lists.

14. Dated April 21, 2005.

No prehistoric or historic era archaeological sites have been recorded in or adjacent or within 0.25 miles of the proposed project.

Six archaeological compliance reports include or cross the proposed project alignments. Two are project related reports from earlier phases and include: *Preliminary Literature Review for Cultural Resources: Morgan Hill/South County Expressway EIR Project* (Garaventa 1988/S-10248 [Alignment B]) and *Cultural Resources Assessment, Sutter Boulevard Extension Project* (Banet with Rossa 1991/S-13455). The former project alignment crosses the current alignment while the latter is crossed by and connects to the current alignment.[15]

In addition, four compliance reports on file at the CHRIS/NWIC include or cross the project.[16]

- *Archaeological Impact Evaluation: San Felipe Division, Central Valley Project. Part I The Southern Santa Clara Valley, California: A General Plan for Archaeology* (King and Hickman 1973a/S-5222);
- *Cultural Resources Supplement Archaeological Resources [City of] Morgan Hill General Plan* (Basin Research Associates 2000/S-27985);
- *Phase 1 Archaeological Survey along Onshore Portions of the Global West Fiber Optic Cable Project* (Science Applications International Corporation (SAIC) 2000/S-22657) [along Monterey Road]; and,
- *Cultural Resources Survey for the Level (3) Communications Long Haul Fiber Optics Project. Segment WS05: San Jose to San Luis Obispo* (Nelson and Carpenter 2000/S-22819) [along the railroad tracks].

None of these reports identified any cultural resources in or adjacent to the proposed project.

5.2 CULTURAL RESOURCES REVIEW AND EVALUATION

5.2A Archaeological Sensitivity

King and Hickman (1973a:Map 15) place the project area along *El Camino Real*/Monterey Road within a zone of "low" archaeological sensitivity and the remainder within a zone of "moderate" archaeological sensitivity.

The *Archaeological Sensitivity Map* completed for the City of Morgan Hill places Little Llagas Creek and vicinity in an area of Archaeological "Sensitivity." This "Sensitivity" includes the southern part of the Butterfield Boulevard Extension near Watsonville Road and the southern portion of the proposed detention pond (Basin Research Associates 2000:Fig. 3).

15. 1988 Alignment B appears to have been the similar to the proposed 1991 Sutter [sic] Boulevard Extension project, but differs from the current 2005 Butterfield Boulevard Extension project alignment.

16. Note the Llagas Creek watershed reports by Cartier et. al. (1981) and Cartier and Detlefs (1981) do not include the project or area adjacent.

5.2B Archaeological Field Inventory

An archaeological field inventory was conducted by Mr. Christopher Canzonieri (M.A.) on May 24, 2005. Mr. Canzonieri was accompanied by Mr. Demetri Loukas., Project Manager (David J. Powers & Associates). All subsurface soil exposures (e.g., gopher burrows, soil cuts, creek bank etc.) were checked for indicators of archaeological deposits. The survey generally used transect intervals not exceeding 30 meters. Overall surface visibility varied from less than 5 percent to 75-95 percent. The various individual parcels surveyed are reviewed below.

APN 871-006-004 - Mr. William Aviles was present during the survey of his parcel located at the southern end of the proposed road (Watsonville Road and Monterey Road). This parcel at 15520 and 15540 Monterey Road is occupied by three residences: a converted fruit stand and two stucco style ranch houses and a barn, corral and sheds. Mr. Aviles noted that he had constructed the barn, corral and sheds within the last 20 years. Surface visibility was approximately 75 percent due to landscaping and paving.

APN 817-006-002 and -003 - the survey continued east into the adjacent and nearby parcels owned by James P. Sergi. Estimated surface visibility was approximately 75 percent due to recent agricultural activities.

APN 817-006-005 - the Marian S. Kirby property at 15570 Monterey Road is adjacent to the Sergi and Aviles property. It had a surface visibility of approximately 75 percent. This parcel includes a residence and lean-to sheds which are outside of the project road alignment.

APN 817-006-016 - the survey continued northeast across the Union Pacific railroad tracks and passed through **APN 817-007-007** - the Will Ray Property on the corner of Railroad and Fisher Avenues. Visibility within the Ray parcel was extremely poor, less than 5 percent.

APN 817-008-017 - after crossing Fisher Avenue, the survey continued north through the eastern edge of the Gallo Ventures Inc. parcel at 15750 Railroad Avenue. A large corrugated shed is present within the road alignment. The buildings/structures and grasses on this parcel limited surface visibility to approximately 10 percent.

APN 817-008-009 - both the road alignment and the 55-foot wide drainage canal follow a dirt road through the Dan Jan & Mei Kiu Ling parcel at 515 Fisher Avenue. Buildings and structures on the parcel which may be within the alignment include a residence, Quonset hut, and a corrugated metal shed. The buildings/structures, debris (cars, pipes, trash, wood, etc.) and raspberry plants along the east side of the alignment limited surface visibility to approximately 10-75 percent.

APN 817-008-020 - the proposed road alignment is present along the eastern edge of the U Save Rockery Inc at 15770 Railroad Avenue on the block between Fisher Avenue and Tenant Avenue. Surface visibility within this parcel was approximately 50 percent. This parcel includes buildings/structures that are outside of the project alignment.

APN 817-008-027 – Lumber Co. on Railroad Avenue. This parcel was not surveyed. It includes buildings and structure that are outside of the project alignment.

APN 817-008-031 - the City of Morgan Hill owns the northernmost project parcel adjacent to Tennant Avenue, north of the Jan & Ling parcel. Both the road and drainage canal are within the parcel. Surface visibility was limited to 10-20 percent due to dense vegetation.

South of Fisher Avenue surface visibility was 75-95 percent. This portion of the project includes a small portion of the proposed Butterfield Boulevard as well as the proposed drainage canal and storm water detention basin.

APN 817-007-021 at 610 Fisher Avenue adjacent to the south side of Fisher Avenue could not be surveyed (no entry permit). This parcel includes buildings/structures that are outside of the project alignment.

APN 817-007-006 - 15490A Railroad Avenue, located on the north side of Maple Avenue and owned by Abolghassem Khamneipur, includes a house and trailers.

APN 825-006-002, -003, -029, and 030 - these four parcels just south of Maple Avenue between Railroad and Seymour avenues to be impacted by the proposed retention pond are agricultural fields owned by the Costa Family Partners.

5.2C Built Environment Review

Mr. Ward Hill (M.A.), consulting architectural historian, completed a review of the built environment using photographs compiled during the archaeological field inventory of the proposed alignments.

6.0 FINDINGS

6.1 ARCHAEOLOGICAL

The research completed for the project suggests a low to moderate potential for the presence of intact subsurface prehistoric or historic era archaeological deposits within the project boundaries. No prehistoric or historic era archaeological sites have been recorded in or adjacent or within 0.25 miles of the proposed project.

No Native American villages, traditional use areas or contemporary use areas or other features of significance have been identified in or adjacent to the proposed project with the exception of a probable Native American trail passing through the general area

No Hispanic era features have been identified in or adjacent to the project with the exception of *El Camino Real*/Monterey Road, El *Camino Real* is listed in *The California History Plan* and *California Inventory of Historic Resources* and is also a State of California landmark. As a landmark designated after #770, it is automatically on the California Register of Historical Resources. The proposed project will have no impact on value for which the resource is recognized.

There are there are no listed, determined or pending California Register of Historical Resources located in or adjacent to the project area. No other significant local, state or federal cultural resources/historic properties, landmarks, points of interest, etc. have been identified in or adjacent to the project (CHRIS/NWIC File No. 04-906 with other sources).

No prehistoric or historic archaeological resources were observed within the proposed project area during the archaeological field inventory conducted for the project. No data are available for APNs 817-008-027 and 817-007-021. APN 817-008-027 is adjacent to the project alignment. A small portion of APN 817-007-021 may be impacted by the future road alignment. Previous surface impacts observed consist of paved and unpaved roads, residences and outbuildings, imported fill, and agricultural practices.

6.2 BUILT ENVIRONMENT [see Fig. 4]

Mr. Ward Hill (M.A.), consulting architectural historian, completed a review of the built environment using both photographs compiled during the archaeological field inventory of the built environment and Metroscan data provided by David J. Powers & Associates. The following are his comments.

California Register of Historical Resources Evaluation Required – Pre-1955

APN 817-006-004 - 15540 Monterey Road

The small house according to MetroScan data dates from 1947. The property includes various sheds and outbuildings contemporary to the house and a later larger house dating from c. 1960. The property owner indicates that the barn, corral and sheds were constructed within the last 20 years.

APN 817-007-006 - 15490A Railroad Avenue

This property includes a modest single-story house that appears to date from the 1940s.

APN 817-008-009 - 515 Fisher Avenue

The three buildings on this property include a single-story, single-family house, a metal storage building and a corrugated metal Quonset hut. The house and related buildings appear to date from the late 1940s or early 1950s.

No California Register of Historical Resources Evaluation Required - Post-1955

APN 817-008-017 - 15750 Railroad Avenue

This corrugated metal storage or agricultural building appears to date from the 1960s or 1970s.

Not Reviewed – Outside of Proposed Alignment, No Evaluation Required

APN 817-006-005 - 15570 Monterey Road

This property includes only a corrugated metal barn or storage building. The building is not within the proposed alignment.

APN 817-007-021 - 610 Fisher Avenue

This property includes two metal clad buildings. One building appears to be a modern storage or office building; assessor records indicate a date of 1984 for one building. The older building

clad in corrugated metal has a roof with a series of adjacent gables. This building appears to date from the late 1940s or early 1950s. The buildings are not within the proposed alignment.

APN 817-008-020 – 15770 Railroad Avenue

This property had no right-of-entry permit and was not reviewed. It includes buildings/structures that are not within the proposed alignments.

APN 817-008-027

This property had no right-of-entry permit and was not reviewed. It includes buildings/structures that are not within the proposed alignments.

Vacant Parcels

These nine parcels include fields under cultivation, a railroad right-of-way, and a road right-of-way.

817-006-002, -003, -016
817-007-007;
817-008-031
825-006-002, -003, -029, -030

7.0 MANAGEMENT RECOMMENDATIONS

7.1 ARCHAEOLOGY

The archaeological research and field inventory indicates that there appear to be no archaeological resources on or adjacent to the project alignments although the general area has a "low" to "moderate" potential for buried prehistoric and/or historic era archaeological resources.

It is recommended, based on the review of pertinent records, maps and other documents, and a field inventory that the proposed project can proceed as planned in regard to prehistoric and historic archaeological resources for the parcels that could be reviewed for archaeological resources. The one parcel that could not be inspected (APN 817-007-021 at 610 Fisher Avenue) and may be subject to ground disturbing construction should be field reviewed for archaeological resources prior to construction.

No subsurface testing for buried archaeological resources appears warranted. If any significant cultural materials[17] are exposed or discovered during either site preparation or subsurface

17. Prehistoric materials may include:

a. Human bone - either isolated or intact burials.
b. Habitation (occupation or ceremonial structures as interpreted from rock rings/features, distinct ground depressions, differences in compaction (e.g., house floors).
c. Artifacts including chipped stone objects such as projectile points and bifaces; groundstone artifacts such as manos, metates, mortars, pestles, grinding stones, pitted hammerstones; and, shell and bone artifacts including ornaments and beads.
d. Various features and samples including hearths (fire-cracked rock; baked and vitrified clay),

construction activities within the project area, operations should stop within 100 feet of the find and a qualified professional archaeologist contacted for further review, evaluation and recommendations consistent with the California Environmental Quality Act. Potential recommendations for treatment could include collection, recordation, and analysis of any significant cultural materials followed by a professional report and curation of materials with a responsible facility. State law shall be followed in the event of the exposure of Native American skeletal remains.

7.2 BUILT ENVIRONMENT

Five buildings over 50 years of age are present within the proposed alignments on three properties based on a review of the photographs of the built environment within the proposed alignments. These include:

15540 Monterey Road (APN 817-006-004)
15490A Rail Avenue (APN 817-007-006)
515 Fisher Avenue (APN 817-008-009)

Four parcels were not reviewed. The buildings/structures are outside of the project alignment and will not be impacted. These include:

15570 Monterey Road (APN 817-006-005)
610 Fisher Avenue (APN 817-007-021)
15770 Railroad Avenue (APN 817-008-020)
APN 817-008-027

The California Environmental Quality Act mandates that the criteria for inclusion on the California Register of Historical Resources be used to evaluate potential historic resources that are over 50 years in age. Additional research is recommended for the properties that appear to over 50 years old in order to evaluate them under the California Register criteria regarding associations with persons, events or cultural patterns of historic significance (Criteria 1 and 2)

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artifact caches, faunal and shellfish remains (which permit dietary reconstruction), distinctive changes in soil stratigraphy indicative of prehistoric activities.

e. Isolated artifacts

Historic cultural materials may include finds from the late 19th through early 20th centuries. Objects and features associated with the Historic Period can include.

a. Structural remains or portions of foundations (bricks, cobbles/boulders, stacked field stone, postholes, etc.).
b. Trash pits, privies, wells and associated artifacts.
c. Isolated artifacts or isolated clusters of manufactured artifacts (e.g., glass bottles, metal cans, manufactured wood items, etc.).
d. Historic human remains.

In addition, cultural materials including both artifacts and structures that can be attributed to Hispanic, Asian and other ethnic or racial groups are potentially significant. Such features or clusters of artifacts and samples include remains of structures, trash pits, and privies.

and architectural interest (Criterion 3). This would include recordation on State of California DPR 523 forms and formal evaluation once research has established their age. [18]

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Abbreviations

n.d. no date
v.d. various dates
N.P. no publisher noted
n.p. no place of publisher noted

The abbreviated phrase "CHRIS/NWIC, CSU Sonoma, Rohnert Park" is used for material on file at the California Historical Resources Information System, Northwest Information Center, California State University Sonoma, Rohnert Park.

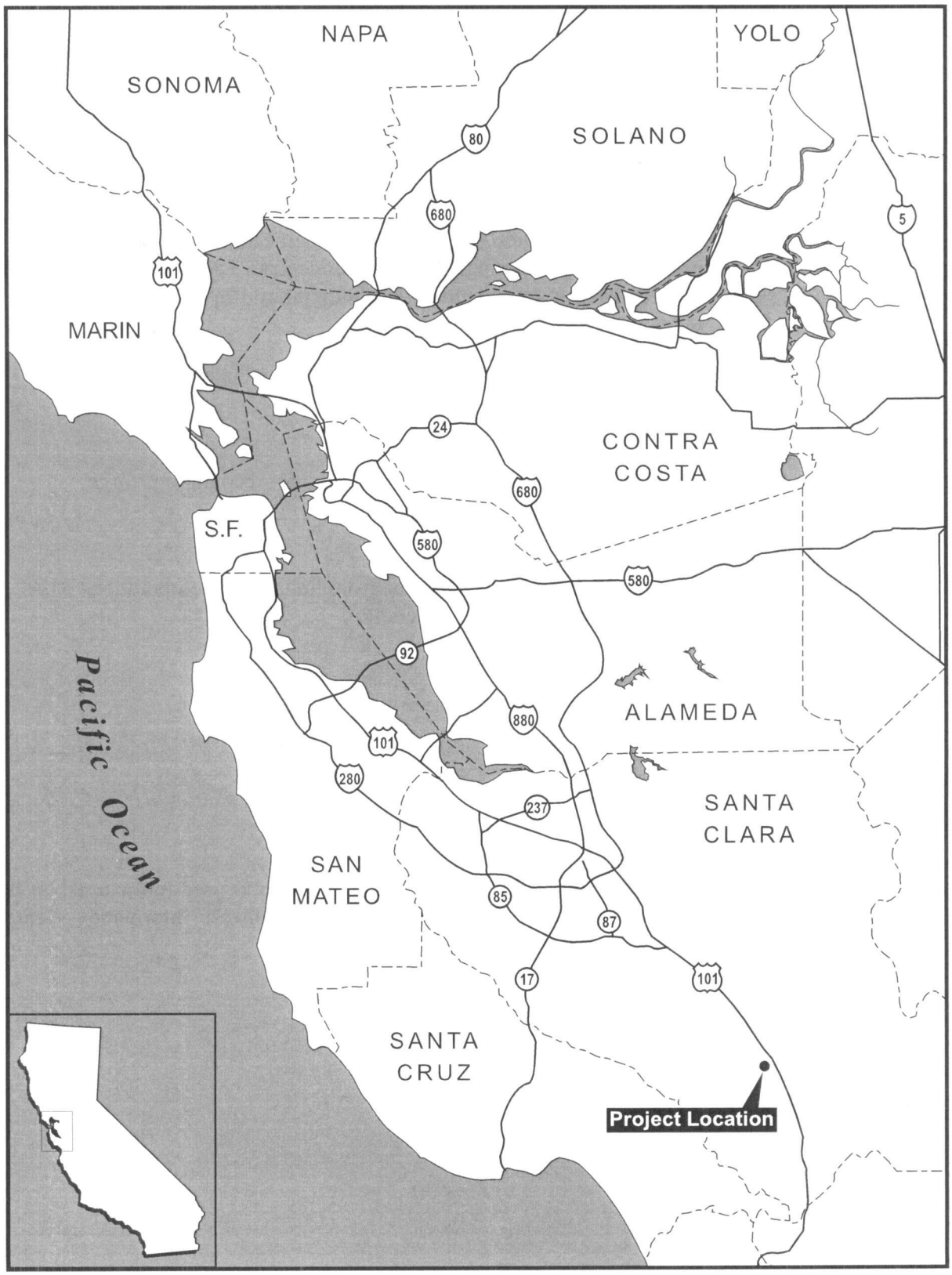


Figure 1: General Project Location

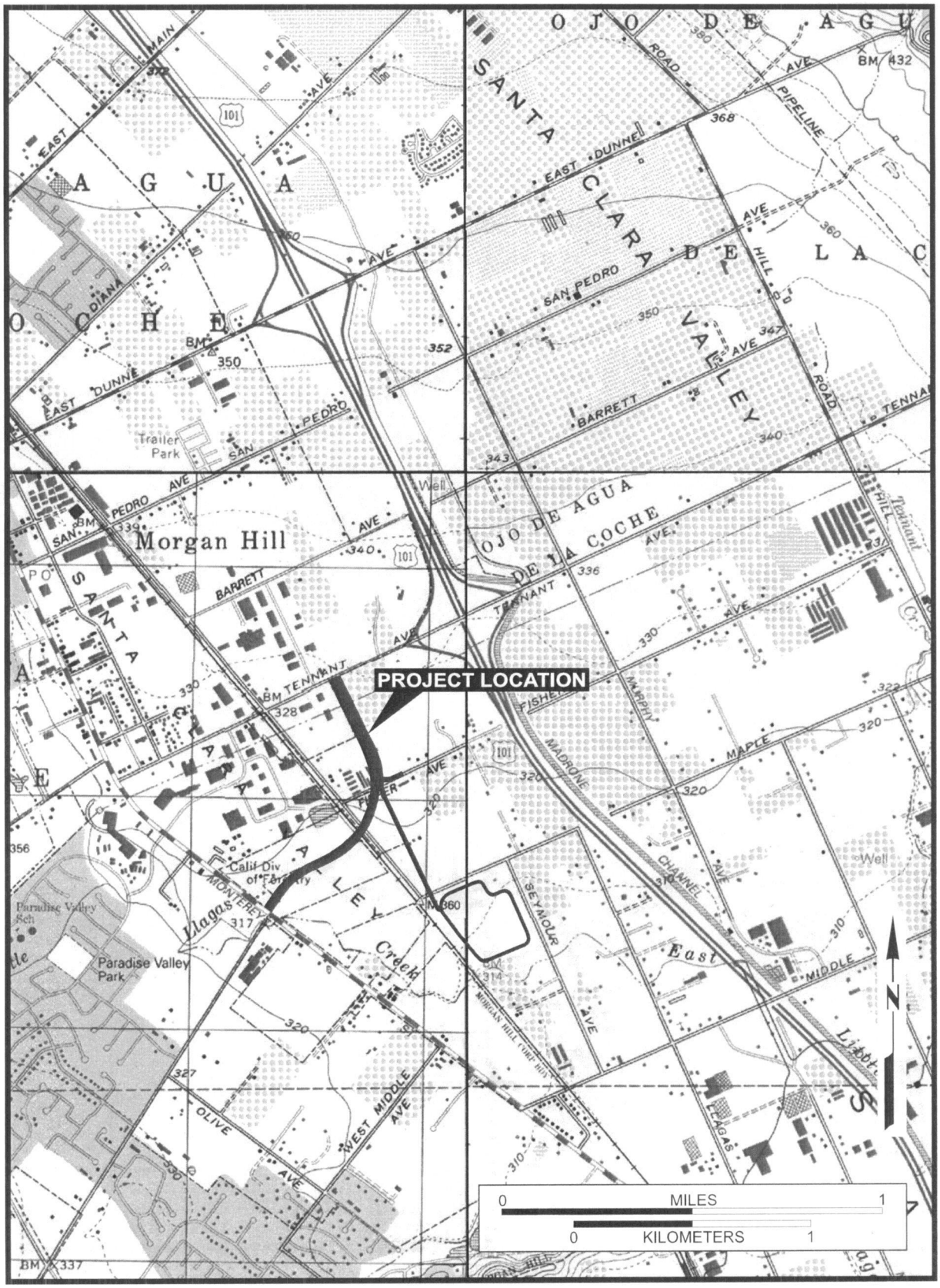


Figure 2: Project Location (USGS Morgan Hill, Calif. 1980; Mt. Sizer, Calif. 1978; Mt. Madonna, Calif. 1996; and Gilroy, Calif. 1993)

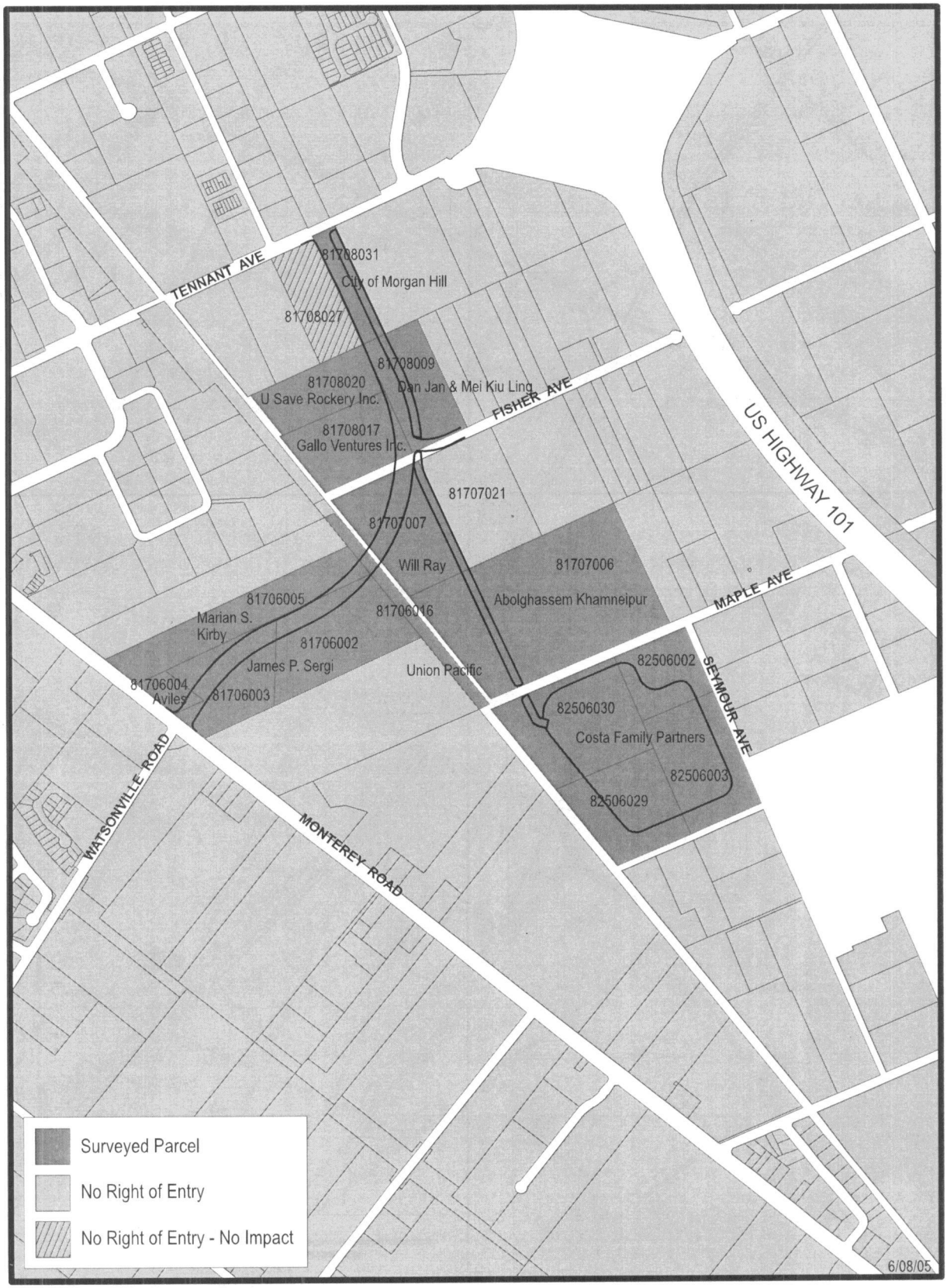


Figure 3: Butterfield Avenue - Proposed Alignments with Parcel APNs

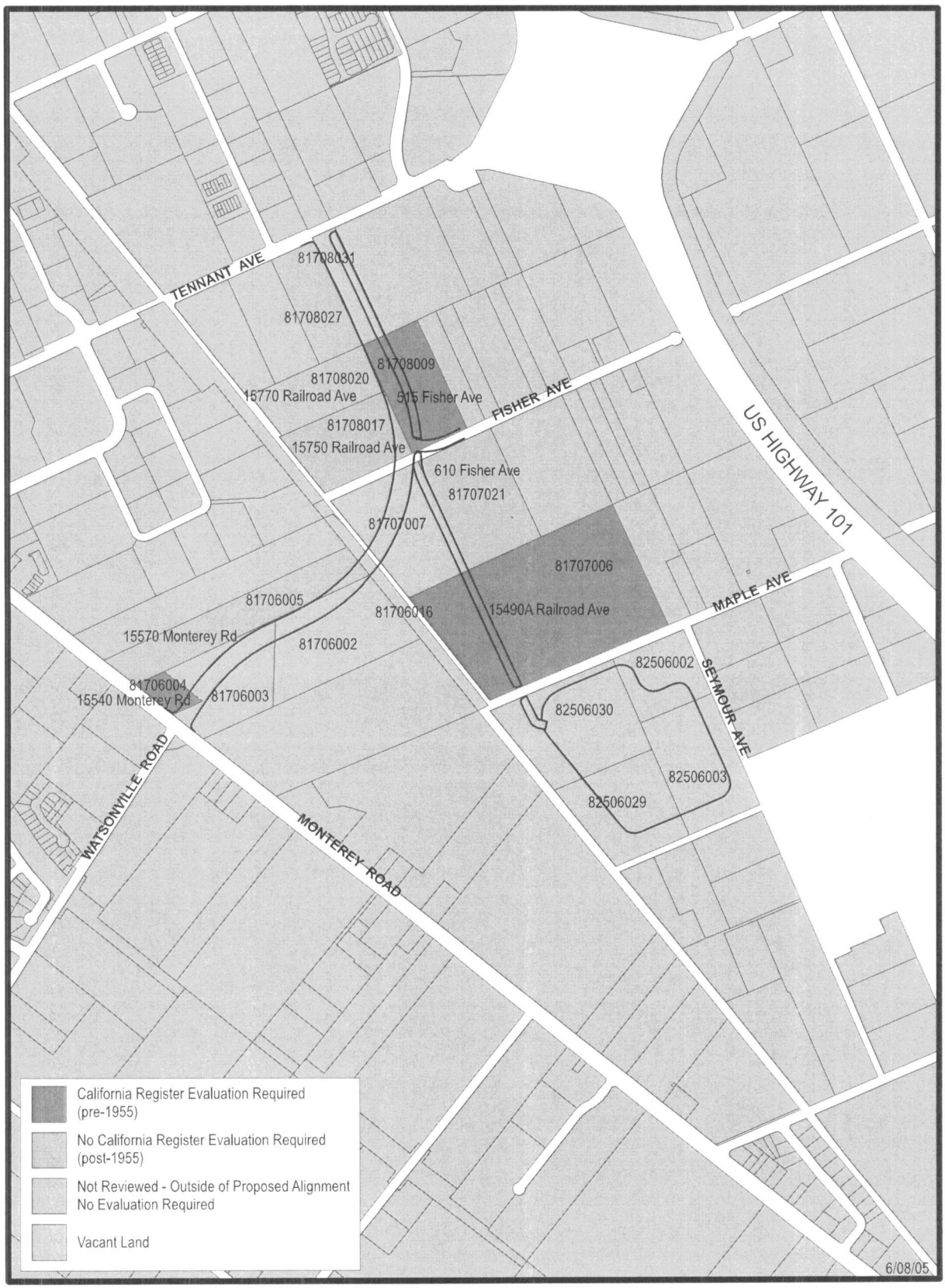


Figure 4: Butterfield Avenue - Built Environment

Appendix D

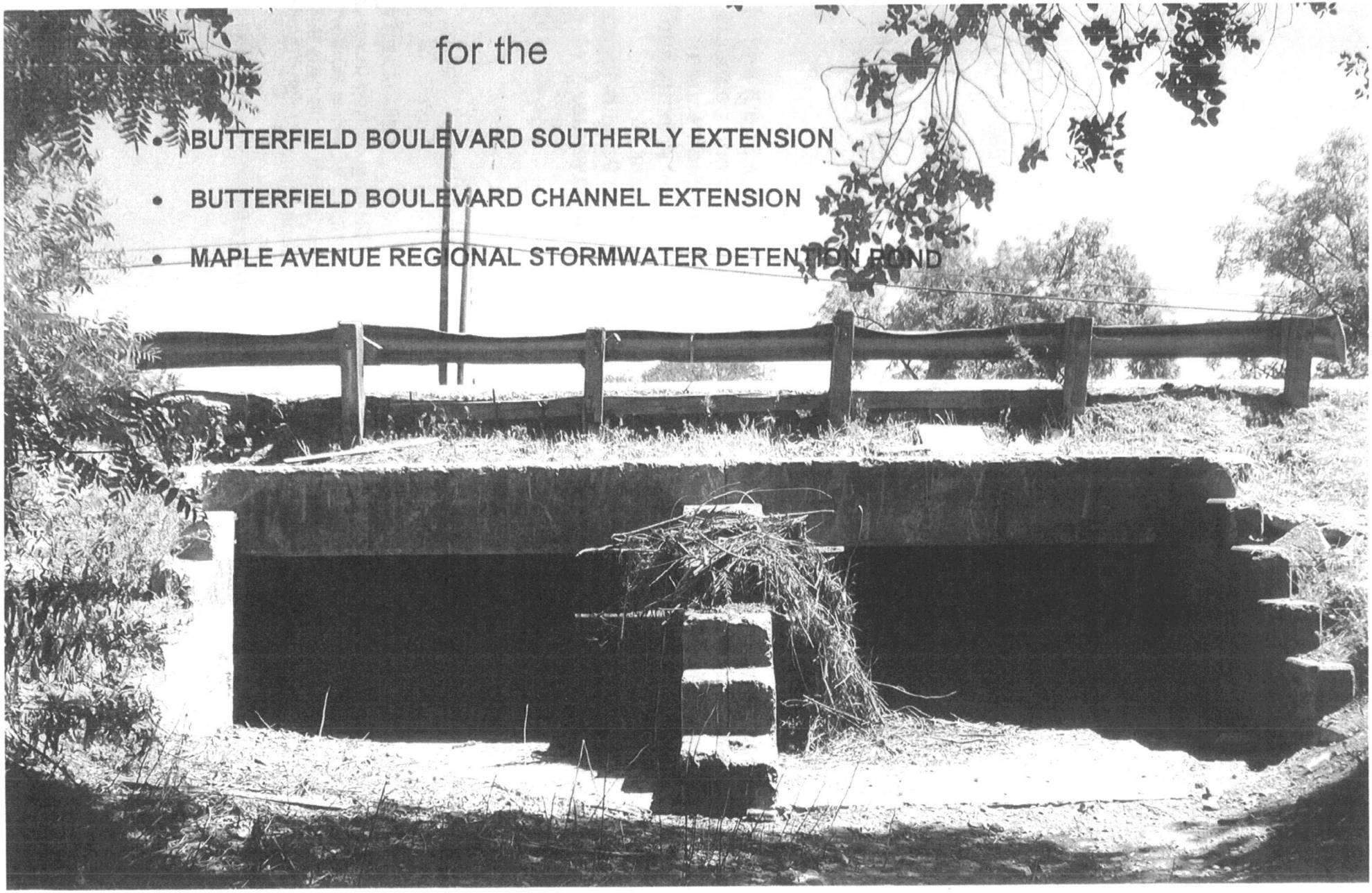
Drainage Study for the

Butterfield Boulevard Southerly Extension
Butterfield Boulevard Channel Extension
Maple Avenue Regional Stormwater Detention Pond

DRAINAGE STUDY

for the

- BUTTERFIELD BOULEVARD SOUTHERLY EXTENSION
- BUTTERFIELD BOULEVARD CHANNEL EXTENSION
- MAPLE AVENUE REGIONAL STORMWATER DETENTION POND



DRAINAGE STUDY

for the

- **BUTTERFIELD BOULEVARD SOUTHERLY EXTENSION**
- **BUTTERFIELD BOULEVARD CHANNEL EXTENSION**
- **MAPLE AVENUE REGIONAL STORM WATER DETENTION POND**

The extension of Butterfield Boulevard begins at the South end of Butterfield Boulevard at the Tennant Avenue Intersection and connects at the East end of Watsonville Road at the Monterey Road Intersection.

The Butterfield Channel extension begins at Tennant Avenue and extends to West Little Llagas Creek south of Maple Avenue.

The Maple Avenue Regional Storm Water Detention Pond is located at the Southwest corner of Maple Avenue and Seymour Avenue.

PREPARED BY:
MH Engineering Company
16075 Vineyard Boulevard
Morgan Hill, California 95037
Phone Number (408)779-7381

MH Engineering Project Number 24061.3 REP

MH engineering Co.

16075 Vineyard Blvd.
Morgan Hill, CA 95037
(408) 779-7381
Fax (408) 226-5712

December 27, 2009

CITY OF MORGAN HILL
DEPARTMENT OF PUBLIC WORKS
17555 Peak Avenue
Morgan Hill, CA 95037-4128

Re: Submission of The Drainage Study for
the Butterfield Boulevard Southerly Extension,
Butterfield Channel Southerly Extension &
Maple Avenue Regional Storm Water Detention Pond

Enclosed for your review, are two (2) copies of the Drainage Study, for the Butterfield Boulevard Southerly Extension Project. This report explains the logic and methodology for the Butterfield watershed bounded by Cochrane Road, UPRR, SVFW and West Little Llagas Creek, totaling 1,608 acres.

It is important to compare runoff derived from the 1980 General Plan to the runoff derived from the current 2008 General Plan, as the 1980 General Plan runoff was the basis of the drainage infrastructure design for Public Law 566, the federally funded regional drainage project which still is not totally completed. Any land uses creating more runoff than the 1980 GP must be mitigated, thus the need for a Regional Stormwater Detention Facility.

If you have any questions or need any additional information, please feel free to call our office at (408)779-7381.

Sincerely,

William McClintock, P.E.
MH Engineering Company

REGISTERED PROFESSIONAL ENGINEER
WILLIAM J McCLINTOCK
C 24893
EXP 12-31-10
CIVIL
STATE OF CALIFORNIA

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1.0 INTRODUCTION AND PURPOSE

This is the Drainage Study for The Butterfield Boulevard Extension Project, Butterfield Channel Extension and Maple Avenue Regional Storm Water Detention Pond Projects. The purpose of this report is to provide hydrologic and hydraulic analyses to determine the overall drainage patterns and constraints for the proposed projects.

This projects physical location and boundaries are currently on land that has not been previously developed to its entirety. The new road alignment will disturb approximately 63 acres of land. The completed proposed project will create a new road that will connect Butterfield Boulevard at Tennant Avenue to Watsonville Road at Monterey Road which includes a bridge over UPRR (formerly SPRR). Butterfield Boulevard Extension Project will require widening of Watsonville Road and relocation of the Watsonville Road/Monterey Road intersection towards the Southeast, approximately 80 feet. The existing culvert under Watsonville Road is a 12.8'x4.4x25'long, passing under two lanes of traffic. Flow from the Watsonville Road culvert then flows in a channel to the Monterey Road culvert which is a double 10'x4' RCB'S which flows to the East side of Monterey Road and then downstream in West Little Llagas Creek, a drainage channel with a very wide floodplain, towards the Southeast.

The project also includes an extension of the existing Butterfield Boulevard Channel which now terminates on the Southside of Tennant Avenue. The extension extends south along the East side of Butterfield Boulevard extension to Railroad Avenue, where it diverts away from the Butterfield Boulevard Extension and continues south on the East side of Railroad Avenue to Maple Avenue. A box culvert will be placed under Maple Avenue and the channel will extend to West Little Llagas Creek. The proposed channel turns and runs parallel to the existing creek but does not tie directly into it. As the proposed channel bottom becomes shallow the flow will overbank into West Little Llagas Creek as it nears Seymour Avenue. The 24.4 acre storm water detention pond is located on the South side of Maple Avenue and is bounded by UPRR to the West, Seymour Avenue to the East and West Little Llagas Creek to the South.

An inlet weir structure is located in the Butterfield channel reducing the downstream flow in Butterfield channel to 3 feet maximum depth. Flows deeper than 3 feet in the Butterfield channel enters the 80.0 acre feet storm water detention pond. As the flows back up from West Little Llagas Creek the pond will reach maximum capacity and water will cease to enter the detention area. When the water elevations subside in West Little Llagas creek, the proposed detention pond will drain via a 24" diameter outlet pipe into West Little Llagas Creek, outfalling east of Seymour Avenue.

This study is a stand alone document that presents the findings of the hydrologic and hydraulic analyses of the site and the contributing watershed. This study has been conducted in accordance with the criteria set forth by the Santa Clara County Drainage Manual 2007 and

The City of Morgan Hill Department of Public Works Design Standards and Details For Construction, Section 4 Storm Drain Design Standards.

A review of the entire Butterfield drainage basin will be reviewed for this drainage analysis. The study will analyze the data by comparing the 1980 General Plan to the 2008 General Plan. The report will assume that drainage basins are at complete build-out, for their respective zoning types. The boundaries of this drainage basin has been defined to begin at the center line of Cochrane Road, from the center line of the railroad tracks that run along side Railroad Avenue and the most westerly side of US Highway 101, moving South down US 101 to where West Little Llagas Creek intercepts US Highway 101.

The Morgan Hill Business Park (MHBP) has been analyzed in two different scenarios. In the 1980 General Plan Analysis, the runoff for the 100 year storm represents the existing development with the MHBP providing its own mitigation with onsite storm water detention. In the 2008 General Plan Study the scenario is with the removal of the MHBP mitigation and free runoff into the Butterfield Boulevard Drainage Channel.

2.0 GENERAL LOCATION AND DEVELOPMENT DESCRIPTION

2.1 Location

The project is located at the South end Butterfield Boulevard at Tennant Avenue and extends Butterfield Boulevard to Watsonville Road at Monterey Road. See Figure 1 in Appendix "A" for the Vicinity Map, which shows the general location of the subject property. See Figure 2 in Appendix "A" which shows the Assessor's Parcel Number (APN) Maps for which parcels will be affected by the completion of this project.

2.2 Existing Site Description

The Butterfield Boulevard Extension will be constructed on land that will be disturbed for residential, agricultural, or other business purposes per the 2008 General Plan. Most of the site is currently fallow grass land. The general area slopes to the south west at one quarter to one percent. Areas adjacent to the site are a patch work of business commercial and residential areas.

The southerly extension of Butterfield Boulevard starts at the south leg of the existing intersection of Tennant Avenue, where existing street and channel improvements extend approx. 100 feet. The Boulevard extension will tie into these improvements with little disruption to traffic at Tennant Avenue or Butterfield Boulevard to the north. An existing temporary parking lot used by Johnson's Lumber Co. will be removed.
The channel improvements will extend southerly and an existing residence located on Fischer Avenue will need to be raised and a Reinforced Concrete Box Culvert (RCBC) will be installed at the realigned Fischer Avenue.

Where Butterfield Boulevard rises up and turns westward to cross Railroad Avenue and Union Pacific Railroad (UPRR) the Butterfield channel extension separates from the roadway improvements and extends southerly, east of Railroad Avenue, through open agricultural land. An existing driveway from Railroad Avenue, to a farm labor camp located at approx. midblock

of Railroad Avenue will be severed by the channel improvements, requiring a RCBC or relocation of the driveway to Maple Avenue.

At Maple Avenue, a RCBC will be installed to allow the channel improvements to continue southerly along UPRR towards West Little Llagas creek through row crop agricultural land.

This corner bounded by Maple Avenue, UPRR, Seymour Avenue, and West Little Llagas Creek is the proposed location for a Regional Storm Water Detention facility, that will be designed also as a city park. This site is also being used currently for row crop agricultural purposes. The existing residence located at the northern corner of the site is currently planned to remain and the grading for the detention pond will avoid conflicts with this existing use.

West Little Llagas Creek located along the southern boundary of the purposed regional detention pond is not proposed to be altered, all grading to be setback a minimum of fifty (50) feet, except that a (2) 24-inch diameter pipes are proposed to be connected to the creek, east of Seymour Avenue.

2.3 FEMA Flood Plain Information

The project site has two areas within its boundary that have been identified as a Flood Zone. These areas are designated an (AE) Flood Zone. The first Flood Zone is in the area where Butterfield Boulevard will connect at Watsonville Road and Monterey Road. The AE Zone is an area of flood inundation by the 1% annual chance flood, this area may have a total water level of less than three feet, but the Base Flood elevation has been determined. This information was obtained from the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM). The FIRM Map Number. See Figure 3 in Appendix "A" to view this map.

The second Flood Zone area within the project boundary is the area of the proposed Regional Storm Water Detention Pond, which is also in an AE Flood Zone.
See attached Figure 3, "FLOOD INSURANCE RATE MAP".

2.4 Previous Studies

2.4.1 Flood Insurance Study (FIS)

In 1988, FEMA published a Flood Insurance Study for West Little Llagas Creek and republished again this year in May 2009. The difference between the two studies were in the elevation datum, changed form NGVD29 to NAVD88, and the 1988 flood boundaries were overlayed onto aerial photo maps. The hydrology and hydraulic calculations were not changed. A copy of Table 6- Summary of Discharges from the 2009 FIS is attached. Also attached is the published 1988 and 2009 Flood Profiles. This study uses the 1988 FIS on N6VD29 Datum.

Inspection of the FIS Table 6 reveals the following:

- Flow at Watsonville Road Culvert in a Q100 is 1936 cfs.

- Flow East of Monterey Road is only 813 cfs, as a result of a split flow condition at the entrance to the existing 10'x4' RCB'S on the Westside of Monterey Road.

- Flood profiles show the Base Flood Elevation (BFE) as follows:

  - Upstream Watsonville Road 320.5

  - Upstream Monterey Road 319.8

  - Downstream Monterey Road 317.0

2.4.2 HEC-RAS Calculations

The Hec-2 hydraulic model that was used in the FIS of W. Little Llagas Creek was obtained from the S.C.V.W.D. website and converted and calibrated for use in this study. Also, MHE has published an overview map which is included herein entitled "Watsonville Road Culvert Study w/ HEC-RAS", which shows:

- Flow distribution.

- City of Morgan Hill Topo (also used for FIS).

- Section Lines used in the Study.

MHE has found some discrepancies in the 1988 and 2009 FIS studies, the most relevant is that the Flood Profile shows the BFE above Watsonville Road to be 320.5 +/-, but the HEC-RAS model determines this elevation to be only 319.69 feet.

MHE recommends that the 319.69 feet elevation be used as the predevelopment BFE for comparison with the post development model.

2.4.3 1991 Water Surface Profile (WSP)

In December 1991, MH Engineering Co. published "Hydraulic Report For Sutter Boulevard Channel". This report provided water surface profile calculations for the "Sutter" now Butterfield Channel. These calculations followed the master plan layout prepared by Aqua Resources for Butterfield Channel and the regional detention pond now being proposed.

These calculations are for Q100 using a Type IA storm distribution in the SCS Unit Hydrograph methodology, and are the basis of the existing channel improvements located north of Tennant Avenue. The current modeling uses the SCVWD "General Storm" which results in flowrates approx. 25% less than in the 1991 study.

3.0 HYDROLOGY

3.1 Hydrologic Model and Parameters

Rainfall - Runoff Model

In order to design the Regional Storm Water Detention Facility a runoff hydrograph was developed for the Butterfield Boulevard Corridor, using SCS unit hydrograph methodology and rainfall distribution developed by the SCVWD entitled "General Storm". This methodology and rainfall distribution were used in the FEMA Flood Insurance Study. Excerpts related to Morgan Hill are attached as Appendix Section 4.

Rainfall

In Morgan Hill, California there was a rainfall event in 1959 that we have utilized for this study. Our Butterfield Avenue Extension project site is located within the NOAA ATLAS II 10-year and 100-year storm event limits acceptable for this study. Based on the gauged rainfall data collected during the 1959 storm. The following represent the rainfall depths for a 24-hour storm event:

- 4.17 inches for the 10-year event. ADJUSTED
- 5.59 inches for the 100-year event. ADJUSTED

The drainage area is approximately 2.5 square miles. Because it is less than 12 square miles, a custom storm distribution was used, based on the above listed rainfall information.

Hydrologic Soils Groups

Morgan Hill is approximately 24 miles south of downtown San Jose13 miles north of Gilroy, and 15 miles inland from the Pacific Coast. Lying in a roughly 4-mile wide southern extension of the Santa Clara Valley, it is bounded by the Santa Cruz Mountains to the west and the

Diablo Range to the east. At the valley floor, Morgan Hill lies at an elevation of about 350 feet above Mean Sea Level. The project site is in the Southern part of Morgan Hill. For the purpose of this Hydrologic analysis, infiltration losses are related to the SCS Soil Classifications. Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

The SCS soil types within the drainage area, and their corresponding hydrologic soil groups, were identified from the 'Department of Agriculture - Natural Resource Conservation Service, Web Soil Survey, web-site and are shown on the following tables for each study period:

Soils For The 1980 Drainage Delineation Map			
Drainage Basin ID	Soil Type	Hydrologic Soil Group	% of Area
101	San Ysidro	D	45%
	Pleasanton Loam	B	55%
102	Arbuckle Gravelly Loam	B	2%
	Pleasanton Loam	B	50%
	San Ysidro	D	46%
	Cortina	D	2%
103	Arbuckle Gravelly Loam	B	10%
	Pleasanton Loam	B	80%
	San Ysidro	D	10%
104	Arbuckle Gravelly Loam	B	10%
	Pleasanton Loam	B	80%
	San Ysidro	D	10%

105	Arbuckle Gravelly Loam Pleasanton Loam	B B	10% 90%
106	Arbuckle Gravelly Loam Pleasanton Loam	B B	10% 90%
107	Arbuckle Gravelly Loam Pleasanton Loam	B B	10% 90%
108	Arbuckle Gravelly Loam Pleasanton Loam San Ysidro	B B D	10% 80% 10%
109	Arbuckle Gravelly Loam Pleasanton Loam San Ysidro	B B D	10% 90% 10%
110	Arbuckle Gravelly Loam Pleasanton Loam San Ysidro	B B D	10% 70% 20%
111	Arbuckle Gravelly Loam Pleasanton Loam San Ysidro	B B D	10% 88% 2%

Soils For The 2008 Drainage Delineation Map			
Drainage Basin ID	Soil Type	Hydrologic Soil Group	% of Area
101	Arbuckle Gravelly Loam (ArA) Pleasanton Loam (PoA)	B B	98% 2%
102	Arbuckle Gravelly Loam (ArA) Pleasanton Loam (PoA) San Ysidro (SdA)	B B D	21% 24% 55%
103	Cortina Pleasanton Loam (PoA) San Ysidro (SdA)	A B D	1% 41% 58%
104	Arbuckle Gravelly Loam (ArA) Pleasanton Loam (PoA) San Ysidro (SdA)	B B D	37% 52% 11%
105	Pleasanton Loam (PoA) San Ysidro (SdA)	B D	98% 2%
106	Arbuckle Gravelly Loam (ArA) Pleasanton Loam (PoA) San Ysidro (SdA)	B B D	81% 9% 10%
107	Pleasanton Loam (PoA) San Ysidro (SdA)	B D	31% 69%
108	Arbuckle Gravelly Loam (ArA) Pleasanton Loam (PoA)	B B	99% 1%
109	Arbuckle Gravelly Loam (ArA) San Ysidro (SdA)	B D	37% 63%
110	Arbuckle Gravelly Loam (ArA) San Ysidro	B D	78% 22%
111	Arbuckle Gravelly Loam (ArA) San Ysidro	B D	96% 4%

112	Arbuckle Gravelly Loam (ArA) San Ysidro	B D	74% 26%
113	Arbuckle Gravelly Loam (ArA)	B	100%
114	Arbuckle Gravelly Loam San Ysidro	B D	98% 2%
115	Arbuckle Gravelly Loam (ArA)	B	100%
116	Arbuckle Gravelly Loam (ArA) Pleasanton Loam (PoA) San Ysidro (SdA)	B B D	60% 5% 35%
117	Arbuckle Gravelly Loam (ArA)	B	100%
118	Arbuckle Gravelly Loam (ArA) Pleasanton Loam (PoA) San Ysidro (SdA)	B B D	96% 1% 3%
119	Arbuckle Gravelly Loam (ArA) Pleasanton Loam (PoA) San Ysidro (SdA)	B B D	93% 2% 5%

Curve Numbers (C_N)

The proposed site is in an area that has been developed for agriculture, commercial, and industrial development. The general area is characterized as rural via the 1980 General Plan, and as Industrial as per the 2008 General Plan. For this study the entire drainage basin was studied and curve numbers were assigned based on the land use type from 1980 and 2008 General Plans. The following represents curve numbers that were used based on the land use types for this study:

Table of Runoff SCS Curve Numbers

Description	Condition	A	B	C	D	Condensed Description	
FULLY DEVELOPED URBAN AREAS	**Vegetation**						
Open space (lawns, parks, etc.)							
grass cover < 50%	Poor	68	79	86	89	< 50% grass cover	
grass cover 50% to 75%	Fair	49	69	79	84	50 - 75% grass cover	
grass cover > 75%	Good	39	61	74	80	> 75% grass cover	
Impervious Areas							
Paved parking lots, roofs, driveways		98	98	98	98	Paved parking & roofs	
Streets and roads							
Paved: curbs and storm sewers		98	98	98	98	Paved roads with curbs & sewers	
Paved: open ditches (with right-of-way)	50% imp	83	89	92	93	Paved roads with open ditches	
Gravel (with right-of-way)		76	85	89	91	Gravel roads	
Dirt (with right-of-way)		72	82	87	89	Dirt roads	
Urban Districts	**impervious**						
Commercial & business	85% imp	89	92	94	95	Urban commercial	
Industrial	72% imp	81	88	91	93	Urban industrial	
Residential Districts							
(by average lot size)	**impervious**						
1/8 acre (town houses)	65% impervious	77	85	90	92	1/8 acre lots	8 du/ac
1/4 acre	38% impervious	61	75	83	87	1/4 acre lots	4 du/ac
1/3 acre	30% impervious	57	72	81	86	1/3 acre lots	3 du/ac
1/2 acre	25% impervious	54	70	80	85	1/2 acre lots	2 du/ac

1 acre	20% impervious	51	68	79	84	1 acre lots	1 du/ac
2 acre	12% impervious	46	65	77	82	2 acre lots	0.5 du/ac
DEVELOPING URBAN AREA	**(No Vegetation)**						
Newly graded area (pervious only)		77	86	91	94	Newly graded area	
CULTIVATED AGRICULTURAL LAND							
Fallow							
Bare soil		77	86	91	94	Fallow, bare soil	
Crop residue (CR)	Poor	76	85	90	93	Fallow, crop residue	
Crop residue (CR)	Good	74	83	88	90	Fallow, crop residue	
Row crops							
Straight row (SR)	Poor	72	81	88	91	Row crops, straight row	
Straight row (SR)	Good	67	78	85	89	Row crops, straight row	
SR + Crop residue	Poor	71	80	87	90	Row crops, SR + CR	
SR + Crop residue	Good	64	75	82	85	Row crops, SR + CR	
Contoured (C)	Poor	70	79	84	88	Row crops, contoured	
Contoured (C)	Good	65	75	82	86	Row crops, contoured	
C + Crop residue	Poor	69	78	83	87	Row crops, C + CR	
C + Crop residue	Good	64	74	81	85	Row crops, C + CR	
Contoured & terraced (C&T)	Poor	66	74	80	82	Row crops, C&T	
Contoured & terraced (C&T)	Good	62	71	78	81	Row crops, C&T	
C&T + Crop residue	Poor	65	73	79	81	Row crops, C&T + CR	
C&T + Crop residue	Good	61	70	77	80	Row crops, C&T + CR	
OTHER AGRICULTURAL LAND							
Pasture, grassland, or range	Poor	68	79	86	89	Pasture, grassland, or range	
	Fair	49	69	79	84	Pasture, grassland, or range	
	Good	39	61	74	80	Pasture, grassland, or range	
Meadow, continuous grass, non-grazed		30	58	71	78	Meadow, non-grazed	
Brush or brush/weed/grass mixture	Poor	48	67	77	83	Brush	
	Fair	35	56	70	77	Brush	
	Good	30	48	65	73	Brush	
Woods & grass combination	Poor	57	73	82	86	Woods & grass combination	
	Fair	43	65	76	82	Woods & grass combination	
	Good	32	58	72	79	Woods & grass combination	
Woods	Poor	45	66	77	83	Woods	
	Fair	36	60	73	79	Woods	
	Good	30	55	70	77	Woods	
Farmsteads		59	74	82	86	Farmsteads	

Time of Concentration

Time of concentration (T_C) is the time that it takes water to flow from a drainage basin's most hydraulically remote point to the basin's outlet. Concentration time is used to determine how "far away" (time wise) the peak of the unit hydrograph is from a point being analyzed. This time is then used to combine unit hydrographs as they would in nature (rather than algebraically adding peaks and yielding much higher theoretical flows).

Concentration Time (T_C) is a combination of an initial overland time (T_i – non-channelized) and travel time (T_t - channelized) in a ditch, channel, gutter, storm sewer, etc.

$$T_c = T_i + T_t$$

T_i will be calculated using Kerby's Equation. This is an equation that was developed in 1959 for computing the time of concentration for overland flow distances of less than 10 feet and not greater than 3000 feet.

$$t_c = 0.83\left(Lns^{-0.5}\right)^{0.467}$$

where:

t_c - time of concentration in minutes.

s - overland slope in ft/ft.

n - roughness coefficient.

L - length of overland flow in feet.

A table of recommended values for n is given below:

RECOMMENDED SURFACE ROUGHNESS VALUES	
Surface Description	N
Smooth, impervious surface	0.012
Poor grass, cultivated row crops of moderately rough bare soil	0.07
Smooth, packed bare soil	0.1
Pasture or average grass	0.4
Deciduous timberland	0.6
Timberland with deep forest litter or dense grass	0.8

Initial overland time (T_i) considers flow resistance (n), overland flow length (L) and an average basin slope (S). Travel time (T_t) considers concentrated flow length and average flow velocity.

$$Ti = 0.83(Lns^{-0.5})^{-0.467}$$
$$Tt = L/(60*V)$$

3.2 The 1980 General Plan

The general area falls to the Southeast at approximately .25 to 1 percent. All of the flow would have flowed to a channel that would have been constructed along Railroad Avenue. All of the flows would have eventually flowed to the Llagas Creek. Please refer to Figure 6, for the Overall Drainage Map – General Plan 1980, to follow the Sub-Basin Delineation and Flow Routing.

Included in this Section is a land use Comparison table in which the 1980 General plan is compared to the 2008 General Plan. While the 2008 General Plan includes a larger developed area, south of Tennant Avenue, there are subtle changes that reduce the runoff in the 2008 land use plan to approximate equal the 1980 General Plan, absent the full runoff release of the MHBP.

The change that produces' the most offset is in the density of the Single Family Residential, Medium. The 1980 GP allowed 4-6 houses per acre while the 2008 GP only allows 3-5 houses per acre. This slight decrease in developed runoff applied to a fairly significant area (613 acres) results in a fairly significant decrease in developed runoff over the 1980 General Plan.

1980 General Plan Summary Table

Kerby's Time Of Concentration Equation

Solving for time of concentration.

$$t_c = 0.83\left(Lns^{-0.5}\right)^{0.467}$$

Sub-Basin ID	Acres	CN	High ELE	Low ELE	Length	Slope	Kerby's n	TC
101	400.0	67	376.7	352.9	5761.02	0.0041	0.07	49.3
102-A	94.4	78.0	379.5	352.9	5010	0.0053	0.012	19.1
102-B	19.5	88.0	352.9	351.3	720	0.0022	0.012	9.5
102	113.9	79.7			5730.0			28.6
103-A	93.5	78.0	378	351	5160	0.0052	0.012	19.4
103-B	16.9	88	351	349.3	720	0.0024	0.012	9.3
103	110.4	79.5			5880.0			28.8
104-A	188.3	78	372	351.2	4200	0.0050	0.012	17.9
104-B	5.4	85	351.2	350	300	0.0040	0.012	5.5
104-*			350	347.3	1200	0.0022	0.012	12.0
104-B	29.6	88	347.3	342.5	630	0.0076	0.012	6.7
104	223.3	77.4			6330.0			42.0
105-A	81.7	78	364.2	355.3	2160	0.0041	0.012	13.7
105-B	14.2	85	355.3	348.2	1020	0.0070	0.012	8.5
105-C	12.6	90	348.2	347	510	0.0024	0.012	7.9
105-D	5.1	90.0	0	0	0	0.0000	0	0.0
105-E	5.2	92.0	347	343	870	0.0046	0.012	8.7
105	118.9	81.2			4560.0			38.9
106-A	37.4	78	354	348.5	1650	0.0033	0.012	12.7
106-B	60.7	85	348.5	341.4	2100	0.0034	0.012	14.1
106-C	15.6	88	0	0	0	0.0000	0	0.0
106-D	18.1	90	0	0	0	0.0000	0	0.0
106-E	17.8	88	341.4	340.33	870	0.0012	0.012	11.9
106	149.6	84.5			4620.0			38.7
107-A	53.2	78	348	337.2	3300	0.0033	0.012	17.6
107-B	44.6	85	337.2	335	510	0.0043	0.012	6.9

107-C	40.6	88	335	333.9	960	0.0011	0.012	12.6
107	138.3	83.2			4770.0			37.1
108-A	64.6	78	340	330	2760	0.0036	0.012	15.8
108-B	48.8	88	330	326	1080	0.0037	0.012	10.1
108	113.4	82.3			3840.0			26.0
109-A	30.1	70	330.5	325.7	1860	0.0026	0.012	14.2
109-B	36.8	67	324.7	322	840	0.0032	0.07	21.3
109-C	7.6	92	0	0	0	0.0000	0	0.0
109-D	10.7	88	0	0	0	0.0000	0	0.0
109-E	14.4	67	322	320.1	660	0.0029	0.07	19.5
109	99.6	72.1			3360.0			55.0
110-A	13.2	70.0	0	0	0.0	0.0000	0	0.0
110-B	87.5	67.0	321.5	314.5	3199.4	0.0022	0.07	43.4
110	100.7	67.4			3199.4			43.4
111	40.7	67	0	0	0	0.0000	0	12.0

No offsite flows will impact this project, because no off site flows enter or are routed in the studied drainage basin.

3.3 The 2008 General Plan

The 2008 General Plan is characterized by full onsite development of the zoning map within our study area. Flows are to be conveyed by a channel that flows along Butterfield Boulevard, and to be detained at a detention basin constructed at Maple Avenue, and then released to the Llagas Creek

2008 General Plan Summary Table

Kerby's Time Of Concentration Equation

Solving for time of concentration.

$$t_c = 0.83\left(Lns^{-0.5}\right)^{0.467}$$

Sub-Basin ID	Acres	CN	High ELE	Low ELE	Length	Slope	Kerby's n	TC
101	400.0	67	376.7	352.9	5761.02	0.0041	0.07	49.3
102-A	73.1	75	377.3	354.6	4125	0.0055	0.012	17.3
102-B	14.2	88	354.6	351.5	840	0.0037	0.012	9.0
102	87.3	77.1			4965.0			26.3
103	16.7	88	359.9	349.6	1538.45	0.0067	0.012	10.4
104-A	29.7	70.0	379.5	368.2	3030	0.0037	0.012	16.4
104-B	49.5	75.0	368.2	357.2	2730	0.0040	0.012	15.3
104-C	14.5	88.0	357.2	354.6	660	0.0039	0.012	7.9
104-D	14.7	90.0	354.6	351	570	0.0063	0.012	6.6
104	108.3	77.4			6990.0			46.3
105	11.7	88	351.7	351.6	1306.82	0.0001	0.012	27.4
106-A	9.1	70	370	366	960	0.0042	0.012	9.3

106-B	35.1	75	366	360.1	1170	0.0050	0.012	9.8
106-C	15.8	70	360.1	357	675	0.0046	0.012	7.7
106-D	22.1	75	357	355.7	930	0.0014	0.012	11.9
106-E	102.2	75	355.7	355.3	570	0.0007	0.012	11.1
106-F	2.2	67	355.7	355.3	180	0.0022	0.012	5.0
106-*			355.3	348.8	495	0.0131	0.012	5.2
106-G	10.0	90	348.8	347.3	600	0.0025	0.012	8.5
106	196.5	75.0			5580			68.5
107-A	7.9	88.0	350.4	347.1	630	0.0052	0.012	7.3
107-B	18.9	88.0	347.1	342	1768	0.0029	0.012	13.5
107	26.8	88	350.4	342	2398.13	0.0035	0.012	20.8
108-A	5.4	75	364.2	360.5	1020	0.0036	0.012	9.9
108-B	6.0	92	0	0	0	0.0000	0	0.0
108-C	36.6	75	0	0	0	0.0000	0	0.0
108-D	14.4	90	360.5	355.2	1020	0.0052	0.012	9.1
108-E	5.5	92	355.2	354.3	930	0.0010	0.012	12.9
108-F	19.1	90	354.3	350.8	540	0.0065	0.012	6.4
108-G	1.7	92	350.8	350.1	315	0.0022	0.012	6.4
108-*			350.1	349	420	0.0026	0.012	7.1
108-H	21.8	90	349	347	810	0.0025	0.012	9.8
108	110.5	84.5			5055			61.7
109	8.4	92	347.7	344	1009.27	0.0037	0.012	9.9
110-A	19.8	92	354	351	870	0.0034	0.012	9.3
110-B	7.8	92	0	0	0	0.0000	0	0.0
110-C	10.5	90	351	347	870	0.0046	0.012	8.7
110-D	10.1	90	347	345.5	540	0.0028	0.012	7.9
110-E	4.6	90	345.5	344	540	0.0000	0	0.0
110-F	15.9	88	344	342.6	1080	0.0013	0.012	13.0
110-G	4.3	92	0	0	0	0.0000	0	0.0
110-H	14.4	90	0	0	0	0.0000	0	0.0
110-I	21.5	90	342.6	342.1	1200	0.0004	0.012	17.8
110-J	10.0	92	0	0	0	0.0000	0	0.0
110-K	7.1	90	0	0	0	0.0000	0	0.0
110	126.0	90.4			5,100.0			56.6
111-A	10.9	92	346	343	1110	0.0027	0.012	11.1
111-B	13.0	92	343	339	1200	0.0033	0.012	10.9
111	23.9	88			2,310.0			22.0
112-A	15.6	70	348	343.3	810	0.0058	0.012	8.0
112-B	6.6	75	343.3	340.2	840	0.0037	0.012	9.0
112-C	9.9	88	340.2	339.6	525	0.0011	0.012	9.5
112-D	18.1	75	339.6	336.5	555	0.0056	0.012	6.8
112-E	22.4	75	336.5	335	360	0.0000	0	0.0
112-F	22.5	90	0	0	0	0.0000	0	0.0
112	95.1	79.1			3,090.0			33.3
113	43.3	88	341.8	333.9	2154.28	0.0037	0.012	14.0
114-A	21.7	88	340.2	337.8	930	0.0026	0.012	10.3
114-B	8.3	92	0	0	0	0.0000	0	0.0

114-C	20.8	90	337.8	335.8	420	0.0048	0.012	6.2
114-D	13.9	92	335.8	330	1470	0.0039	0.012	11.5
114	64.6	90.0	340	330	2779.05	0.0036	0.012	28.0
115	49.5	88	336	326	2698.28	0.0037	0.07	35.5
116-A	32.7	92	330.5	327.7	825	0.0034	0.012	9.1
116-B	31.5	88	327.7	321	870	0.0077	0.012	7.7
116	64.2	90.0			1695			16.9
117-A	19.8	92	328.5	322.8	1950	0.0029	0.012	14.1
117-B	15.3	88	322.8	322	690	0.0012	0.012	10.8
117	35.1	90.3	328.5	320.1	2245.42	0.0037	0.012	24.9
118	100.3	88.0	321.5	314.5	3199.36	0.0022	0.012	19.1
119	40.7	88	0	0	0	0.0000	0	12.0

No known offsite flows affect the drainage basin.

3.4 Basin Summary

There were moderate changes in the General Plan from 1980 to 2008. The Land Use Comparison Table shown in Figure 8 represents the land use changes from that period.

1980 GP
Total Flow Time (Tc)
Ttot=tc+ Lag

Hyd. No.	Basin 101	Lag.	ET	Desc.
6	1005 ÷60 1.93	8.67 min.	57.97 min.	@ Central
9	990 ÷ 60 2.41	6.85 min.	64.82 min.	@ East Main
12	2100 ÷ 60 3.09	11.33 min.	76.15 min.	@ Diana
15	510 ÷60 2.33	3.65 min.	79.8 min.	@ E. Dunne
18	1710 ÷60 3.90	7.31 min.	87.11 min.	@ San Pedro
21	1710 ÷60 4.05	7.04 min.	94.15 min.	@ Barrett
24	1680 ÷60 4.62	6.06 min.	100.21 min.	@ Tennant
27	1680÷60 4.27	6.56 min.	106.77 min.	@ Fischer
30	1800÷60 4.18	7.18 min.	113.95 min.	@ Maple

A=1608.8 CN=81.2 Tc=114 min. = 1.9 hours

Q= 720.34 cfs@ 18.63 hours Routed Q2 683 cfs@ 18.40 hours

2008 GP
Total Flow Time (Tc)
Ttot= tc+ Lag

Hyd. No.	Tc	Lag	ET	Desc.
1	49.3 min.			MHBP (101)
7	1200÷60 2.61	7.66 min.	56.96 min.	@ Central
11	990 ÷60 1.47	11.22 min.	68.18 min.	@ E. Main
15	2010 ÷60 2.51	13.35 min.	81.53 min.	@ Diana
19	810 ÷60 1.62	8.33 min.	89.86 min.	@ E. Dunne
23	1680 ÷60 3.65	7.67 min.	97.53 min.	@ San Pedro
27	1950 ÷60 3.86	8.42 min.	105.95 min.	@ Barrett
31	1680 ÷60 3.83	7.31 min.	113.26 min.	@Tennant
35	1650 ÷60 4.88	5.63 min.	118.89 min.	@ Fischer
38	1800 ÷60 4.30	6.98 min.	125.87 min.	@ Maple

A= 1608.8 acres CN= 84.8 Tc= 126 min = 2.1 hrs

Q= 734.74 cfs @ 18.73 hours Routed Q= 745.98 cfs @ 18.27 hrs

The following table represents the flows for the 1980 General Plan and the 2008 General Plan:

BUTTERFIELD CHANNEL
Basin Summary Table

Location	Area Acres	Accum. Area (Acres)	1980 Q_{10}/Q_{100} cfs	2008 Q_{10}/Q_{100} cfs
MHBP	400	400	88/118	193/259
East Central Ave.	97	497	131/176	224/300
East Main Ave.	127	624	173/232	266/357
Diana Ave.	223	847	256/343	338/453
East Dunne Ave.	119	966	304/407	383/514
San Pedro Ave.	150	1,116	363/487	441/591
Barrett Ave.	138	1,254	416/557	476/638
Tennant Ave.	114	1,368	449/602	512/686
Fisher Ave.	100	1,468	479/642	535/717
Maple Ave.	100	1,568	504/676	556/746
W. Little Llagas Creek	41	1,609	510/684	571/766

See Hydrographs in Appendix "A Sections 2 and 3"

4.0 HYDRAULICS

4.1 Street Flow Calculations

For the purposes of this study street flows were not studied.

4.2 The Butterfield Channel

The Butterfield Channel is a channel that is adjacent to Butterfield Boulevard. The general dimensions for this channel are 2 to 1 side slopes, 8 feet of total depth and 10 to 30 feet bottom width. The Channel is generally earthen with planted grass along the bottom. At least two feet of freeboard will flow throughout the channel meeting the minimum requirements for channels. Water surface profile calculations using HEC-RAS are provided in Appendix B, Section 1.

Butterfield Channel 100yr Storm Data

Location	B.W.	Slope	Q100 (cfs)	Water Depth (ft)	Velocity (ft/s)
MHBD	5' Dia	.11 %	259	6.0	9.2*
East Central Ave.	10'	.15%	300	4.6	3.5
East Main Ave.	10'	.15%	357	4.3	4.7
Diana Ave.	10'	.28%	453	4.9	4.7
East Dunne Ave.	10'	.21%	514	5.2	4.9
San Pedro Ave.	10'	.22%	591	5.5	5.0
Barrett Ave.	10'	.23%	638	5.7	5.1
Tennant Ave.	10'	.31%	686	5.8	5.3
Fisher Ave.	22'	.28%	717	6.1	5.3
Maple Ave.	30'	.10%	746	4.8	4.0

*** 60" Pipe flows under pressure. BW= Bottom Width**

4.3 Storm Drain and Drop Inlets

For the purposes of this study Storm Drain and Drop Inlets were not studied.

4.4 West Little Llagas Creek

The Hydrologic Engineering Center (HEC), developed the River Analysis System (HEC-RAS). This software was used to model the W. Little Llagas Creek for pre and post development conditions.

Watsonville Road Culvert

Currently, West Little Llagas Creek floods over Watsonville Road on a near annual frequency. Every two to three years the road is closed until flood waters recede. The root cause of flooding is the limited capacity of the existing Monterey Road culvert located just downstream of Watsonville Road. The Monterey Road culvert cannot be enlarged as it will cause increased flooding east of Monterey Road as there is currently a split flow; 800+/- cfs under Monterey Road through the culvert and 1,100 +/- cfs flowing overland on the west side of Monterey Road. Eventually the west split floods over the crown of Monterey Road within 1,000 feet south of Watsonville road, and rejoins West Little Llagas Creek before it flows under the UPRR culvert.

At Watsonville Road it was decided at a meeting with the City's consultants, Mark Thomas & Co, MH Engineering, and City Public Works staff, to use a design alternative using a double 10x4 RCBC under Watsonville Road, replacing the existing 12.8 x 4.4 RCBC, and maintaining a small reach of the existing channel upstream of the existing double 10' x 4 under Monterey Road.

This alternative maintained the existing upstream Q100 flood elevation and maintaining the existing downstream Westside split flows without change in flow pattern. This alternative does reduce the frequency of flooding over Watsonville Road to approximately Q2.

This is a temporary problem as the PL566 flood improvement project located to the southwest of Monterey Road will be completed within 5 to 10 years, rerouting flood waters away from Monterey Road. The watershed after PL566 is completed is reduced to 32.3 acres of local drainage requiring only a 48 diameter pipe for even Q100 flows.

Butterfield Channel Confluence

As West little Llagas Creek flows under the UPRR, a split flow occurs on the West Side of the tracks. The existing culvert is a 13'x 5.4 RCBC and the elevation of the top rail is at 316.3. Before the flood waters can reach the top of the rail, the flood moves southerly along the West side of the tracks to Llagas Creek. HEC-RAS analysis of this split flow computes 700 cfs flowing through the box culvert and 1,260 cfs flooding to Llagas Creek. The FEMA FIS only reports 460 cfs. 700 cfs were used in our WSP Study for the confluence of Butterfield Channel and West Little Llagas Creek. Before and after effects of flow reduction benefited by the Regional Storm Water Detention Pond, a floodplain analysis on the reach adjacent to the regional pond was performed using the flows from the FEMA FIS (except 700 cfs under UPRR). Due to the berming of the pond in the floodplain, a reduction of conveyance resulted on the original layout. So after several interations, the current layout which moved the berm northerly by 100 feet and the Butterfield Channel extending to Seymour Avenue, provides the conveyance needed for less than 0.09 feet of difference.

4.5 REGIONAL STORM WATER DETENTION POND

Significant reduction of peak flow runoff is provided by the proposed Regional Storm Water Detention Pond, where the FEMA FIS shows 1770 cfs in West Little Llagas Creek at a point just upstream of Seymour Avenue (See attached Figure 1). The FIS shows only 460 cfs downstream of SPRR in West Little Llagas Creek, which means the difference, 1310 cfs, results from the Butterfield Boulevard Corridor Watershed. A footnote in said FIS qualifies the runoff rates as "not computed", which allows this study to be adopted as best community information.

The computed runoff hydrograph for the Butterfield Corridor and 2008 General Plan resulted in a Peak runoff rate of 746 cfs, much less than FEMA's estimate of 1,310 cfs, but MHE calculations show 700 cfs flowing under UPPR instead of 460 cfs per FIS. Net results in unrouted flow of 1,446 cfs instead of 1,770 cfs (FIS) upstream of Seymour Avenue.

With Butterfield Channel side weir flowing into the Regional Detention Pond, the Butterfield flow is reduced from 746 cfs to 352 cfs (Hydrograph 45) in the channel. 394 cfs continues down the Butterfield Channel to West Little Llagas Creek. When the pond outflow, SPRR and Butterfield hydrographs are added together the total downstream flow in West Little Llagas Creek is 1,109 cfs.

Since the 1980 General Plan flows are the limiting peak runoff flow rates allowed out of the

system, we have calculated the maximum flow rate to be the sum of 1980 GP Butterfield plus SPRR which equals 684 + 700 or 1,384 cfs.

The proposed pond mitigates the increased flow from the MHBP and 2008 General Plan ultimate development.

These hydrograph routing calculations are provided in Appendix A, Sections 2 and 3.

5.0 CONCLUSIONS AND RECOMMENDATION

5.1 Effectiveness of Proposed Facilities

With the installation of a new RCBC under the realigned and widened Watsonville Road, no increase in flooding will result upstream or downstream.

The slight upsizing of the culvert from its existing size allows less frequent flooding and the ability to use the ultimate raised curb median in Watsonville Road over the creek.

The proposed Butterfield Channel improvements will alleviate nuisance flooding of Tennant Avenue near SPRR, provide Q100 capacity of the Butterfield Boulevard 2008 General Plan Build out and allow the MHBP to remove bricked connection to Butterfield Channel, which was installed in Phase 2 of Butterfield Boulevard Improvements.

Other nuisance flooding occurs along the east side of Butterfield Boulevard as a result of the temporary check dams used to slow the water in the channel. Upon completion of the Regional Storm Water Detention pond, these check dams can be removed and Butterfield Boulevard will not experience this nuisance flooding.

The proposed Regional Detention pond reduces the 2008 GP flows to below 1980 GP flow rates and in accordance with flowrates used to design PL566 public improvements, which have been installed downstream in Llagas Creek.

Also upon completion of the detention pond, the MHBP may remove onsite detention with City approval.

5.2 Compliance with Regulations and Adopted Plans

MH Engineering has designed this site to comply with the "Uniform Regulations for the Control of Drainage," "Santa Clara County Hydrologic Criteria" Federal Emergency Management Agency requirements, Santa Clara County Grading Ordinance, and the Santa Clara Valley Water District Collaborative Standards and Details and The City of Morgan Hill criteria.

5.3 Recommendation

We recommend acceptance of this drainage study and construction of this project. City of Morgan hill Public Works should circulate this document for review and comment to the following agencies:

- Santa Clara Valley Water District
- Santa Clara County LDE
- U.S. Fish and Game
- Army Corp. of Engineers
- Regional Water Quality Control Board

A follow up meeting and project modifications should be anticipated from recommendations from these agencies, before approvals and permitting are obtained.

6.0 REFERENCES

1.) ***Flood Insurance Rate Map.*** Federal Emergency Management Agency, May 19, 2009.

2.) Hydraulic Report For Sutter Boulevard Channel Drainage Study for Q100 Prepared by MHE, dated December 17, 2009.

3.) FIS excerpts

Appendix "A"

General Figures

Figure 1

Vicinity Maps

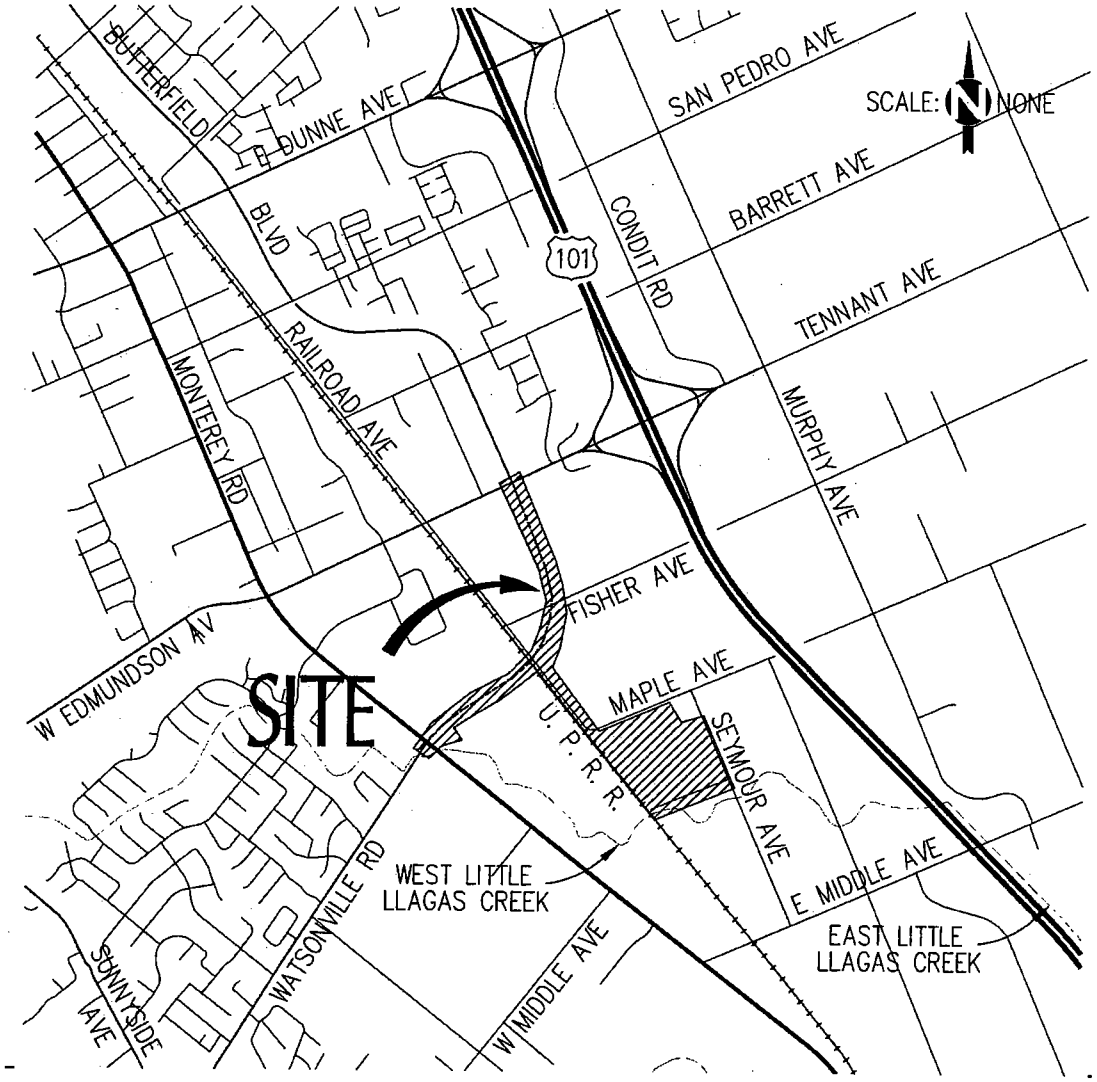

Figure 1: Vicinity Map

Figure 2

APN Maps

Santa Clara, CA, 2008-2009 - 817-08-032, 740 TENNANT AVE, MORGAN HILL CA 95037-5515, Sheet: 1 of 1

OFFICE OF COUNTY ASSESSOR — SANTA CLARA COUNTY, CALIFORNIA

BOOK	PAGE
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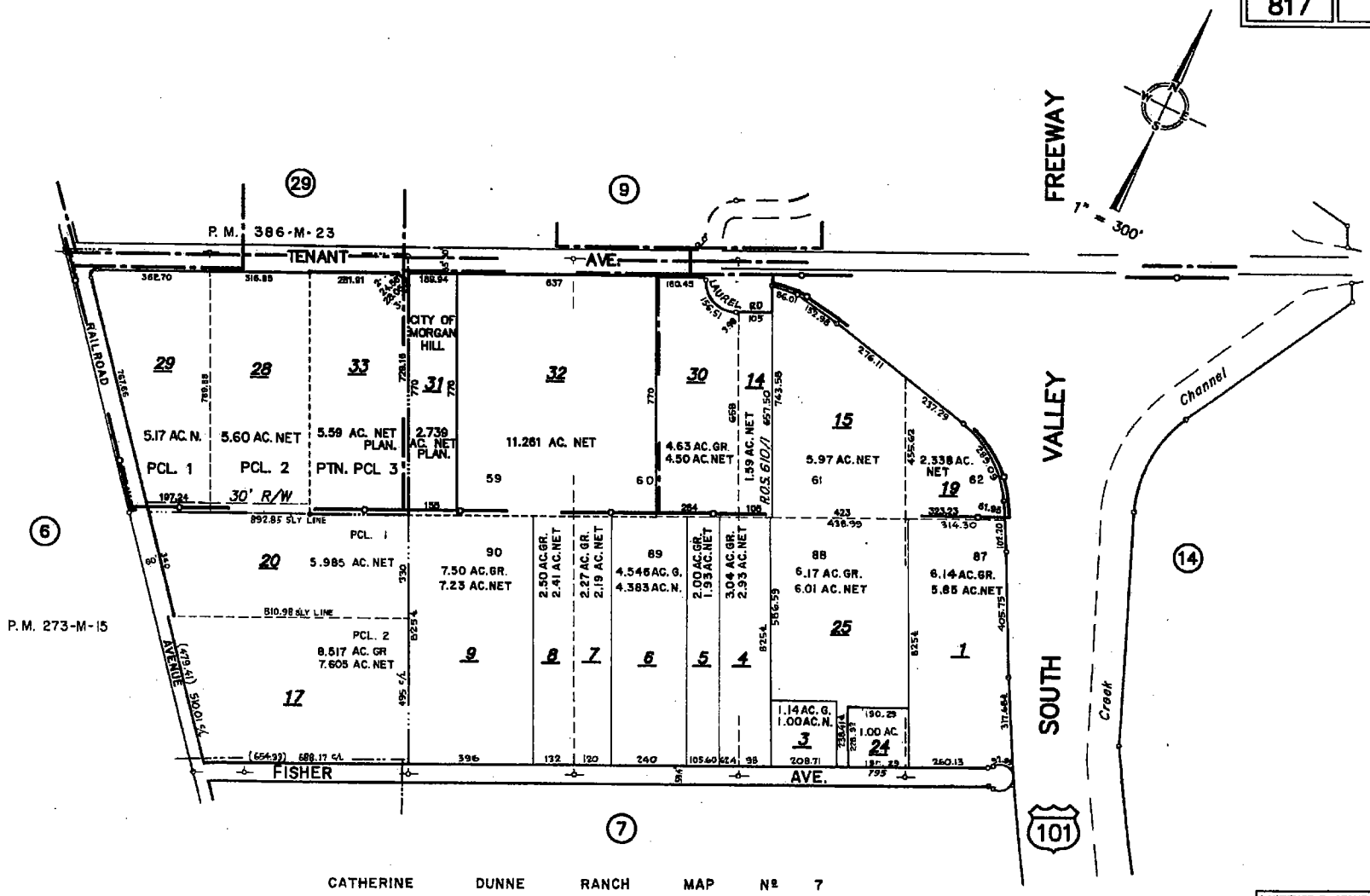

CATHERINE DUNNE RANCH MAP Nº 7

LAWRENCE E. STONE — ASSESSOR
Cadastral map for assessment purposes only.
Compiled under R. & T. Code, Sec. 327.
Effective Roll Year 2008–2009

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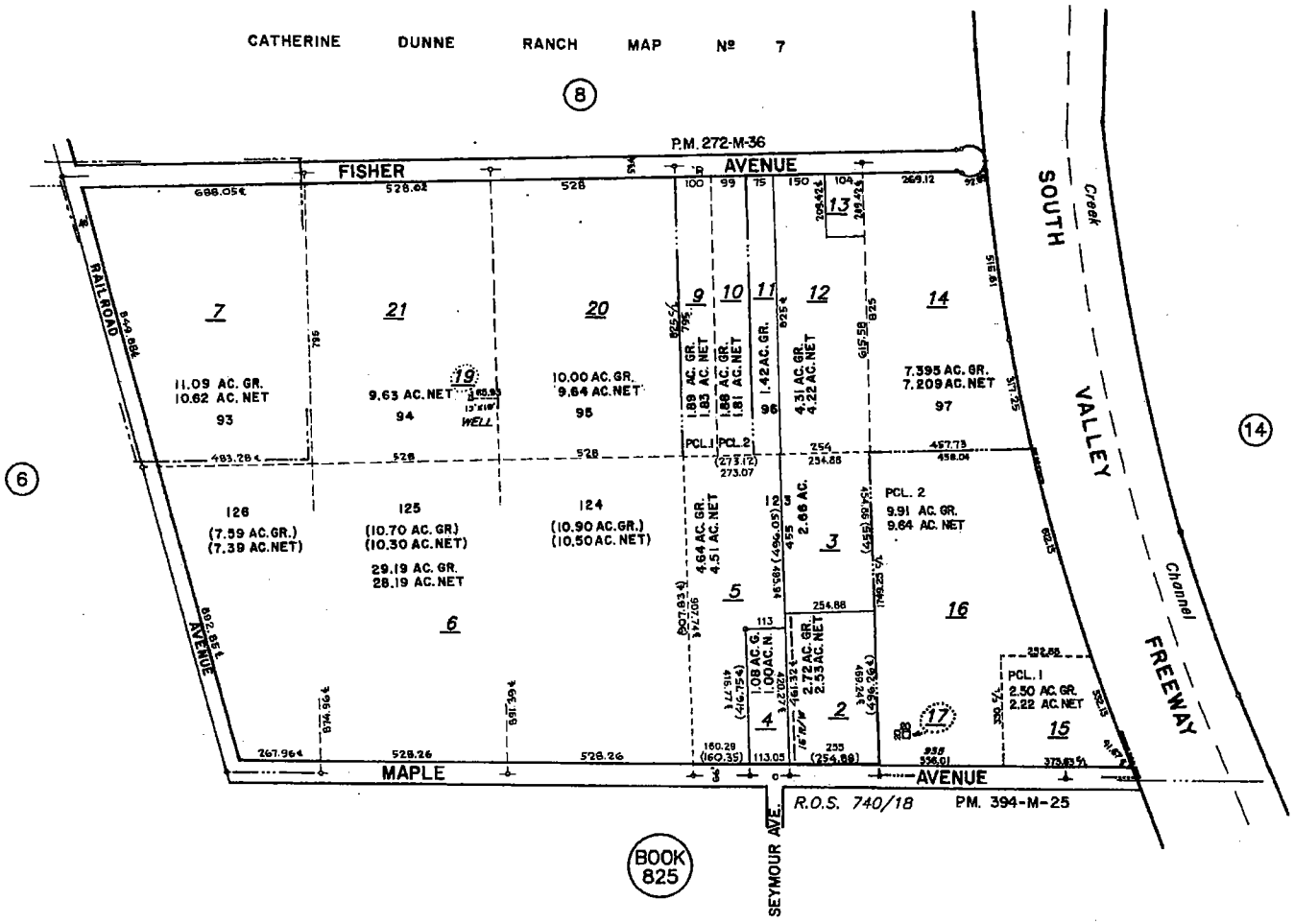
BOOK	PAGE
817	7

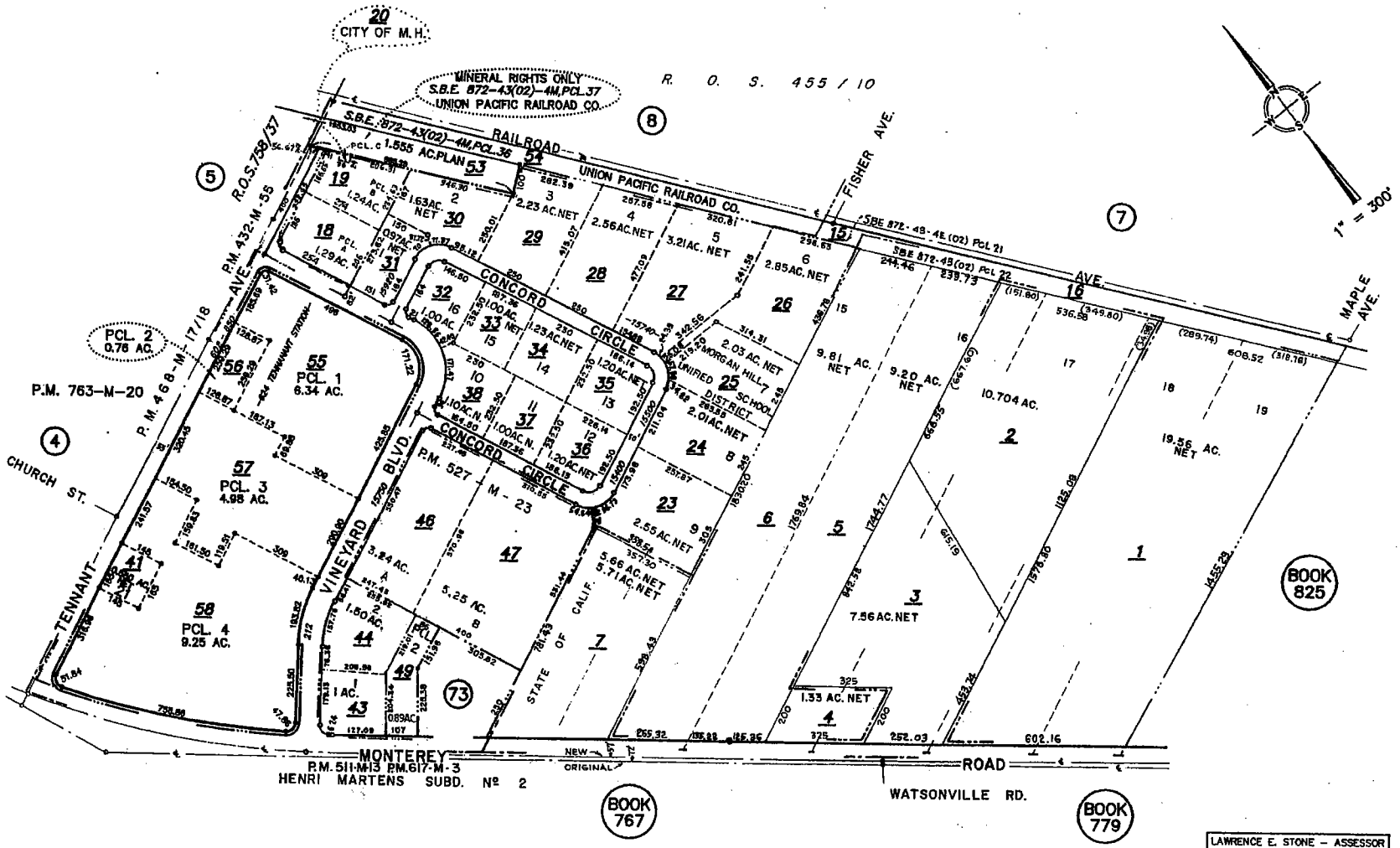


LAWRENCE E. STONE – ASSESSOR
Cadastral map for assessment purposes only.
Compiled under R. & T. Code, Sec. 327.
Effective Roll Year 2004-2005

Santa Clara, CA, 2006-2008 - 817-06-005, 15570 MONTEREY ST, MORGAN HILL CA 95037-5433, Sheet: 1 of 1

OFFICE OF COUNTY ASSESSOR — SANTA CLARA COUNTY, CALIFORNIA

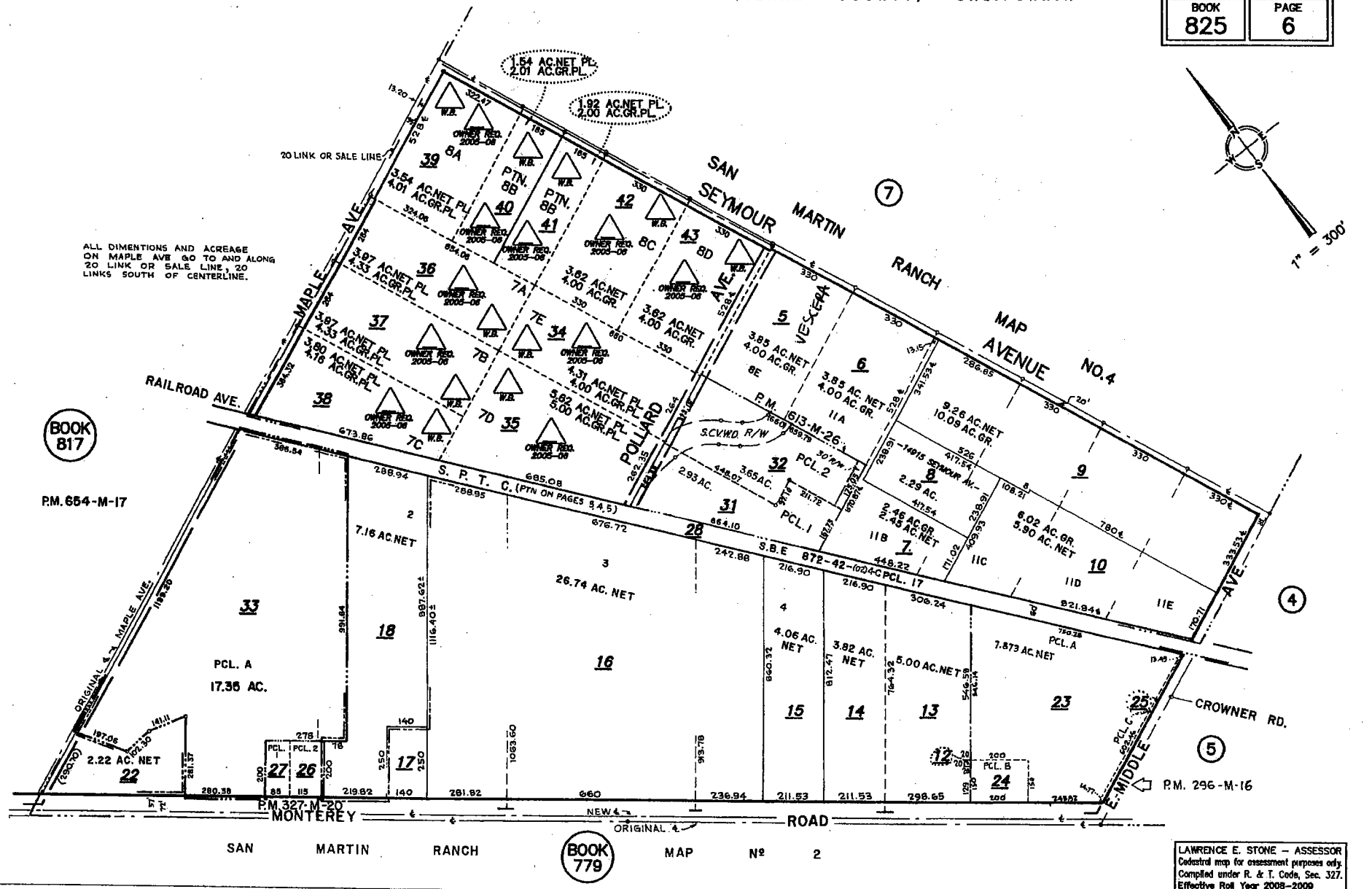
BOOK	PAGE
817	6



LAWRENCE E. STONE — ASSESSOR
Cadastral map for assessment purposes only.
Compiled under R. & T. Code, Sec. 327.
Effective Roll Year 2007-2008

OFFICE OF COUNTY ASSESSOR — SANTA CLARA COUNTY, CALIFORNIA

BOOK	PAGE
825	6



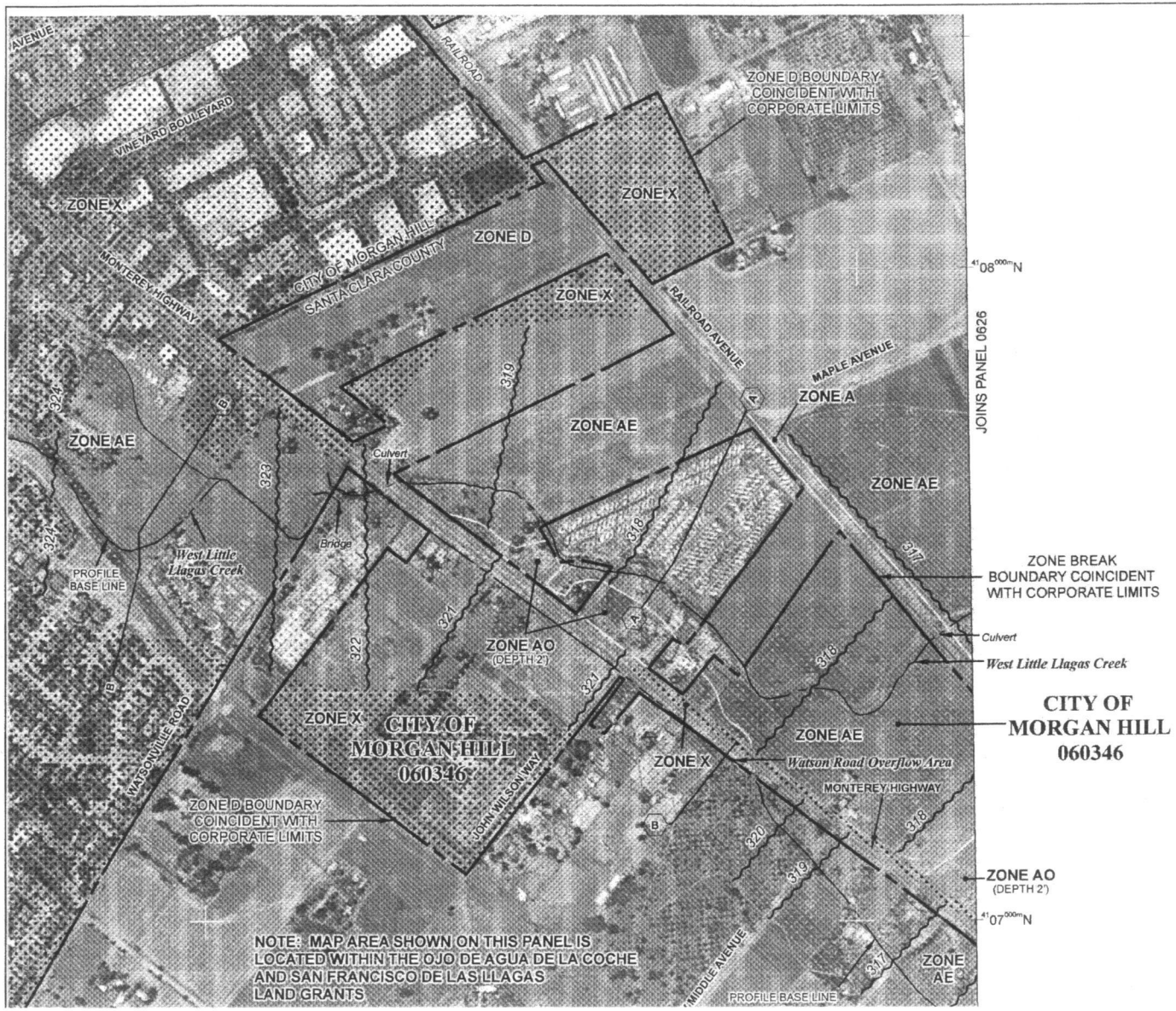
SAN MARTIN RANCH MAP Nº 2

LAWRENCE E. STONE – ASSESSOR
Cadastral map for assessment purposes only.
Compiled under R. & T. Code, Sec. 327.
Effective Roll Year 2008–2009

Figure 3

Flood Insurance Rate Maps

FIG. 3



MAP SCALE 1" = 500'

250 0 500 1000 FEET

0 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0607H

FIRM

FLOOD INSURANCE RATE MAP

SANTA CLARA COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 607 OF 830

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MORGAN HILL, CITY OF	060346	0607	H
SANTA CLARA COUNTY	060337	0607	H

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06085C0607H

EFFECTIVE DATE
MAY 18, 2009

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using FIRMette - Desktop version 2.3. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. Further information about National Flood Insurance Program flood hazard maps is available at http://msc.fema.gov/.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0626H

FIRM

FLOOD INSURANCE RATE MAP

SANTA CLARA COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 626 OF 830

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MORGAN HILL, CITY OF	060346	0626	H
SANTA CLARA COUNTY	060337	0626	H

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06085C0626H

EFFECTIVE DATE
MAY 18, 2009

Federal Emergency Management Agency

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FLOOD INSURANCE STUDY

SANTA CLARA COUNTY, CALIFORNIA
AND INCORPORATED AREAS
VOLUME 1 OF 4

COMMUNITY NAME	COMMUNITY NUMBER
CAMPBELL, CITY OF	060338
CUPERTINO, CITY OF	060339
GILROY, CITY OF	060340
LOS ALTOS, CITY OF	060341
LOS ALTOS HILLS, TOWN OF	060342
LOS GATOS, TOWN OF	060343
MILPITAS, CITY OF	060344
MONTE SERENO, CITY OF	060345
MORGAN HILL, CITY OF	060346
MOUNTAIN VIEW, CITY OF	060347
PALO ALTO, CITY OF	060348
SAN JOSE, CITY OF	060349
SANTA CLARA, CITY OF	060350
SARATOGA, CITY OF	060351
SUNNYVALE, CITY OF	060352
SANTA CLARA COUNTY (UNINCORPORATED AREAS)	060337

May 18, 2009

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
06085CV001A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Select Flood Insurance Rate Map panels for the community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways, cross-sections). Former flood hazard zone designations have been changed as follows:

Old Zone	New Zone
A1 through A30	AE
B	X
C	X

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Countywide FIS Effective Date: May 18, 2009

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Published Separately – Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
SANTA CLARA COUNTY, CALIFORNIA AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide Flood Insurance Study (FIS) investigates the existence and severity of flood hazards in, or revises and updates previous FISs/Flood Insurance Rate Maps (FIRMs) for the geographic area of Santa Clara County, California, including: the Cities of Campbell, Cupertino, Gilroy, Los Altos, Milpitas, Monte Sereno, Morgan Hill, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga, Sunnyvale, the Towns of Los Altos Hills and Los Gatos, and the unincorporated areas of Santa Clara County (hereinafter referred to collectively as Santa Clara County).

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This FIS has developed flood risk data for various areas of the county that will be used to establish actuarial flood insurance rates. This information will also be used by Santa Clara County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and will also be used by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some States or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this FIS are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This FIS was prepared to include all jurisdictions within Santa Clara County in a countywide FIS. The authority and acknowledgments prior to this countywide FIS, were compiled from the previously identified FIS reports for flood prone jurisdictions within Santa Clara County and are shown below:

Campbell, City of: The behind levee analyses for this study were performed by URS Corporation, for the Federal Emergency Management Agency (FEMA), under Contract No. EMF-2003-CO-0047. This work was completed in October and November 2007.

Cupertino, City of: The hydrologic and hydraulic analyses for this study were performed by George S. Nolte and Associates, for FEMA, under Contract No. H-4035. This work, which was completed in October 1978, covered all significant flooding sources affecting the City of Cupertino.

Gilroy, City of: The hydrologic and hydraulic analyses for this study were performed by George S. Nolte Associates, for FEMA, under Contract No. H-4035. This work, which was completed in January 1978, covered all significant flooding sources affecting the City of Gilroy.

This study was revised September 4, 1987, to add approximate Zone A flooding along Uvas Creek for an area located west of Thomas Road to the Railroad. The flood boundaries were delineated from information provided by the City of Gilroy based on the February 1986 flood.

A third study was revised on August 17, 1998, to incorporate the results of restudies of Lions, Llagas, Uvas, and North and South Morey Creeks, West Branch Llagas Creek (upstream and downstream of Day Road), West Branch Llagas Creek-East Split, Llagas Overbank (Old Miller Slough), and Miller Slough.

The restudies were conducted by Nolte and Associates, Inc., for FEMA, under Contract No. EMW-90-C-3108. This work also includes a restudy of the lower portion of Uvas Creek, from the Railroad to the downstream limit of the study conducted by the SCVWD, and a portion of West Branch Llagas Creek, from the NRCS, formerly the SCS, PL566 interceptor project at Day Road to approximately 2,500 feet upstream of Coolidge Avenue. The area revised within the City of Gilroy includes the area from Golden Gate Avenue to approximately 600 feet upstream along West Branch Llagas Creek and from the NRCS, formerly the SCS, PL566 to approximately 650 feet upstream of Golden Gate Avenue along West Branch Llagas Creek-East Split.

The behind levee analyses for this study were performed by Nolte Engineering Company, for FEMA. This work was completed in June 2007.

The behind levee analyses for this study were also performed by URS Corporation, for the Federal Emergency Management Agency (FEMA), under Contract No. EMF-

2003-CO-0047. This work was completed in October and November 2007.

Los Altos, City of: The hydrologic and hydraulic analyses for this study were performed by George S. Nolte and Associates, for FEMA, under Contract No. H-4035. This work, which was completed in December 1977, covered all significant flooding sources affecting the City of Los Altos.

Los Altos Hills, Town of: The hydrologic and hydraulic analyses for this study were performed by the United States Geological Survey (USGS), for FEMA, under Inter-Agency Agreement No. IAA-H-17-75, Project Order No. 12. This work, which was completed in November 1976, covered all significant flooding sources affecting the Town of Los Altos Hills.

Los Gatos, City of: The hydrologic and hydraulic analyses for this study were performed by George S. Nolte and Associates, for FEMA, under Contract No. H-4035. This work, which was completed in December 1977, covered all significant flooding sources affecting the Town of Los Gatos.

Milpitas, City of: The hydrologic and hydraulic analyses for this study were performed by George S. Nolte and Associates, for FEMA, under Contract No. H-4035. This study was completed in November 1978.

Revisions to riverine flooding adjacent to Coyote Creek in the vicinity of Nimitz Freeway (State Highway 17) between Montague Expressway and Dixon Road were based on information obtained from a report dated October 11, 1983, prepared by the Santa Clara Valley Water District (SCVWD) (Reference 1).

This study was revised on April 15, 1988, to incorporate detailed flooding information from a report entitled "Upper Penitencia Creek Floodplain Management Study, Santa Clara County, California," dated February 1985. This report was prepared by the NRCS, formerly the SCS, Davis, California. Detailed flooding information from a report entitled "San Francisco Bay Tidal Stage vs. Frequency Study," dated October 1994, and prepared by the San Francisco District of the USACE, was also incorporated in this revision. In addition, flooding from Line A-Zone 6 was updated to agree with contiguous areas on the Flood Insurance Rate Map for the City of Fremont, California.

A third study was revised on June 8, 1998, to show modifications to the flooding along an approximately 1.5-mile reach of Berryessa Creek from the confluence with Lower Penitencia Creek to the confluence with Arroyo De Los Coches, a 1.3-mile reach of Arroyo De Los Coches from the confluence with Berryessa Creek to approximately 200 feet upstream of Piedmont Road, and a 1.4-mile reach of Calera Creek from the confluence with Berryessa Creek to approximately 100 feet upstream of Old Piedmont Road. The study was performed using detailed methods. The hydraulic analyses were conducted by Nolte and Associates Consulting Engineers, the study contractor, for FEMA, under Contract No. EMW-90-C-3108.

The behind levee analyses for this study were performed by Nolte Engineering Company, for FEMA. This work was completed in June 2007.

The behind levee analyses for this study were also performed by URS Corporation, for the Federal Emergency Management Agency (FEMA), under Contract No. EMF-2003-CO-0047. This work was completed in October and November 2007.

Monte Sereno, City of: No FIS available.

Morgan Hill, City of: The hydrologic and hydraulic analyses for this study were performed by George S. Nolte and Associates, for FEMA, under Contract No. H-4035. This work, which was completed in May 1978, covered all significant flooding sources affecting the City of Morgan Hill.

This study was revised on December 22, 1998, to incorporate detailed flood-hazard information along West Little Llagas Creek, from approximately .89 mile downstream of Monterey Highway to approximately .23 mile upstream of Llagas Road; Madrone Channel, from approximately 420 feet downstream of East Dunne Avenue to approximately 1.02 miles upstream of East Main Avenue; Tennant Creek, from approximately .44 mile downstream of Fountain Oaks Drive to approximately .27 mile upstream of Fountain Oaks Drive; and the Watsonville Road Overflow Area, from its convergence with Llagas Creek to its divergence from West Little Llagas Creek. The hydrologic and hydraulic analyses for this revision were performed for FEMA by Nolte and Associates, Inc., under Contract No. EMW-90-C3108.

Uvas Creek

- Levee improvements along the left bank of Uvas Creek from approximately 2,000 feet downstream of Thomas Road to approximately 4,500 feet upstream of Miller Avenue.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this FIS. Flood events of a magnitude, which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood, which equals or exceeds the 1-percent annual chance flood in any 50-year period, is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this FIS. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

Flood hydrographs and peak flow rates for the 10-percent, 2-percent, 1-percent, and 0.2-percent annual chance floods for streams studied by detailed procedures were based on rainfall-runoff computations and regional regression equations developed by the SCVWD (Reference 10).

The regional regression equations are based on the frequency statistics of the records of 20 stream gages in Santa Clara County and the surrounding area. The parameters used in the regional regression equation are the drainage area of the basin mean annual precipitation, characteristic drainage lengths of the basin, and slope of the main drainage course of the basin. With these parameters, the statistics of the peak flow rate and 24-hour flow volume can be determined through use of the regression equations.

Drainage areas were broken down into smaller subbasins. The HEC-1 computer program (Reference 11) was used with the SCVWD's 24-hour storm pattern and storm depth to produce subbasin hydrographs. For rural areas, the hydrographs were balanced using HEC-1 to reflect both the peak flow rate and 24-hour volume

as predicted by the regional regression equations. For urban areas, the hydrographs were based on runoff coefficients from the SCVWD Urban Hydrology Methodology (Reference 12). Actual storm drain capacities were included for routing these hydrographs.

The effects of channel and valley (overbank) storage on floodflow rates were determined by developing storage-discharge relationships for reaches of each stream. The storage-discharge relationships were developed by computing a series of water-surface profiles for various flow rates and determining the storage in the reach for each outflow rate. Flood hydrographs from the smaller subbasins were combined and routed downstream using the Modified Puls routing procedure. For reaches outside the limits of detailed study, storage-discharge relationships were generally obtained from normal depth computations, most of which were developed previously by the SCVWD.

Flood hydrographs for streams studied by approximate methods were calculated only when required to complete the detailed study analysis. Relative flood magnitudes for other streams studied by approximate methods were based on historic information, existing hydrologic analyses, available watershed information, and field observations.

City of Campbell

There is no hydrologic data available at this time.

City of Cupertino

Stevens Creek-Reservoir, with a capacity of 3,800 acre-feet, was built in 1936. The reservoir's principal purpose is water supply, and any flood-control benefits are incidental. Reservoir storage for each of the four recurrence intervals was determined with a coincidental frequency analysis of storage level and inflow flood hydrograph.

Channel flow rates generally increase downstream with increase in drainage area. The flow rate for Calabazas Creek is reduced by capacity restrictions of the channel sections and bridge sizes. Excess flows were routed overland to a downstream subbasin.

Two stream gages near Cupertino were considered to possess an adequate record to be included in the stations used to develop the regional regression equations (Reference 22). Permanente Creek (1955-1975) and Calabazas Creek (1946-1975) were used.

The results of the gage analysis on Calabazas Creek were compared to the predictions of the regional regression equations and flow values from the USACE. The three sets of predicted flow rates were almost identical for the 1-percent annual chance flood recurrence interval at this location. A log-Pearson Type III analysis (Reference 19) of the Permanente Creek gage records compared favorably with the predictions from the regional regression equations.

The early storm of October 1962 caused some minor flooding in Milpitas. As in previous years, Milpitas experienced less damage than the majority of neighboring communities.

The February 6, 1963, issue of the Milpitas Post described flooding in the Alviso area as a result of a storm in the last week of January 1963. While other areas of the county suffered from flood conditions of varying severity during this storm, Milpitas experienced only nuisance variety flooding, such as standing water and puddles at intersections. No damage was reported in Milpitas.

In contrast to previous years, Milpitas had more serious flood conditions in 1973 than many other areas in the county. The downtown section of town was affected, as were residential areas.

In early 1983, a series of storms caused extensive flooding in Milpitas, as well as in Santa Clara County as a whole. The first of these storms, which occurred in late January, caused street flooding along most of the drainageways in Milpitas. Flooding along_ Berryessa Creek between Yosemite Drive and Calaveras Boulevard caused water and sediment damage to businesses in this area (Reference 1).

The second in this series of storms, which occurred in early February, only caused flooding of streets and yards. No flood damage was reported (Reference 1).

The third storm occurred in late February and early March. Again, most flooding was confined to streets, parking areas, and yards; however, damage in many areas was averted only through emergency sand-bagging (Reference 1).

City of Monte Sereno

There are no known principal flood problems within the City of Monte Sereno.

City of Morgan Hill

Information on flooding of the streams under investigation covers the years from 1914 through 1973. During this period, the Morgan Hill area experienced 13 floods of varying severity.

The severity of the floods, and the relative development of the area, vary from year to year. Accordingly, the damage resulting from these floods reflects the prevailing conditions. Years marked by more serious flood conditions in Morgan Hill include 1937, 1945, 1958, and 1963. The 1955 flood, which produced the flood of record in neighboring Gilroy (an inundation which caused the most extensive damage in Santa Clara County of any recorded flood) was not severe in Morgan Hill. The frequencies of the following flood events could not be estimated due to a lack of long-term stream gage records in the area.

The winter storms of 1931-1932 were well received in the Morgan Hill area, because local agriculture had suffered a series of dry years prior to these storms. In the central area of the city, however, flooding did occur. Morgan Hill received 5.50 inches of rain during a 24-hour period on December 10-11, 1937. This extreme precipitation flooded both Morgan Hill and Gilroy.

The flood conditions resulting from this storm were the most severe experienced in Morgan Hill for floods recorded through 1937.

The storm of early April 1941 came at the end of a very wet year. By April 10, 1941, 34.70 inches of rain had fallen in Morgan Hill-approximately 9 inches more than at the same time in the previous year. During the heaviest precipitation, the central section of the city experienced mild flooding.

Nearly 7 inches of rain fell in Morgan Hill on the first two days of February 1945.

Early precipitation in the winter of 1950 gave Morgan Hill a total of 8.59 inches of precipitation by November 21. Of this amount, over 4 inches fell during a 3-day period (November 17-19). This storm produced localized flooding, but negligible damage in Morgan Hill.

The storm, which began on January 10, 1952, produced 5.78 inches of rain in the Morgan Hill area during a period of one week. This heavy precipitation, occurring prior to construction of Chesbro Dam, caused considerable flooding in orchard lands along Llagas Creek; damage, however, was minimal.

Although suffering some flood conditions, Morgan Hill fared much better than many neighboring communities during the Christmas storm of 1955. In a 4-day period, ending December 25, Morgan Hill received 8.06 inches of rain. During the same period, Gilroy had 12.9 inches of precipitation. One beneficial influence in the Morgan Hill area was the installation of the Chesbro Dam, which absorbed some of the runoff. Unlike in 1952 there now existed a manmade check on the Llagas watershed.

The storms in March and April 1958 came at the end of a wet winter. Approximately 8 inches of rain fell in Morgan Hill during a 5-day period ending on April 3.

On October 13 and 14, 1962, Morgan Hill received 4.13 inches of rain. Although other parts of the county suffered flood conditions as a result of this storm, no flooding was reported in Morgan Hill.

Extreme precipitation, accompanied by heavy winds, hit the Morgan Hill area on January 31, 1963. Previous dry weather moderated the impact of the storm. Many trees and power lines came down during the storm, victims of the high winds. However, flooding was the principal problem.

Another January storm hit Morgan Hill in 1967. Although less severe than the deluge in 1963, the storm did produce localized flooding. The city's storm sewer system was able to cope with the runoff for the most part, and flooding occurred only in isolated areas.

The winter of 1972-1973 produced high levels of precipitation in Morgan Hill. For the most part, the rainfall was steady, and it did not produce storms reaching the intensity of previous years. However, on February 6, 1973, 1.76 inches of rain fell on Morgan Hill, resulting in some localized flooding.

City of Mountain View

The principal watercourses in Mountain View are Adobe, Permanente, and Stevens Creeks. Mountain View has experienced flood conditions on several occasions. However, because of its topography and precipitations extremes, Mountain View has not been as severely inundated as several of its neighboring communities in Santa Clara County. The areas in Mountain View nearest San Francisco Bay are characteristically the most flood prone.

The Bayshore Area depends on an extensive diking system for its protection from salt-water flooding. The construction of the Shoreline Regional Park with its attendant filling operation also aids in the prevention of tidewater flooding (Reference 12).

The severity of the floods, and the relative development of the area, varies from year to year. Accordingly, the damage resulting from these floods reflects the prevailing conditions. Both 1955 and 1958 were serious flood years in the county, and Los Altos experienced significant damage, although faring better than many neighboring areas. Other years, marked by more serious flood conditions in the Los Altos area, were 1950 and 1952.

Some of the earliest reports on flooding in the Mountain View-Los Altos area appeared on Saturday, January 14th, 1911 when 4.60 inches, the greatest recorded in the history of Mountain View, was dropped on the city. In March 1911, various areas in Santa Clara County again received heavy precipitation. Although Mountain View had 2.5 inches of rain during a 2-day period (March 6 and 7), the city was relatively undisturbed.

Although various areas of Santa Clara County suffered from flood conditions in 1931, the Mountain View area was not appreciably affected.

Heavy rains (2.35 inches during 24 hours) and the accumulation of debris contributed to significant flooding in the Mountain View area during November 1950. Agricultural areas were affected, however, the bulk of the damage was in the commercial area.

In January 1952, stormwaters caused significant damage in the Mountain View area. Flooding occurred in the San Ramon-San Luis Avenue section of Rex

Arroyo De Los Coches

Topography and land-features mapping upstream of old Piedmont Road was supplemented by proposed improvement plans for Los Coches prepared by the SCVWD in 1973 (not built).

Berryessa Creek

Upstream of this study's limits, at Montague Expressway, the flow rate in Berryessa Creek is reduced to 800 cfs by a capacity restriction. Additionally, spills totaling approximately 2,000 cfs occur upstream of Arroyo De Los Coches. The 1-percent annual chance peak discharges for reaches downstream of the confluence with Arroyo De Los Coches reflect this 2,000 cfs loss, which occurs upstream of the confluence.

Calera Creek

Topography upstream of Interstate Highway 680/North Park Victoria Drive was supplemented by landscape plans for Higuera Adobe Park supplied by the City of Milpitas.

City of Monte Sereno

There is no hydrologic data available at this time.

City of Morgan Hill

Chesbro Reservoir, with a capacity of 8,090 acre-feet, is the only regulation on Llagas Creek. The principal function of the reservoir is water supply. The dam was not constructed for flood-control purposes. However, Chesbro Reservoir does provide an incidental flood-control benefit.

Coyote and Anderson Reservoirs regulate the Coyote Creek outflow. Coyote Reservoir has a capacity equal to 23,700 acre-feet, and Anderson Reservoir has capacity equal to 91,300 acre-feet. Coyote Reservoir is intended to act as a water-supply source for storage in Anderson Reservoir. The principal function of Anderson Reservoir is water supply for ground-water recharge and irrigation. However, both reservoirs provide an incidental flood-control benefit.

Modified Puls routings were performed for each of the four flood recurrence intervals. An appropriate starting reservoir level for each flood recurrence interval was determined by a coincidental frequency analysis, which was performed by the SCVWD.

Four stream gages in the area were considered to possess an adequate record (Reference 19): Fisher Creek (1963-1975), Uvas Creek at Morgan Hill (1931-1957), Uvas Creek above the Uvas Reservoir (1962-1975), and Coyote Creek at

Madrone (1925-1935). These records were analyzed by the log-Pearson Type III method of analysis (Reference 23) and were included in the stations used to develop the regional regression equations.

The attenuation caused by Chesbro Reservoir is the reason the peak flow rates for Llagas Creek decrease with an increase in drainage area below the dam. Flow rates on West Little Llagas Creek at Monterey Highway and Llagas Road decrease due to capacity restrictions at existing culverts. The spill at Monterey Highway was routed with normal depth computations to Llagas Creek. The spill at Llagas Road weired over Llagas Road into the overbank and out of the West Little Llagas Creek watershed into the Fisher Creek watershed.

The 1-percent annual chance peak discharges used for this restudy were determined using Urban Hydrology Methodology (Reference 18) and regional regression equations developed by the SCVWD. The discharge values given in Table 6, Summary of Discharges, reflect existing conditions in the watershed and take into account attenuation of overbank storage.

City of Mountain View

Channel flow rates generally increase downstream with increase in drainage area. The flow rates for Stevens, Hale, Permanente, and Adobe Creeks are reduced by capacity restrictions of the channel sections and bridge sizes. Excess flows were pounded then routed overland and downslope to an adjacent subbasin.

The Permanente Creek stream gage near Mountain View (1955-1975) was considered to possess an adequate record to be included in the stations used to develop the regional regression equations. A log Pearson Type III analysis of the gage records matched the predictions from the regional regression equations (Reference 30). Flow values for Adobe Creek matched the routed flow values from the SCVWD regional equations from an ongoing study by the USGS (Reference 31).

Analyses were carried out to establish the peak elevation-frequency relationships for each flooding source studied in detail.

The 1984 USACE report (Reference 3) summarizes the results of a tidal stage-frequency restudy of the San Francisco Bay. The tidal data, as well as other tidal parameters presented in the report, reflect only stillwater conditions. It does not consider the effects of wave height or wave run-up on the 1-percent annual chance water-surface elevation. Based on this report, the 1-percent annual chance water-surface elevation for the San Francisco Bay in the City of Mountain View is 11 feet NAVD.

Elevations for floods of the selected recurrence intervals on the San Francisco Bay are shown in Table 7, "Summary of Stillwater Elevations."

Table 6 – Summary of Discharges, continued

Flooding Source and Location	Drainage Area (sq mi)	Peak Discharges (cfs) 10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
WEST BRANCH LLAGAS CREEK – UPPER SPLIT					
Upstream of Highland Avenue	[1]	[1]	[1]	200	[1]
WEST LITTLE LLAGAS CREEK					
1,000 feet upstream of Wright Avenue	1.50	[3]	[3]	188[2]	[3]
At Fourth Street	3.00	[3]	[3]	900[2]	[3]
At U.S. Highway 101	8.00	[3]	[3]	1,080[2]	[3]
Downstream of Edmundson Avenue	6.00	[3]	[3]	1,269	[3]
Downstream of Monterey Highway	5.60	[3]	[3]	813[2]	[3]
Downstream of Railroad	6.00	[3]	[3]	460[2]	[3]
Upstream of Llagas Avenue	1.00	[3]	[3]	1,702[2]	[3]
Upstream of Monterey Highway	5.60	[3]	[3]	1,936	[3]
Upstream of Seymour Avenue	6.20	[3]	[3]	1,770[2]	[3]
WILDCAT CREEK					
Above Portos Drive	2.00	480	810	960	1,230
At Saratoga and Los Gatos Roads	1.10	310	500	570	740
Below Douglas Lane	1.60	430	710	840	1,070

[1] *Flooding due to spill – drainage area not applicable*

[2] *Data not computed*

[3] *Decrease in flow rate based on capacity restrictions*

Elevations for floods of the selected recurrence intervals on the San Francisco Bay are shown in Table 7, "Summary of Stillwater Elevations."

Table 6 – Summary of Discharges, continued

Flooding Source and Location	Drainage Area (sq mi)	Peak Discharges (cfs) 10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance	
WEST BRANCH LLAGAS CREEK – UPPER SPLIT						
Upstream of Highland Avenue	[1]	[1]	[1]	200	[1]	
WEST LITTLE LLAGAS CREEK						
1,000 feet upstream of Wright Avenue	1.50	[3]	[3]	188[2]	[3]	498
At Fourth Street	3.00	[3]	[3]	900[2]	[3]	374
At U.S. Highway 101	8.00	[3]	[3]	1,080[2]	[3]	
Downstream of Edmundson Avenue	6.00	[3]	[3]	1,269	[3]	328
Downstream of Monterey Highway	5.60	[3]	[3]	813[2]	[3]	278
Downstream of Railroad	6.00	[3]	[3]	460[2]	[3]	256
Upstream of Llagas Avenue (NORTH MU)	1.00	[3]	[3]	1,702[2]	[3]	214
Upstream of Monterey Highway	5.60	[3]	[3]	1,936	[3]	290
Upstream of Seymour Avenue	6.20	[3]	[3]	1,770[2]	[3]	250
WILDCAT CREEK						
Above Portos Drive	2.00	480	810	960	1,230	
At Saratoga and Los Gatos Roads	1.10	310	500	570	740	
Below Douglas Lane	1.60	430	710	840	1,070	

[1] *Flooding due to spill – drainage area not applicable*

[2] *Data not computed*

[3] *Decrease in flow rate based on capacity restrictions*

Elevations for floods of the selected recurrence intervals on the San Francisco Bay are shown in Table 7, "Summary of Stillwater Elevations."

Figure 4

Soils Maps

United States Department of Agriculture

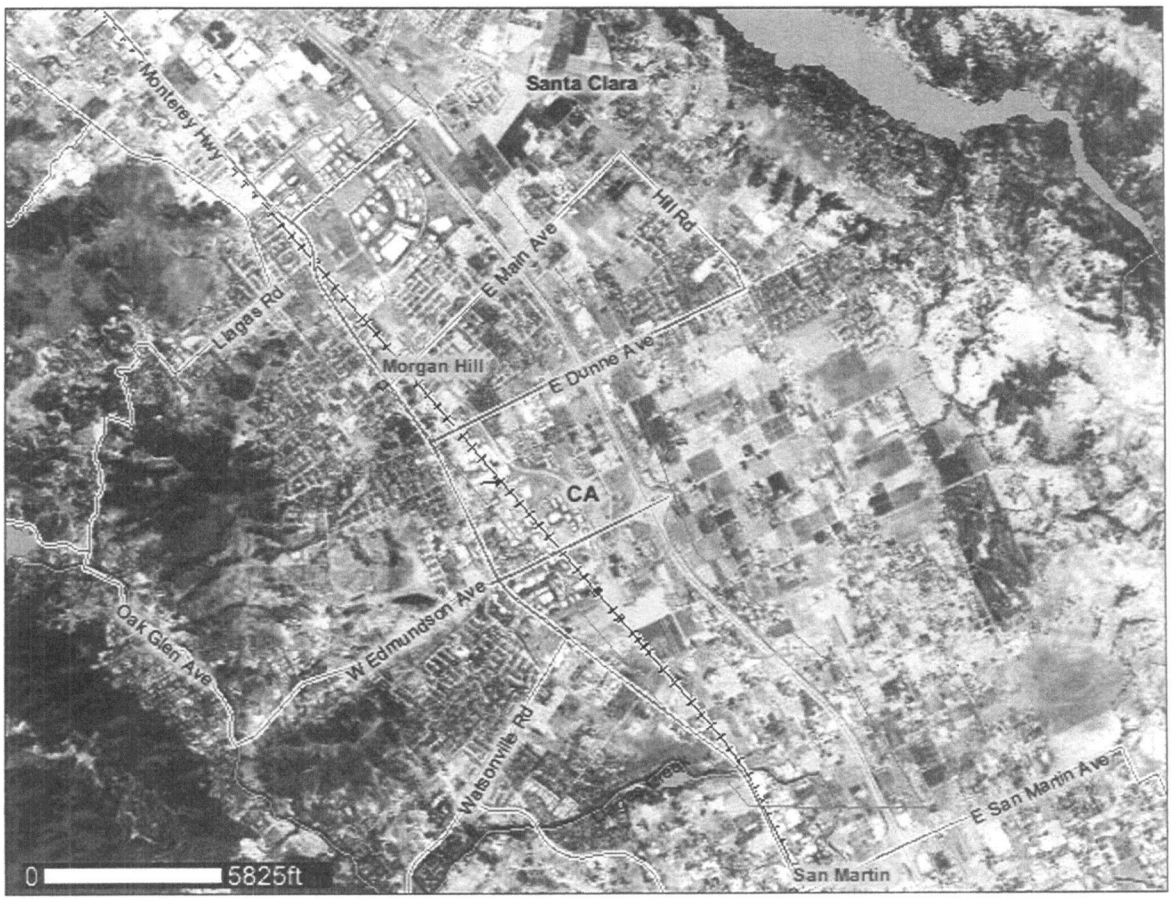
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Eastern Santa Clara Area, California

Butterfield Boulevard South Extension



December 22, 2009

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Butterfield Boulevard South Extension)

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features

- Gully
- Short Steep Slope
- Other

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:50,400 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Eastern Santa Clara Area, California
Survey Area Data: Version 5, Dec 17, 2007

Date(s) aerial images were photographed: 6/13/2005; 6/30/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Butterfield Boulevard South Extension)

Eastern Santa Clara Area, California (CA646)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
ArA	Arbuckle gravelly loam, 0 to 2 percent slopes	1,746.7	51.4%
CoB	Cortina very gravelly loam, 0 to 5 percent slopes	51.5	1.5%
CrA	Cropley clay, 0 to 2 percent slopes	35.6	1.0%
CrC	Cropley clay, 2 to 9 percent slopes	7.0	0.2%
GaA	Garretson loam, gravel substratum, 0 to 2 percent slopes	33.2	1.0%
GoE2	Gilroy clay loam, 15 to 30 percent slopes, eroded	1.9	0.1%
GoF	Gilroy clay loam, 30 to 50 percent slopes	1.5	0.0%
KeA	Keefers clay loam, 0 to 2 percent slopes	5.4	0.2%
KeC2	Keefers clay loam, 2 to 9 percent slopes, eroded	0.5	0.0%
LoF	Los Osos clay loam, 30 to 50 percent slopes	1.6	0.0%
McB	Maxwell clay, 0 to 5 percent slopes	21.4	0.6%
PoA	Pleasanton loam, 0 to 2 percent slopes	720.3	21.2%
PpA	Pleasanton gravelly loam, 0 to 2 percent slopes	41.9	1.2%
PpC	Pleasanton gravelly loam, 2 to 9 percent slopes	24.2	0.7%
RaA	Rincon clay loam, 0 to 2 percent slopes	7.3	0.2%
RaC2	Rincon clay loam, 2 to 9 percent slopes, eroded	0.2	0.0%
Rg	Riverwash	24.5	0.7%
SdA	San Ysidro loam, 0 to 2 percent slopes	655.2	19.3%
ZaA	Zamora loam, 0 to 2 percent slopes	14.0	0.4%
ZbA	Zamora clay loam, 0 to 2 percent slopes	0.0	0.0%
ZbC	Zamora clay loam, 2 to 9 percent slopes	8.0	0.2%
Totals for Area of Interest		**3,400.8**	**100.0%**

Map Unit Descriptions (Butterfield Boulevard South Extension)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic

class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical

or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group (Butterfield Boulevard South Extension)

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report
Map—Hydrologic Soil Group (Butterfield Boulevard South Extension)

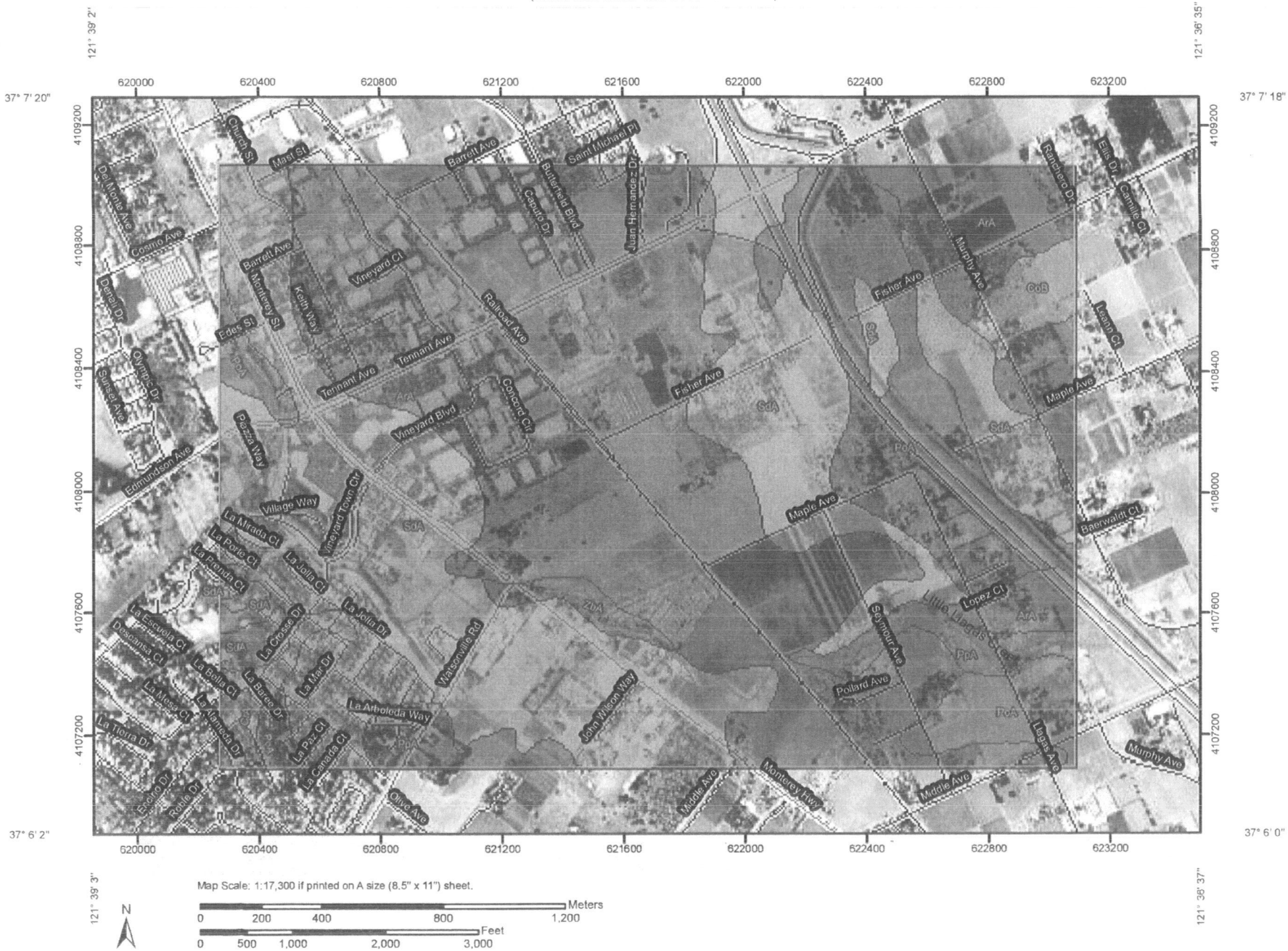
Map Scale: 1:50,400 if printed on A size (8.5" x 11") sheet.

N

Meters
0 450 900 1,800 2,700

Feet
0 1,500 3,000 6,000 9,000

Hydrologic Soil Group—Eastern Santa Clara Area, California
(Butterfield Boulevard South Extension)



Map Scale: 1:17,300 if printed on A size (8.5" x 11") sheet.

N

Meters: 0 200 400 800 1,200

Feet: 0 500 1,000 2,000 3,000

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Political Features

Cities

Water Features

Oceans

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

MAP INFORMATION

Map Scale: 1:50,400 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Eastern Santa Clara Area, California
Survey Area Data: Version 5, Dec 17, 2007

Date(s) aerial images were photographed: 6/13/2005; 6/30/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group (Butterfield Boulevard South Extension)

Hydrologic Soil Group— Summary by Map Unit — Eastern Santa Clara Area, California				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
ArA	Arbuckle gravelly loam, 0 to 2 percent slopes	B	1,746.7	51.4%
CoB	Cortina very gravelly loam, 0 to 5 percent slopes	A	51.5	1.5%
CrA	Cropley clay, 0 to 2 percent slopes	D	35.6	1.0%
CrC	Cropley clay, 2 to 9 percent slopes	D	7.0	0.2%
GaA	Garretson loam, gravel substratum, 0 to 2 percent slopes	B	33.2	1.0%
GoE2	Gilroy clay loam, 15 to 30 percent slopes, eroded	C	1.9	0.1%
GoF	Gilroy clay loam, 30 to 50 percent slopes	C	1.5	0.0%
KeA	Keefers clay loam, 0 to 2 percent slopes	C	5.4	0.2%
KeC2	Keefers clay loam, 2 to 9 percent slopes, eroded	C	0.5	0.0%
LoF	Los Osos clay loam, 30 to 50 percent slopes	C	1.6	0.0%
McB	Maxwell clay, 0 to 5 percent slopes	D	21.4	0.6%
PoA	Pleasanton loam, 0 to 2 percent slopes	B	720.3	21.2%
PpA	Pleasanton gravelly loam, 0 to 2 percent slopes	B	41.9	1.2%
PpC	Pleasanton gravelly loam, 2 to 9 percent slopes	B	24.2	0.7%
RaA	Rincon clay loam, 0 to 2 percent slopes	D	7.3	0.2%
RaC2	Rincon clay loam, 2 to 9 percent slopes, eroded	D	0.2	0.0%
Rg	Riverwash	D	24.5	0.7%
SdA	San Ysidro loam, 0 to 2 percent slopes	D	655.2	19.3%
ZaA	Zamora loam, 0 to 2 percent slopes	B	14.0	0.4%
ZbA	Zamora clay loam, 0 to 2 percent slopes	B	0.0	0.0%
ZbC	Zamora clay loam, 2 to 9 percent slopes	B	8.0	0.2%
Totals for Area of Interest			**3,400.8**	**100.0%**

Rating Options—Hydrologic Soil Group (Butterfield Boulevard South Extension)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

References

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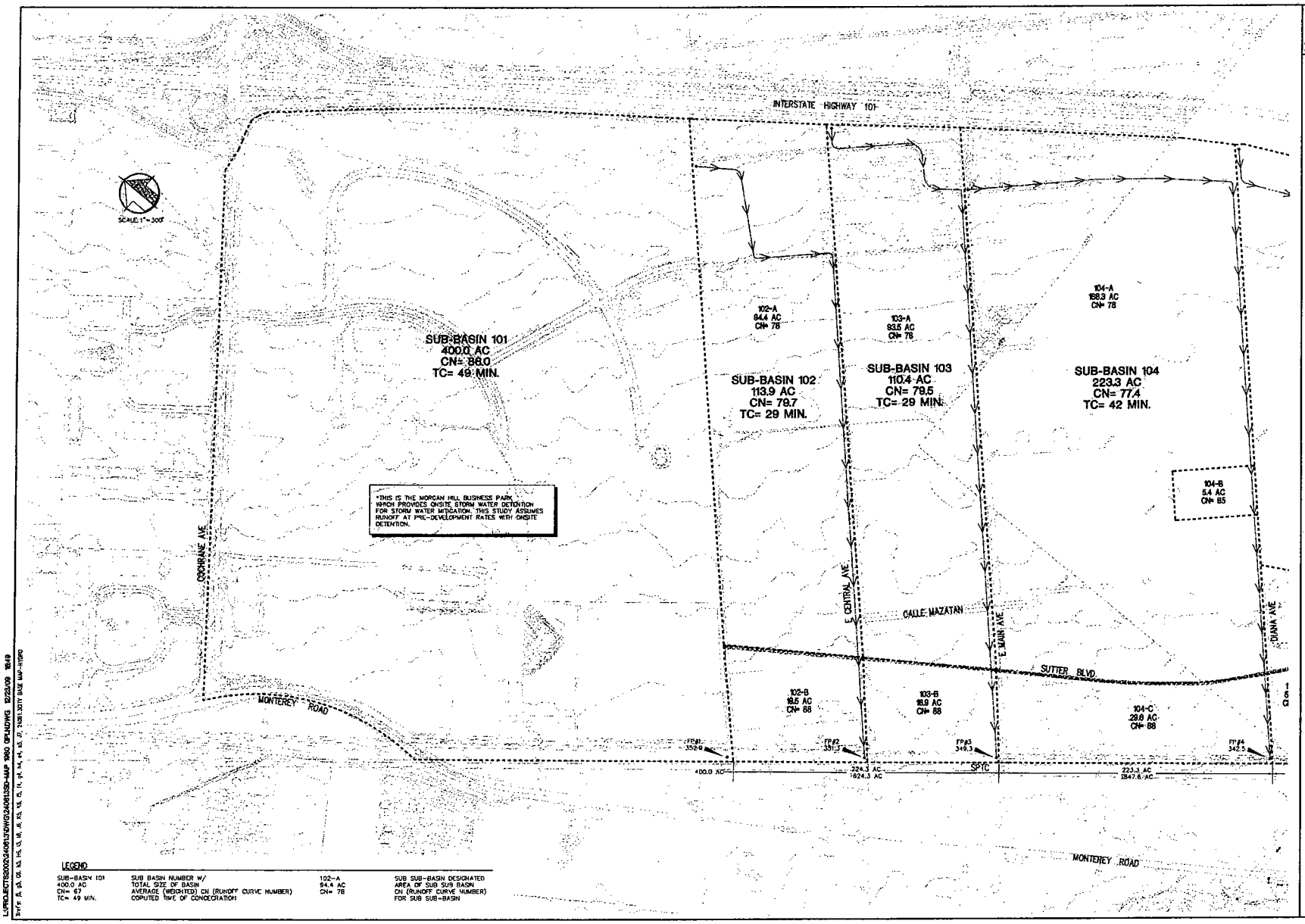
Figure 5

Overall Drainage Maps
1980 General Plan



LEGEND

SUB-BASIN 101 400.0 AC CN= 67 TC= 49 MIN.	SUB BASIN NUMBER W/ TOTAL SIZE OF BASIN AVERAGE (WEIGHTED) CN (RUNOFF CURVE NUMBER) COPUTED TIME OF CONCENTRATION	102-A 94.4 AC CN= 78	SUB SUB-BASIN DESIGNATED AREA OF SUB SUB BASIN CN (RUNOFF CURVE NUMBER) FOR SUB SUB-BASIN

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	SHEET 1"=300'
	DRAWN BY MK
	CHECKED BY KS
APPROVED BY	
SUPERVISED BY	

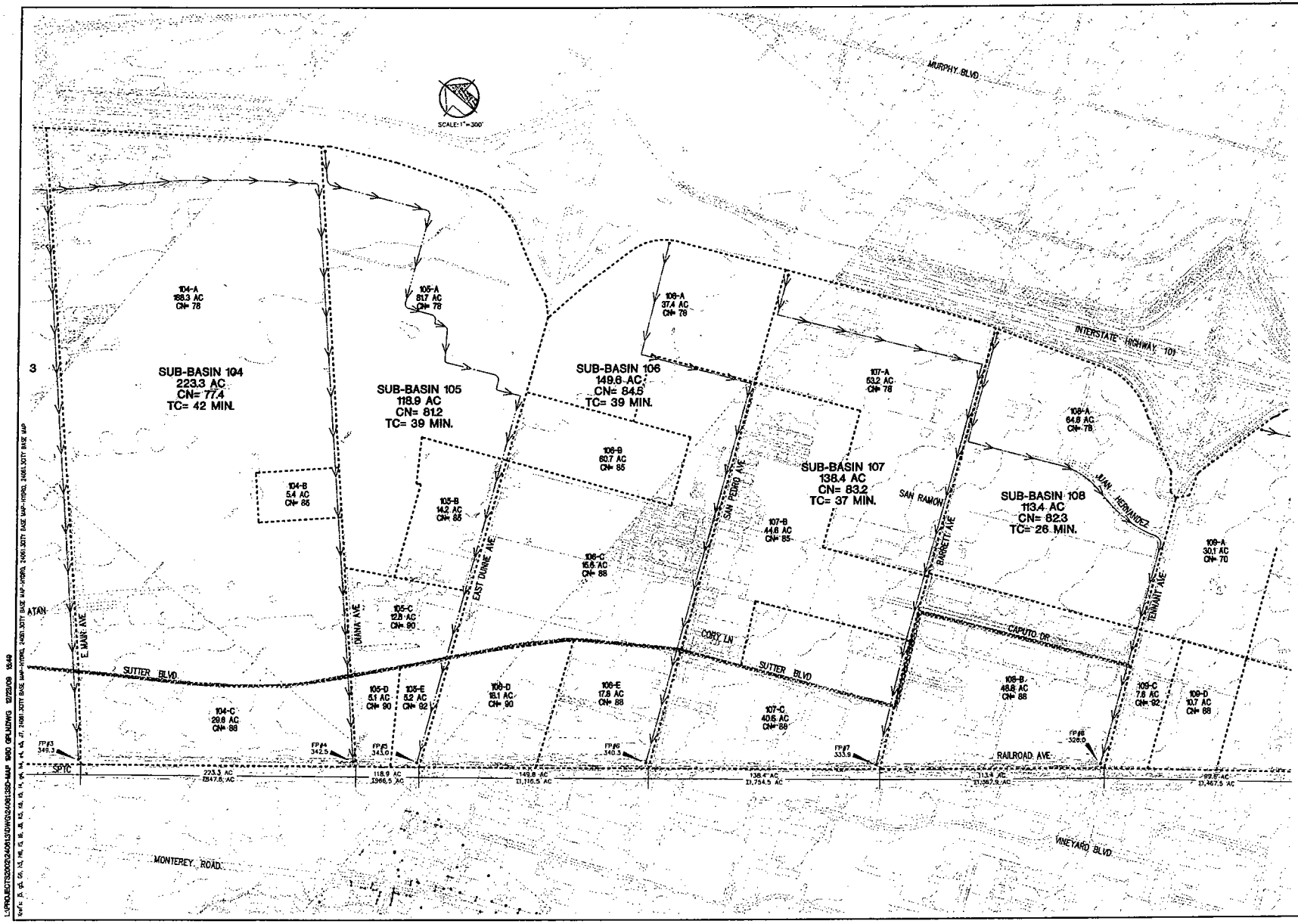
MH engineering Co.
18975 Vaughn Boulevard
Morgan Hill, CA 95037

BUTTERFIELD HYDROLOGY

OVERALL DRAINAGE MAP - GENERAL PLAN 1990

JOB NO. 240613

SHEET 01 OF 03



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DATE 12/09
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DRAWN BY MM
CHECKED BY HS

APPROVED BY

SUPERVISED BY

MH engineering Co.
1675 Tapscott Boulevard
Morgan Hill, CA 95037

BUTTERFIELD HYDROLOGY

OVERALL DRAINAGE MAP - GENERAL PLAN 1980

JOB NO. 240613

SHEET 02 OF 03

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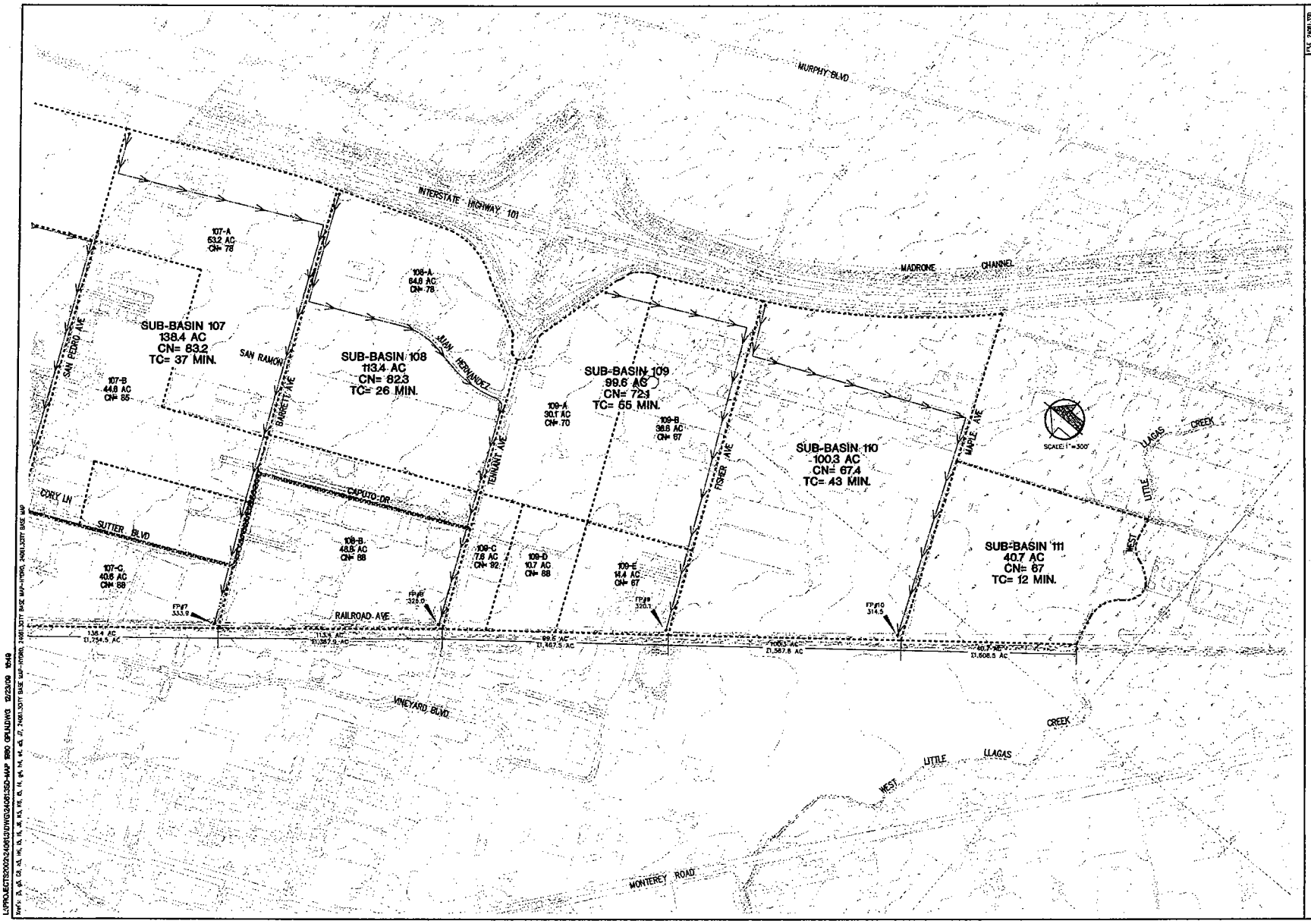

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DATE 12/09
DRAWN BY MM
CHECKED BY KS

APPROVED BY

SUPERVISED BY

MH engineering Co.
1970 Triangle Boulevard Santa Rosa, CA 95407

BUTTERFIELD HYDROLOGY

OVERALL DRAINAGE MAP - GENERAL PLAN 1990

JOB NO. 240613

SHEET 03 OF 03

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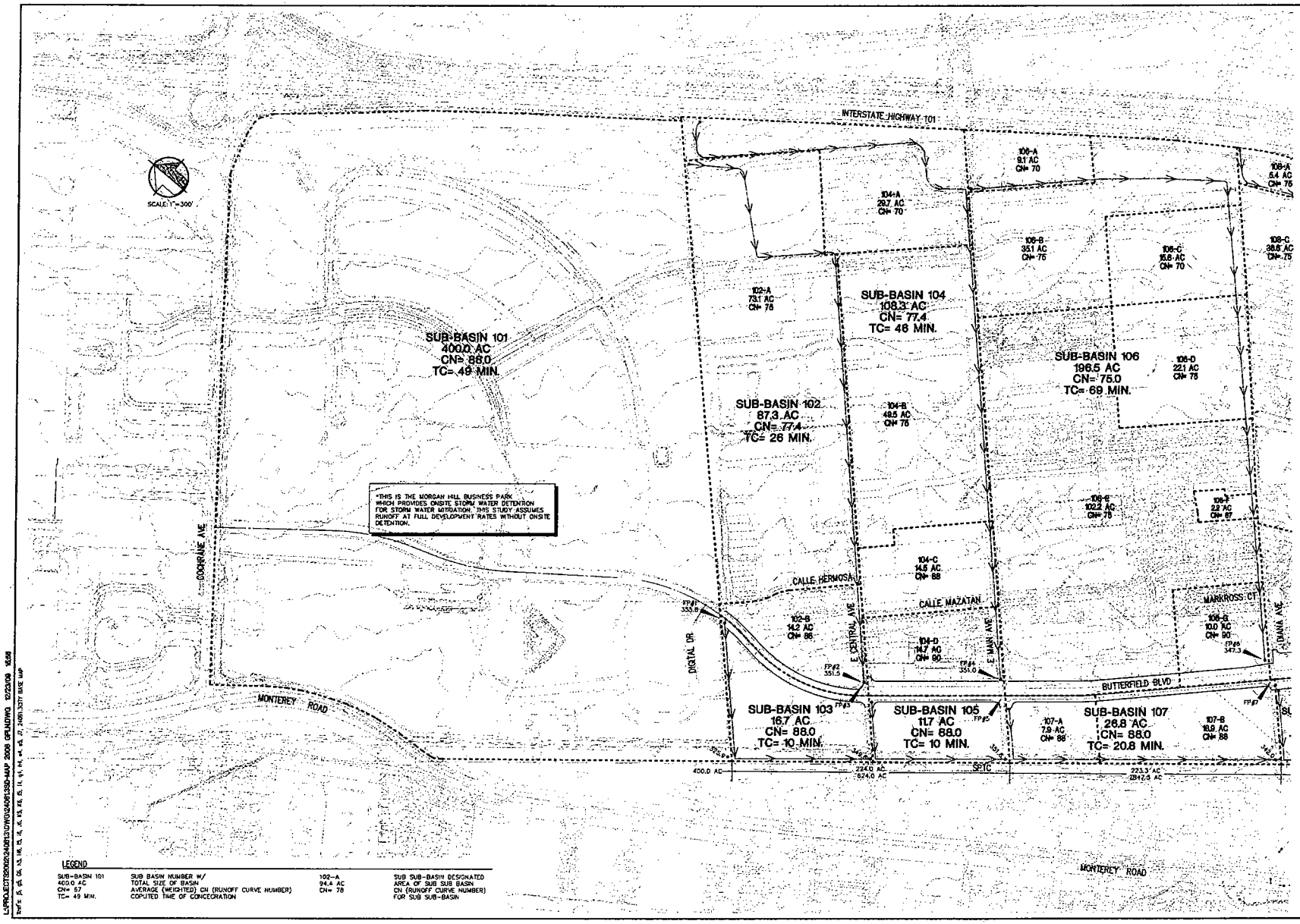
Xref's: B, gb, C0, c4, ms, s, t1, t2, k1, k2, k3, k4, k5, k6, k7, 240613DTT BASE MAP-HYDRO, 240613DTT BASE MAP-HYDRO, 240613DTT BASE MAP

Figure 6

Overall Drainage Maps
2008 General Plan



MH engineering Co.
1675 Tanyard Boulevard
Morgan Hill, Ca. 95037

BUTTERFIELD HYDROLOGY

OVERALL DRAINAGE MAP - GENERAL PLAN 2008

JOB NO. 240613

SHEET 01 OF 03

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DRAWN BY MH

CHECKED BY KS

APPROVED BY

SUPERVISED BY

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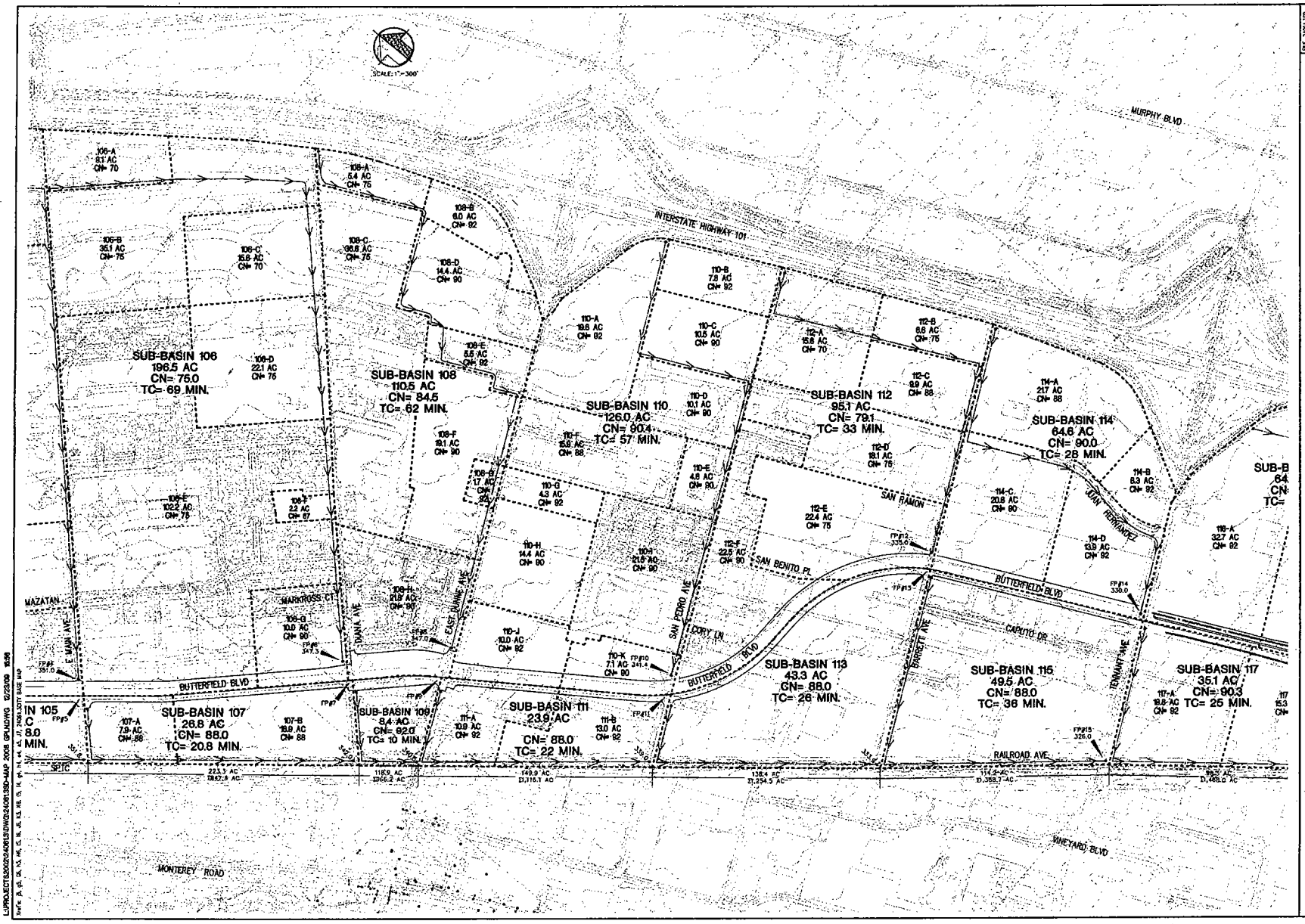

MH engineering Co.
1905 Tenaya Boulevard Morgan Hill, Ca. 95037

BUTTERFIELD HYDROLOGY

OVERALL DRAINAGE MAP - GENERAL PLAN 2008

JOB NO. 240613

SHEET 02 OF 03

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APPROVED BY
SUPERVISED BY

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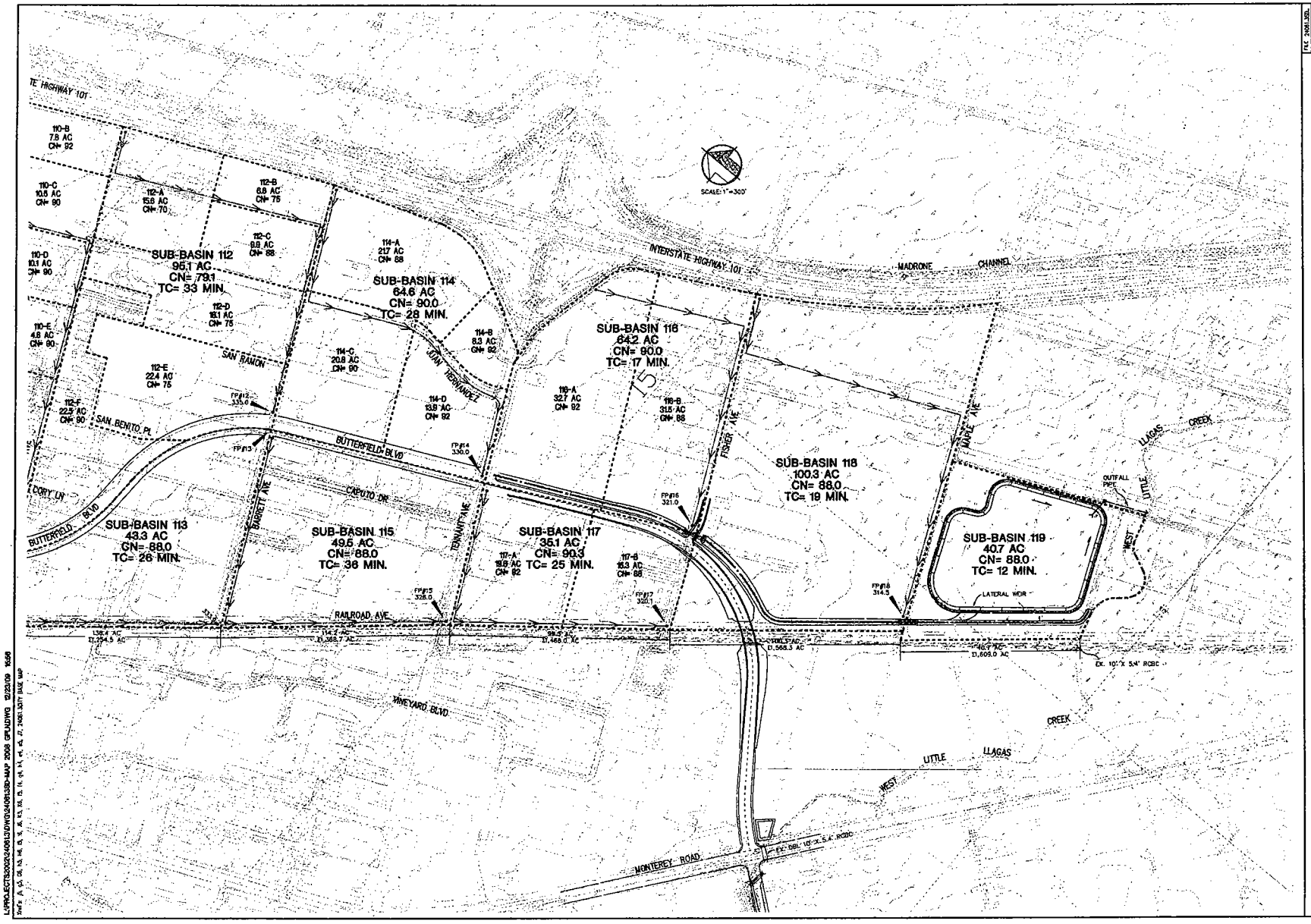

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CHECKED BY RS
APPROVED BY
APPROVED BY

MH engineering Co.
16870 Vineyard Boulevard Morgan Hill, CA 95037

BUTTERFIELD HYDROLOGY
OVERALL DRAINAGE MAP - GENERAL PLAN 2008

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OF 03

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Appendix "B"

Hydrology

Section 1

1980 Hydrologic Model
100 Year Storm

Hydraflow Table of Contents

24061.3 hyd 1980 100yr.gpw

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Tuesday, Dec 22, 2009

Watershed Model Schematic 1

Hydrograph Return Period Recap 2

2 - Year
Summary Report 3

10 - Year
Summary Report 4

25 - Year
Summary Report 5

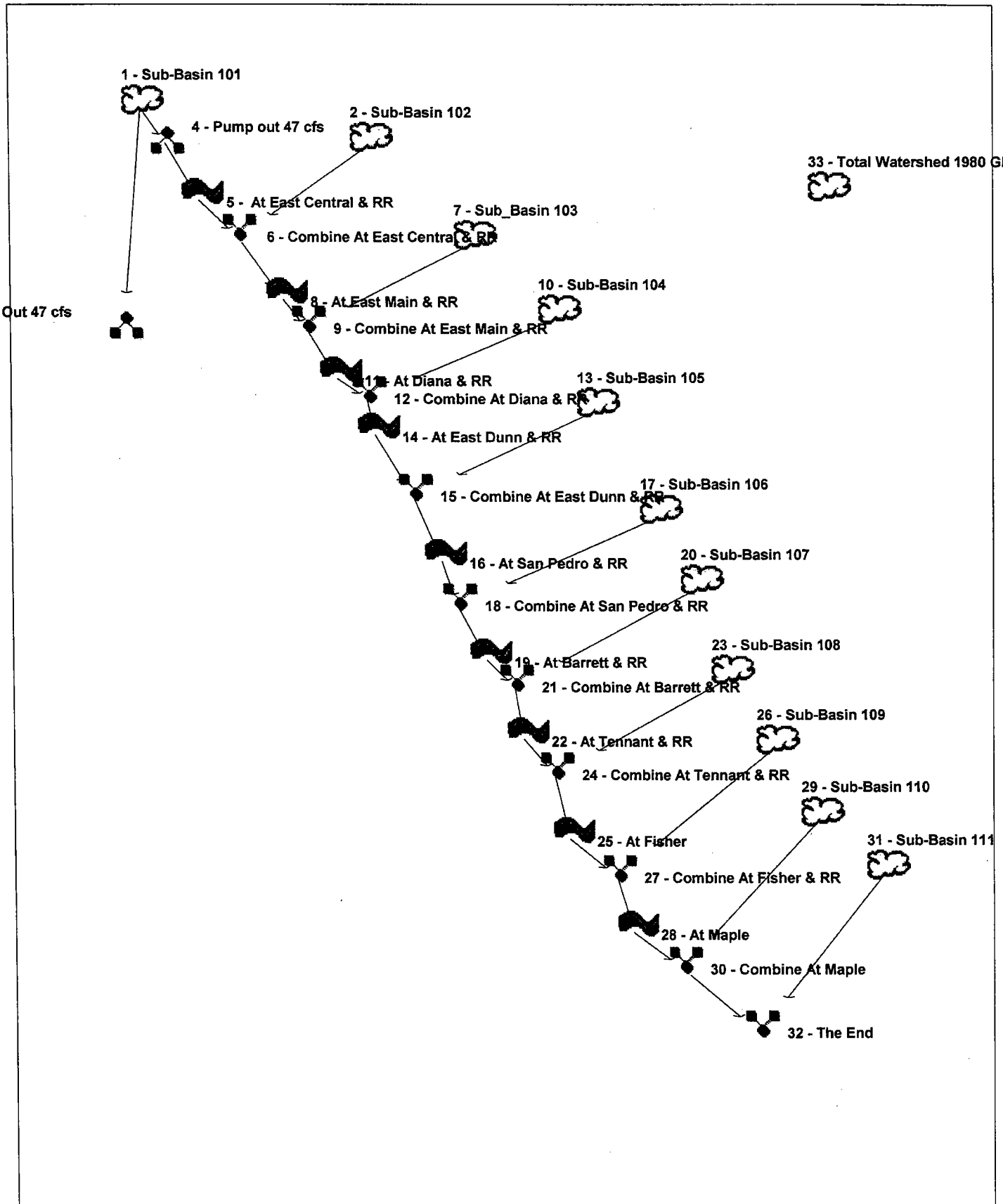
50 - Year
Summary Report 6

100 - Year
Summary Report 7

IDF Report 8

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066



Project: 24061.3 hyd 1980 100yr.gpw	Tuesday, Dec 22, 2009

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	——	——	36.48	——	——	98.50	126.70	145.91	164.50	Sub-Basin 101
2	SCS Runoff	——	——	22.01	——	——	44.07	53.29	59.41	65.24	Sub-Basin 102
3	Diversion1	1	——	36.48	——	——	47.00	47.00	47.00	47.00	Pump Out 47 cfs
4	Diversion2	1	——	0.000	——	——	51.50	79.70	98.91	117.50	Pump out 47 cfs
5	Reach	4	——	0.000	——	——	0.000	0.000	0.000	115.59	At East Central & RR
6	Combine	2, 5	——	22.01	——	——	44.07	53.29	59.41	175.64	Combine At East Central & RR
7	SCS Runoff	——	——	21.16	——	——	42.50	51.44	57.37	63.02	Sub_Basin 103
8	Reach	6	——	21.61	——	——	43.64	52.87	59.00	173.97	At East Main & RR
9	Combine	7, 8	——	42.59	——	——	85.91	104.07	116.13	232.06	Combine At East Main & RR
10	SCS Runoff	——	——	38.37	——	——	80.51	98.38	110.28	121.67	Sub-Basin 104
11	Reach	9	——	40.86	——	——	83.81	101.90	113.92	227.00	At Diana & RR
12	Combine	10, 11	——	78.72	——	——	163.80	199.72	223.64	343.20	Combine At Diana & RR
13	SCS Runoff	——	——	24.12	——	——	47.28	56.91	63.29	69.37	Sub-Basin 105
14	Reach	12	——	78.33	——	——	163.29	199.17	223.12	342.58	At East Dunn & RR
15	Combine	13, 14	——	101.53	——	——	209.32	254.78	285.04	407.37	Combine At East Dunn & RR
16	Reach	15	——	99.74	——	——	207.00	252.21	282.40	404.12	At San Pedro & RR
17	SCS Runoff	——	——	34.47	——	——	64.08	76.22	84.24	91.85	Sub-Basin 106
18	Combine	16, 17	——	131.58	——	——	267.53	324.61	362.52	487.24	Combine At San Pedro & RR
19	Reach	18	——	129.60	——	——	264.91	321.81	359.60	483.91	At Barrett & RR
20	SCS Runoff	——	——	30.38	——	——	57.63	68.87	76.30	83.36	Sub-Basin 107
21	Combine	19, 20	——	156.58	——	——	317.73	385.46	430.44	557.23	Combine At Barrett & RR
22	Reach	21	——	154.95	——	——	315.53	383.02	427.85	554.60	At Tennant & RR
23	SCS Runoff	——	——	24.06	——	——	46.05	55.13	61.13	66.84	Sub-Basin 108
24	Combine	22, 23	——	171.77	——	——	351.05	426.59	476.80	601.61	Combine At Tennant & RR
25	Reach	24	——	169.71	——	——	347.88	423.11	473.08	598.14	At Fisher
26	SCS Runoff	——	——	12.13	——	——	28.51	35.71	40.56	45.21	Sub-Basin 109
27	Combine	25, 26	——	181.44	——	——	375.89	458.15	513.15	641.90	Combine At Fisher & RR
28	Reach	27	——	179.18	——	——	372.27	454.26	508.82	637.84	At Maple
29	SCS Runoff	——	——	10.78	——	——	28.67	36.79	42.31	47.65	Sub-Basin 110
30	Combine	28, 29	——	187.47	——	——	396.15	485.41	544.98	676.44	Combine At Maple
31	SCS Runoff	——	——	4.301	——	——	11.21	14.32	16.44	18.48	Sub-Basin 111
32	Combine	30, 31	——	189.22	——	——	400.56	491.02	551.41	683.67	The End
33	SCS Runoff	——	——	247.38	——	——	489.11	589.89	656.71	720.34	Total Watershed 1980 GP

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	36.48	2	1090	610,732	—	—	—	Sub-Basin 101
2	SCS Runoff	22.01	2	1080	404,150	—	—	—	Sub-Basin 102
3	Diversion1	36.48	2	1090	610,732	1	—	—	Pump Out 47 cfs
4	Diversion2	0.000	2	n/a	0	1	—	—	Pump out 47 cfs
5	Reach	0.000	2	n/a	0	4	—	—	At East Central & RR
6	Combine	22.01	2	1080	404,150	2, 5	—	—	Combine At East Central & RR
7	SCS Runoff	21.16	2	1080	387,338	—	—	—	Sub_Basin 103
8	Reach	21.61	2	1086	404,144	6	—	—	At East Main & RR
9	Combine	42.59	2	1082	791,481	7, 8	—	—	Combine At East Main & RR
10	SCS Runoff	38.37	2	1084	700,609	—	—	—	Sub-Basin 104
11	Reach	40.86	2	1092	791,474	9	—	—	At Diana & RR
12	Combine	78.72	2	1088	1,492,083	10, 11	—	—	Combine At Diana & RR
13	SCS Runoff	24.12	2	1082	458,499	—	—	—	Sub-Basin 105
14	Reach	78.33	2	1092	1,492,081	12	—	—	At East Dunn & RR
15	Combine	101.53	2	1090	1,950,579	13, 14	—	—	Combine At East Dunn & RR
16	Reach	99.74	2	1096	1,950,574	15	—	—	At San Pedro & RR
17	SCS Runoff	34.47	2	1082	687,501	—	—	—	Sub-Basin 106
18	Combine	131.58	2	1092	2,638,075	16, 17	—	—	Combine At San Pedro & RR
19	Reach	129.60	2	1100	2,638,070	18	—	—	At Barrett & RR
20	SCS Runoff	30.38	2	1082	594,242	—	—	—	Sub-Basin 107
21	Combine	156.58	2	1094	3,232,314	19, 20	—	—	Combine At Barrett & RR
22	Reach	154.95	2	1102	3,232,307	21	—	—	At Tennant & RR
23	SCS Runoff	24.06	2	1080	456,877	—	—	—	Sub-Basin 108
24	Combine	171.77	2	1094	3,689,185	22, 23	—	—	Combine At Tennant & RR
25	Reach	169.71	2	1102	3,689,182	24	—	—	At Fisher
26	SCS Runoff	12.13	2	1092	219,846	—	—	—	Sub-Basin 109
27	Combine	181.44	2	1102	3,909,027	25, 26	—	—	Combine At Fisher & RR
28	Reach	179.18	2	1110	3,909,023	27	—	—	At Maple
29	SCS Runoff	10.78	2	1086	176,191	—	—	—	Sub-Basin 110
30	Combine	187.47	2	1108	4,085,213	28, 29	—	—	Combine At Maple
31	SCS Runoff	4.301	2	1080	64,084	—	—	—	Sub-Basin 111
32	Combine	189.22	2	1108	4,149,297	30, 31	—	—	The End
33	SCS Runoff	247.38	2	1122	6,226,611	—	—	—	Total Watershed 1980 GP

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	98.50	2	1088	1,816,052	—	—	—	Sub-Basin 101
2	SCS Runoff	44.07	2	1080	892,495	—	—	—	Sub-Basin 102
3	Diversion1	47.00	2	1020	1,626,747	1	—	—	Pump Out 47 cfs
4	Diversion2	51.50	2	1088	189,305	1	—	—	Pump out 47 cfs
5	Reach	0.000	2	n/a	0	4	—	—	At East Central & RR
6	Combine	44.07	2	1080	892,495	2, 5	—	—	Combine At East Central & RR
7	SCS Runoff	42.50	2	1080	858,596	—	—	—	Sub_Basin 103
8	Reach	43.64	2	1084	892,491	6	—	—	At East Main & RR
9	Combine	85.91	2	1082	1,751,087	7, 8	—	—	Combine At East Main & RR
10	SCS Runoff	80.51	2	1084	1,617,589	—	—	—	Sub-Basin 104
11	Reach	83.81	2	1090	1,751,080	9	—	—	At Diana & RR
12	Combine	163.80	2	1086	3,368,670	10, 11	—	—	Combine At Diana & RR
13	SCS Runoff	47.28	2	1082	984,838	—	—	—	Sub-Basin 105
14	Reach	163.29	2	1090	3,368,667	12	—	—	At East Dunn & RR
15	Combine	209.32	2	1088	4,353,503	13, 14	—	—	Combine At East Dunn & RR
16	Reach	207.00	2	1094	4,353,499	15	—	—	At San Pedro & RR
17	SCS Runoff	64.08	2	1080	1,393,280	—	—	—	Sub-Basin 106
18	Combine	267.53	2	1090	5,746,780	16, 17	—	—	Combine At San Pedro & RR
19	Reach	264.91	2	1096	5,746,780	18	—	—	At Barrett & RR
20	SCS Runoff	57.63	2	1080	1,231,704	—	—	—	Sub-Basin 107
21	Combine	317.73	2	1092	6,978,484	19, 20	—	—	Combine At Barrett & RR
22	Reach	315.53	2	1098	6,978,478	21	—	—	At Tennant & RR
23	SCS Runoff	46.05	2	1080	962,138	—	—	—	Sub-Basin 108
24	Combine	351.05	2	1092	7,940,621	22, 23	—	—	Combine At Tennant & RR
25	Reach	347.88	2	1098	7,940,617	24	—	—	At Fisher
26	SCS Runoff	28.51	2	1090	569,689	—	—	—	Sub-Basin 109
27	Combine	375.89	2	1098	8,510,303	25, 26	—	—	Combine At Fisher & RR
28	Reach	372.27	2	1104	8,510,302	27	—	—	At Maple
29	SCS Runoff	28.67	2	1084	517,608	—	—	—	Sub-Basin 110
30	Combine	396.15	2	1102	9,027,911	28, 29	—	—	Combine At Maple
31	SCS Runoff	11.21	2	1080	190,558	—	—	—	Sub-Basin 111
32	Combine	400.56	2	1102	9,218,467	30, 31	—	—	The End
33	SCS Runoff	489.11	2	1120	13,374,530	—	—	—	Total Watershed 1980 GP

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	126.70	2	1088	2,407,851	—	—	—	Sub-Basin 101
2	SCS Runoff	53.29	2	1080	1,109,599	—	—	—	Sub-Basin 102
3	Diversion1	47.00	2	942	1,984,008	1	—	—	Pump Out 47 cfs
4	Diversion2	79.70	2	1088	423,841	1	—	—	Pump out 47 cfs
5	Reach	0.000	2	n/a	0	4	—	—	At East Central & RR
6	Combine	53.29	2	1080	1,109,599	2, 5	—	—	Combine At East Central & RR
7	SCS Runoff	51.44	2	1080	1,068,382	—	—	—	Sub_Basin 103
8	Reach	52.87	2	1084	1,109,595	6	—	—	At East Main & RR
9	Combine	104.07	2	1080	2,177,977	7, 8	—	—	Combine At East Main & RR
10	SCS Runoff	98.38	2	1084	2,031,670	—	—	—	Sub-Basin 104
11	Reach	101.90	2	1088	2,177,972	9	—	—	At Diana & RR
12	Combine	199.72	2	1086	4,209,641	10, 11	—	—	Combine At Diana & RR
13	SCS Runoff	56.91	2	1080	1,216,573	—	—	—	Sub-Basin 105
14	Reach	199.17	2	1088	4,209,640	12	—	—	At East Dunn & RR
15	Combine	254.78	2	1086	5,426,213	13, 14	—	—	Combine At East Dunn & RR
16	Reach	252.21	2	1092	5,426,207	15	—	—	At San Pedro & RR
17	SCS Runoff	76.22	2	1080	1,697,856	—	—	—	Sub-Basin 106
18	Combine	324.61	2	1090	7,124,063	16, 17	—	—	Combine At San Pedro & RR
19	Reach	321.81	2	1096	7,124,062	18	—	—	At Barrett & RR
20	SCS Runoff	68.87	2	1080	1,508,917	—	—	—	Sub-Basin 107
21	Combine	385.46	2	1092	8,632,971	19, 20	—	—	Combine At Barrett & RR
22	Reach	383.02	2	1098	8,632,973	21	—	—	At Tennant & RR
23	SCS Runoff	55.13	2	1080	1,183,068	—	—	—	Sub-Basin 108
24	Combine	426.59	2	1092	9,816,044	22, 23	—	—	Combine At Tennant & RR
25	Reach	423.11	2	1098	9,816,039	24	—	—	At Fisher
26	SCS Runoff	35.71	2	1090	734,047	—	—	—	Sub-Basin 109
27	Combine	458.15	2	1096	10,550,080	25, 26	—	—	Combine At Fisher & RR
28	Reach	454.26	2	1104	10,550,090	27	—	—	At Maple
29	SCS Runoff	36.79	2	1084	684,617	—	—	—	Sub-Basin 110
30	Combine	485.41	2	1102	11,234,710	28, 29	—	—	Combine At Maple
31	SCS Runoff	14.32	2	1080	252,655	—	—	—	Sub-Basin 111
32	Combine	491.02	2	1102	11,487,370	30, 31	—	—	The End
33	SCS Runoff	589.89	2	1120	16,521,590	—	—	—	Total Watershed 1980 GP

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	145.91	2	1088	2,822,187	----	----	----	Sub-Basin 101
2	SCS Runoff	59.41	2	1080	1,256,862	----	----	----	Sub-Basin 102
3	Diversion1	47.00	2	928	2,161,535	1	----	----	Pump Out 47 cfs
4	Diversion2	98.91	2	1088	660,652	1	----	----	Pump out 47 cfs
5	Reach	0.000	2	n/a	0	4	----	----	At East Central & RR
6	Combine	59.41	2	1080	1,256,862	2, 5	----	----	Combine At East Central & RR
7	SCS Runoff	57.37	2	1080	1,210,740	----	----	----	Sub_Basin 103
8	Reach	59.00	2	1084	1,256,858	6	----	----	At East Main & RR
9	Combine	116.13	2	1080	2,467,598	7, 8	----	----	Combine At East Main & RR
10	SCS Runoff	110.28	2	1082	2,313,932	----	----	----	Sub-Basin 104
11	Reach	113.92	2	1088	2,467,592	9	----	----	At Diana & RR
12	Combine	223.64	2	1084	4,781,519	10, 11	----	----	Combine At Diana & RR
13	SCS Runoff	63.29	2	1080	1,373,281	----	----	----	Sub-Basin 105
14	Reach	223.12	2	1088	4,781,519	12	----	----	At East Dunn & RR
15	Combine	285.04	2	1086	6,154,803	13, 14	----	----	Combine At East Dunn & RR
16	Reach	282.40	2	1092	6,154,801	15	----	----	At San Pedro & RR
17	SCS Runoff	84.24	2	1080	1,902,550	----	----	----	Sub-Basin 106
18	Combine	362.52	2	1088	8,057,349	16, 17	----	----	Combine At San Pedro & RR
19	Reach	359.60	2	1094	8,057,345	18	----	----	At Barrett & RR
20	SCS Runoff	76.30	2	1080	1,695,658	----	----	----	Sub-Basin 107
21	Combine	430.44	2	1092	9,752,997	19, 20	----	----	Combine At Barrett & RR
22	Reach	427.85	2	1096	9,752,996	21	----	----	At Tennant & RR
23	SCS Runoff	61.13	2	1080	1,332,149	----	----	----	Sub-Basin 108
24	Combine	476.80	2	1092	11,085,150	22, 23	----	----	Combine At Tennant & RR
25	Reach	473.08	2	1098	11,085,150	24	----	----	At Fisher
26	SCS Runoff	40.56	2	1090	847,511	----	----	----	Sub-Basin 109
27	Combine	513.15	2	1096	11,932,670	25, 26	----	----	Combine At Fisher & RR
28	Reach	508.82	2	1102	11,932,650	27	----	----	At Maple
29	SCS Runoff	42.31	2	1084	801,406	----	----	----	Sub-Basin 110
30	Combine	544.98	2	1100	12,734,060	28, 29	----	----	Combine At Maple
31	SCS Runoff	16.44	2	1080	296,132	----	----	----	Sub-Basin 111
32	Combine	551.41	2	1100	13,030,200	30, 31	----	----	The End
33	SCS Runoff	656.71	2	1120	18,649,770	----	----	----	Total Watershed 1980 GP

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	164.50	2	1088	3,230,763	—	—	—	Sub-Basin 101
2	SCS Runoff	65.24	2	1080	1,399,163	—	—	—	Sub-Basin 102
3	Diversion1	47.00	2	830	2,288,786	1	—	—	Pump Out 47 cfs
4	Diversion2	117.50	2	1088	941,977	1	—	—	Pump out 47 cfs
5	Reach	115.59	2	1094	941,974	4	—	—	At East Central & RR
6	Combine	175.64	2	1088	2,341,135	2, 5	—	—	Combine At East Central & RR
7	SCS Runoff	63.02	2	1080	1,348,337	—	—	—	Sub_Basin 103
8	Reach	173.97	2	1092	2,341,134	6	—	—	At East Main & RR
9	Combine	232.06	2	1088	3,689,469	7, 8	—	—	Combine At East Main & RR
10	SCS Runoff	121.67	2	1082	2,587,540	—	—	—	Sub-Basin 104
11	Reach	227.00	2	1096	3,689,464	9	—	—	At Diana & RR
12	Combine	343.20	2	1090	6,277,004	10, 11	—	—	Combine At Diana & RR
13	SCS Runoff	69.37	2	1080	1,524,415	—	—	—	Sub-Basin 105
14	Reach	342.58	2	1094	6,277,002	12	—	—	At East Dunn & RR
15	Combine	407.37	2	1092	7,801,416	13, 14	—	—	Combine At East Dunn & RR
16	Reach	404.12	2	1096	7,801,412	15	—	—	At San Pedro & RR
17	SCS Runoff	91.85	2	1080	2,099,193	—	—	—	Sub-Basin 106
18	Combine	487.24	2	1094	9,900,608	16, 17	—	—	Combine At San Pedro & RR
19	Reach	483.91	2	1098	9,900,608	18	—	—	At Barrett & RR
20	SCS Runoff	83.36	2	1080	1,875,322	—	—	—	Sub-Basin 107
21	Combine	557.23	2	1096	11,775,930	19, 20	—	—	Combine At Barrett & RR
22	Reach	554.60	2	1100	11,775,920	21	—	—	At Tennant & RR
23	SCS Runoff	66.84	2	1080	1,475,734	—	—	—	Sub-Basin 108
24	Combine	601.61	2	1094	13,251,660	22, 23	—	—	Combine At Tennant & RR
25	Reach	598.14	2	1100	13,251,650	24	—	—	At Fisher
26	SCS Runoff	45.21	2	1090	958,391	—	—	—	Sub-Basin 109
27	Combine	641.90	2	1100	14,210,050	25, 26	—	—	Combine At Fisher & RR
28	Reach	637.84	2	1106	14,210,040	27	—	—	At Maple
29	SCS Runoff	47.65	2	1084	916,485	—	—	—	Sub-Basin 110
30	Combine	676.44	2	1104	15,126,520	28, 29	—	—	Combine At Maple
31	SCS Runoff	18.48	2	1080	339,003	—	—	—	Sub-Basin 111
32	Combine	683.67	2	1104	15,465,530	30, 31	—	—	The End
33	SCS Runoff	720.34	2	1118	20,702,230	—	—	—	Total Watershed 1980 GP

Hydraflow Rainfall Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Dec 22, 2009

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	------
2	0.0000	0.0000	0.0000	------
3	0.0000	0.0000	0.0000	------
5	7.0453	18.8000	0.5714	------
10	9.3905	18.9000	0.5598	------
25	0.0000	0.0000	0.0000	------
50	0.0000	0.0000	0.0000	------
100	11.5407	17.6000	0.5048	------

File name: Morgan Hill City.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	1.15	1.03	0.94	0.87	0.81	0.76	0.72	0.69	0.66	0.63	0.60	0.58
10	1.59	1.43	1.31	1.21	1.13	1.06	1.01	0.96	0.92	0.88	0.84	0.81
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	2.39	2.16	1.99	1.85	1.74	1.64	1.56	1.49	1.43	1.38	1.33	1.28

Tc = time in minutes. Values may exceed 60.

Precip. file name: MORGAN HILL SCS.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	2.65	0.00	0.00	4.17	4.79	5.20	5.59
SCS 6-Hr	0.00	1.44	0.00	0.00	2.30	2.65	2.88	3.09
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	2.65	0.00	0.00	4.17	4.79	5.20	5.59

Section 2

2008 Hydrologic Model
100 Year Storm

Hydraflow Table of Contents

24061.3 hyd 2008 100yr.gpw

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Watershed Model Schematic

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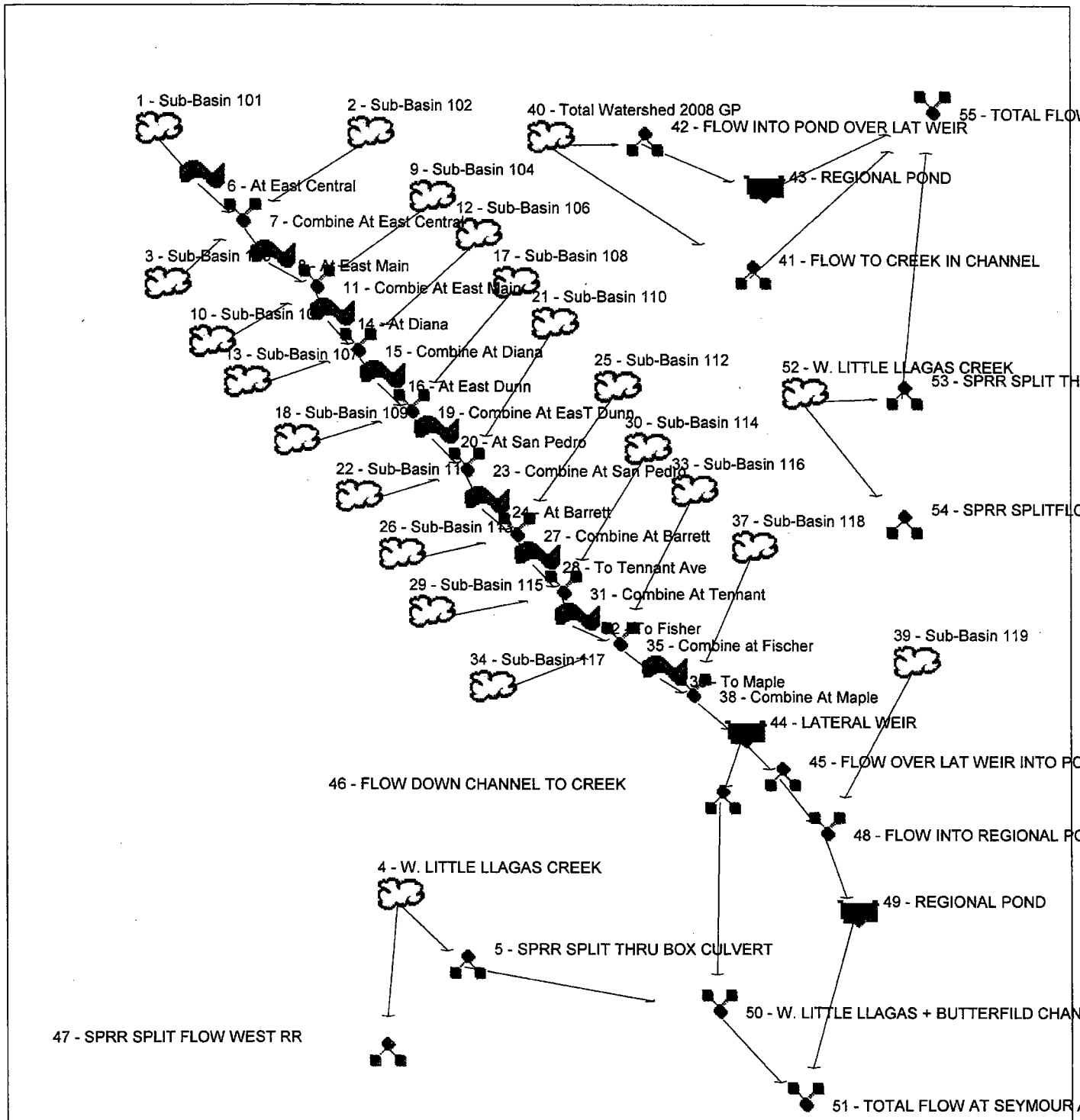


Project: 24061.3 hyd 2008 100yr.gpw	Tuesday, Dec 22, 2009

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	——	——	100.52	——	——	177.62	208.88	229.47	249.00	Sub-Basin 101
2	SCS Runoff	——	——	14.90	——	——	31.18	38.08	42.67	47.06	Sub-Basin 102
3	SCS Runoff	——	——	4.556	——	——	7.982	9.370	10.28	11.15	Sub-Basin 103
4	SCS Runoff	——	——	631.00	——	——	1292.58	1572.16	1758.33	1935.90	W. LITTLE LLAGAS CREEK
5	Diversion1	4	——	631.00	——	——	700.00	700.00	700.00	700.00	SPRR SPLIT THRU BOX CULVER
6	Reach	1	——	99.51	——	——	176.31	207.49	228.05	247.55	At East Central
7	Combine	2, 3, 6	——	116.34	——	——	211.37	250.22	275.87	300.24	Combine At East Central
8	Reach	7	——	113.59	——	——	207.64	246.26	271.74	295.95	At East Main
9	SCS Runoff	——	——	18.10	——	——	37.99	46.44	52.07	57.45	Sub-Basin 104
10	SCS Runoff	——	——	3.192	——	——	5.592	6.564	7.205	7.812	Sub-Basin 105
11	Combine	8, 9, 10	——	132.70	——	——	248.11	295.73	327.22	357.22	Combie At East Main
12	SCS Runoff	——	——	26.44	——	——	58.42	72.21	81.44	90.28	Sub-Basin 106
13	SCS Runoff	——	——	7.170	——	——	12.60	14.80	16.25	17.62	Sub-Basin 107
14	Reach	11	——	129.00	——	——	242.77	289.94	321.15	350.80	At Diana
15	Combine	12, 13, 14	——	159.29	——	——	309.14	371.84	413.42	453.01	Combine At Diana
16	Reach	15	——	157.63	——	——	306.72	369.09	410.55	450.00	At East Dunn
17	SCS Runoff	——	——	23.31	——	——	43.44	51.70	57.15	62.33	Sub-Basin 108
18	SCS Runoff	——	——	2.550	——	——	4.250	4.936	5.388	5.817	Sub-Basin 109
19	Combine	16, 17, 18	——	180.80	——	——	350.71	421.57	468.64	513.55	Combine At EasT Dunn
20	Reach	19	——	179.23	——	——	348.47	419.12	466.11	510.88	At San Pedro
21	SCS Runoff	——	——	32.88	——	——	56.24	65.68	71.90	77.79	Sub-Basin 110
22	SCS Runoff	——	——	7.136	——	——	11.91	13.84	15.11	16.32	Sub-Basin 111
23	Combine	20, 21, 22	——	210.38	——	——	405.02	486.03	539.91	591.20	Combine At San Pedro
24	Reach	23	——	208.47	——	——	402.19	482.95	536.59	587.75	At Barrett
25	SCS Runoff	——	——	18.04	——	——	36.58	44.36	49.53	54.45	Sub-Basin 112
26	SCS Runoff	——	——	11.18	——	——	19.67	23.10	25.37	27.51	Sub-Basin 113
27	Combine	24, 25, 26	——	223.14	——	——	434.39	523.07	582.03	638.33	Combine At Barrett
28	Reach	27	——	222.22	——	——	432.81	521.19	580.01	636.06	To Tennant Ave
29	SCS Runoff	——	——	12.75	——	——	22.49	26.44	29.04	31.51	Sub-Basin 115
30	SCS Runoff	——	——	17.96	——	——	30.78	35.96	39.37	42.61	Sub-Basin 114
31	Combine	28, 29, 30	——	238.82	——	——	466.07	561.63	625.20	685.85	Combine At Tennant
32	Reach	31	——	238.23	——	——	464.85	560.15	623.51	684.12	To Fisher
33	SCS Runoff	——	——	17.92	——	——	30.63	35.76	39.14	42.35	Sub-Basin 116

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
34	SCS Runoff	——	——	9.690	——	——	16.53	19.29	21.11	22.83	Sub-Basin 117
35	Combine	32, 33, 34	——	250.60	——	——	487.53	587.27	653.70	717.14	Combine at Fischer
36	Reach	35	——	249.77	——	——	486.00	585.51	651.75	715.06	To Maple
37	SCS Runoff	——	——	26.43	——	——	46.39	54.47	59.79	64.84	Sub-Basin 118
38	Combine	36, 37	——	262.65	——	——	507.38	610.90	679.96	745.98	Combine At Maple
39	SCS Runoff	——	——	4.592	——	——	11.63	14.78	16.91	18.97	Sub-Basin 119
40	SCS Runoff	——	——	274.40	——	——	511.86	609.29	673.62	734.74	Total Watershed 2008 GP
41	Diversion1	40	——	274.40	——	——	326.00	326.00	326.00	326.00	FLOW TO CREEK IN CHANNEL
42	Diversion2	40	——	0.000	——	——	185.86	283.29	347.62	408.74	FLOW INTO POND OVER LAT WE
43	Reservoir	42	——	0.000	——	——	6.094	14.93	19.07	22.77	REGIONAL POND
44	Reservoir	38	——	262.64	——	——	507.39	610.90	679.96	745.98	LATERAL WEIR
45	Diversion1	44	——	0.000	——	——	164.73	245.10	299.66	352.25	FLOW OVER LAT WEIR INTO PO
46	Diversion2	44	——	262.64	——	——	342.66	365.80	380.30	393.73	FLOW DOWN CHANNEL TO CRE
47	Diversion2	4	——	0.000	——	——	0.000	0.000	0.000	1231.32	SPRR SPLIT FLOW WEST RR
48	Combine	39, 45,	——	4.592	——	——	171.24	253.09	308.61	362.15	FLOW INTO REGIONAL POND
49	Reservoir	48	——	0.000	——	——	7.569	14.60	18.39	21.73	REGIONAL POND
50	Combine	5, 46,	——	770.29	——	——	1042.66	1065.80	1080.30	1093.73	W. LITTLE LLAGAS + BUTTERFIL
51	Combine	49, 50	——	770.29	——	——	1042.66	1073.35	1091.98	1108.67	TOTAL FLOW AT SEYMOUR AVE.
52	SCS Runoff	——	——	631.00	——	——	1292.58	1572.16	1758.33	1935.90	W. LITTLE LLAGAS CREEK
53	Diversion1	52	——	631.00	——	——	700.00	700.00	700.00	700.00	SPRR SPLIT THRU BOX CULVER
54	Diversion2	52	——	0.000	——	——	592.57	872.16	1058.33	1235.90	SPRR SPLITFLOW WEST RR
55	Combine	41, 43, 53,	——	799.64	——	——	1032.09	1040.93	1045.07	1048.77	TOTAL FLOW AT SEYMOUR

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	249.00	2	1086	6,144,812	----	----	----	Sub-Basin 101
2	SCS Runoff	47.06	2	1080	977,399	----	----	----	Sub-Basin 102
3	SCS Runoff	11.15	2	1080	264,563	----	----	----	Sub-Basin 103
4	SCS Runoff	1935.90	2	1236	75,435,390	----	----	----	W. LITTLE LLAGAS CREEK
5	Diversion1	700.00	2	850	46,684,590	4	----	----	SPRR SPLIT THRU BOX CULVER
6	Reach	247.55	2	1090	6,144,811	1	----	----	At East Central
7	Combine	300.24	2	1084	7,386,772	2, 3, 6	----	----	Combine At East Central
8	Reach	295.95	2	1092	7,386,771	7	----	----	At East Main
9	SCS Runoff	57.45	2	1084	1,231,901	----	----	----	Sub-Basin 104
10	SCS Runoff	7.812	2	1080	185,353	----	----	----	Sub-Basin 105
11	Combine	357.22	2	1088	8,804,023	8, 9, 10	----	----	Combie At East Main
12	SCS Runoff	90.28	2	1096	2,094,030	----	----	----	Sub-Basin 106
13	SCS Runoff	17.62	2	1080	419,055	----	----	----	Sub-Basin 107
14	Reach	350.80	2	1098	8,804,020	11	----	----	At Diana
15	Combine	453.01	2	1096	11,317,100	12, 13, 14	----	----	Combine At Diana
16	Reach	450.00	2	1102	11,317,100	15	----	----	At East Dunn
17	SCS Runoff	62.33	2	1092	1,560,742	----	----	----	Sub-Basin 108
18	SCS Runoff	5.817	2	1080	146,748	----	----	----	Sub-Basin 109
19	Combine	513.55	2	1100	13,024,580	16, 17, 18	----	----	Combine At EasT Dunn
20	Reach	510.88	2	1106	13,024,590	19	----	----	At San Pedro
21	SCS Runoff	77.79	2	1088	2,038,895	----	----	----	Sub-Basin 110
22	SCS Runoff	16.32	2	1080	412,109	----	----	----	Sub-Basin 111
23	Combine	591.20	2	1102	15,475,590	20, 21, 22	----	----	Combine At San Pedro
24	Reach	587.75	2	1108	15,475,580	23	----	----	At Barrett
25	SCS Runoff	54.45	2	1080	1,162,375	----	----	----	Sub-Basin 112
26	SCS Runoff	27.51	2	1080	654,783	----	----	----	Sub-Basin 113
27	Combine	638.33	2	1100	17,292,740	24, 25, 26	----	----	Combine At Barrett
28	Reach	636.06	2	1106	17,292,750	27	----	----	To Tennant Ave
29	SCS Runoff	31.51	2	1080	751,780	----	----	----	Sub-Basin 115
30	SCS Runoff	42.61	2	1080	1,044,479	----	----	----	Sub-Basin 114
31	Combine	685.85	2	1100	19,088,990	28, 29, 30	----	----	Combine At Tennant
32	Reach	684.12	2	1104	19,089,000	31	----	----	To Fisher
33	SCS Runoff	42.35	2	1080	1,036,407	----	----	----	Sub-Basin 116

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
34	SCS Runoff	22.83	2	1080	561,876	—	—	—	Sub-Basin 117
35	Combine	717.14	2	1098	20,687,270	32, 33, 34	—	—	Combine at Fischer
36	Reach	715.06	2	1104	20,687,290	35	—	—	To Maple
37	SCS Runoff	64.84	2	1080	1,540,812	—	—	—	Sub-Basin 118
38	Combine	745.98	2	1096	22,228,100	36, 37	—	—	Combine At Maple
39	SCS Runoff	18.97	2	1080	351,982	—	—	—	Sub-Basin 119
40	SCS Runoff	734.74	2	1124	22,680,360	—	—	—	Total Watershed 2008 GP
41	Diversion1	326.00	2	870	18,563,100	40	—	—	FLOW TO CREEK IN CHANNEL
42	Diversion2	408.74	2	1124	4,117,261	40	—	—	FLOW INTO POND OVER LAT WE
43	Reservoir	22.77	2	1270	3,163,038	42	312.93	3,883,711	REGIONAL POND
44	Reservoir	745.98	2	1096	22,228,080	38	311.29	5,322	LATERAL WEIR
45	Diversion1	352.25	2	1096	3,619,514	44	—	—	FLOW OVER LAT WEIR INTO PO
46	Diversion2	393.73	2	1096	18,608,570	44	—	—	FLOW DOWN CHANNEL TO CRE
47	Diversion2	1231.32	2	1136	18,347,320	4	—	—	SPRR SPLIT FLOW WEST RR
48	Combine	362.15	2	1090	3,971,498	39, 45,	—	—	FLOW INTO REGIONAL POND
49	Reservoir	21.73	2	1282	3,020,174	48	312.64	3,612,040	REGIONAL POND
50	Combine	1093.73	2	1096	65,293,140	5, 46,	—	—	W. LITTLE LLAGAS + BUTTERFIL
51	Combine	1108.67	2	1102	68,313,460	49, 50	—	—	TOTAL FLOW AT SEYMOUR AVE.
52	SCS Runoff	1935.90	2	1236	75,435,390	—	—	—	W. LITTLE LLAGAS CREEK
53	Diversion1	700.00	2	850	46,684,590	52	—	—	SPRR SPLIT THRU BOX CULVER
54	Diversion2	1235.90	2	1236	28,750,770	52	—	—	SPRR SPLITFLOW WEST RR
55	Combine	1048.77	2	1270	68,410,710	41, 43, 53,	—	—	TOTAL FLOW AT SEYMOUR

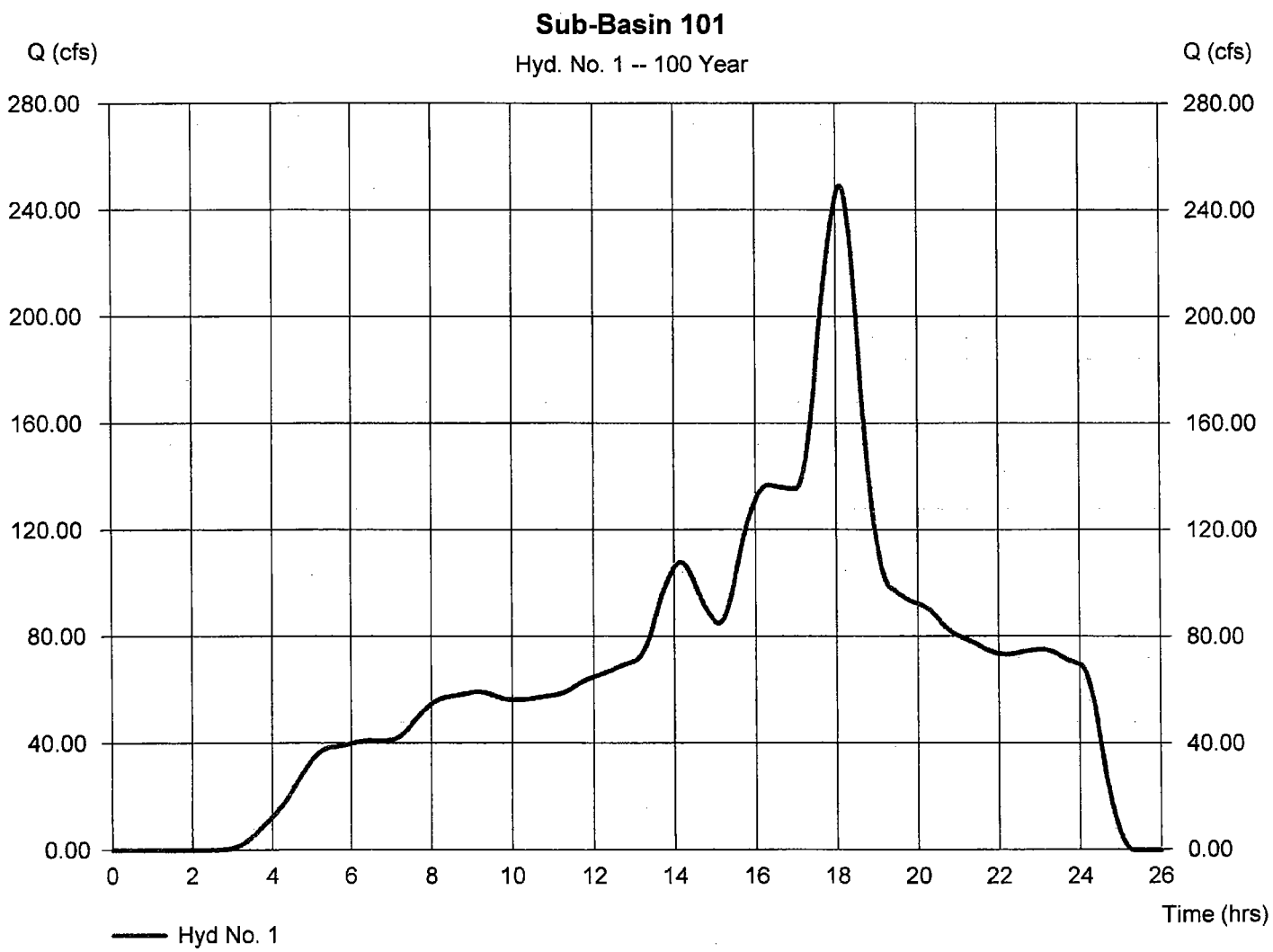
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 1

Sub-Basin 101

Hydrograph type	= SCS Runoff	Peak discharge	= 249.00 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.10 hrs
Time interval	= 2 min	Hyd. volume	= 6,144,812 cuft
Drainage area	= 400.000 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 49.30 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



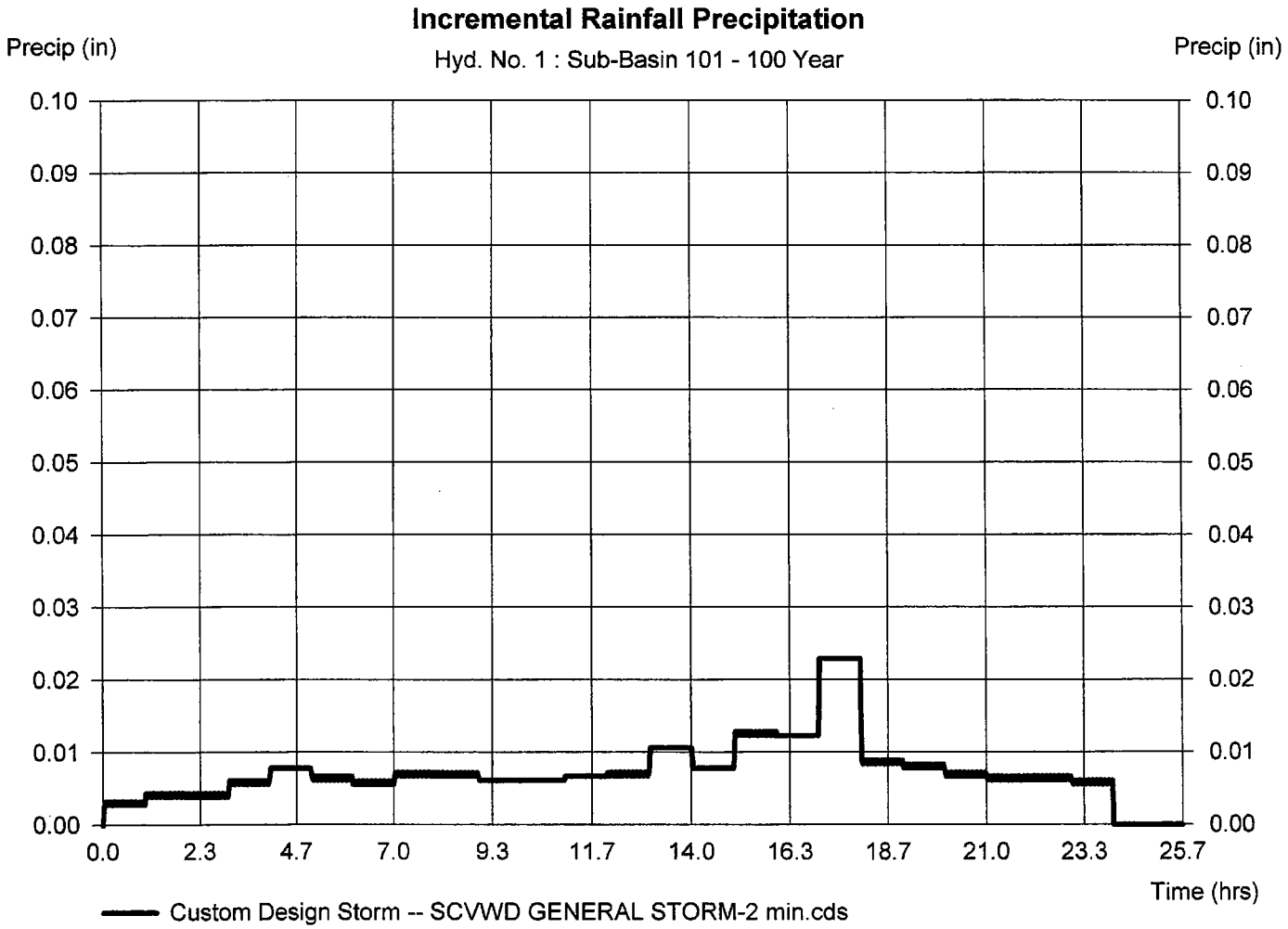
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 1

Sub-Basin 101

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



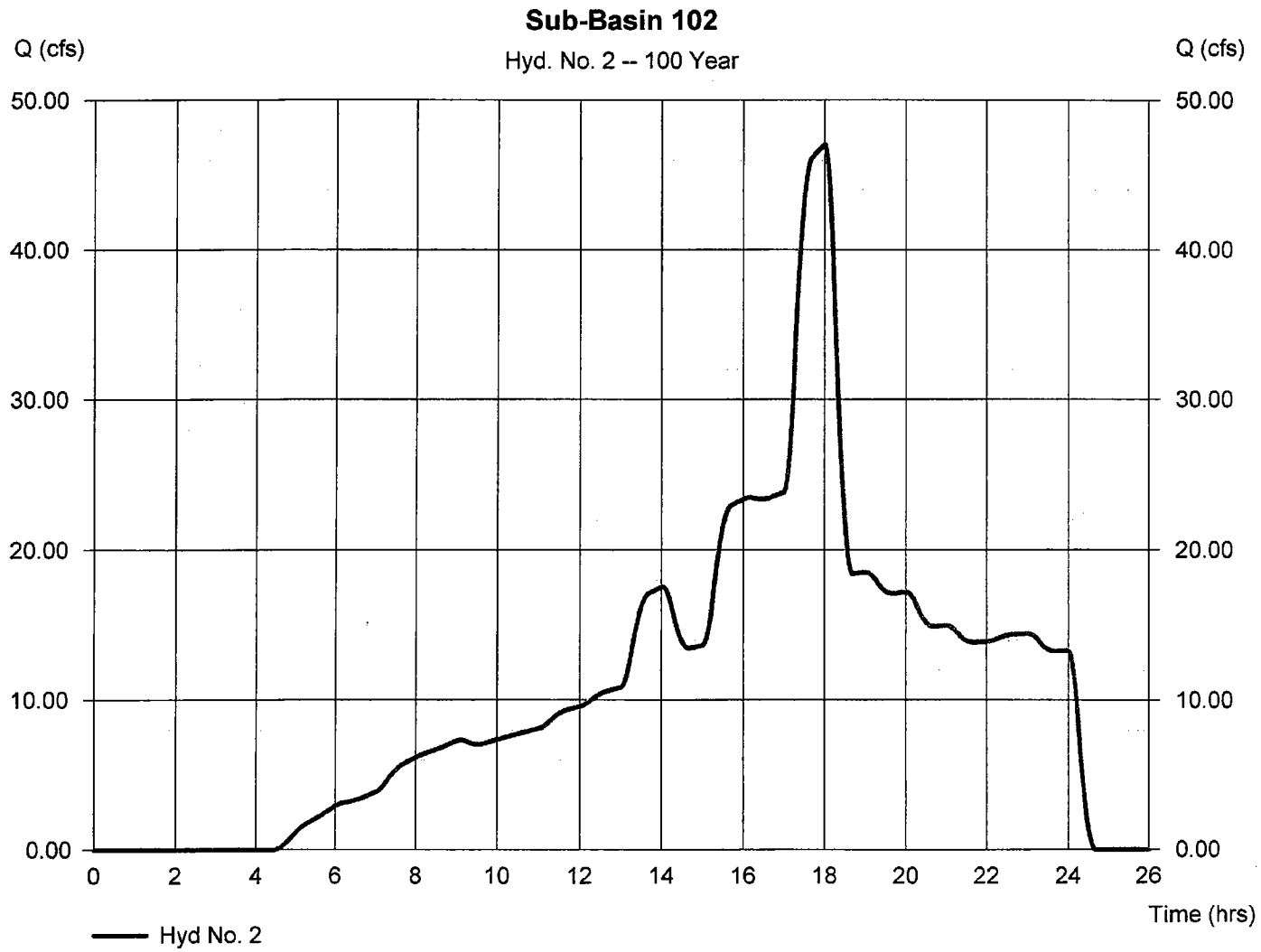
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 2

Sub-Basin 102

Hydrograph type	= SCS Runoff	Peak discharge	= 47.06 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.00 hrs
Time interval	= 2 min	Hyd. volume	= 977,399 cuft
Drainage area	= 87.300 ac	Curve number	= 77.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 26.30 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



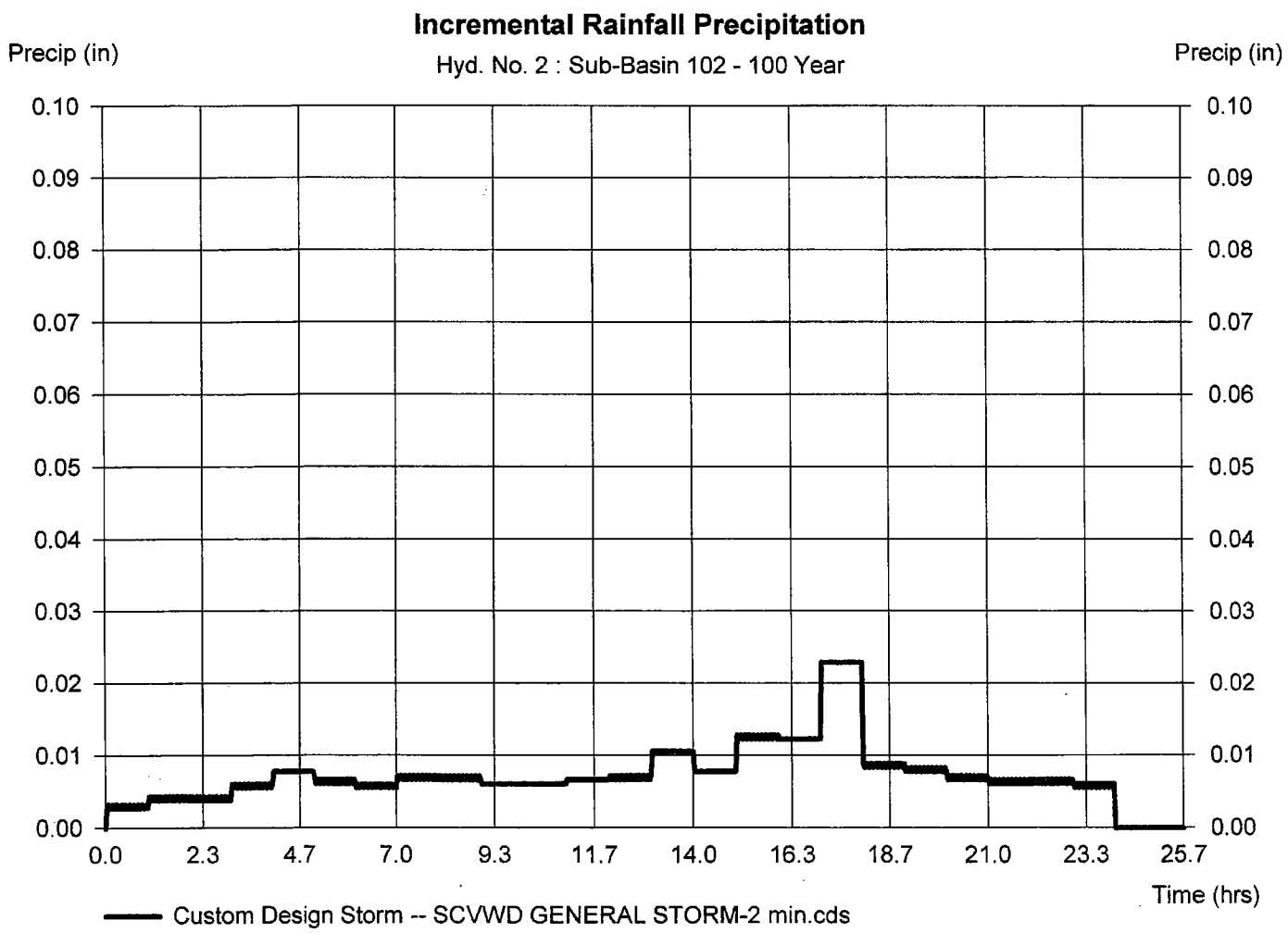
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 2

Sub-Basin 102

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



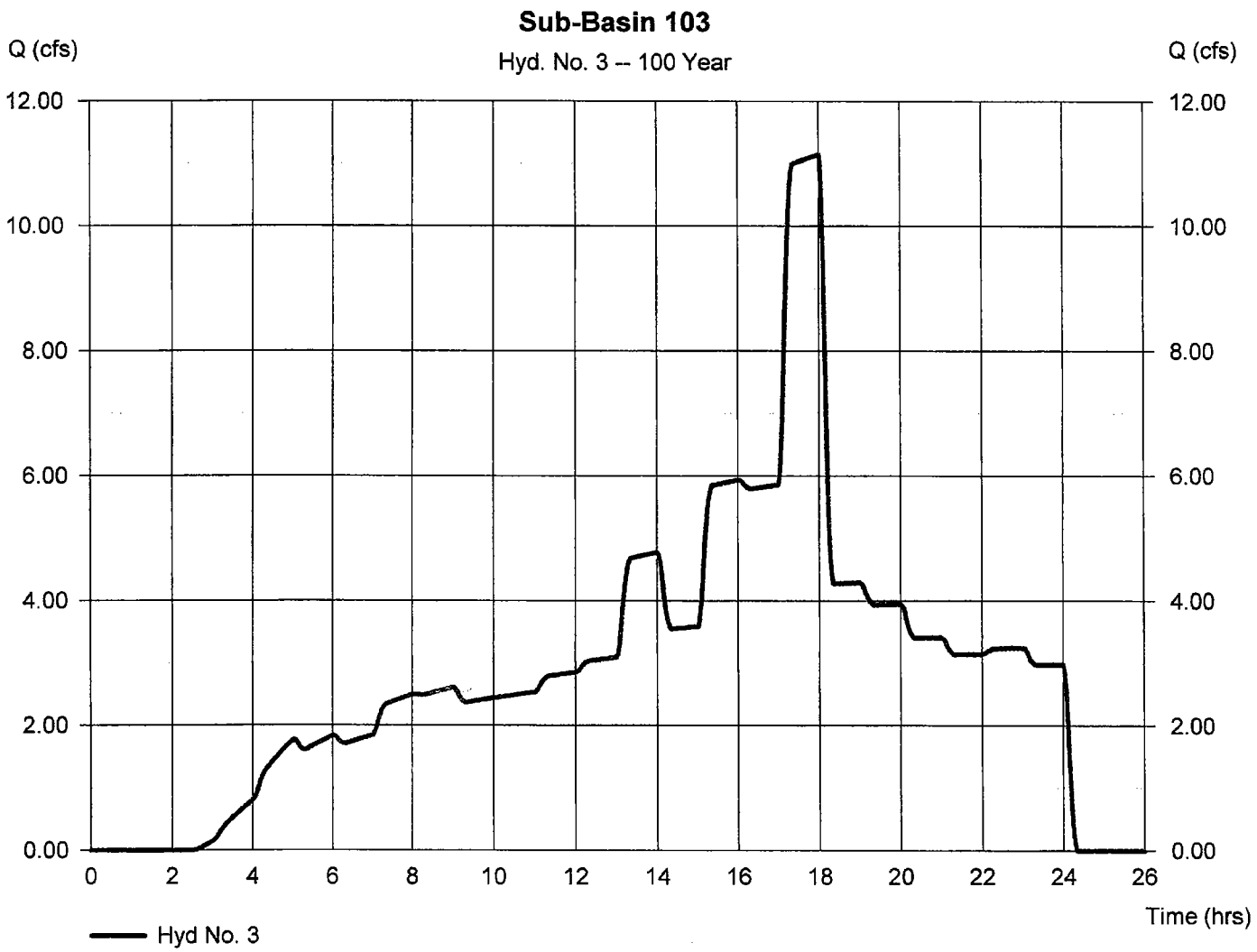
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 3

Sub-Basin 103

Hydrograph type	= SCS Runoff	Peak discharge	= 11.15 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.00 hrs
Time interval	= 2 min	Hyd. volume	= 264,563 cuft
Drainage area	= 16.700 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.40 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



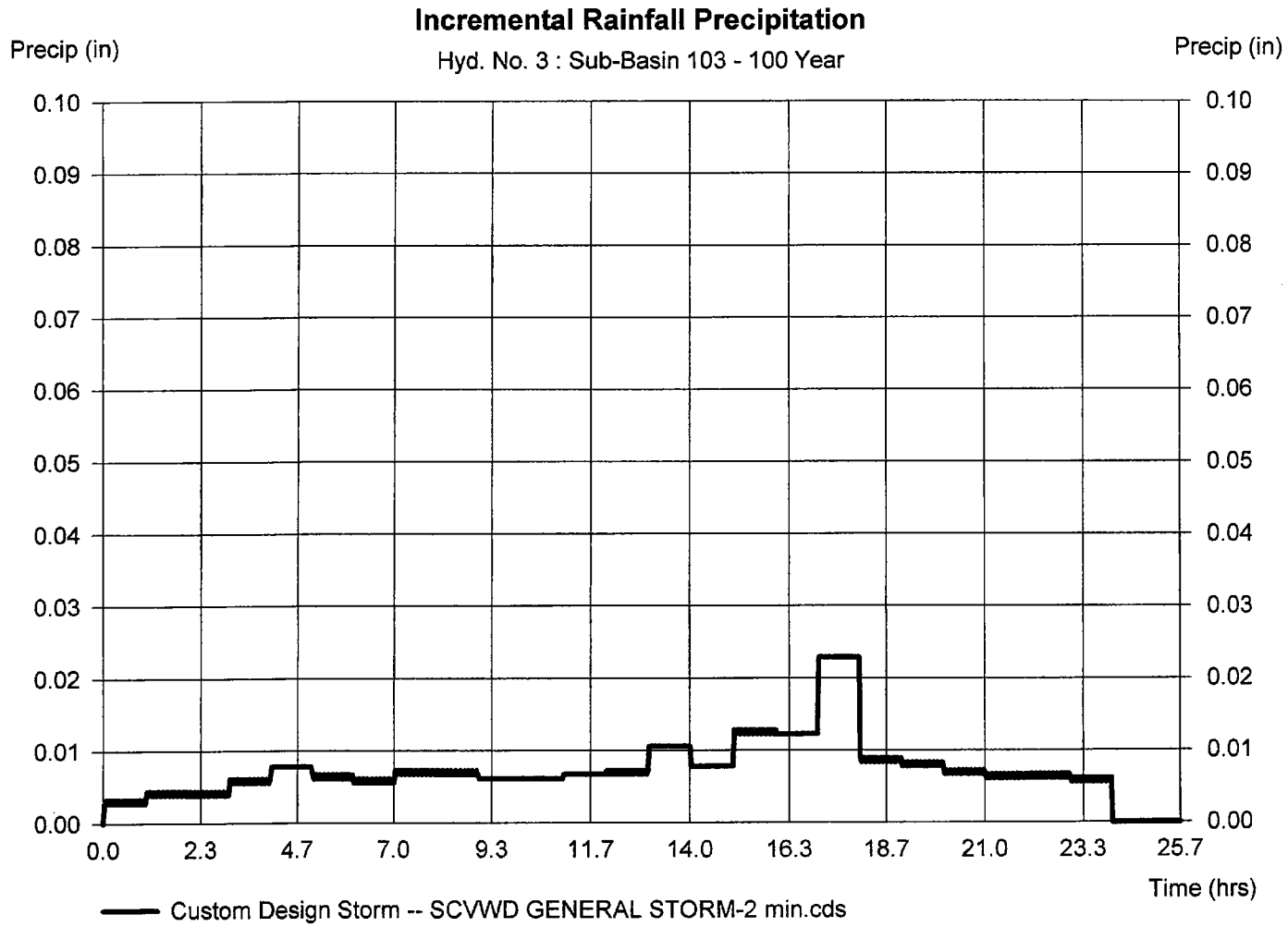
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 3

Sub-Basin 103

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



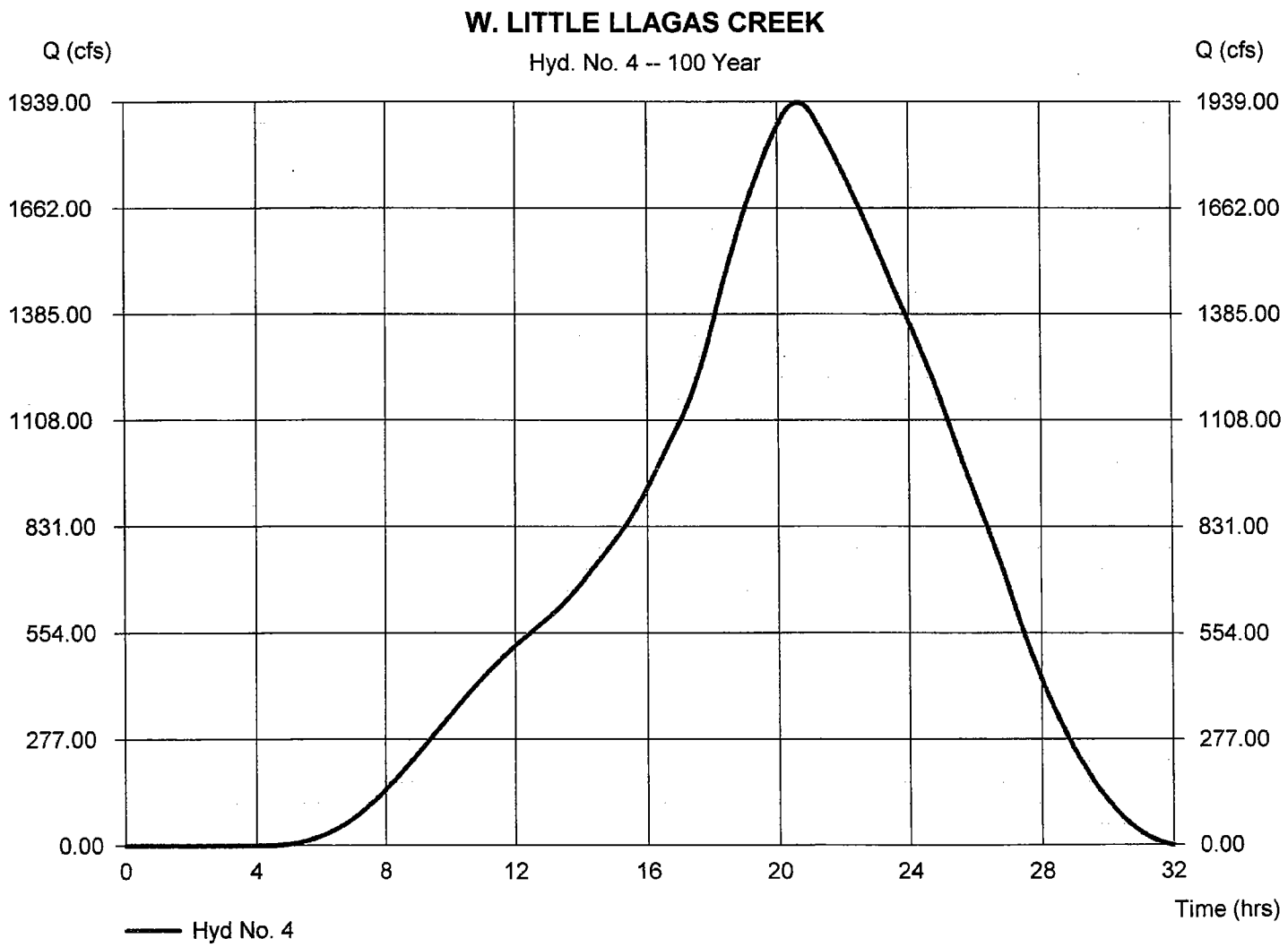
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 4

W. LITTLE LLAGAS CREEK

Hydrograph type	= SCS Runoff	Peak discharge	= 1935.90 cfs
Storm frequency	= 100 yrs	Time to peak	= 20.60 hrs
Time interval	= 2 min	Hyd. volume	= 75,435,390 cuft
Drainage area	= 6088.000 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 315.00 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



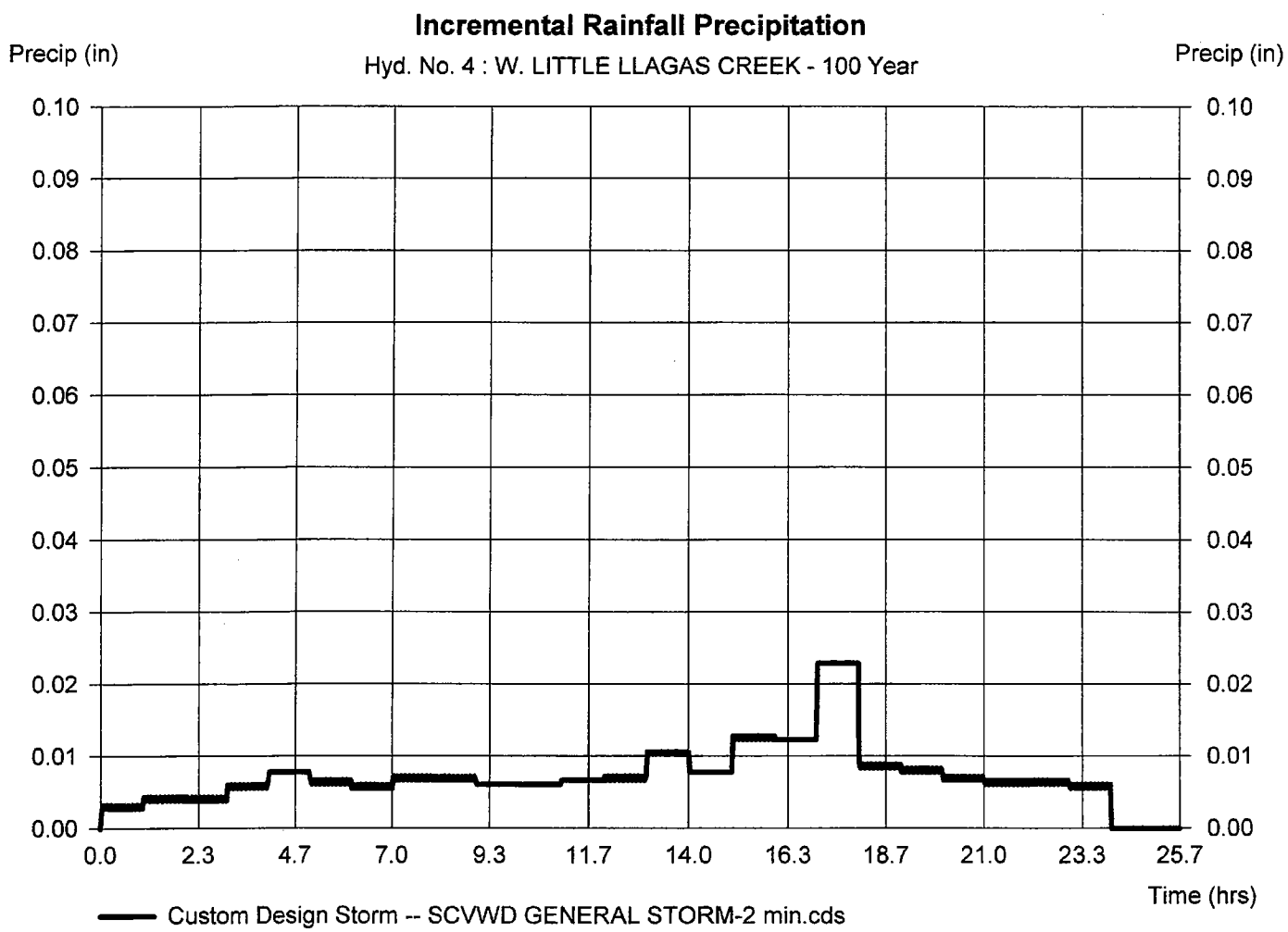
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 4

W. LITTLE LLAGAS CREEK

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



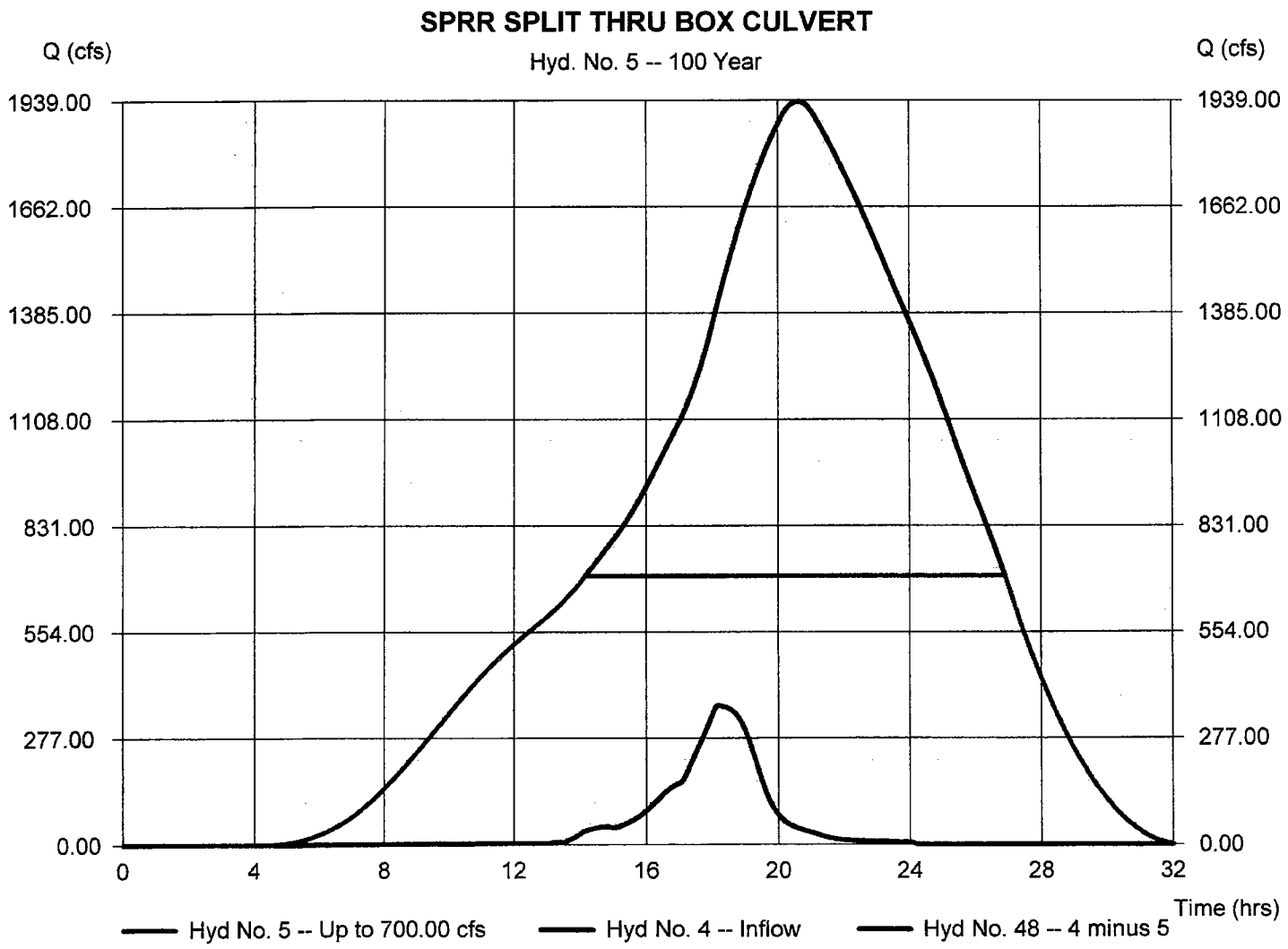
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 5

SPRR SPLIT THRU BOX CULVERT

Hydrograph type	= Diversion1	Peak discharge	= 700.00 cfs
Storm frequency	= 100 yrs	Time to peak	= 14.17 hrs
Time interval	= 2 min	Hyd. volume	= 46,684,590 cuft
Inflow hydrograph	= 4 - W. LITTLE LLAGAS CREEK	2nd diverted hyd.	= 48
Diversion method	= Constant Q	Constant Q	= 700.00 cfs



Hydrograph Report

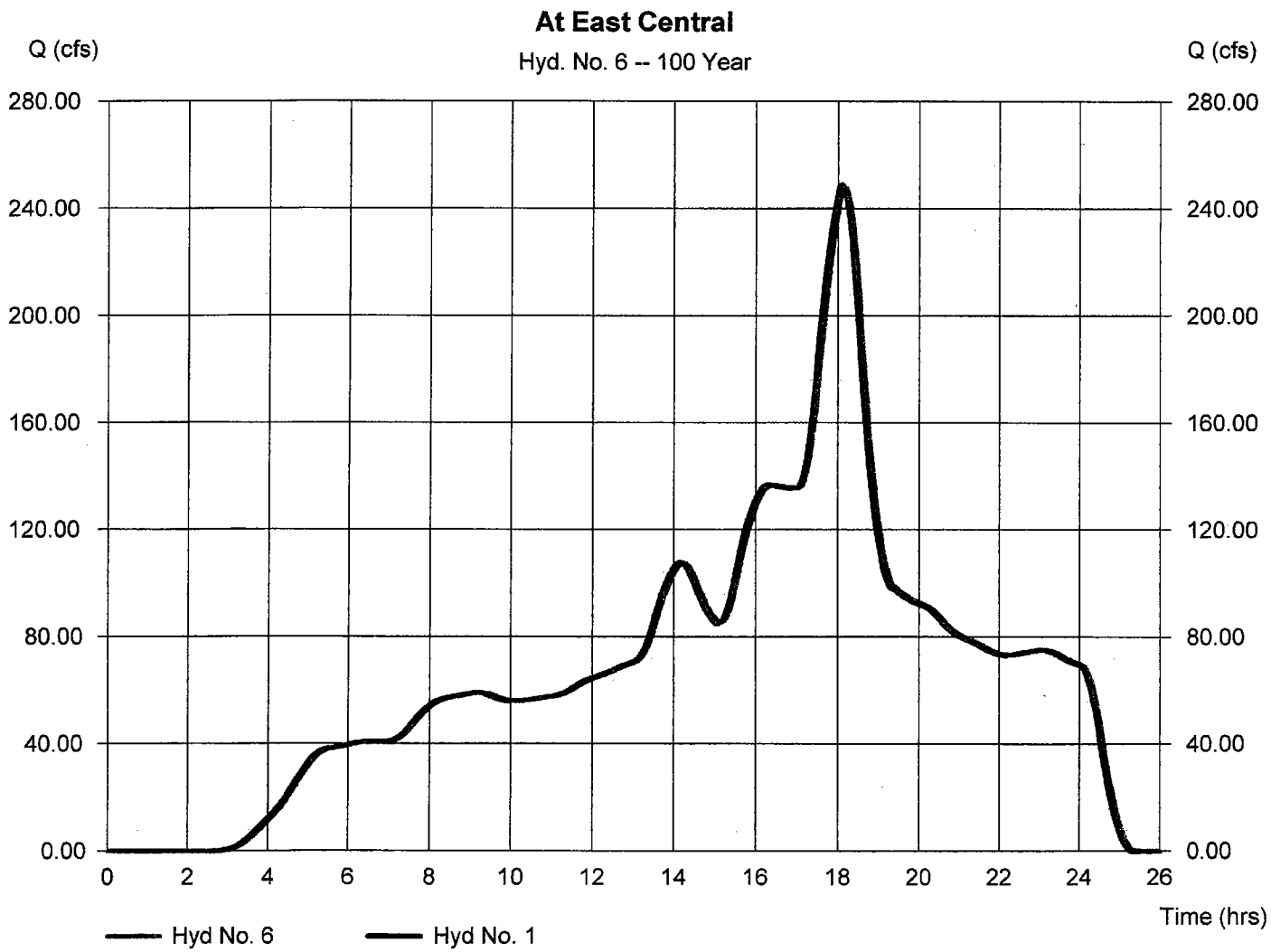
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 6

At East Central

Hydrograph type	= Reach	Peak discharge	= 247.55 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.17 hrs
Time interval	= 2 min	Hyd. volume	= 6,144,811 cuft
Inflow hyd. No.	= 1 - Sub-Basin 101	Section type	= Trapezoidal
Reach length	= 1200.0 ft	Channel slope	= 0.4 %
Manning's n	= 0.040	Bottom width	= 10.0 ft
Side slope	= 2.0:1	Max. depth	= 10.0 ft
Rating curve x	= 0.481	Rating curve m	= 1.444
Ave. velocity	= 3.29 ft/s	Routing coeff.	= 0.3841

Modified Att-Kin routing method used.



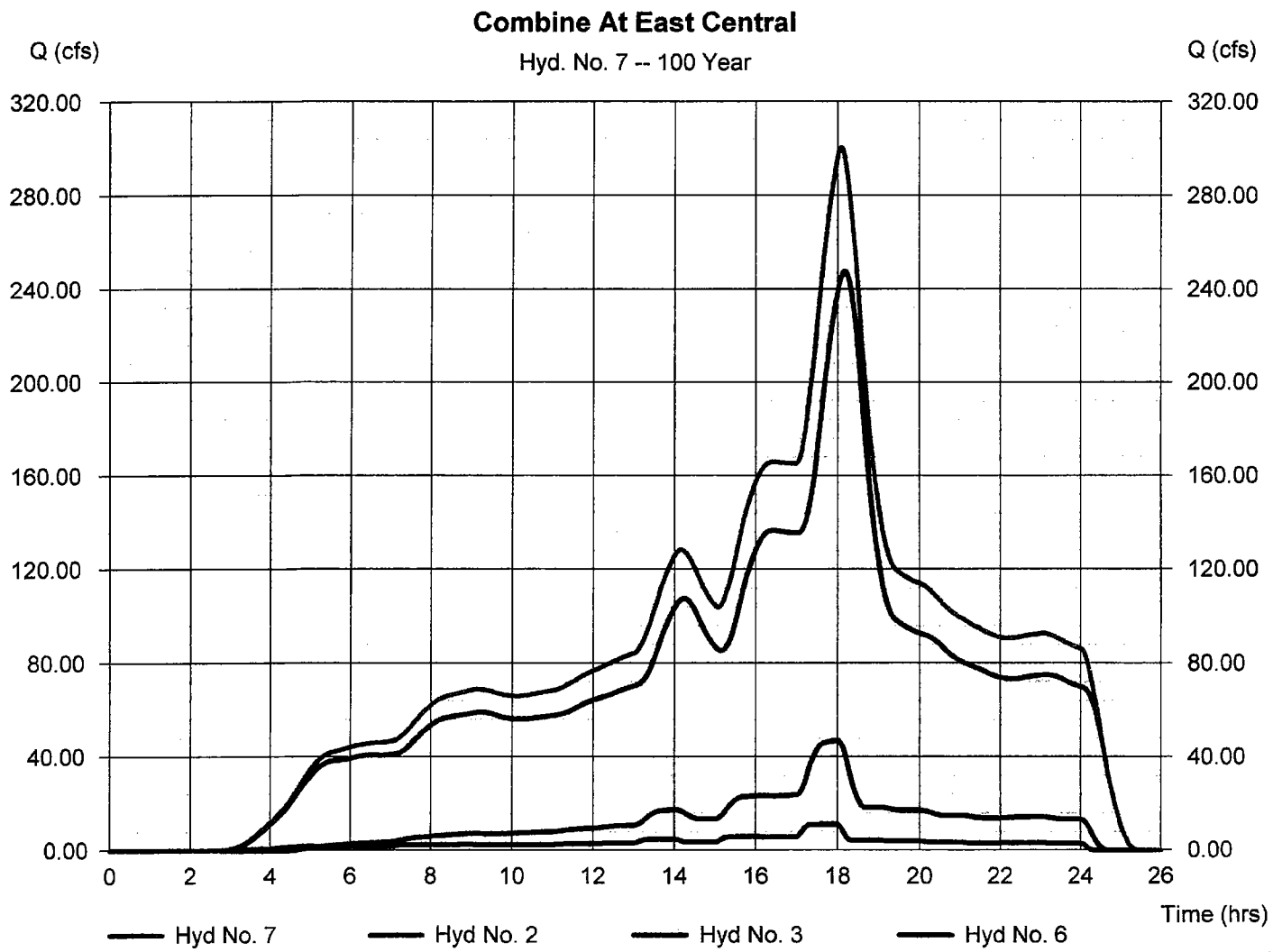
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 7

Combine At East Central

Hydrograph type	= Combine	Peak discharge	= 300.24 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.07 hrs
Time interval	= 2 min	Hyd. volume	= 7,386,772 cuft
Inflow hyds.	= 2, 3, 6	Contrib. drain. area	= 104.000 ac



Hydrograph Report

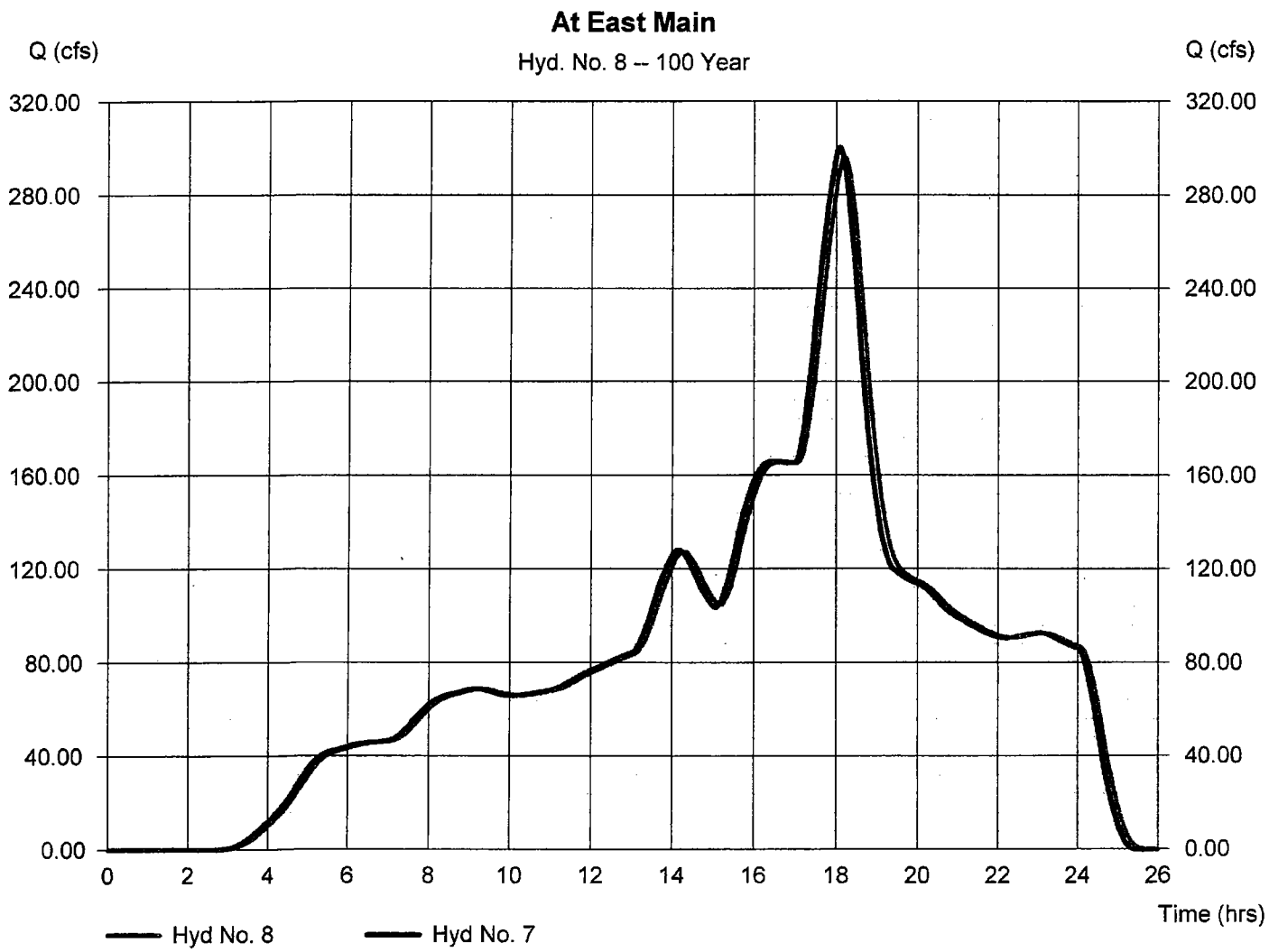
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 8

At East Main

Hydrograph type	= Reach	Peak discharge	= 295.95 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.20 hrs
Time interval	= 2 min	Hyd. volume	= 7,386,771 cuft
Inflow hyd. No.	= 7 - Combine At East Central	Section type	= Trapezoidal
Reach length	= 990.0 ft	Channel slope	= 0.1 %
Manning's n	= 0.040	Bottom width	= 10.0 ft
Side slope	= 2.0:1	Max. depth	= 10.0 ft
Rating curve x	= 0.179	Rating curve m	= 1.444
Ave. velocity	= 1.76 ft/s	Routing coeff.	= 0.2670

Modified Att-Kin routing method used.



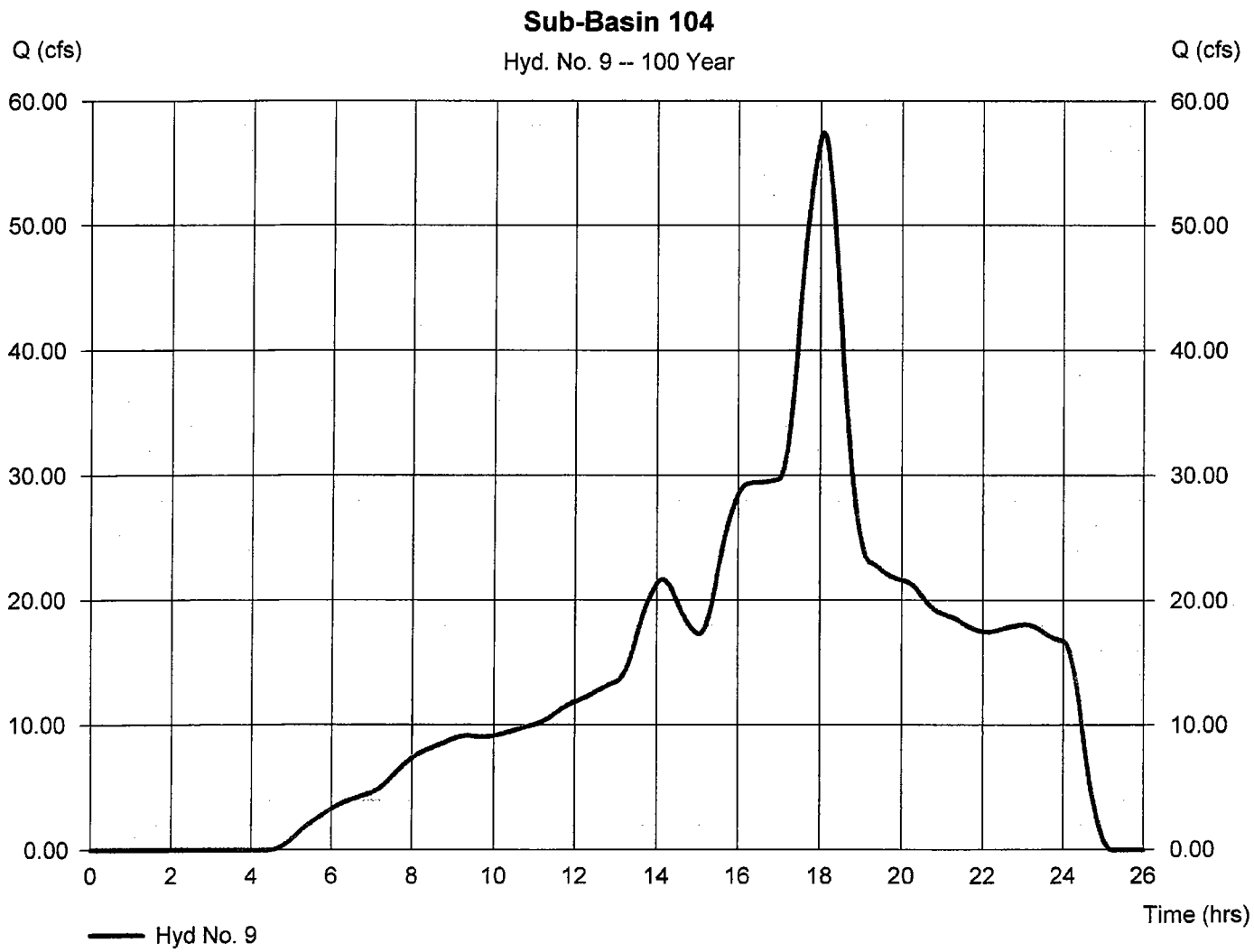
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 9

Sub-Basin 104

Hydrograph type	= SCS Runoff	Peak discharge	= 57.45 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,231,901 cuft
Drainage area	= 108.300 ac	Curve number	= 77.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 46.30 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



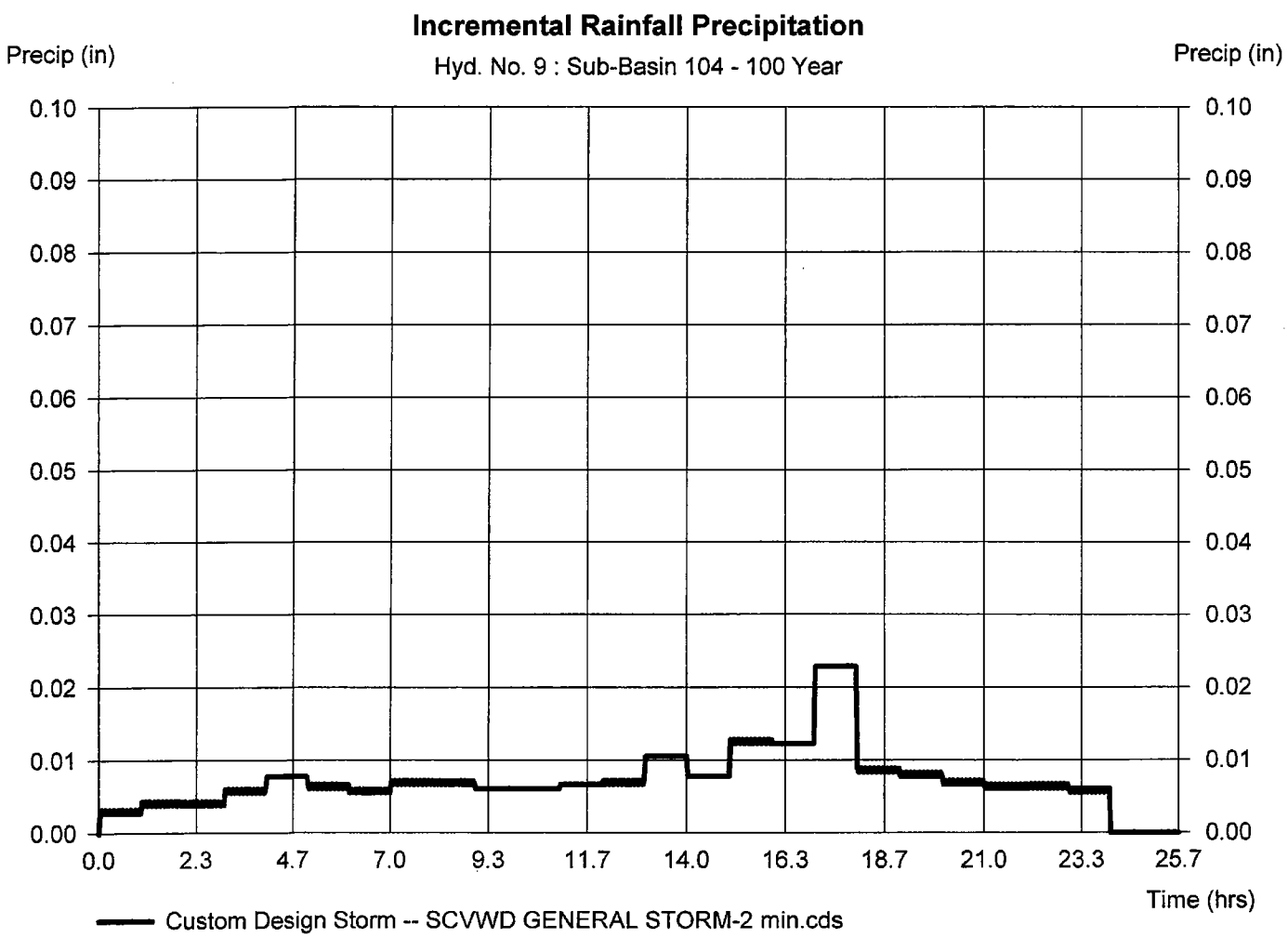
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 9

Sub-Basin 104

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



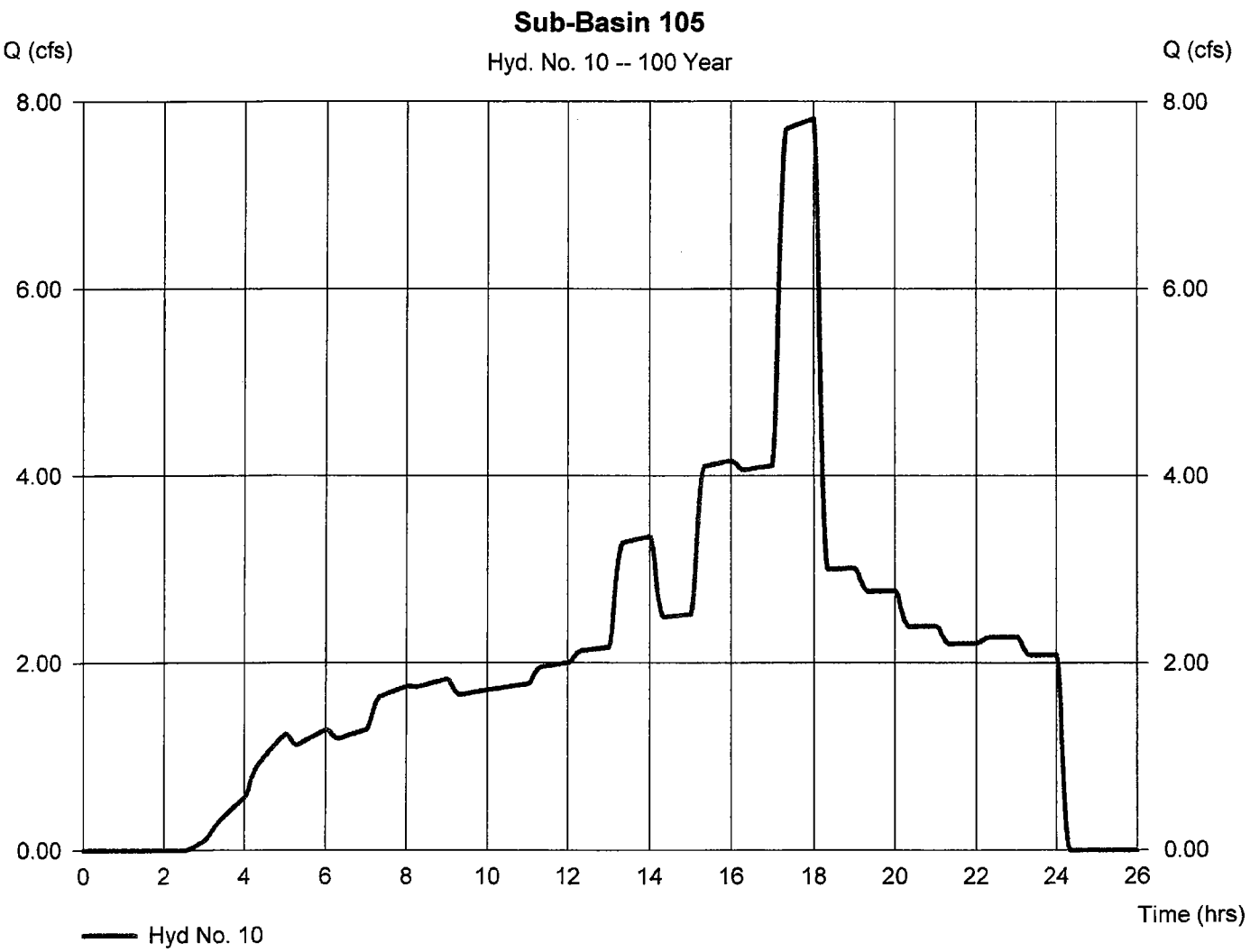
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 10

Sub-Basin 105

Hydrograph type	= SCS Runoff	Peak discharge	= 7.812 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.00 hrs
Time interval	= 2 min	Hyd. volume	= 185,353 cuft
Drainage area	= 11.700 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



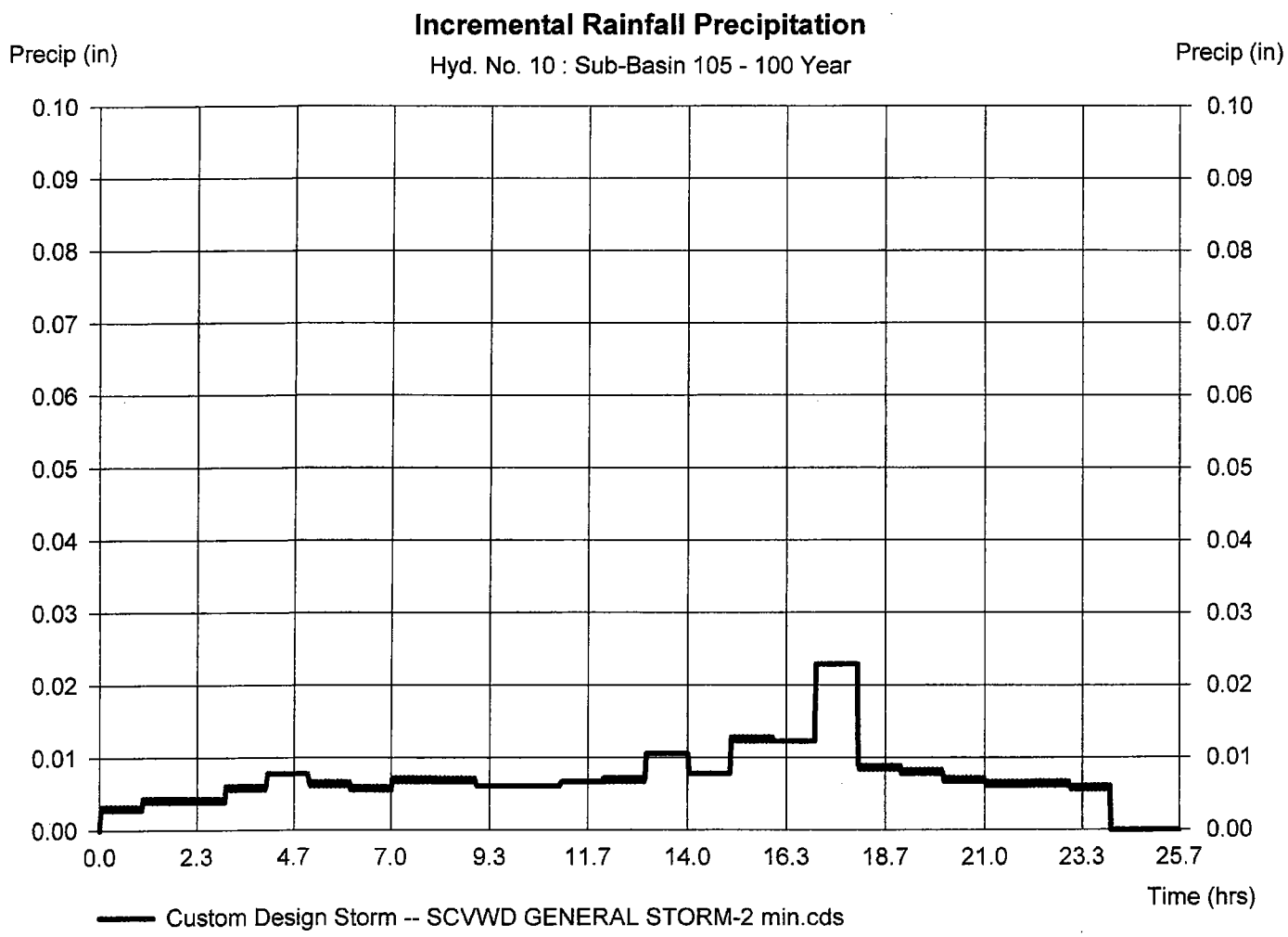
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 10

Sub-Basin 105

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



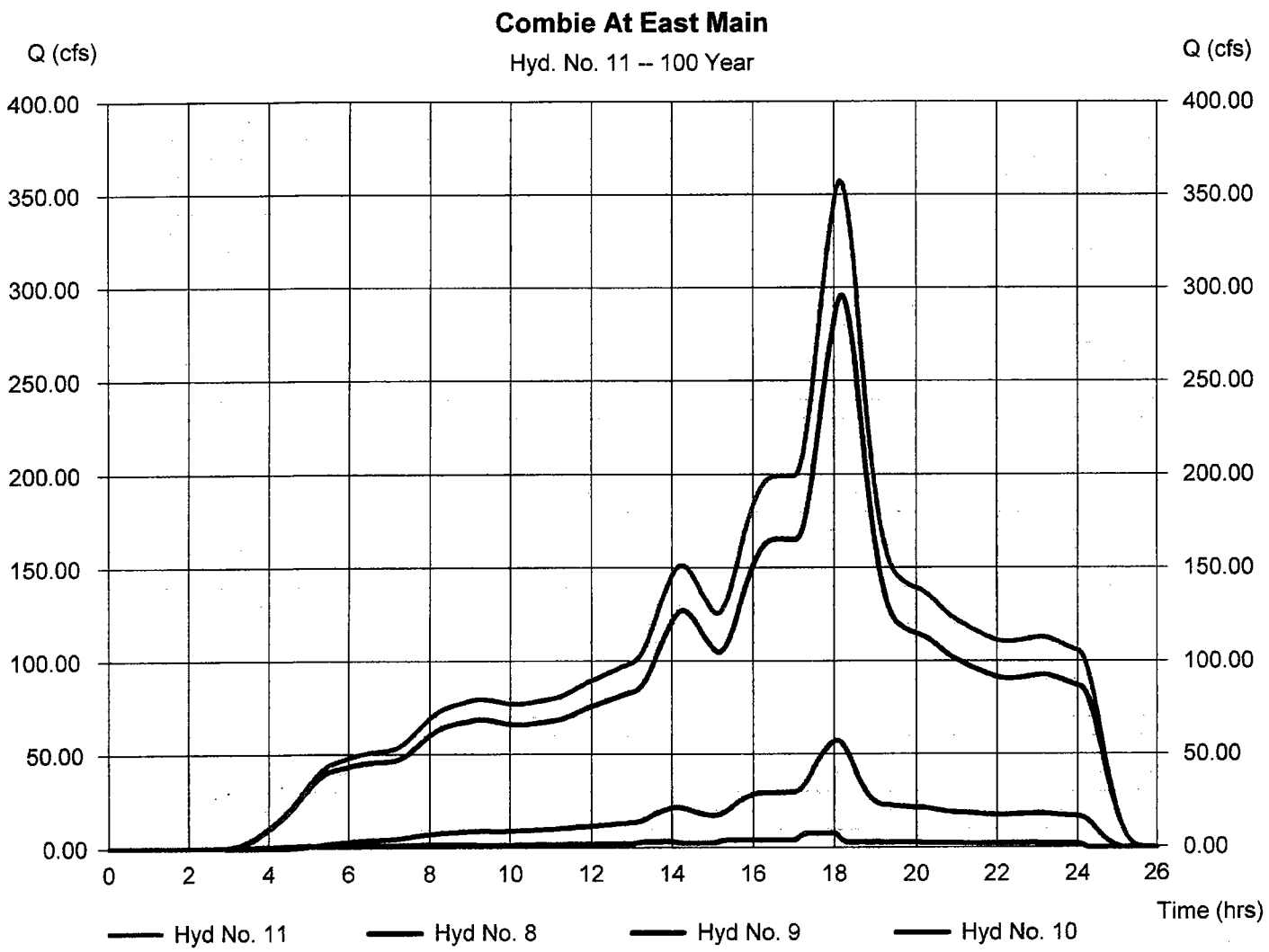
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 11

Combie At East Main

Hydrograph type	= Combine	Peak discharge	= 357.22 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.13 hrs
Time interval	= 2 min	Hyd. volume	= 8,804,023 cuft
Inflow hyds.	= 8, 9, 10	Contrib. drain. area	= 120.000 ac



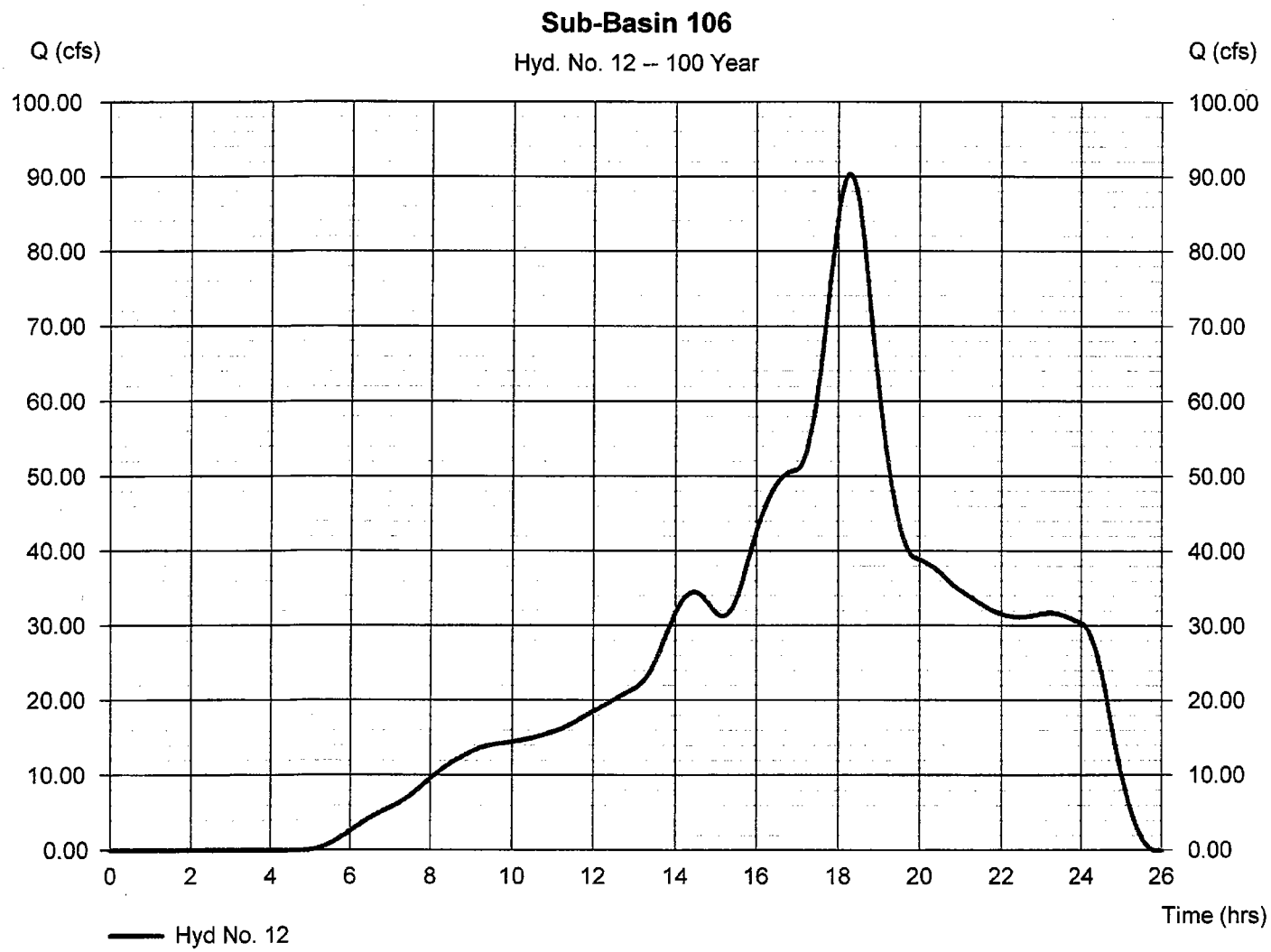
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 12

Sub-Basin 106

Hydrograph type	= SCS Runoff	Peak discharge	= 90.28 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.27 hrs
Time interval	= 2 min	Hyd. volume	= 2,094,030 cuft
Drainage area	= 196.500 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 68.50 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



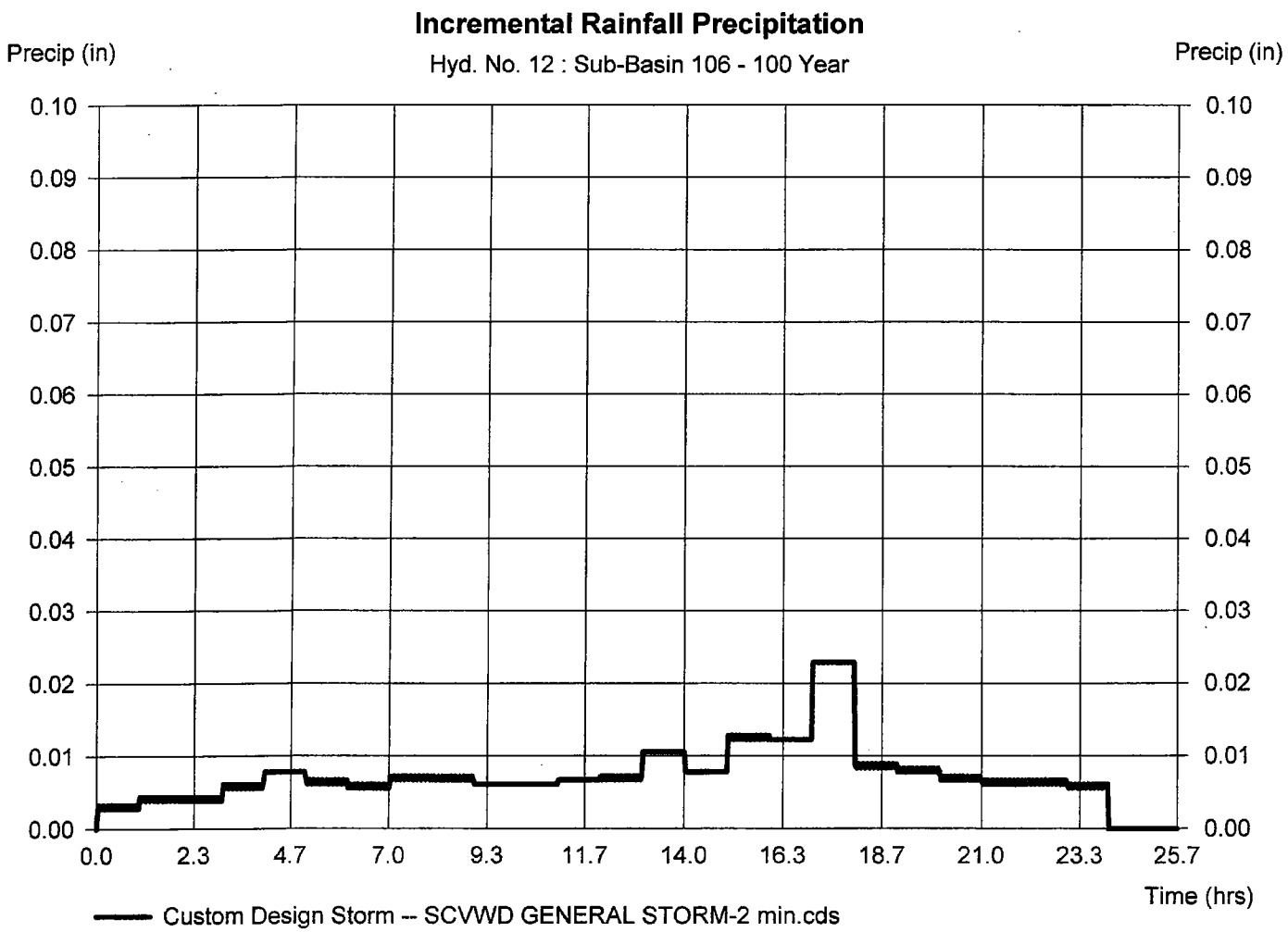
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 12

Sub-Basin 106

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



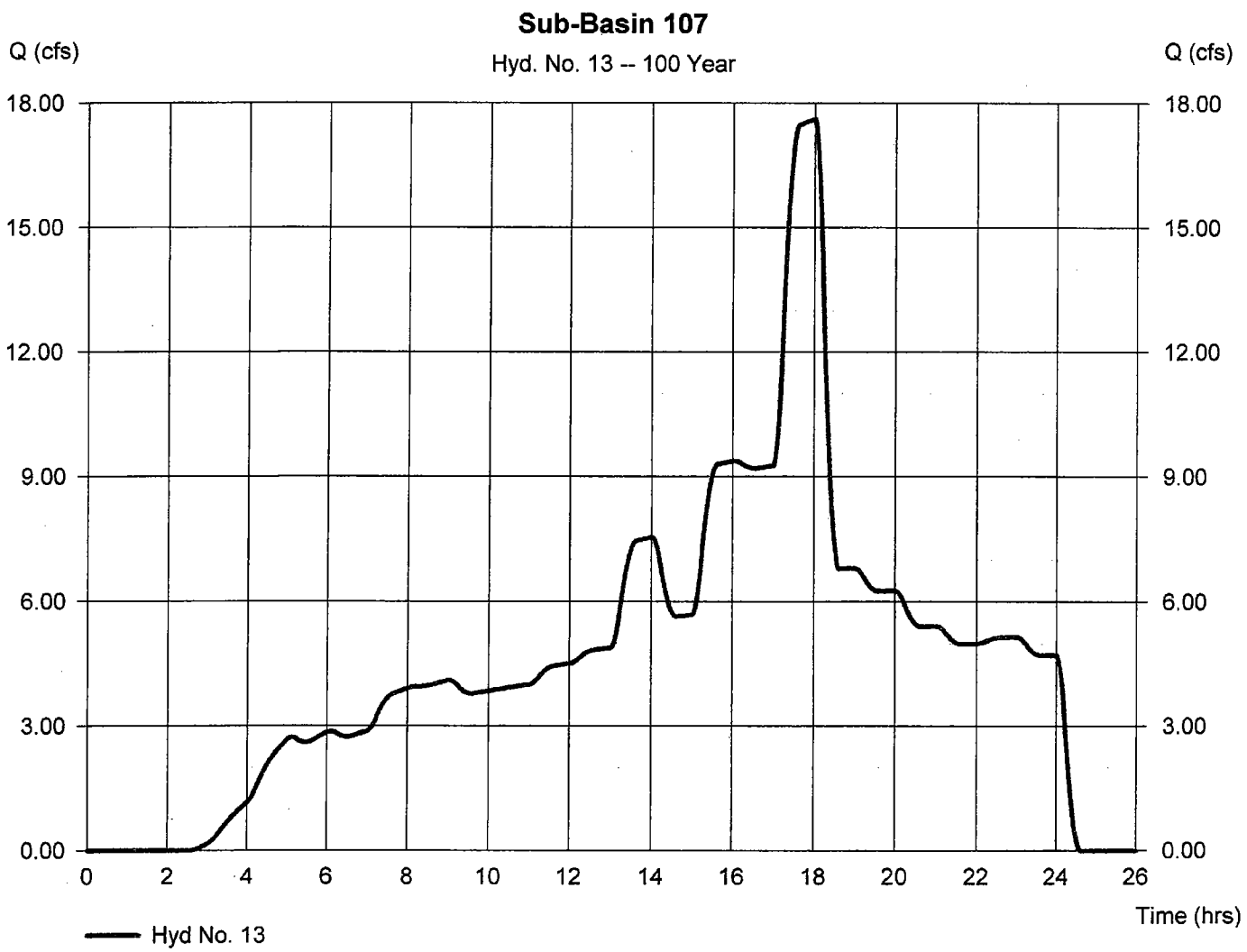
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 13

Sub-Basin 107

Hydrograph type	= SCS Runoff	Peak discharge	= 17.62 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.00 hrs
Time interval	= 2 min	Hyd. volume	= 419,055 cuft
Drainage area	= 26.800 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 20.80 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



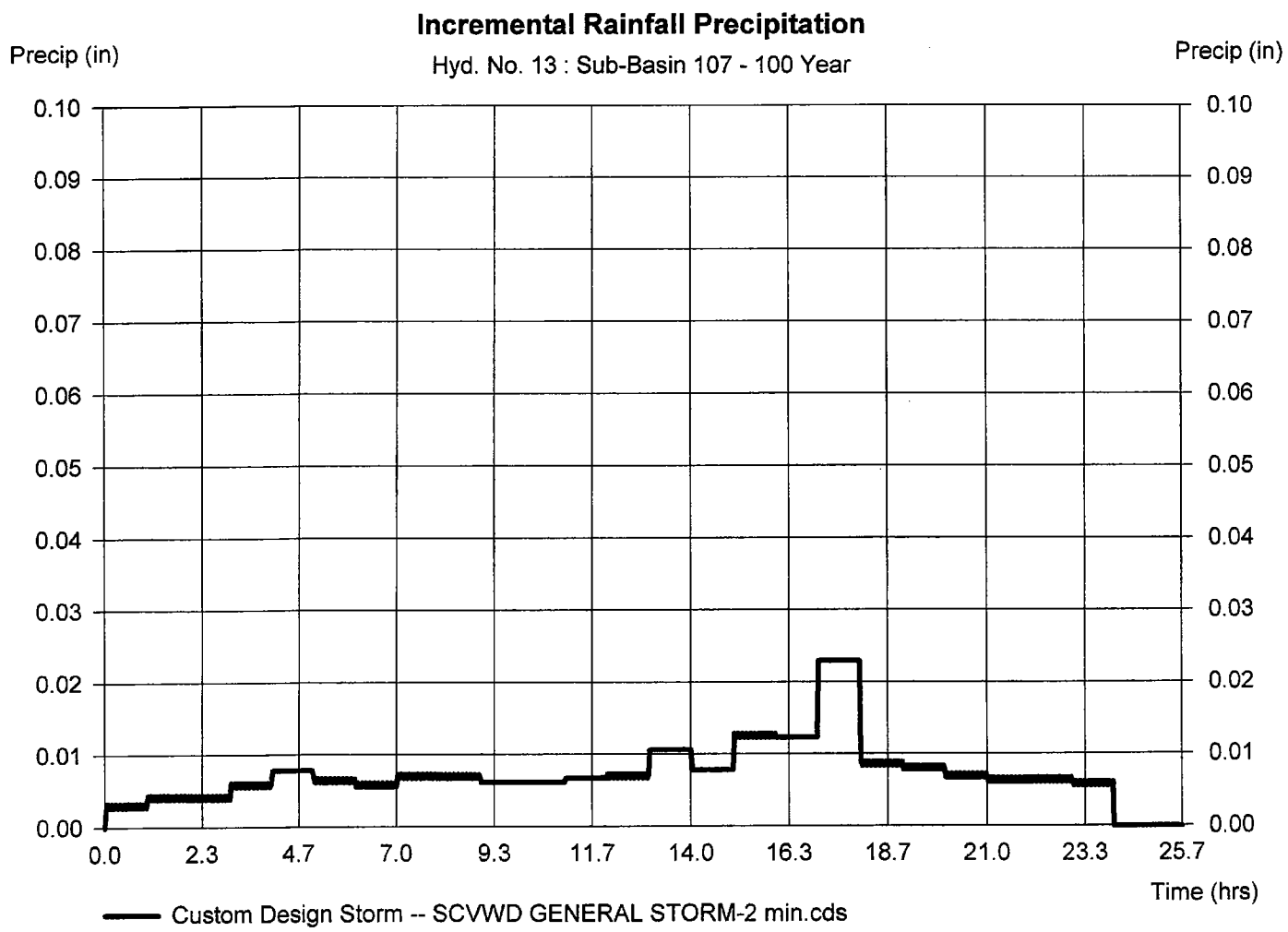
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 13

Sub-Basin 107

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



Hydrograph Report

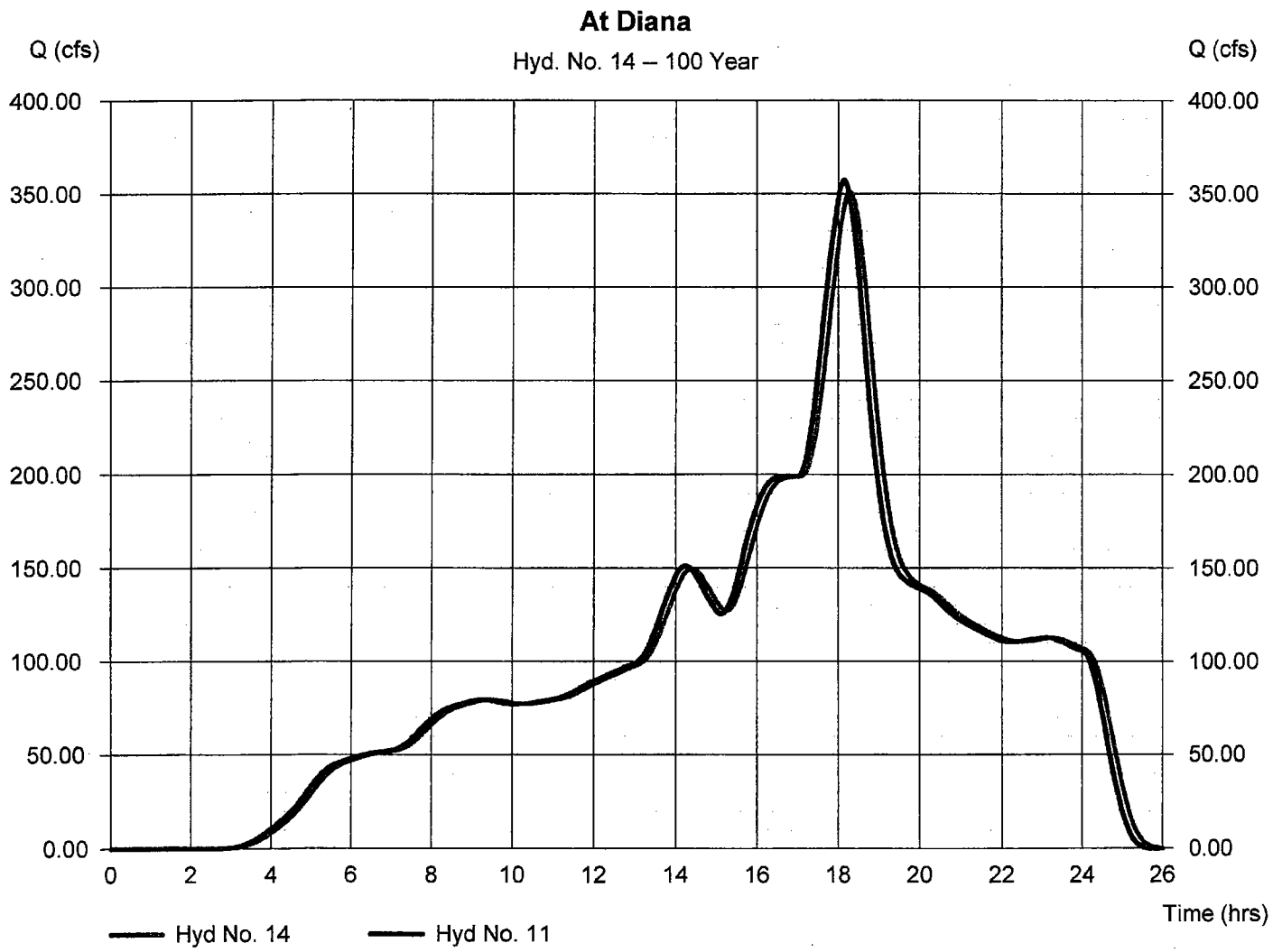
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 14

At Diana

Hydrograph type	= Reach	Peak discharge	= 350.80 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.30 hrs
Time interval	= 2 min	Hyd. volume	= 8,804,020 cuft
Inflow hyd. No.	= 11 - Combie At East Main	Section type	= Trapezoidal
Reach length	= 2010.0 ft	Channel slope	= 0.2 %
Manning's n	= 0.040	Bottom width	= 10.0 ft
Side slope	= 2.0:1	Max. depth	= 10.0 ft
Rating curve x	= 0.340	Rating curve m	= 1.444
Ave. velocity	= 2.89 ft/s	Routing coeff.	= 0.2218

Modified Att-Kin routing method used.



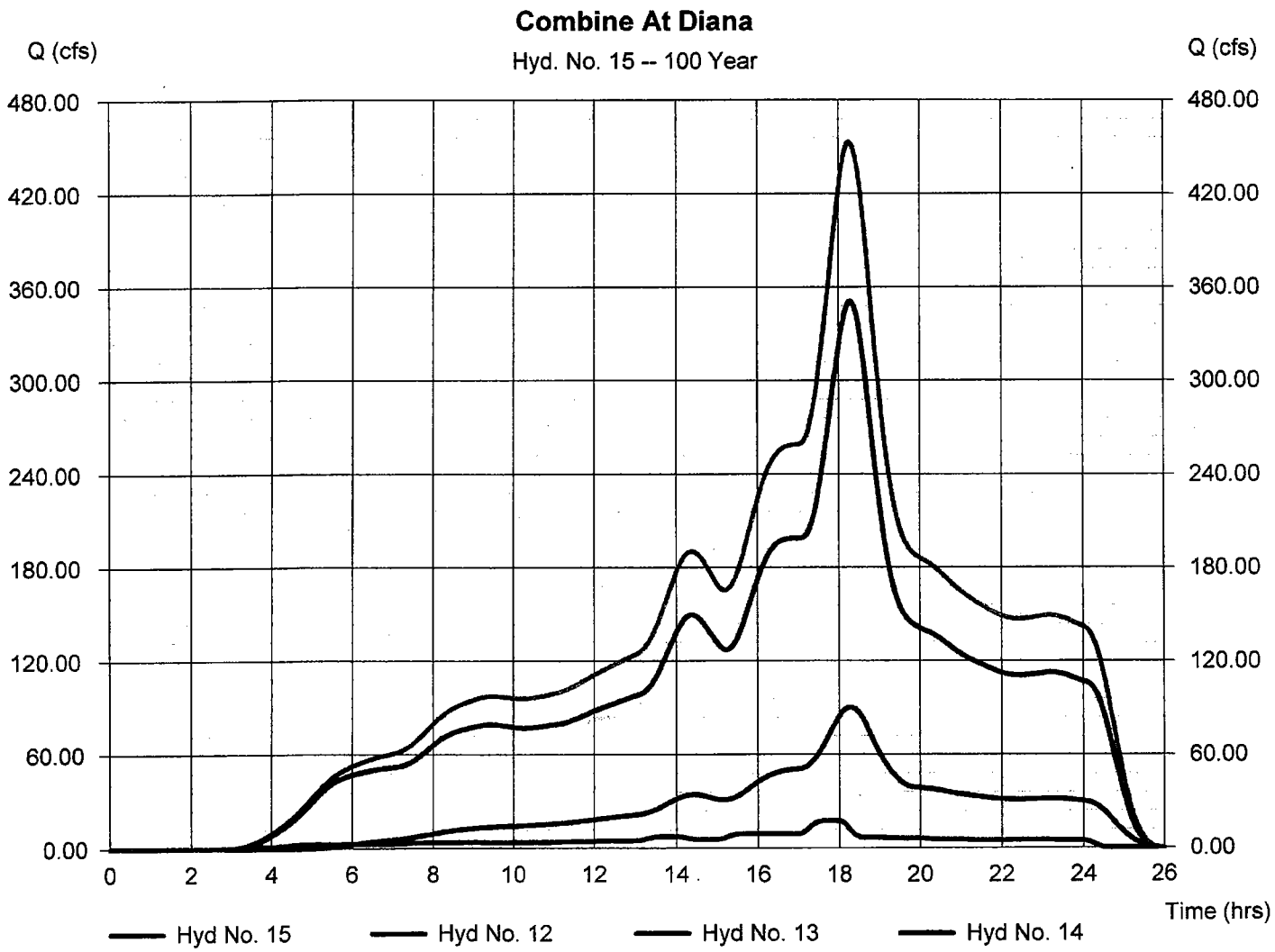
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 15

Combine At Diana

Hydrograph type	= Combine	Peak discharge	= 453.01 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.27 hrs
Time interval	= 2 min	Hyd. volume	= 11,317,100 cuft
Inflow hyds.	= 12, 13, 14	Contrib. drain. area	= 223.300 ac



Hydrograph Report

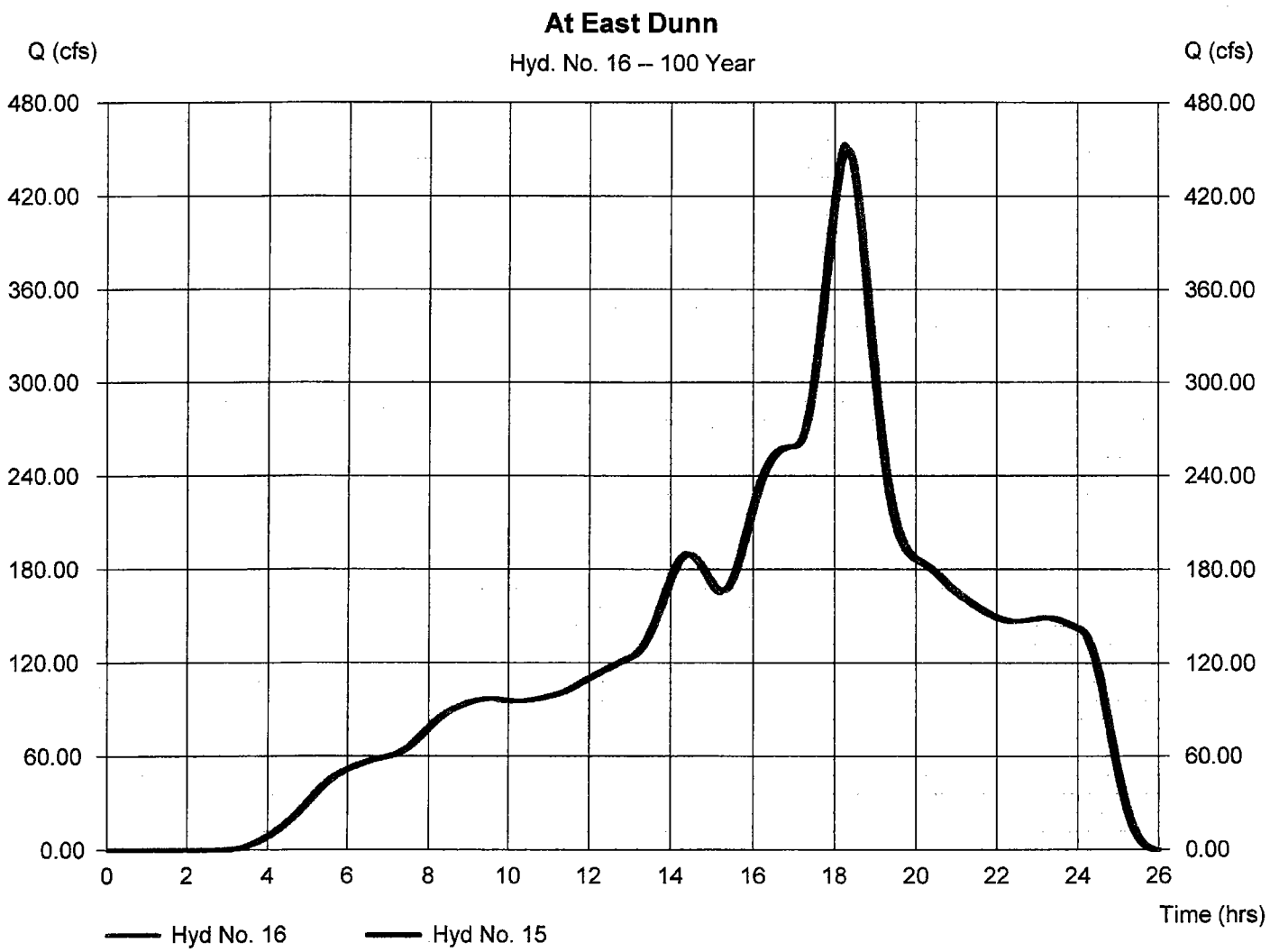
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 16

At East Dunn

Hydrograph type	= Reach	Peak discharge	= 450.00 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.37 hrs
Time interval	= 2 min	Hyd. volume	= 11,317,100 cuft
Inflow hyd. No.	= 15 - Combine At Diana	Section type	= Trapezoidal
Reach length	= 810.0 ft	Channel slope	= 0.0 %
Manning's n	= 0.040	Bottom width	= 10.0 ft
Side slope	= 2.0:1	Max. depth	= 10.0 ft
Rating curve x	= 0.154	Rating curve m	= 1.444
Ave. velocity	= 1.80 ft/s	Routing coeff.	= 0.3230

Modified Att-Kin routing method used.



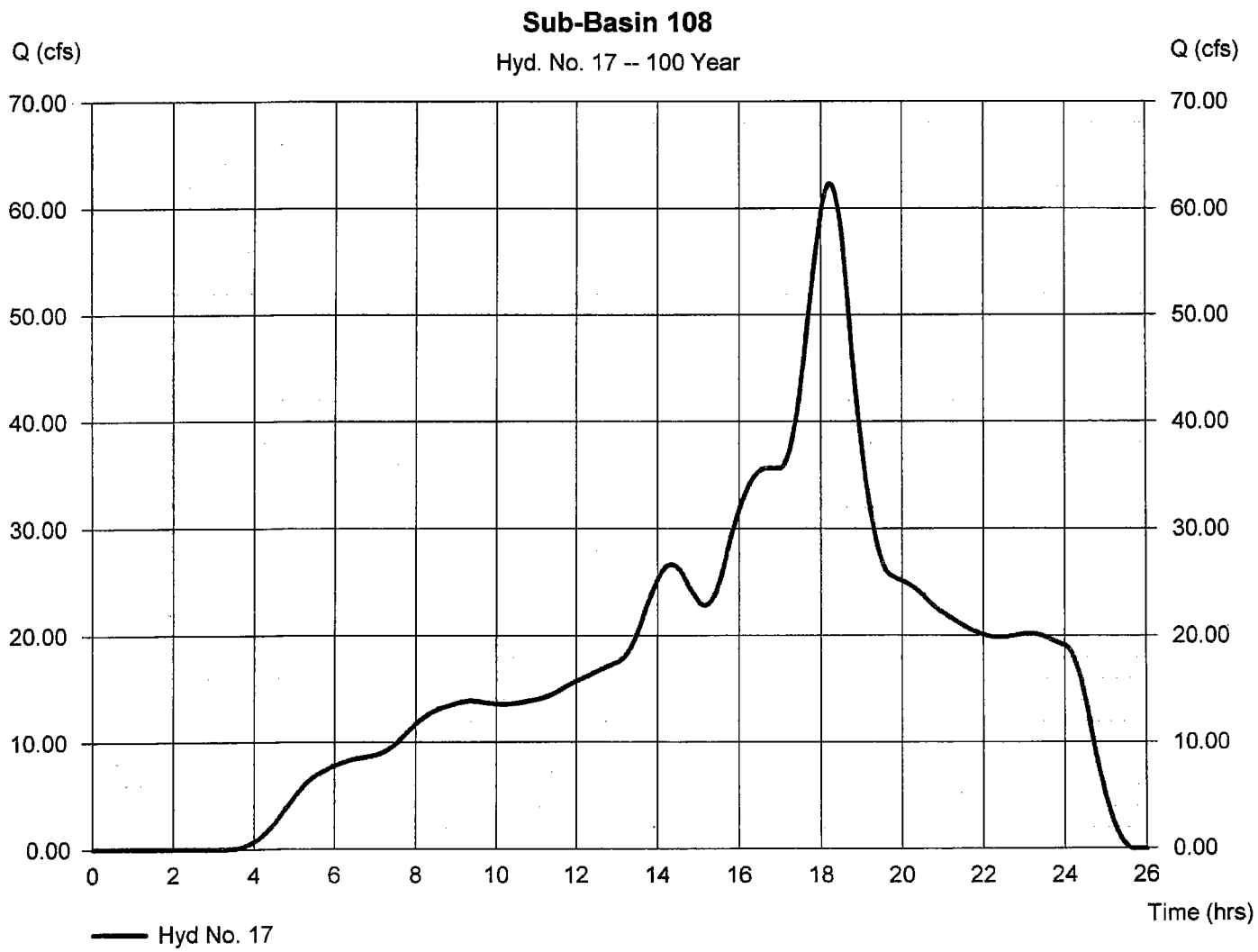
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 17

Sub-Basin 108

Hydrograph type	= SCS Runoff	Peak discharge	= 62.33 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.20 hrs
Time interval	= 2 min	Hyd. volume	= 1,560,742 cuft
Drainage area	= 110.500 ac	Curve number	= 84.5
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 61.70 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



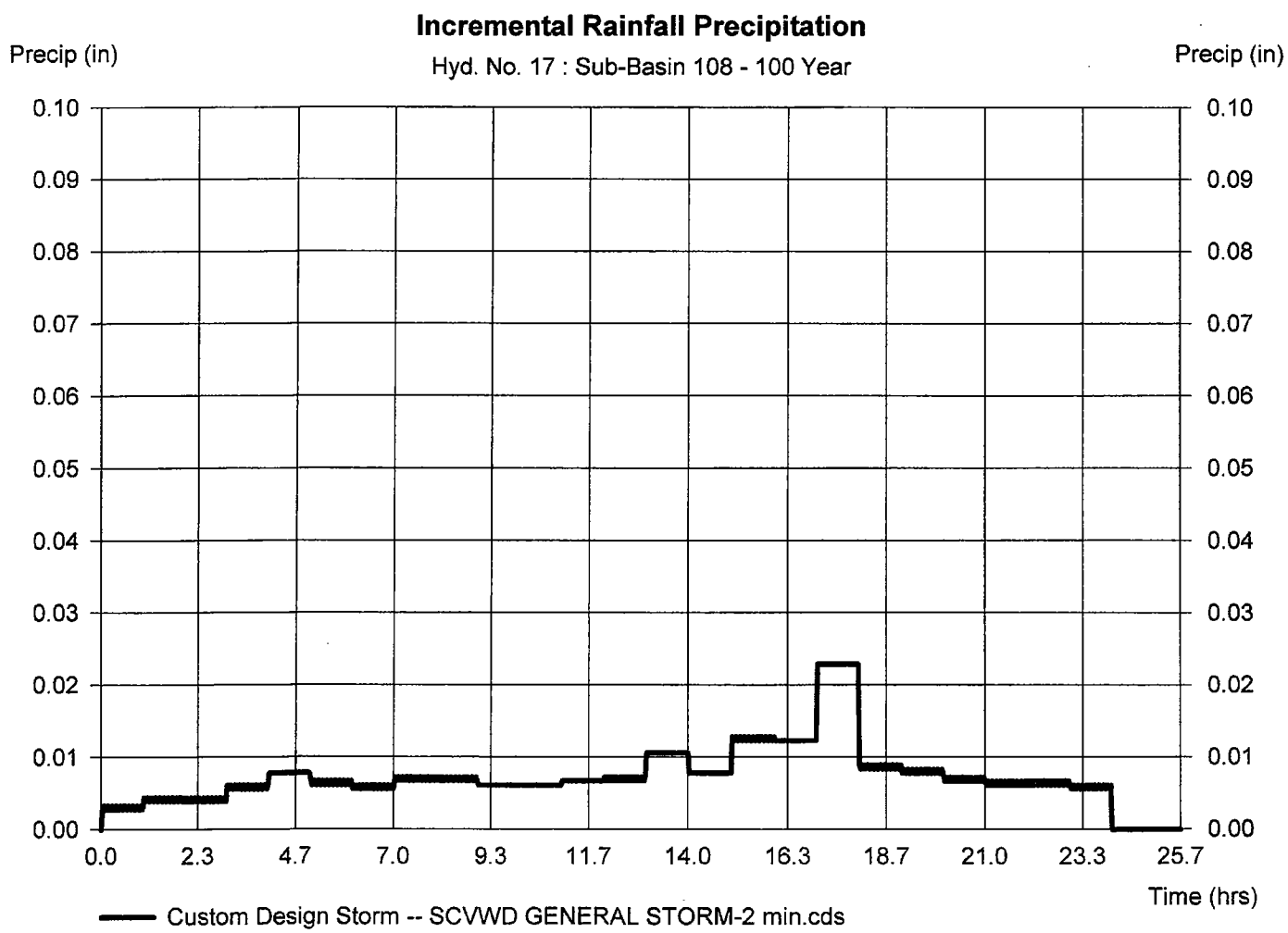
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 17

Sub-Basin 108

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



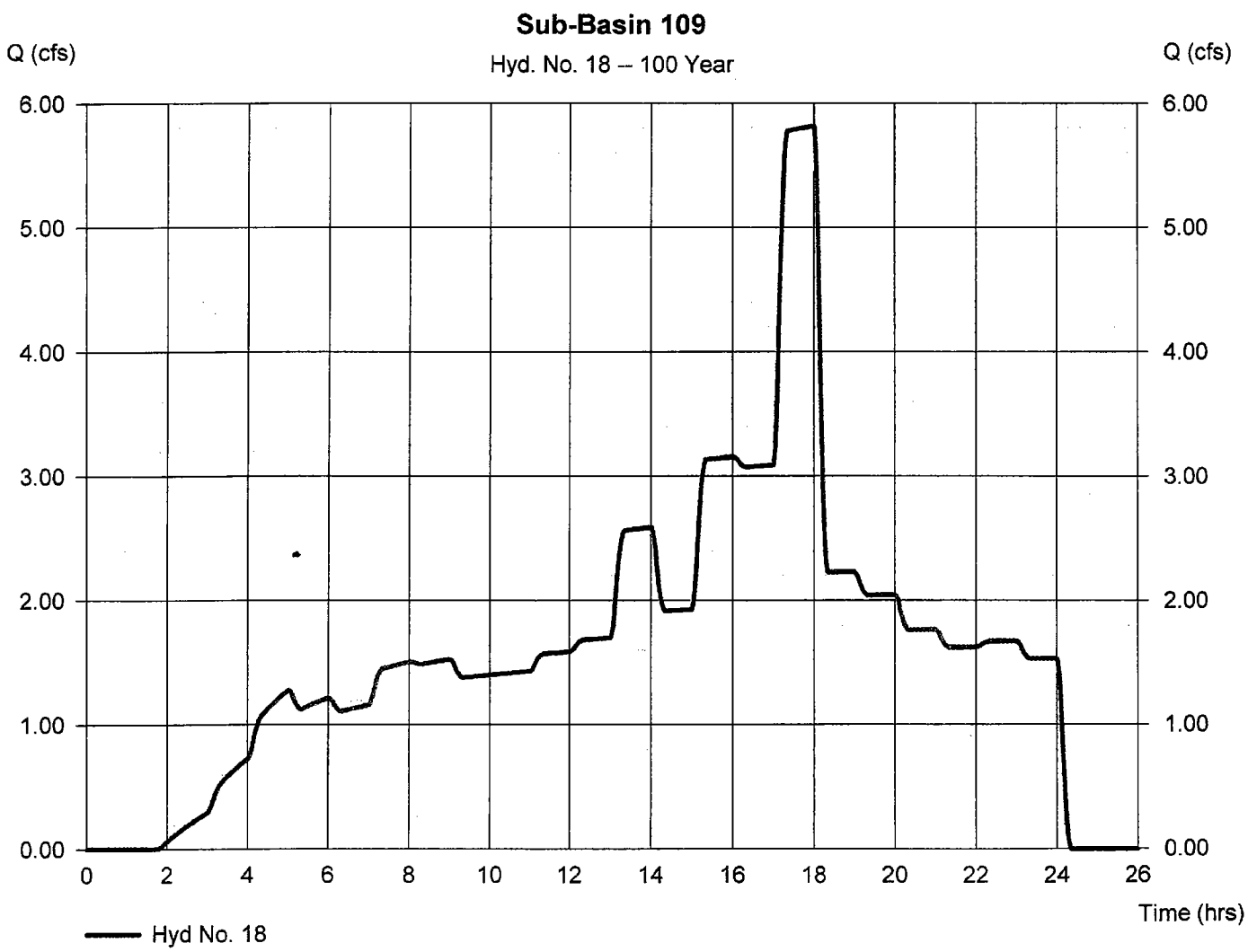
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 18

Sub-Basin 109

Hydrograph type	= SCS Runoff	Peak discharge	= 5.817 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.00 hrs
Time interval	= 2 min	Hyd. volume	= 146,748 cuft
Drainage area	= 8.400 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 9.90 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



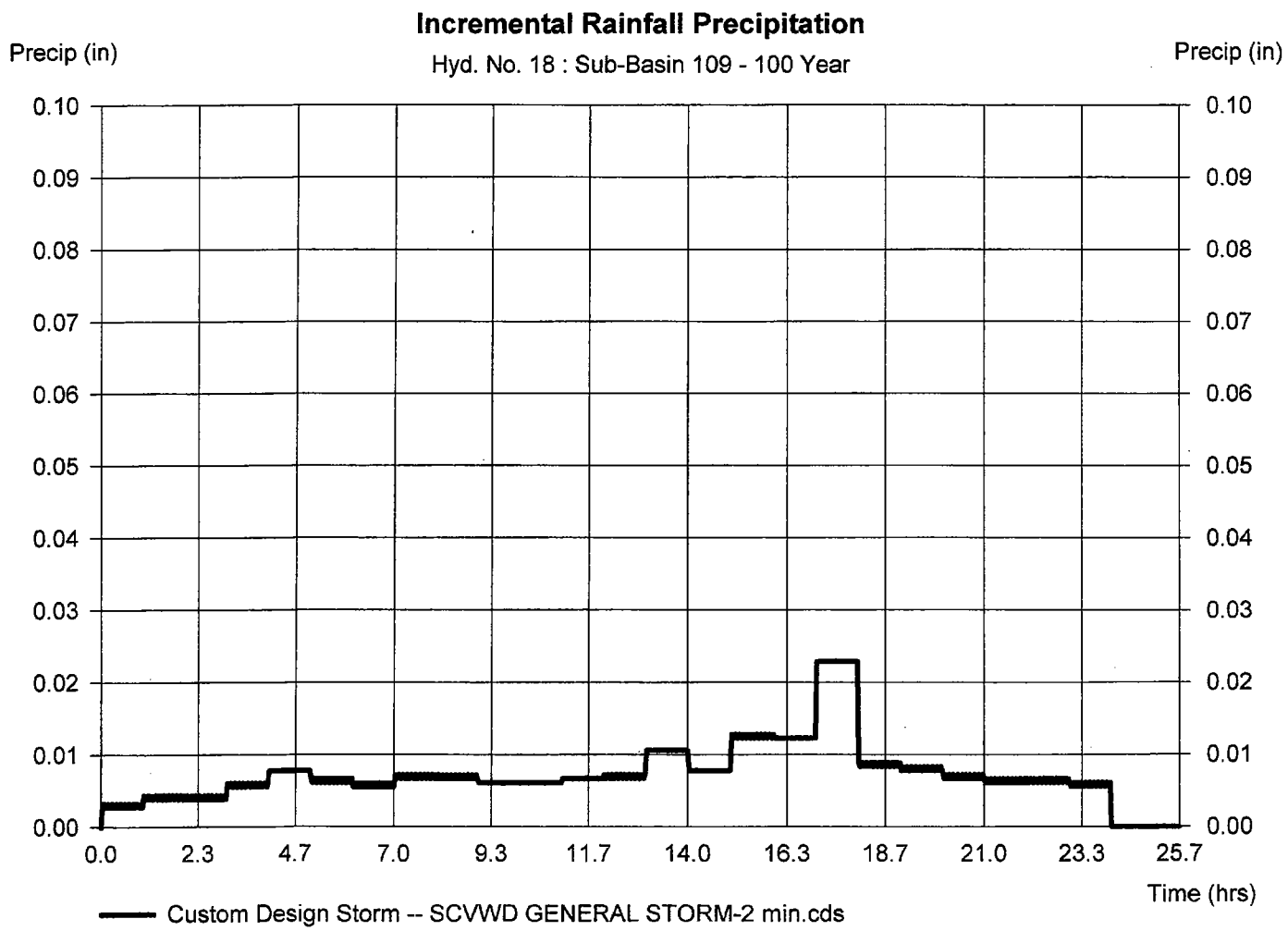
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 18

Sub-Basin 109

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



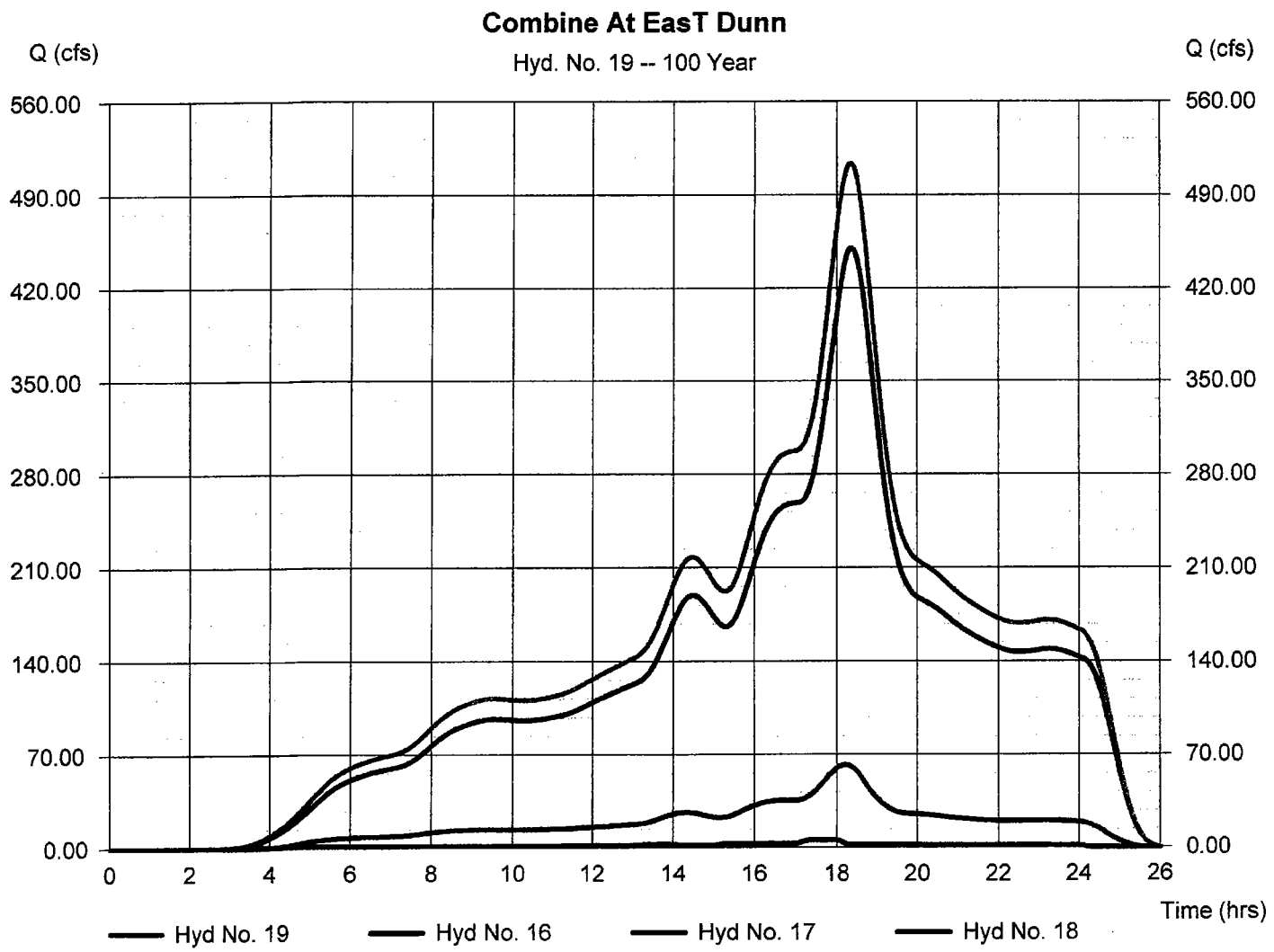
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 19

Combine At EasT Dunn

Hydrograph type	= Combine	Peak discharge	= 513.55 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.33 hrs
Time interval	= 2 min	Hyd. volume	= 13,024,580 cuft
Inflow hyds.	= 16, 17, 18	Contrib. drain. area	= 118.900 ac



Hydrograph Report

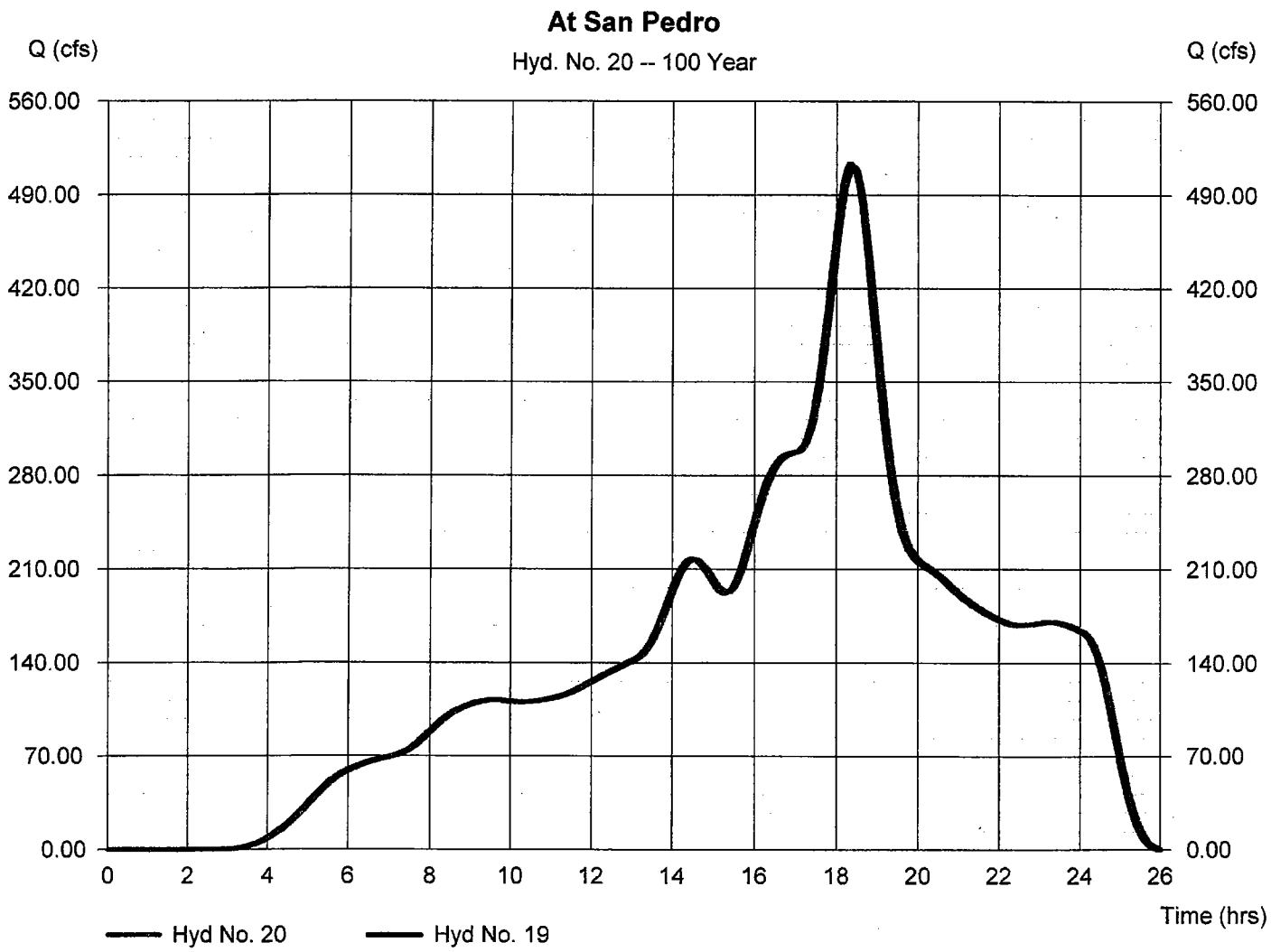
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 20

At San Pedro

Hydrograph type	= Reach	Peak discharge	= 510.88 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.43 hrs
Time interval	= 2 min	Hyd. volume	= 13,024,590 cuft
Inflow hyd. No.	= 19 - Combine At EasT Dunn	Section type	= Trapezoidal
Reach length	= 1680.0 ft	Channel slope	= 0.3 %
Manning's n	= 0.040	Bottom width	= 10.0 ft
Side slope	= 2.0:1	Max. depth	= 10.0 ft
Rating curve x	= 0.463	Rating curve m	= 1.444
Ave. velocity	= 4.00 ft/s	Routing coeff.	= 0.3423

Modified Att-Kin routing method used.



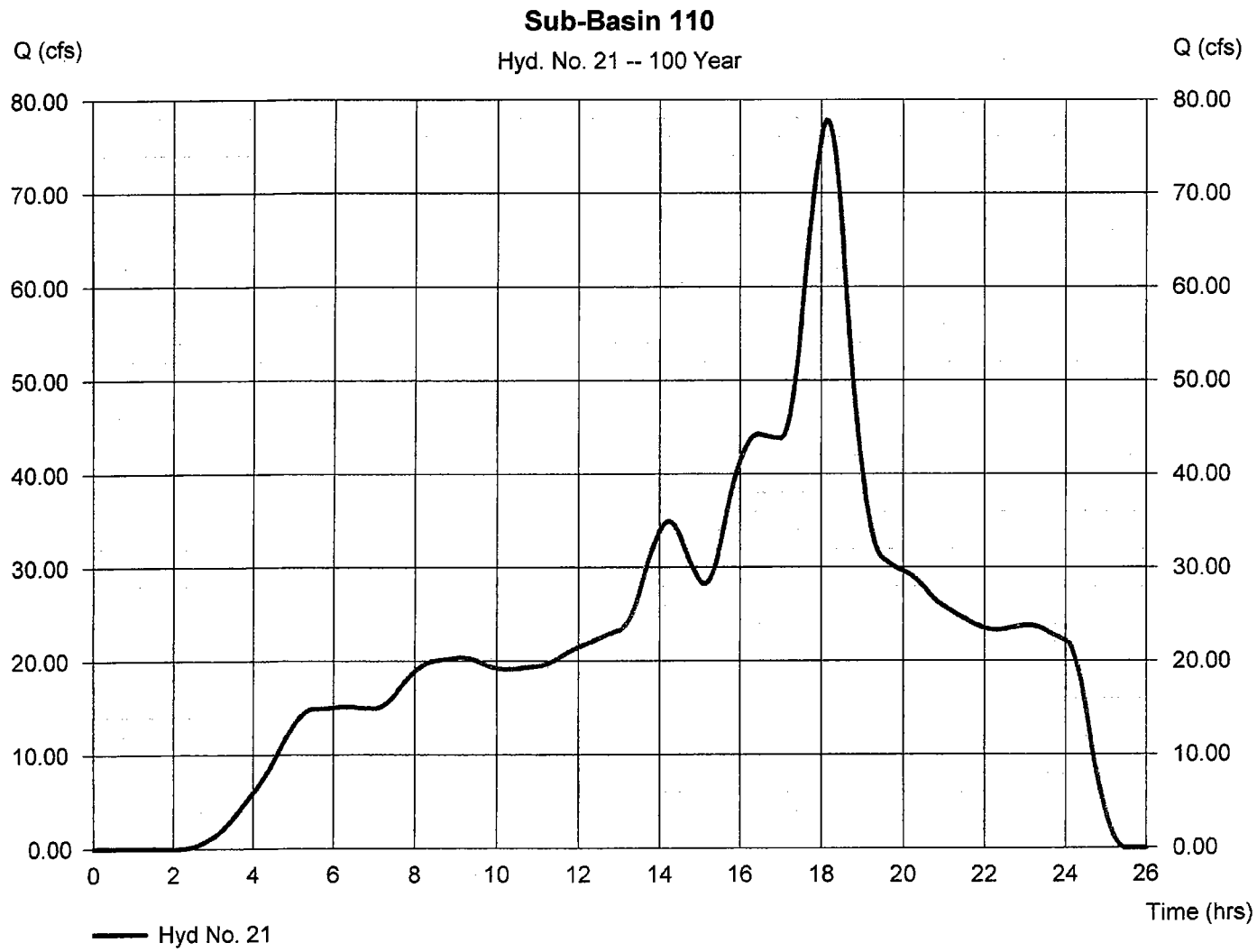
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 21

Sub-Basin 110

Hydrograph type	= SCS Runoff	Peak discharge	= 77.79 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.13 hrs
Time interval	= 2 min	Hyd. volume	= 2,038,895 cuft
Drainage area	= 126.000 ac	Curve number	= 90.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 56.60 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



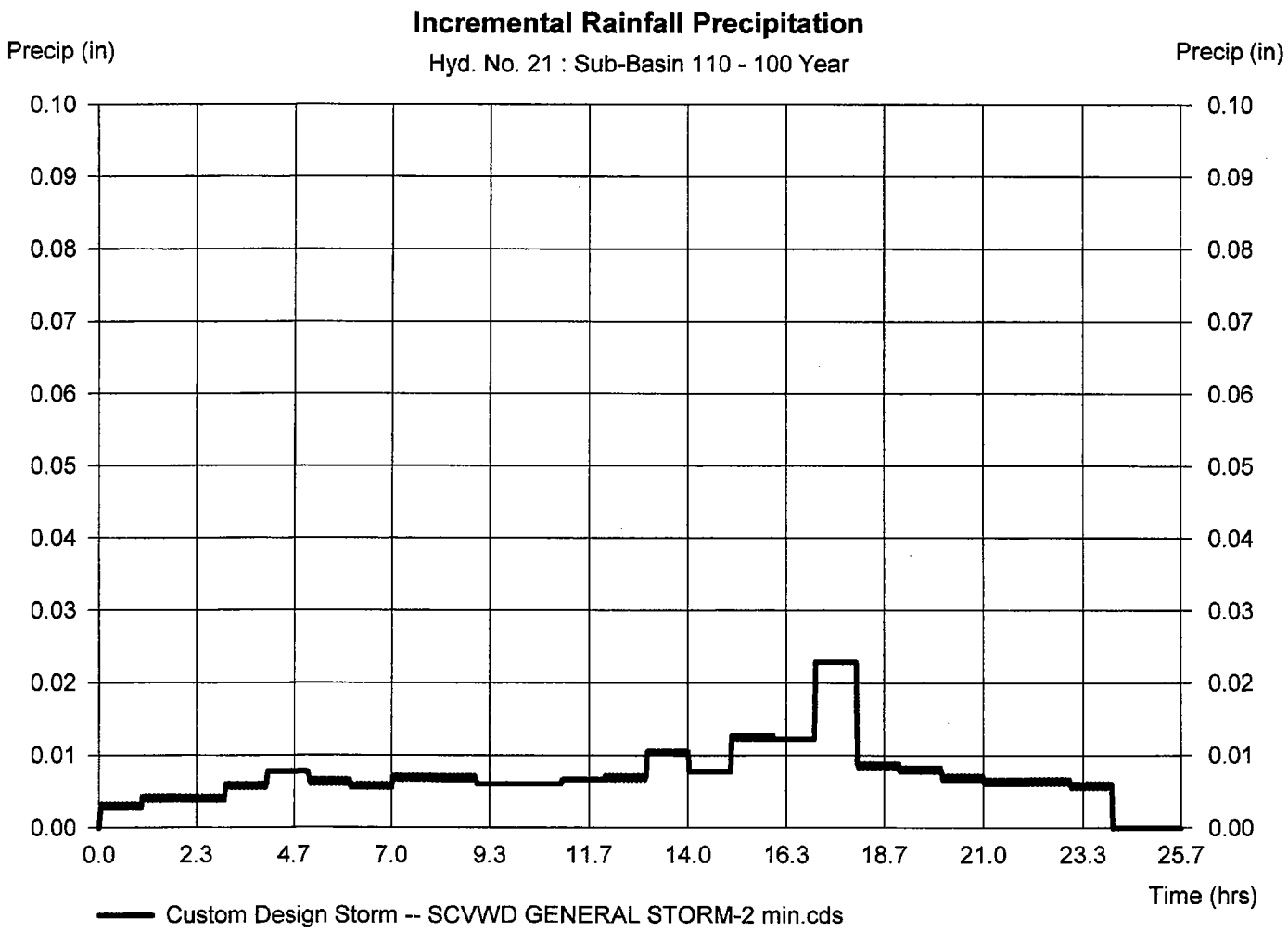
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 21

Sub-Basin 110

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



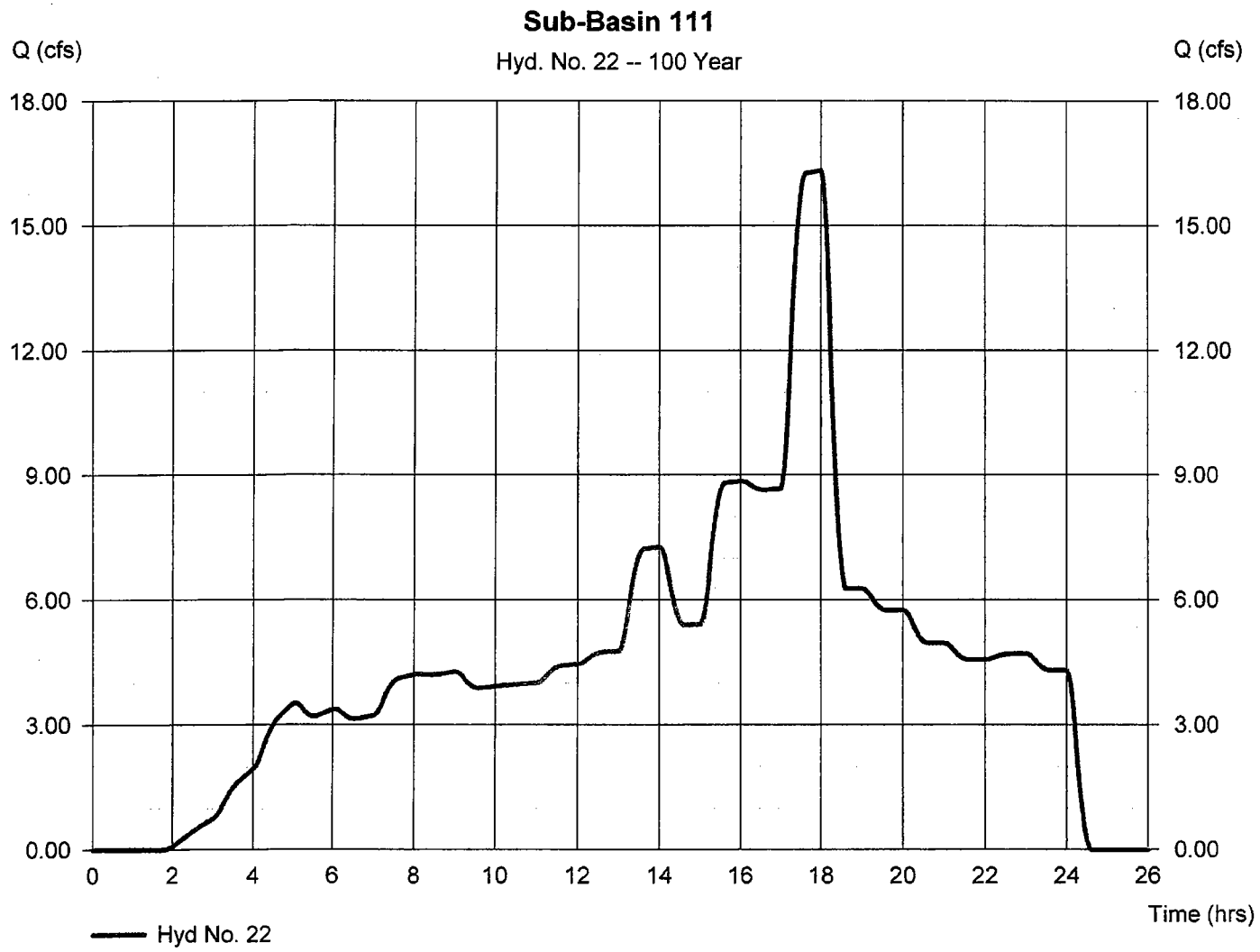
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 22

Sub-Basin 111

Hydrograph type	= SCS Runoff	Peak discharge	= 16.32 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.00 hrs
Time interval	= 2 min	Hyd. volume	= 412,109 cuft
Drainage area	= 23.900 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 22.00 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



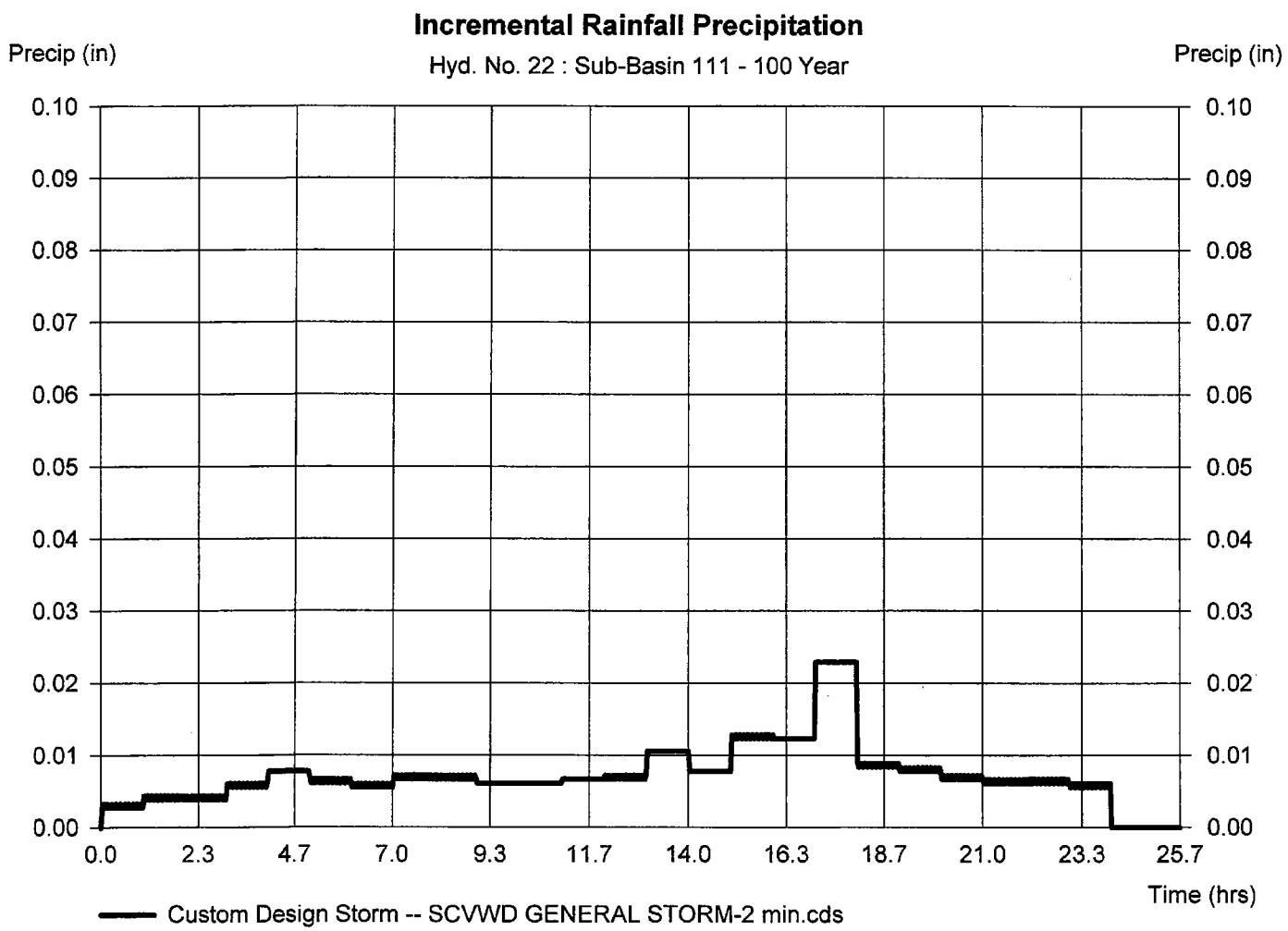
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 22

Sub-Basin 111

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



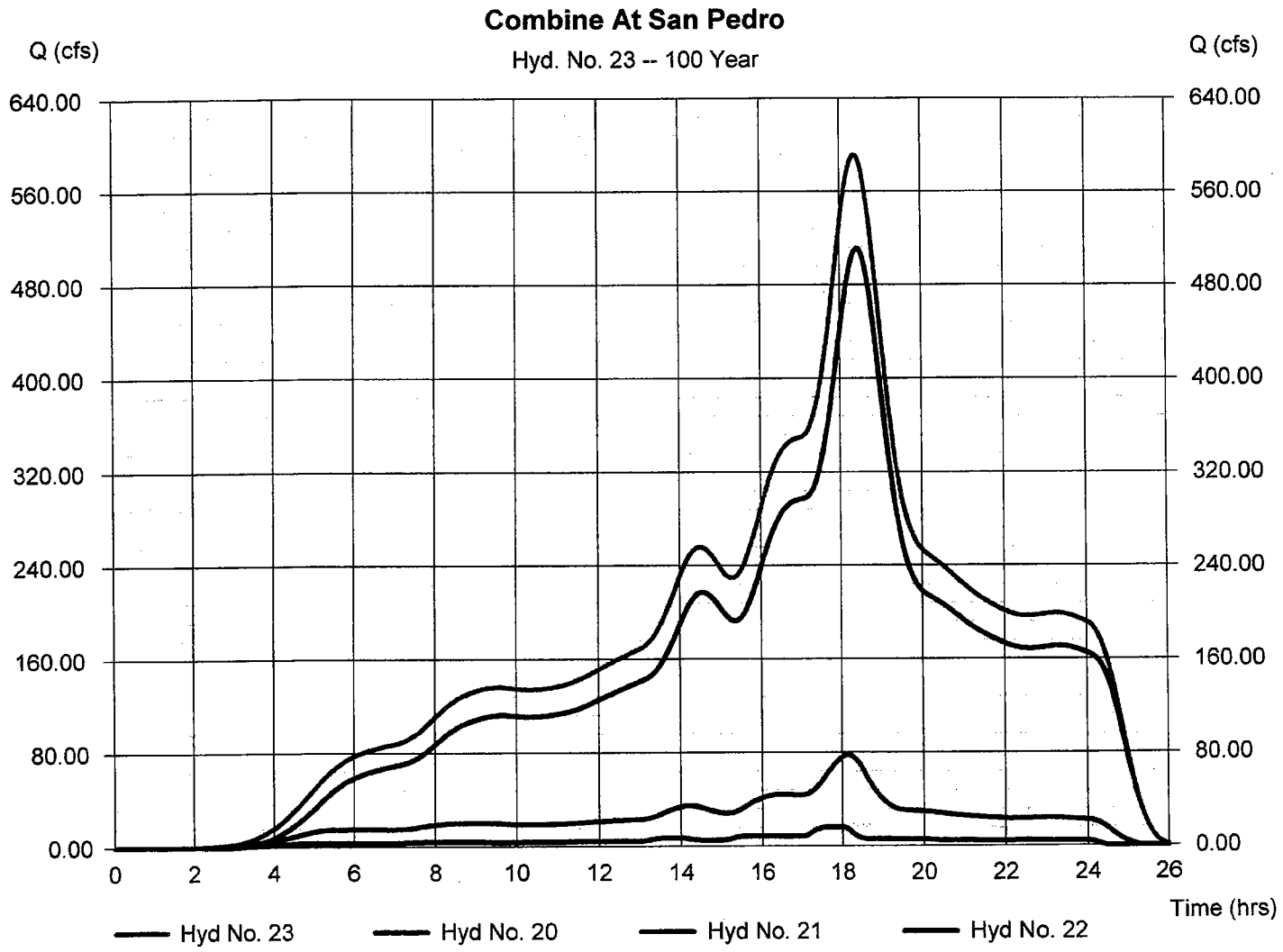
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 23

Combine At San Pedro

Hydrograph type	= Combine	Peak discharge	= 591.20 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.37 hrs
Time interval	= 2 min	Hyd. volume	= 15,475,590 cuft
Inflow hyds.	= 20, 21, 22	Contrib. drain. area	= 149.900 ac



Hydrograph Report

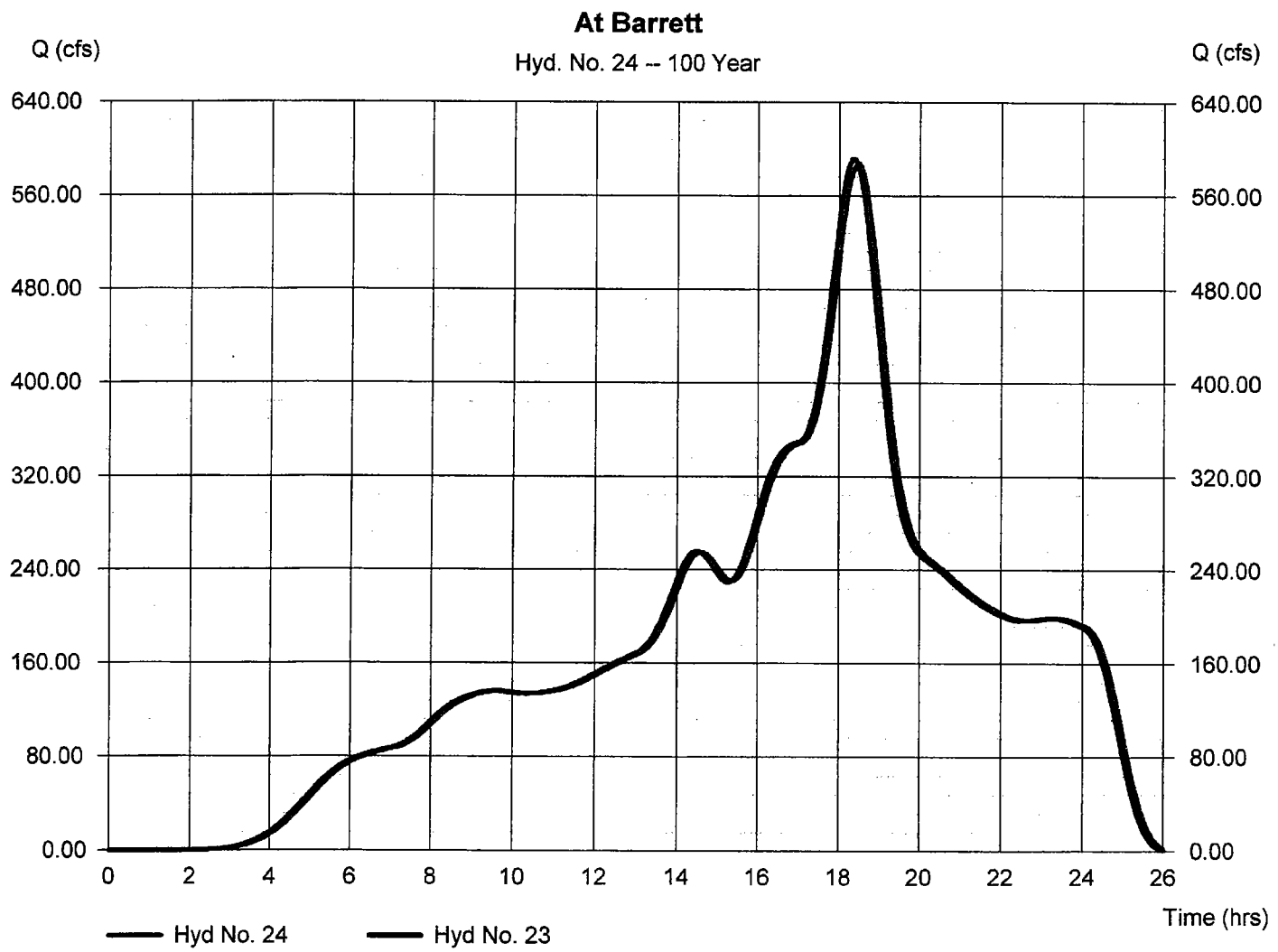
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 24

At Barrett

Hydrograph type	= Reach	Peak discharge	= 587.75 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.47 hrs
Time interval	= 2 min	Hyd. volume	= 15,475,580 cuft
Inflow hyd. No.	= 23 - Combine At San Pedro	Section type	= Trapezoidal
Reach length	= 1950.0 ft	Channel slope	= 0.3 %
Manning's n	= 0.040	Bottom width	= 10.0 ft
Side slope	= 2.0:1	Max. depth	= 10.0 ft
Rating curve x	= 0.463	Rating curve m	= 1.444
Ave. velocity	= 4.18 ft/s	Routing coeff.	= 0.3133

Modified Att-Kin routing method used.



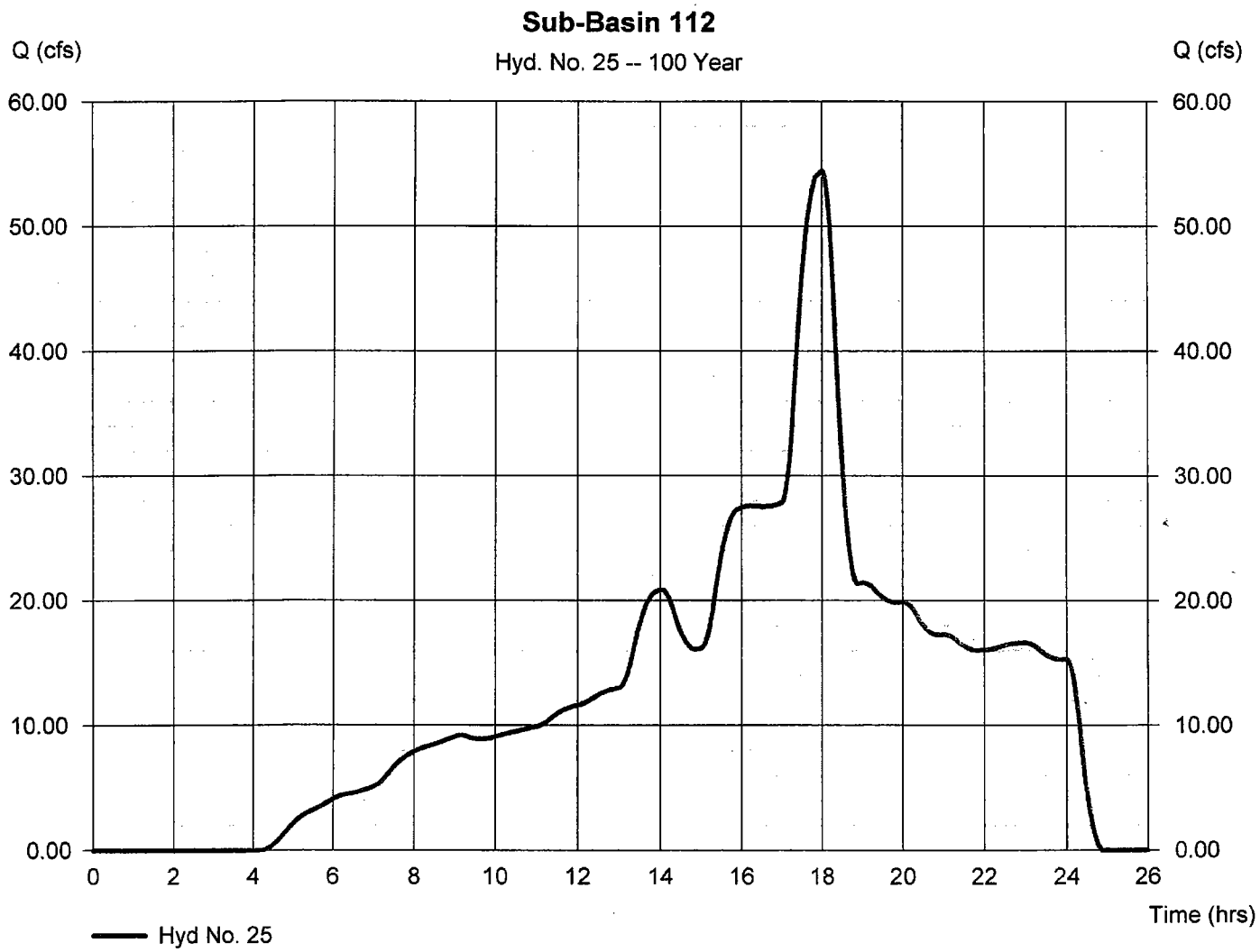
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 25

Sub-Basin 112

Hydrograph type	= SCS Runoff	Peak discharge	= 54.45 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.00 hrs
Time interval	= 2 min	Hyd. volume	= 1,162,375 cuft
Drainage area	= 95.100 ac	Curve number	= 79.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 33.30 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



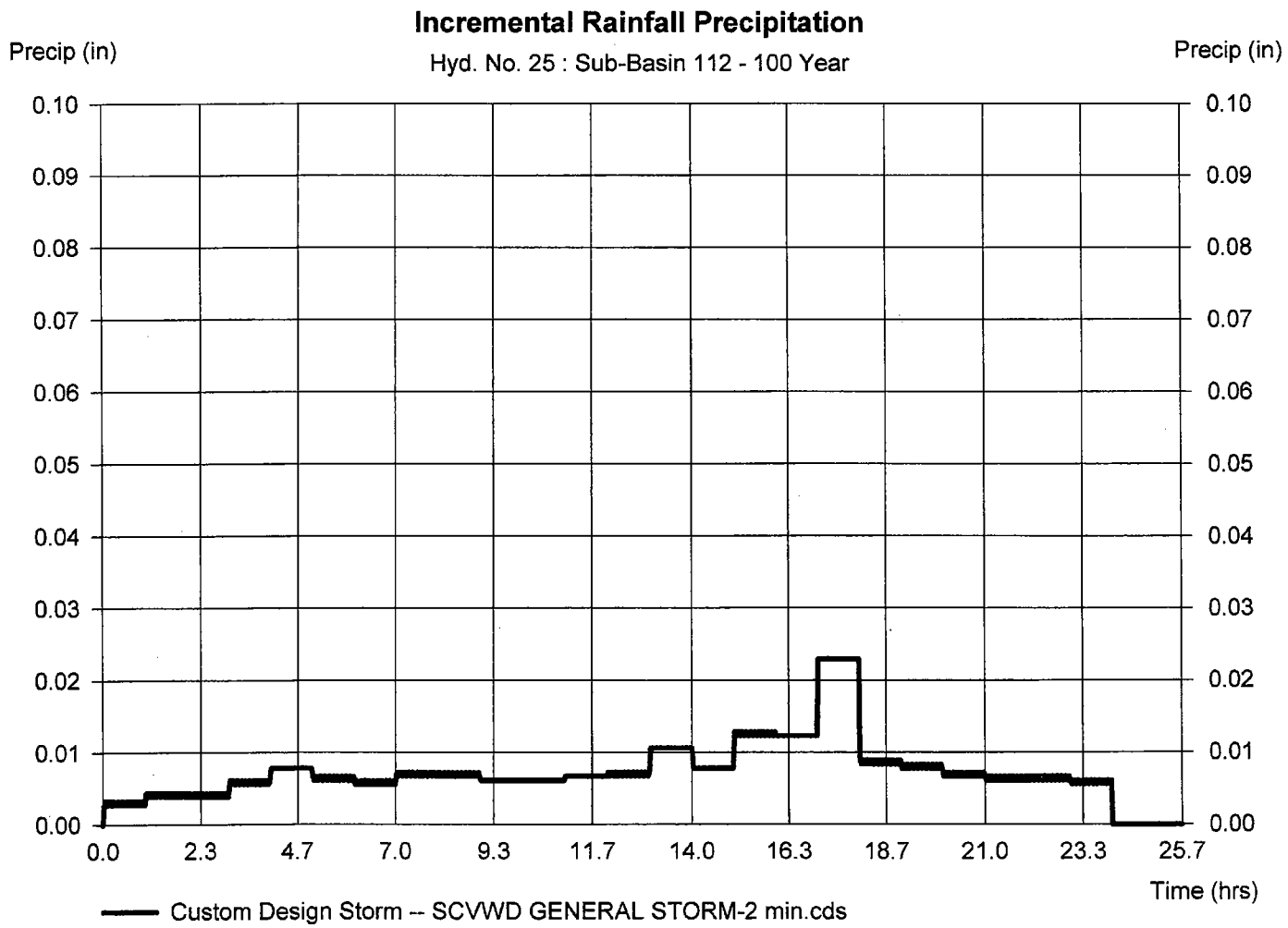
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 25

Sub-Basin 112

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



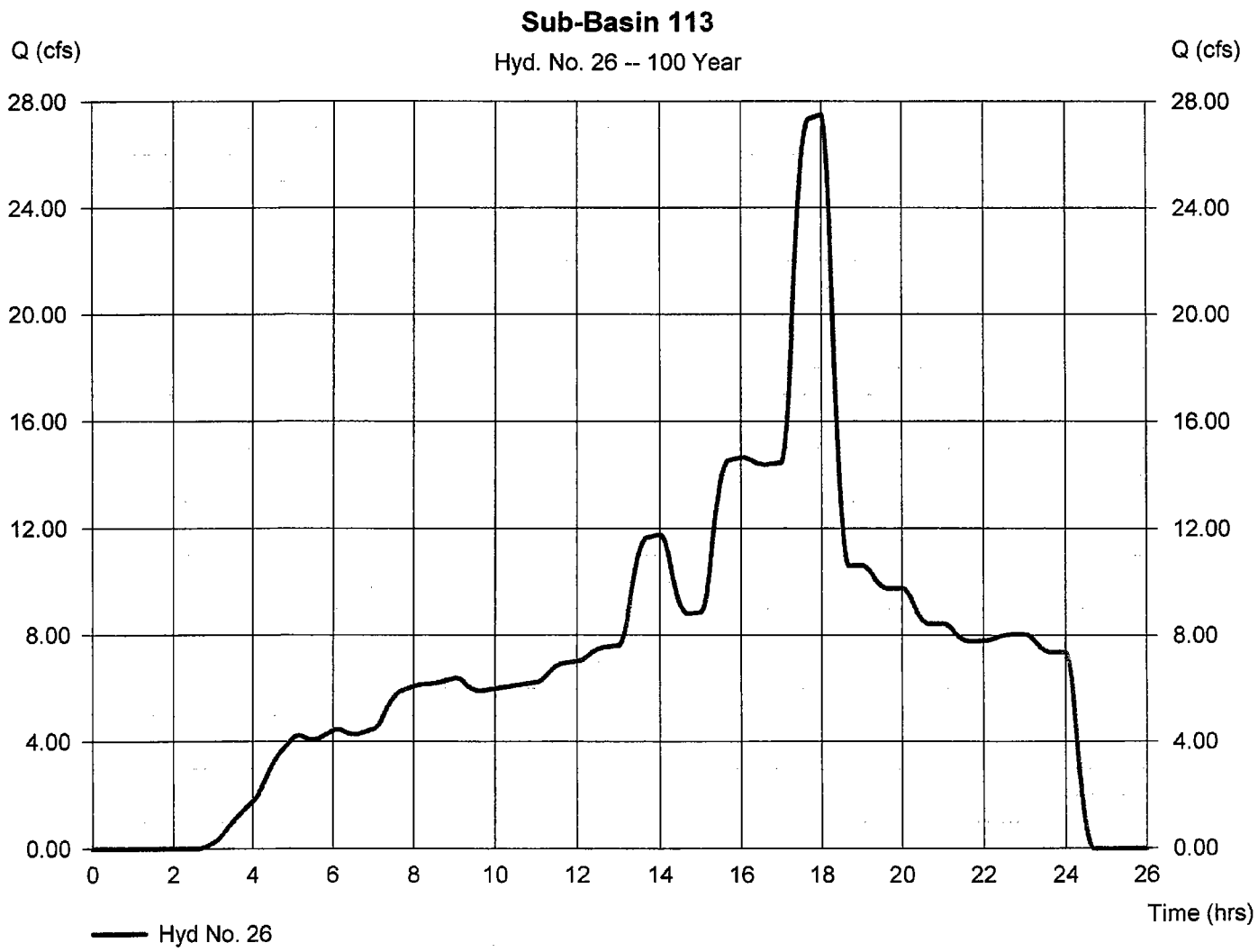
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 26

Sub-Basin 113

Hydrograph type	= SCS Runoff	Peak discharge	= 27.51 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.00 hrs
Time interval	= 2 min	Hyd. volume	= 654,783 cuft
Drainage area	= 43.300 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 26.00 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



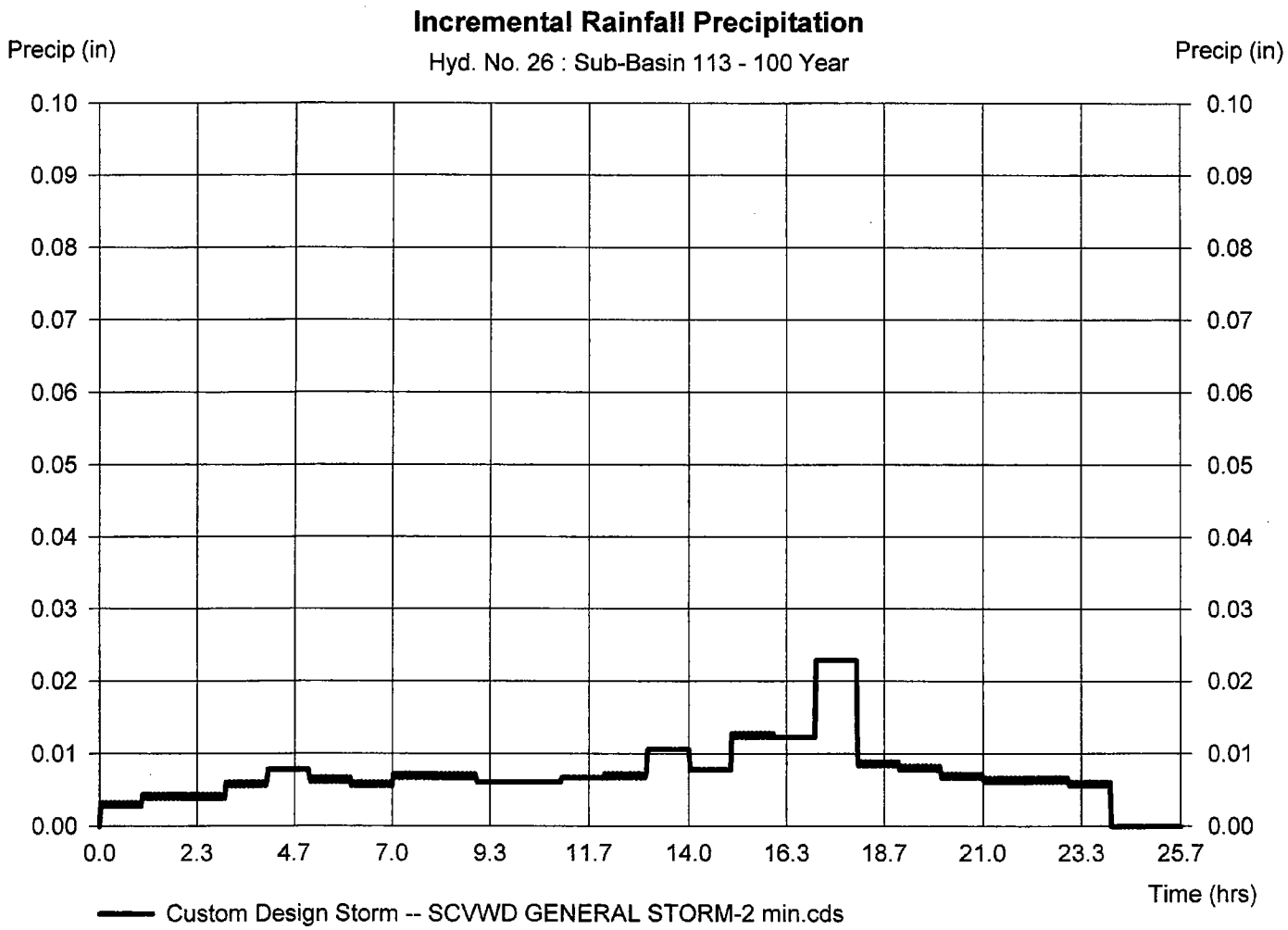
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 26

Sub-Basin 113

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



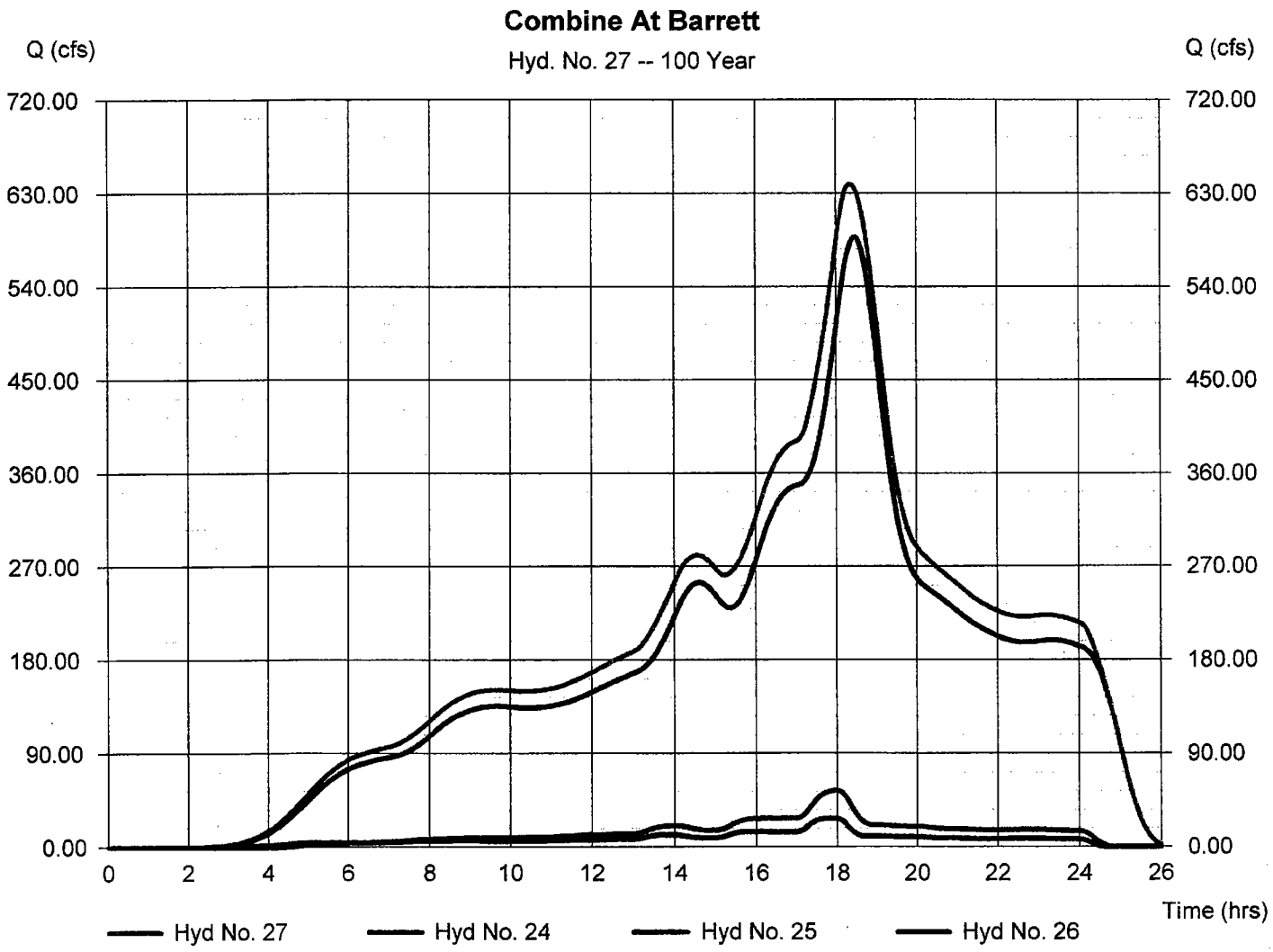
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 27

Combine At Barrett

Hydrograph type	= Combine	Peak discharge	= 638.33 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.33 hrs
Time interval	= 2 min	Hyd. volume	= 17,292,740 cuft
Inflow hyds.	= 24, 25, 26	Contrib. drain. area	= 138.400 ac



Hydrograph Report

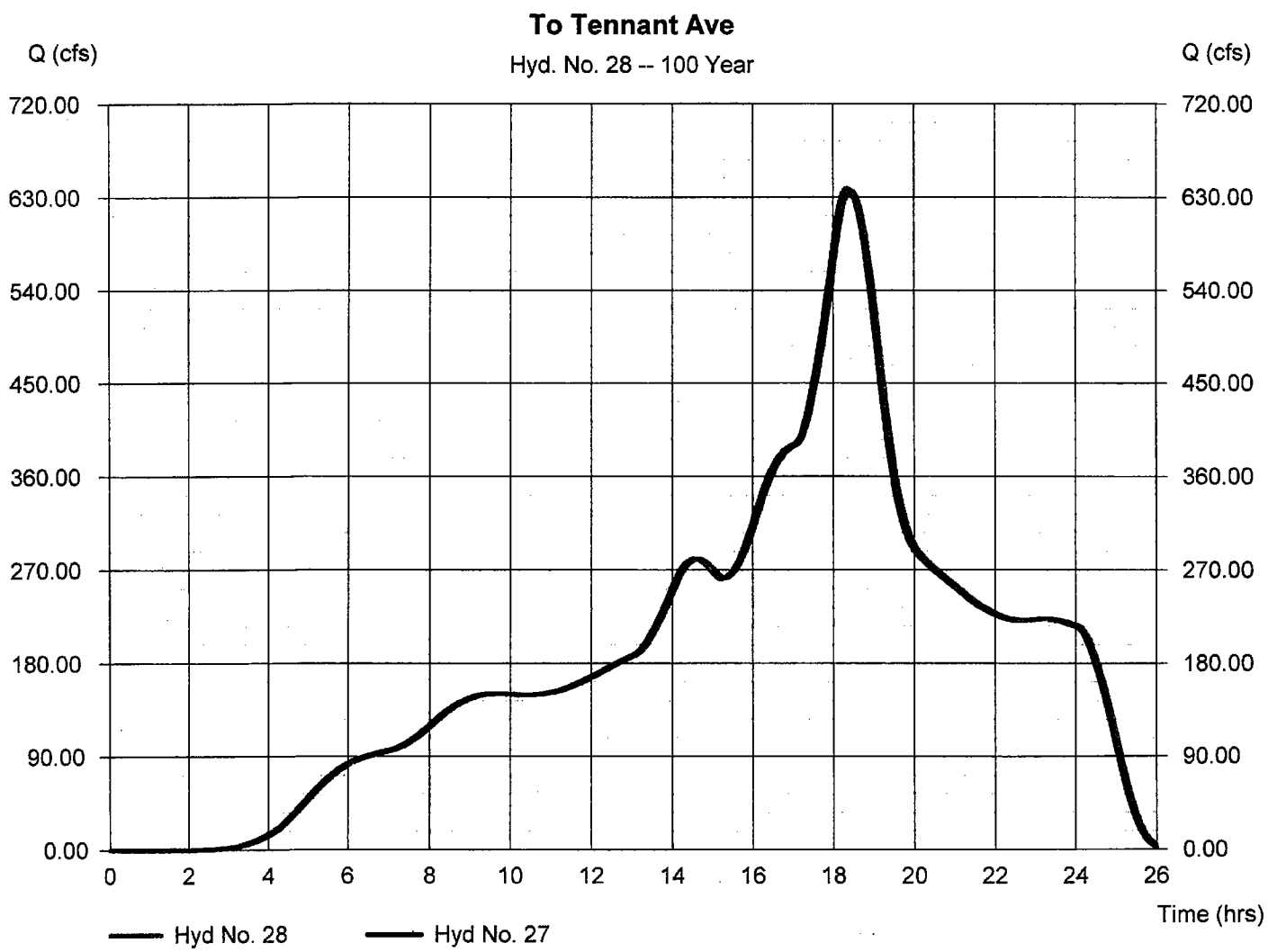
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 28

To Tennant Ave

Hydrograph type	= Reach	Peak discharge	= 636.06 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.43 hrs
Time interval	= 2 min	Hyd. volume	= 17,292,750 cuft
Inflow hyd. No.	= 27 - Combine At Barrett	Section type	= Trapezoidal
Reach length	= 1680.0 ft	Channel slope	= 0.3 %
Manning's n	= 0.040	Bottom width	= 10.0 ft
Side slope	= 2.0:1	Max. depth	= 10.0 ft
Rating curve x	= 0.439	Rating curve m	= 1.444
Ave. velocity	= 4.13 ft/s	Routing coeff.	= 0.3511

Modified Att-Kin routing method used.



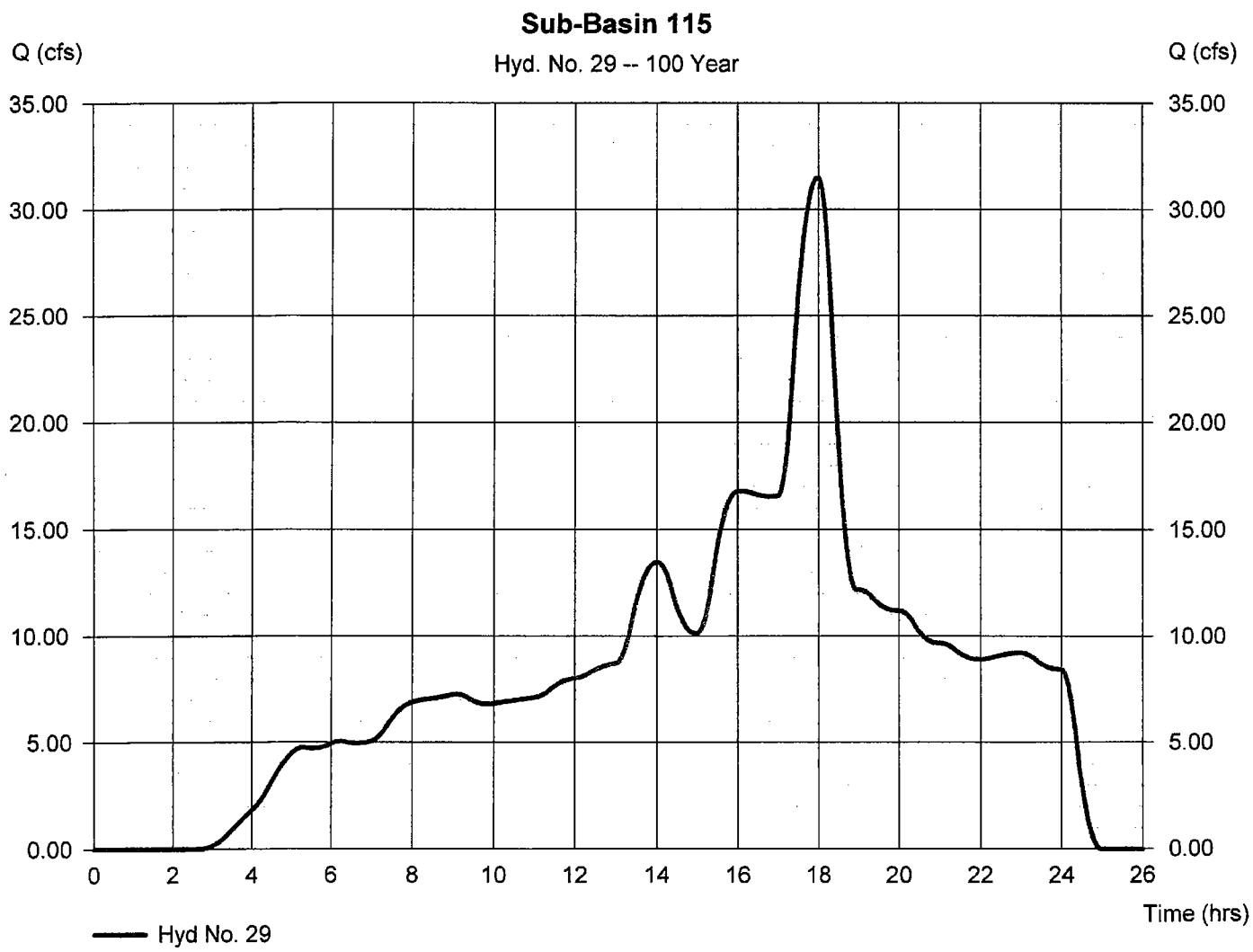
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 29

Sub-Basin 115

Hydrograph type	= SCS Runoff	Peak discharge	= 31.51 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.00 hrs
Time interval	= 2 min	Hyd. volume	= 751,780 cuft
Drainage area	= 49.500 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 35.50 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



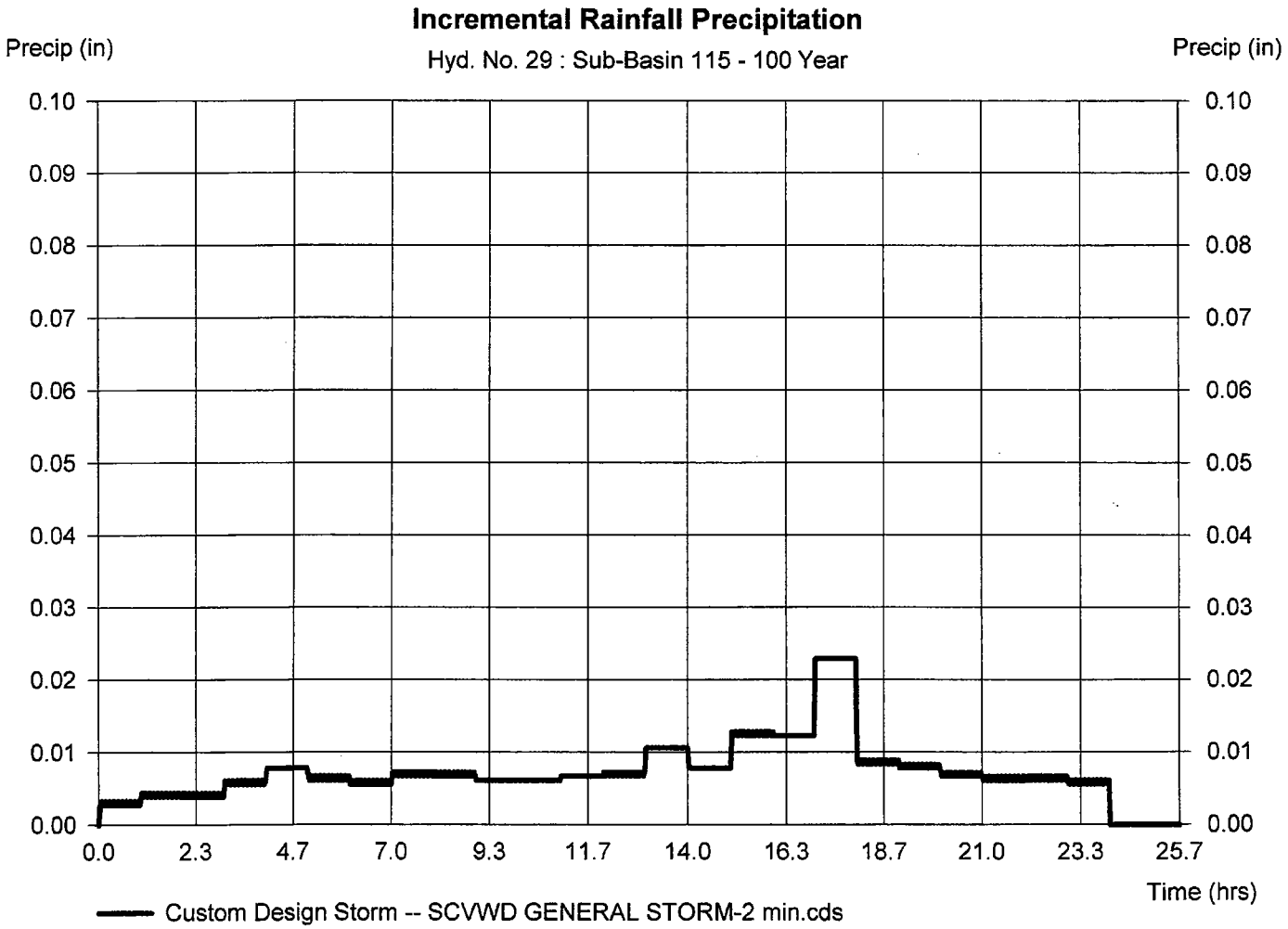
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 29

Sub-Basin 115

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



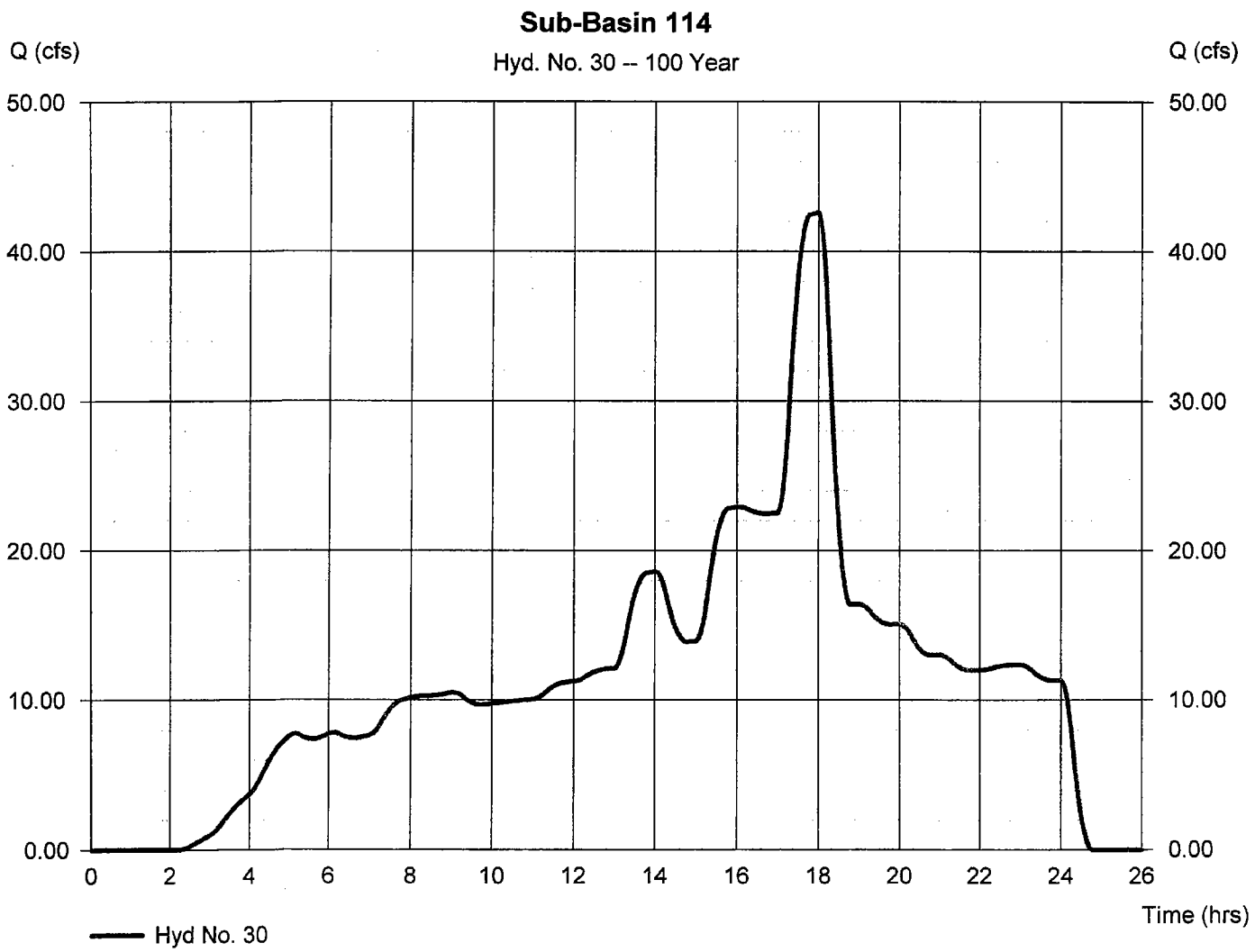
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 30

Sub-Basin 114

Hydrograph type	= SCS Runoff	Peak discharge	= 42.61 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.00 hrs
Time interval	= 2 min	Hyd. volume	= 1,044,479 cuft
Drainage area	= 64.700 ac	Curve number	= 90
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 28.00 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



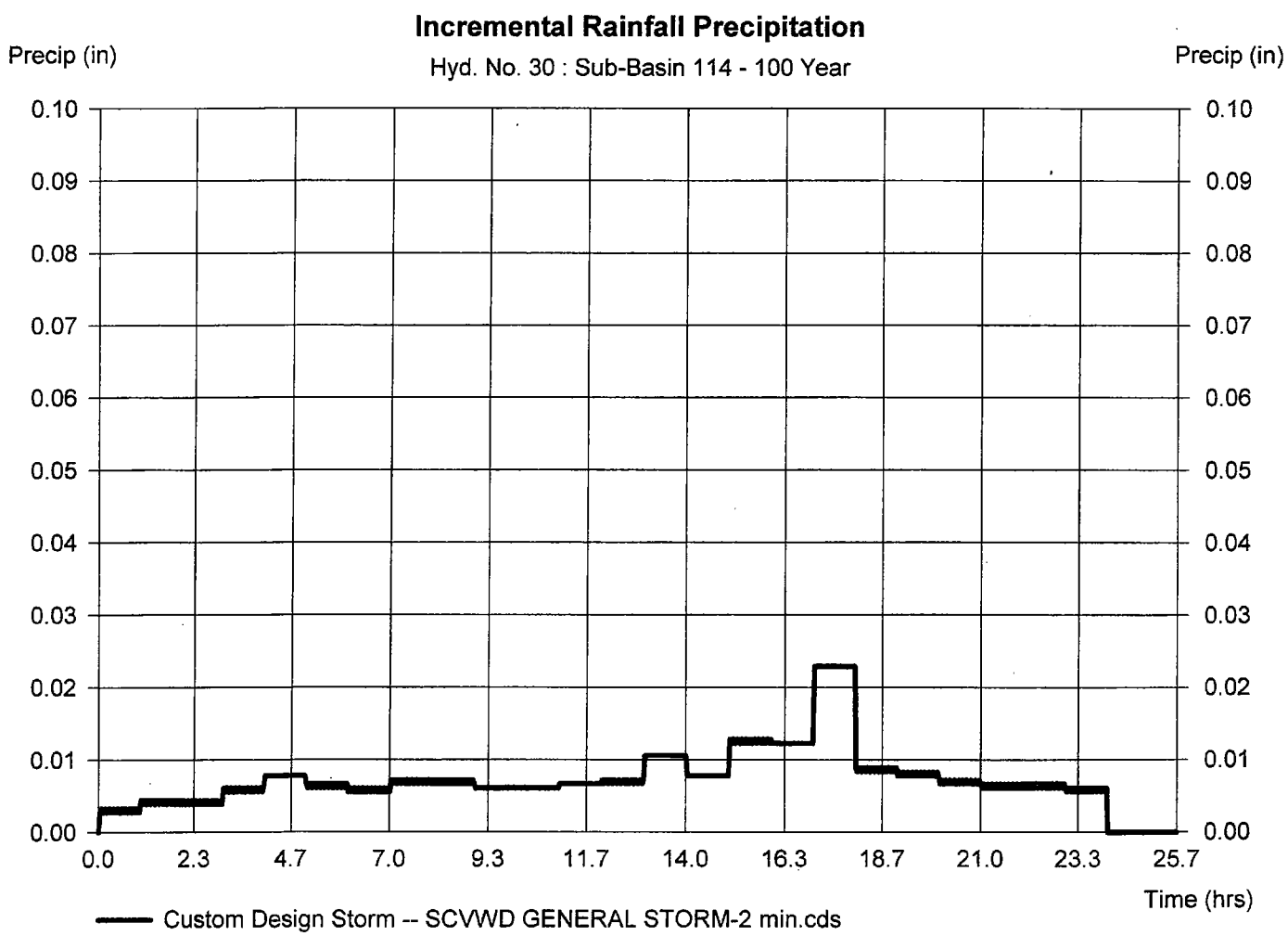
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 30

Sub-Basin 114

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



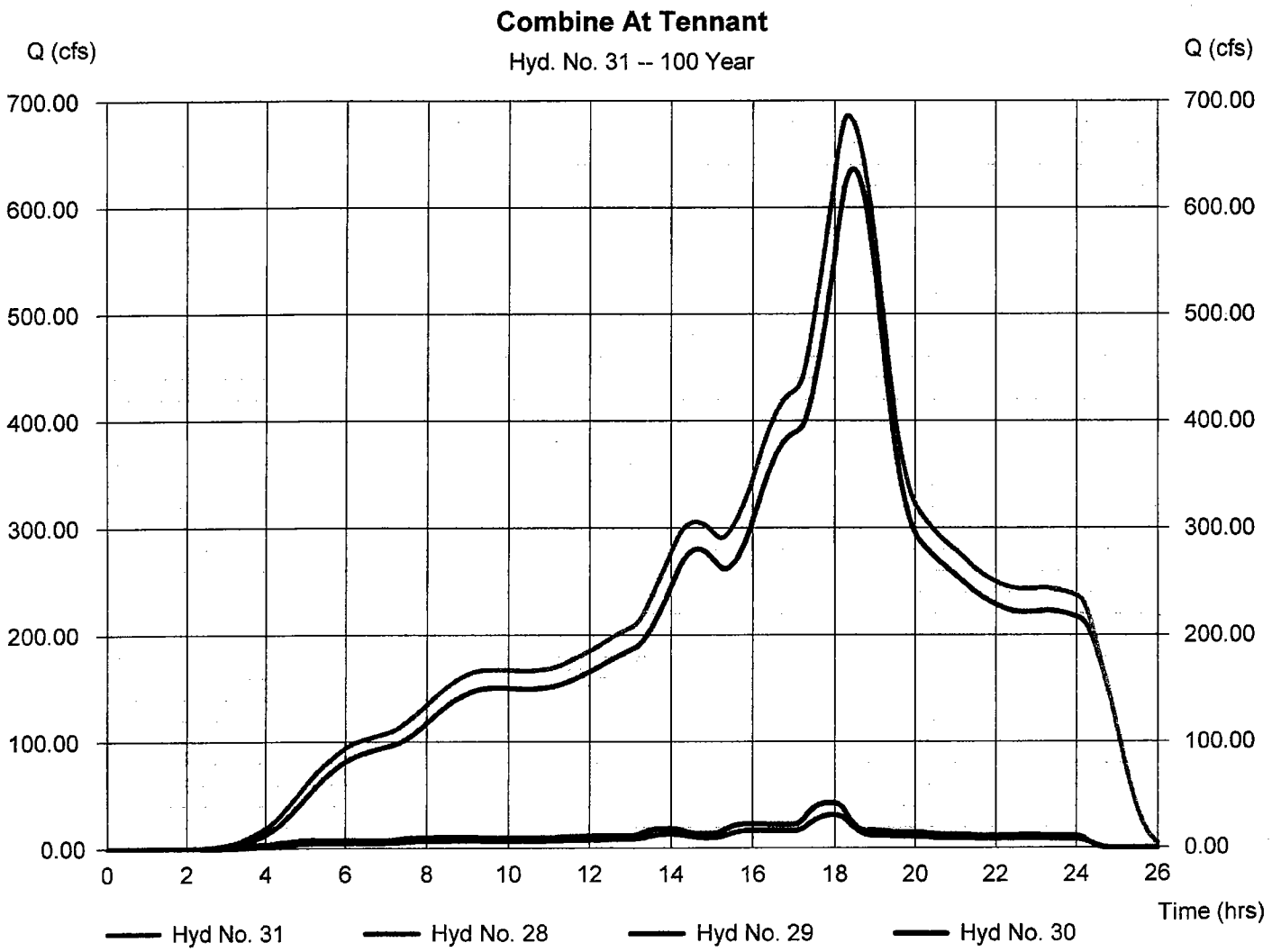
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 31

Combine At Tennant

Hydrograph type	= Combine	Peak discharge	= 685.85 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.33 hrs
Time interval	= 2 min	Hyd. volume	= 19,088,990 cuft
Inflow hyds.	= 28, 29, 30	Contrib. drain. area	= 114.200 ac



Hydrograph Report

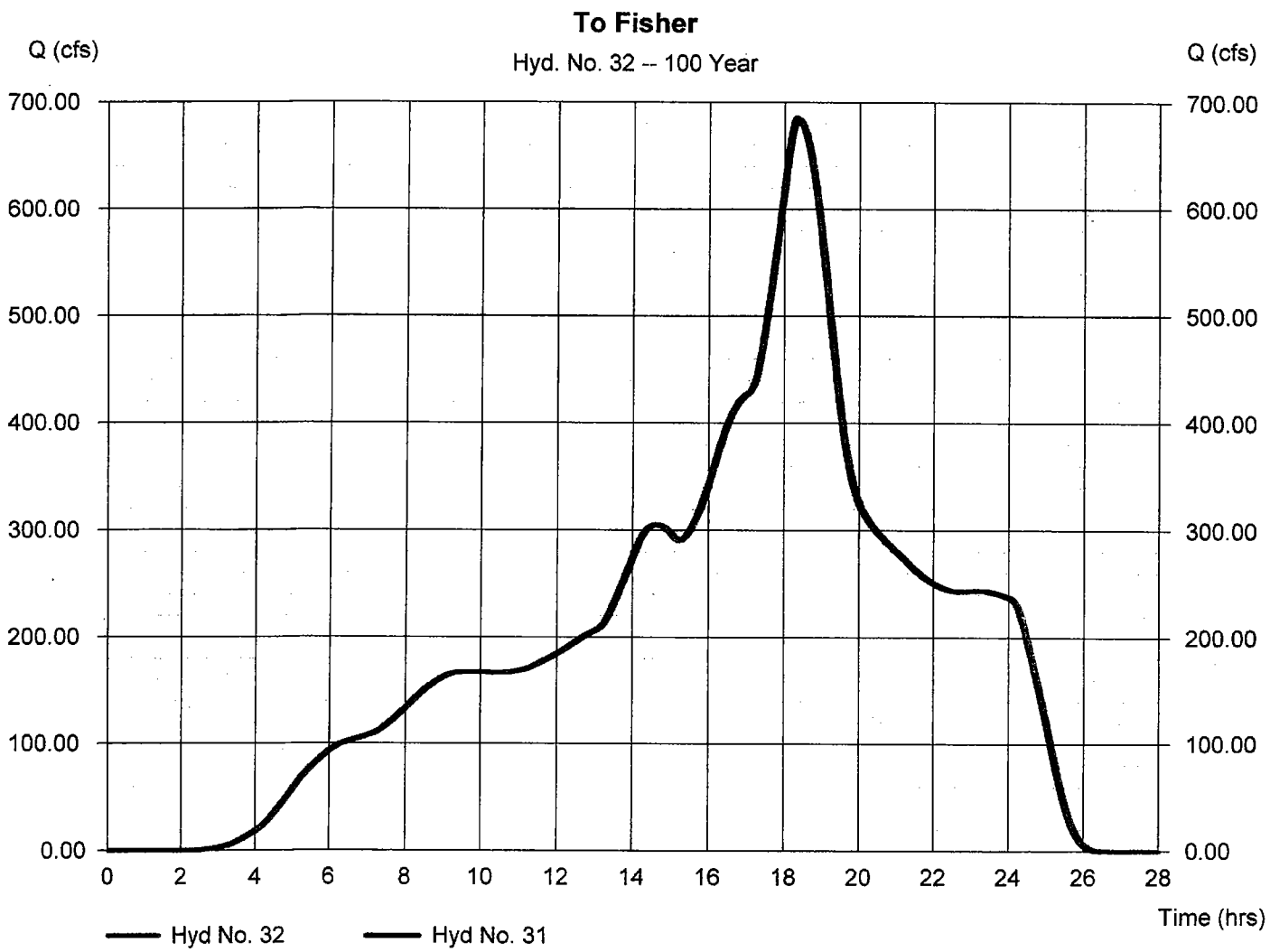
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 32

To Fisher

Hydrograph type	= Reach	Peak discharge	= 684.12 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.40 hrs
Time interval	= 2 min	Hyd. volume	= 19,089,000 cuft
Inflow hyd. No.	= 31 - Combine At Tennant	Section type	= Trapezoidal
Reach length	= 1650.0 ft	Channel slope	= 0.6 %
Manning's n	= 0.040	Bottom width	= 10.0 ft
Side slope	= 2.0:1	Max. depth	= 10.0 ft
Rating curve x	= 0.595	Rating curve m	= 1.444
Ave. velocity	= 5.20 ft/s	Routing coeff.	= 0.4294

Modified Att-Kin routing method used.



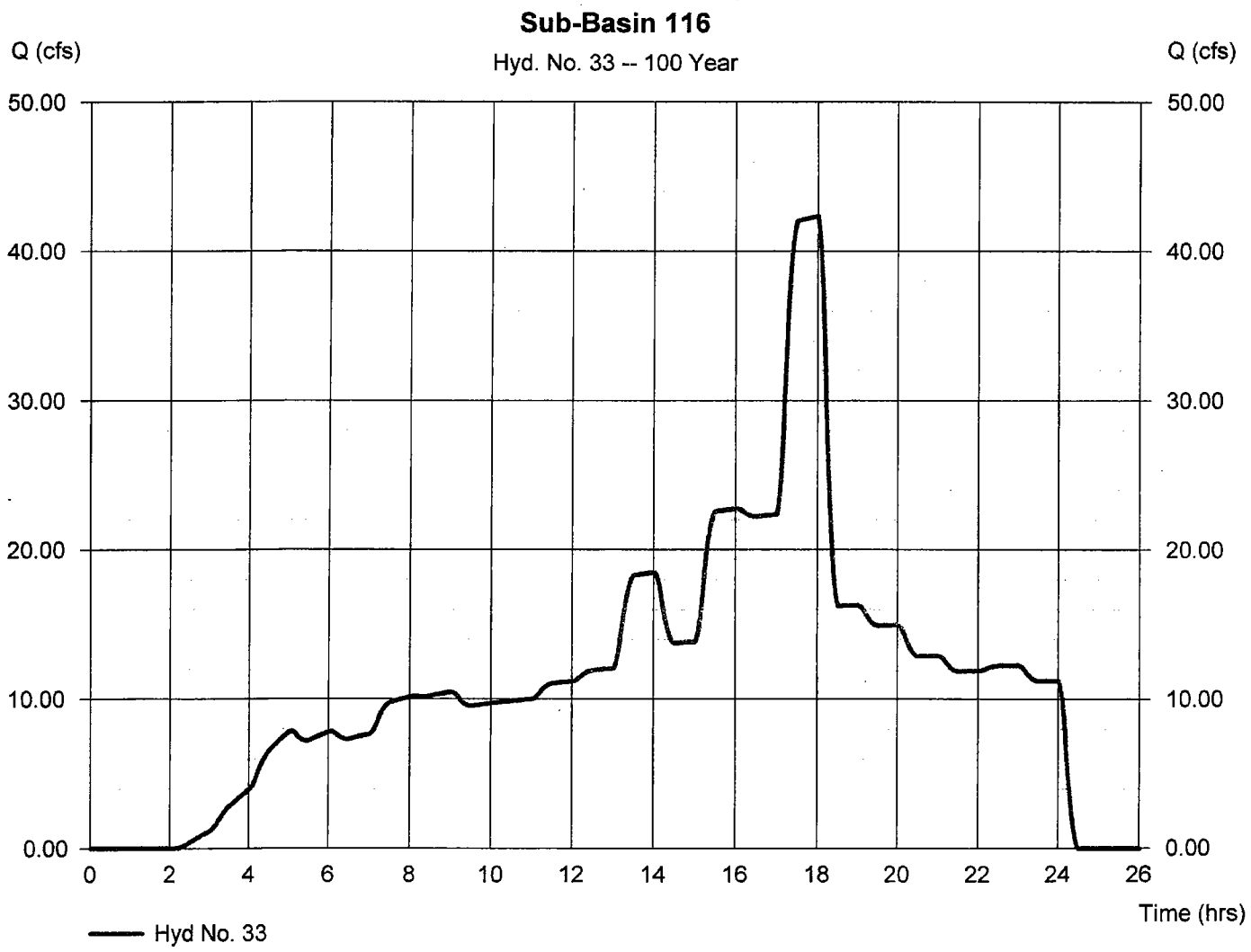
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 33

Sub-Basin 116

Hydrograph type	= SCS Runoff	Peak discharge	= 42.35 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.00 hrs
Time interval	= 2 min	Hyd. volume	= 1,036,407 cuft
Drainage area	= 64.200 ac	Curve number	= 90
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 16.90 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



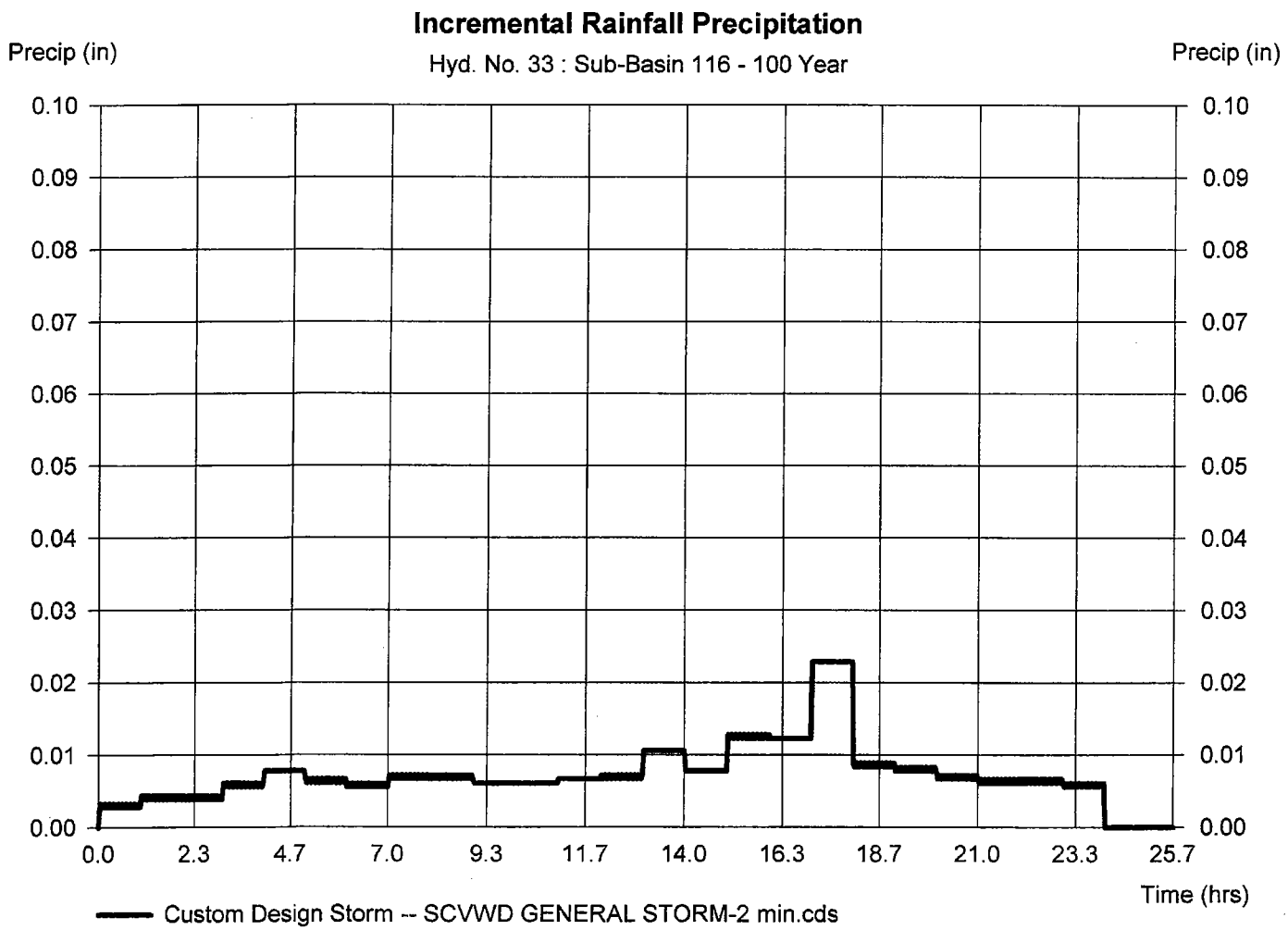
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 33

Sub-Basin 116

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



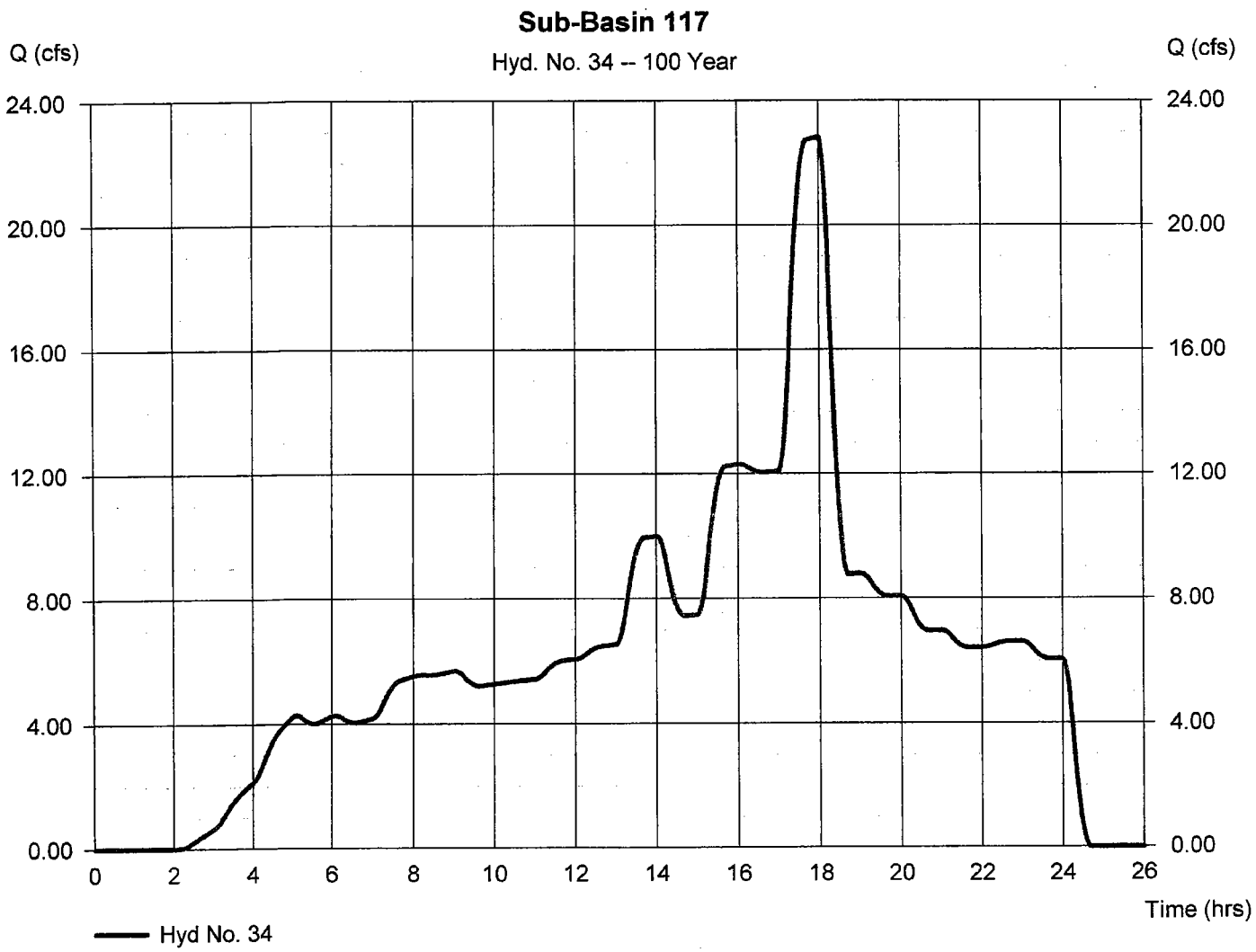
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 34

Sub-Basin 117

Hydrograph type	= SCS Runoff	Peak discharge	= 22.83 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.00 hrs
Time interval	= 2 min	Hyd. volume	= 561,876 cuft
Drainage area	= 35.100 ac	Curve number	= 90.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 24.90 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



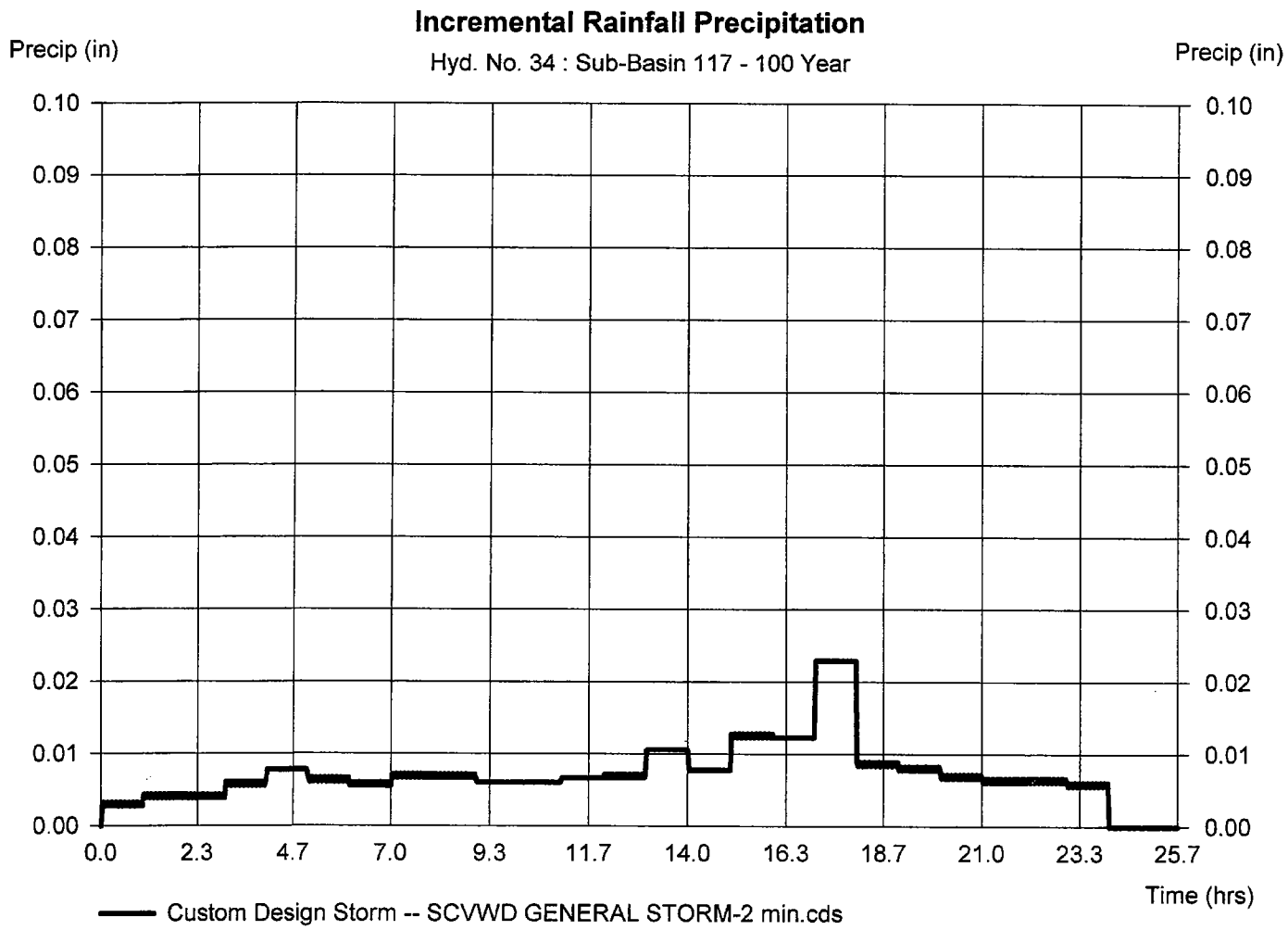
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 34

Sub-Basin 117

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



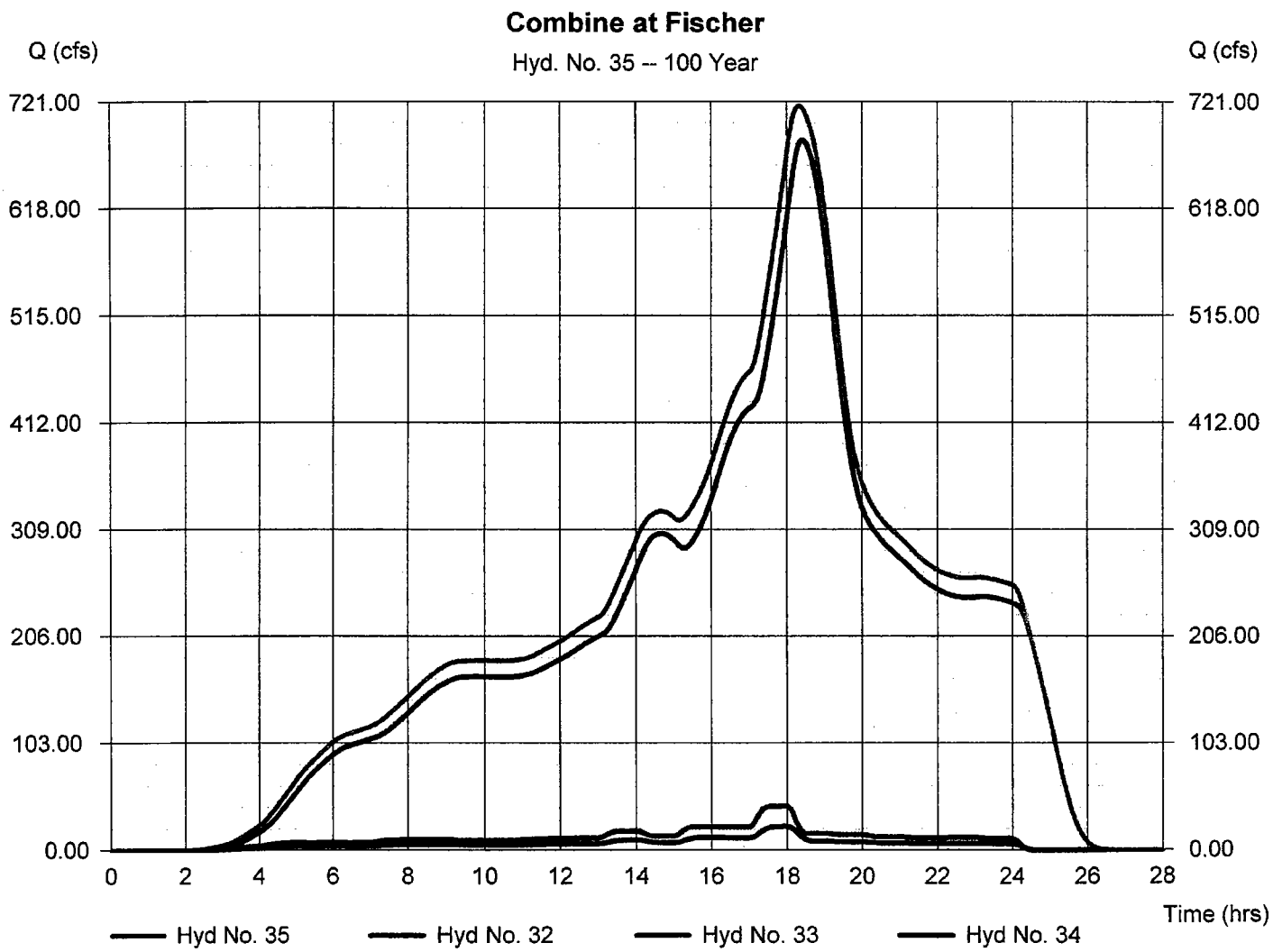
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 35

Combine at Fischer

Hydrograph type	= Combine	Peak discharge	= 717.14 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.30 hrs
Time interval	= 2 min	Hyd. volume	= 20,687,270 cuft
Inflow hyds.	= 32, 33, 34	Contrib. drain. area	= 99.300 ac



Hydrograph Report

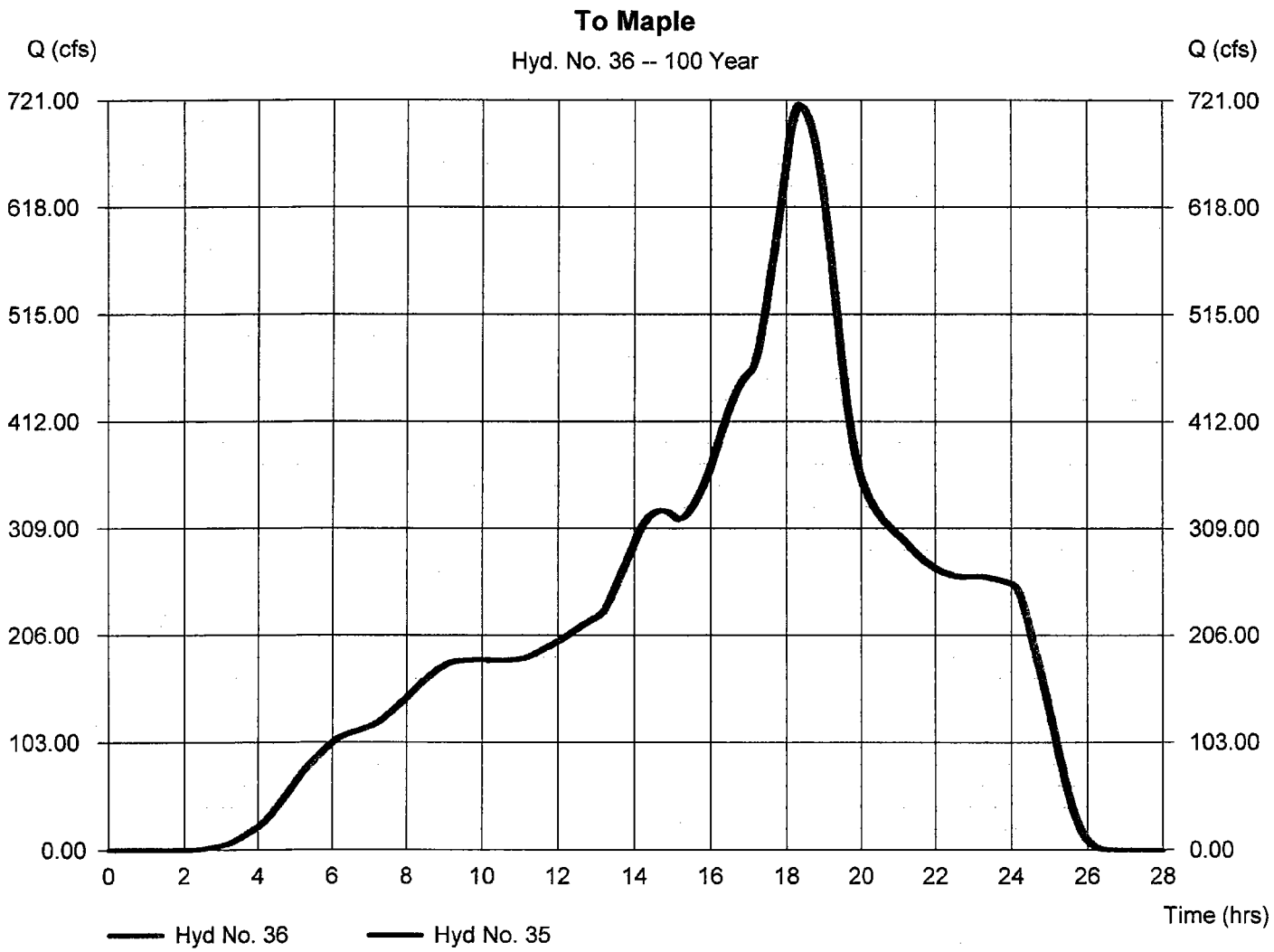
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 36

To Maple

Hydrograph type	= Reach	Peak discharge	= 715.06 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.40 hrs
Time interval	= 2 min	Hyd. volume	= 20,687,290 cuft
Inflow hyd. No.	= 35 - Combine at Fischer	Section type	= Trapezoidal
Reach length	= 1800.0 ft	Channel slope	= 0.4 %
Manning's n	= 0.040	Bottom width	= 10.0 ft
Side slope	= 2.0:1	Max. depth	= 10.0 ft
Rating curve x	= 0.481	Rating curve m	= 1.444
Ave. velocity	= 4.56 ft/s	Routing coeff.	= 0.3598

Modified Att-Kin routing method used.



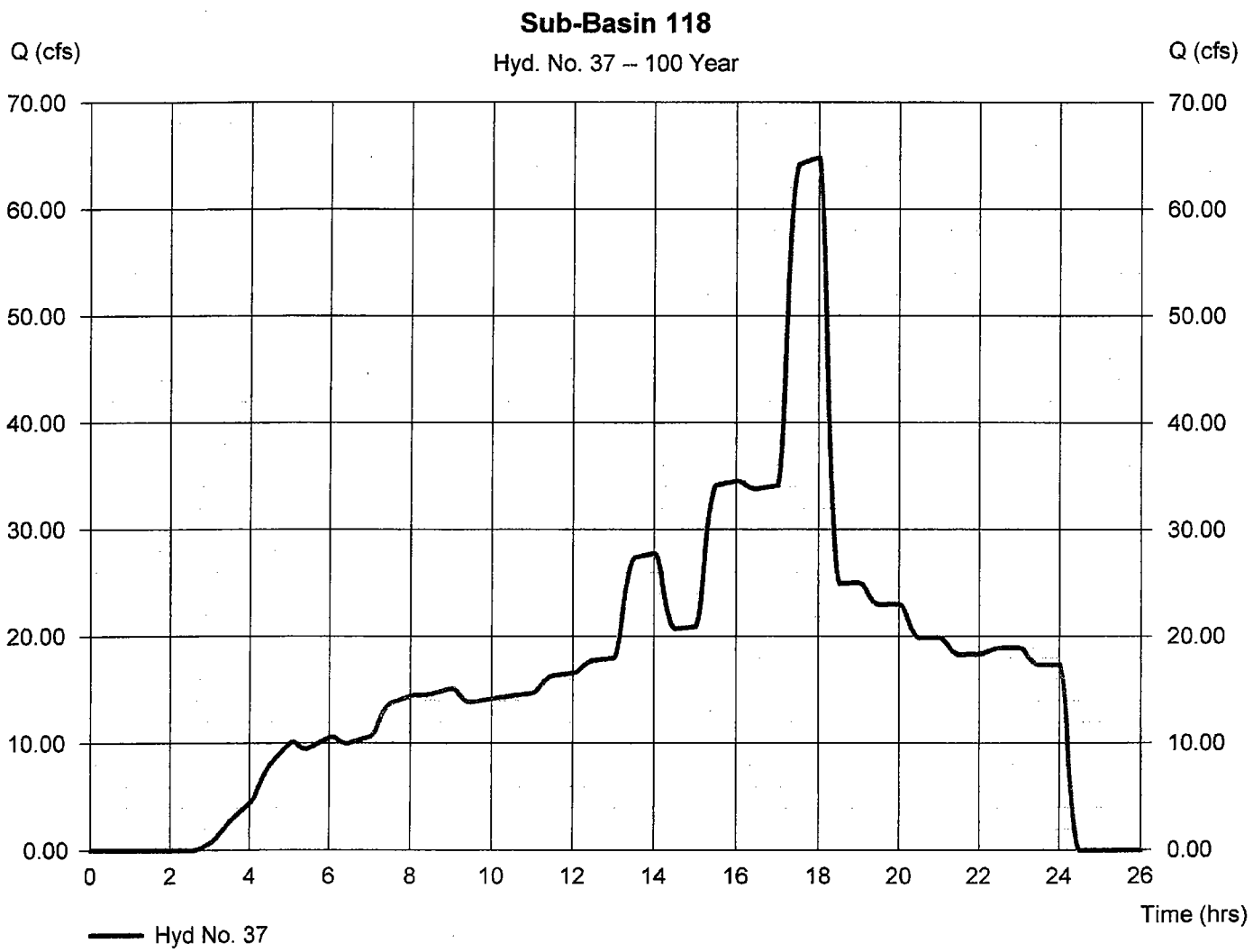
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 37

Sub-Basin 118

Hydrograph type	= SCS Runoff	Peak discharge	= 64.84 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.00 hrs
Time interval	= 2 min	Hyd. volume	= 1,540,812 cuft
Drainage area	= 100.300 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 19.10 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



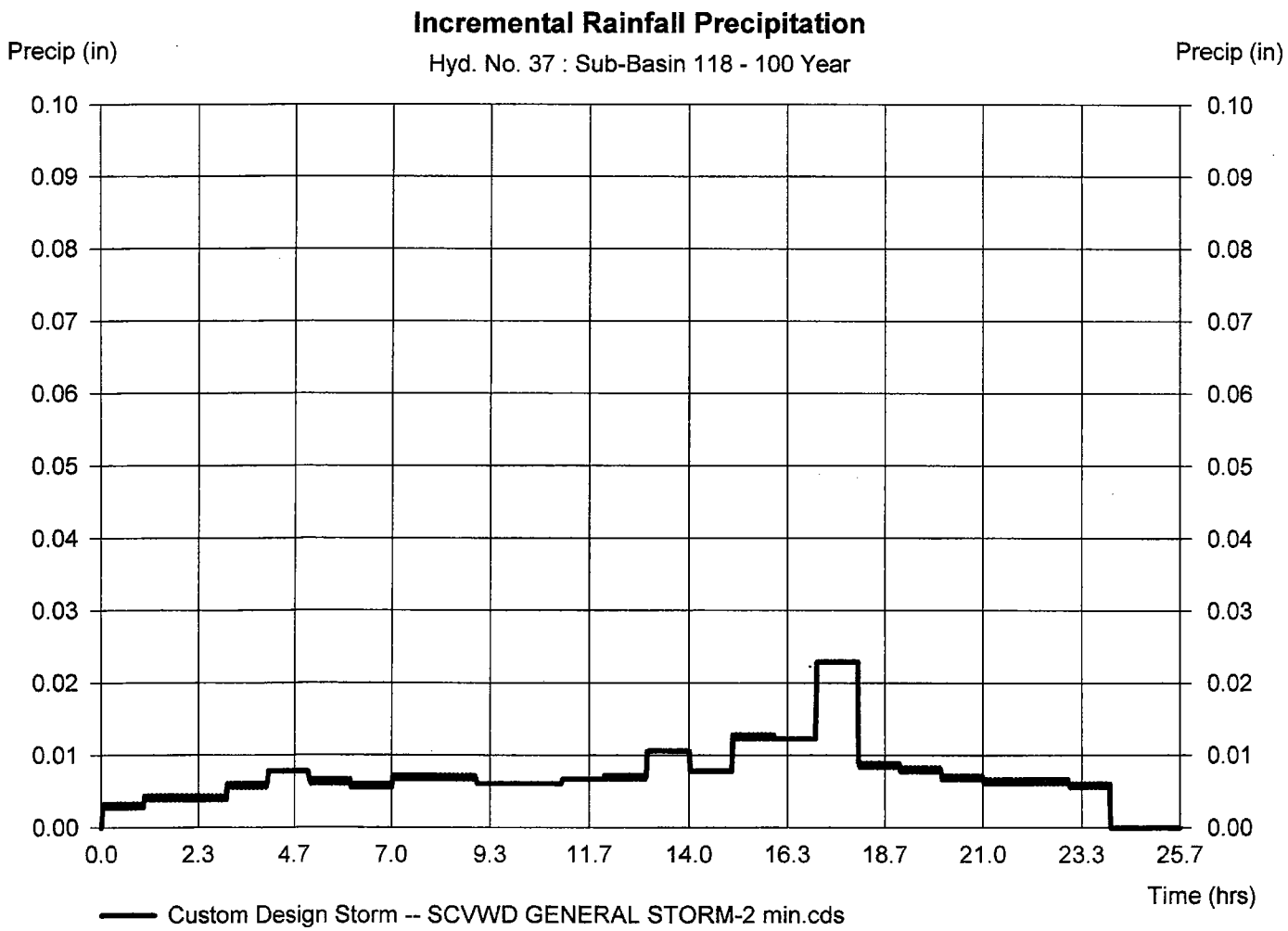
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 37

Sub-Basin 118

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



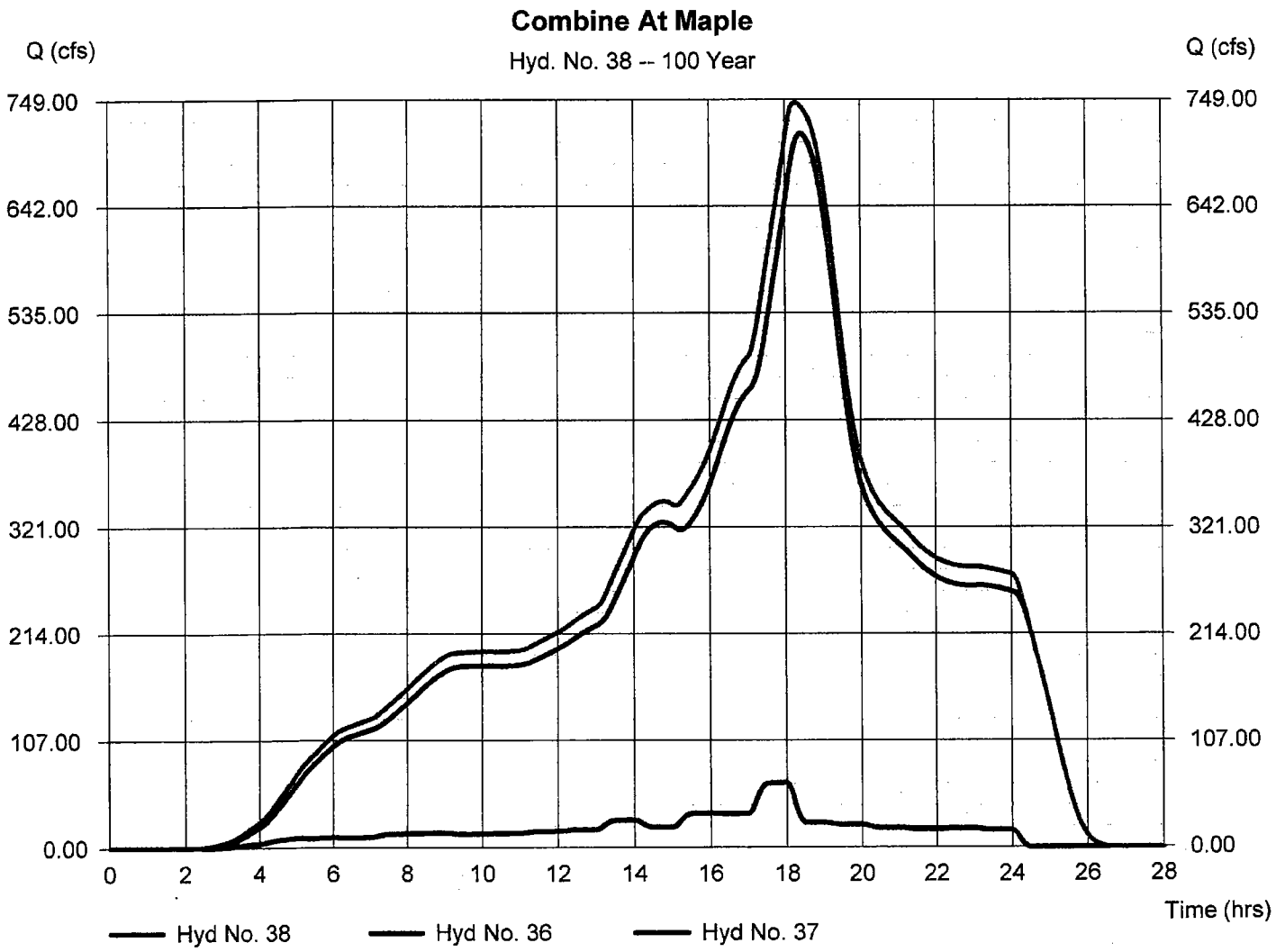
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 38

Combine At Maple

Hydrograph type	= Combine	Peak discharge	= 745.98 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.27 hrs
Time interval	= 2 min	Hyd. volume	= 22,228,100 cuft
Inflow hyds.	= 36, 37	Contrib. drain. area	= 100.300 ac



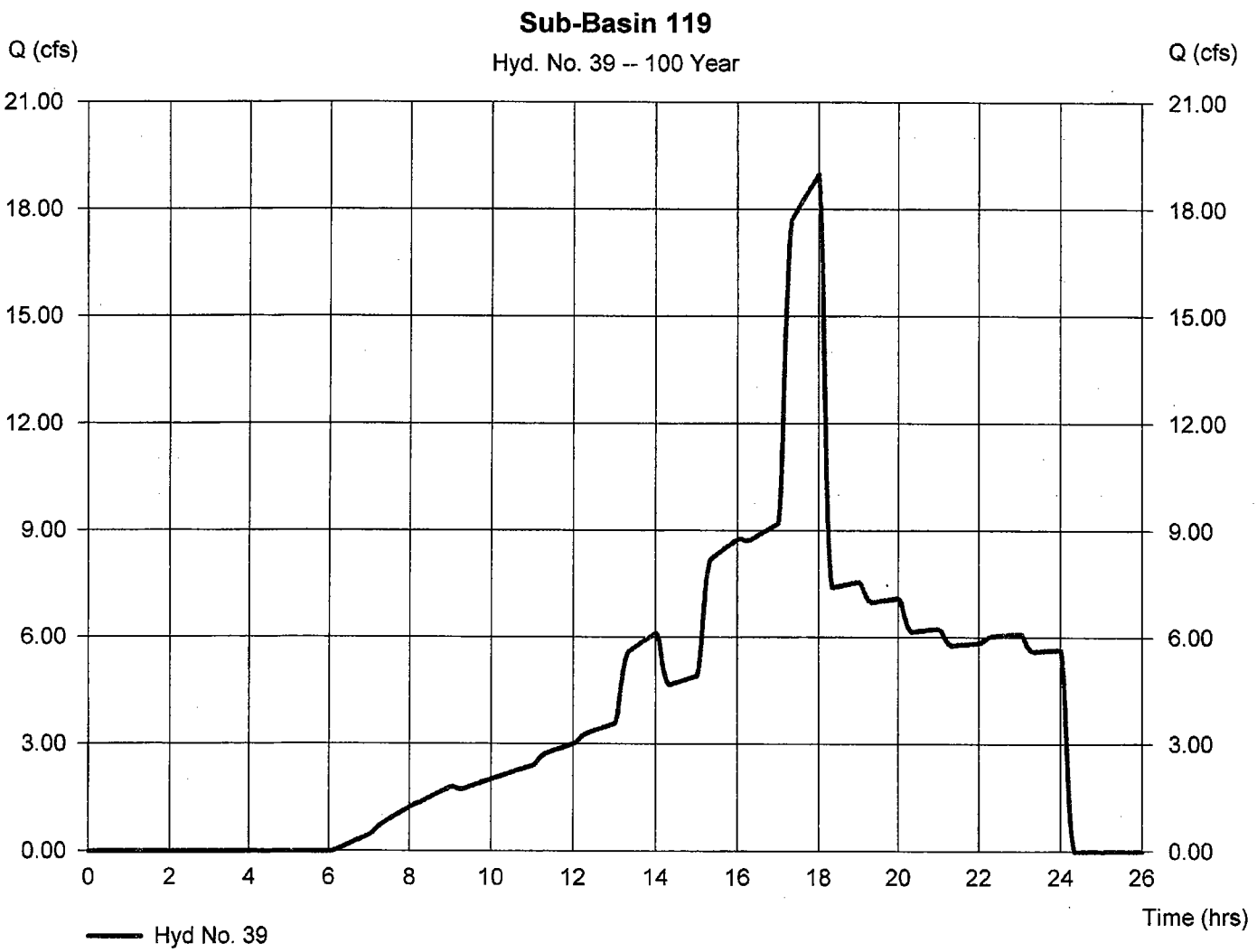
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 39

Sub-Basin 119

Hydrograph type	= SCS Runoff	Peak discharge	= 18.97 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.00 hrs
Time interval	= 2 min	Hyd. volume	= 351,982 cuft
Drainage area	= 40.700 ac	Curve number	= 68
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 12.00 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



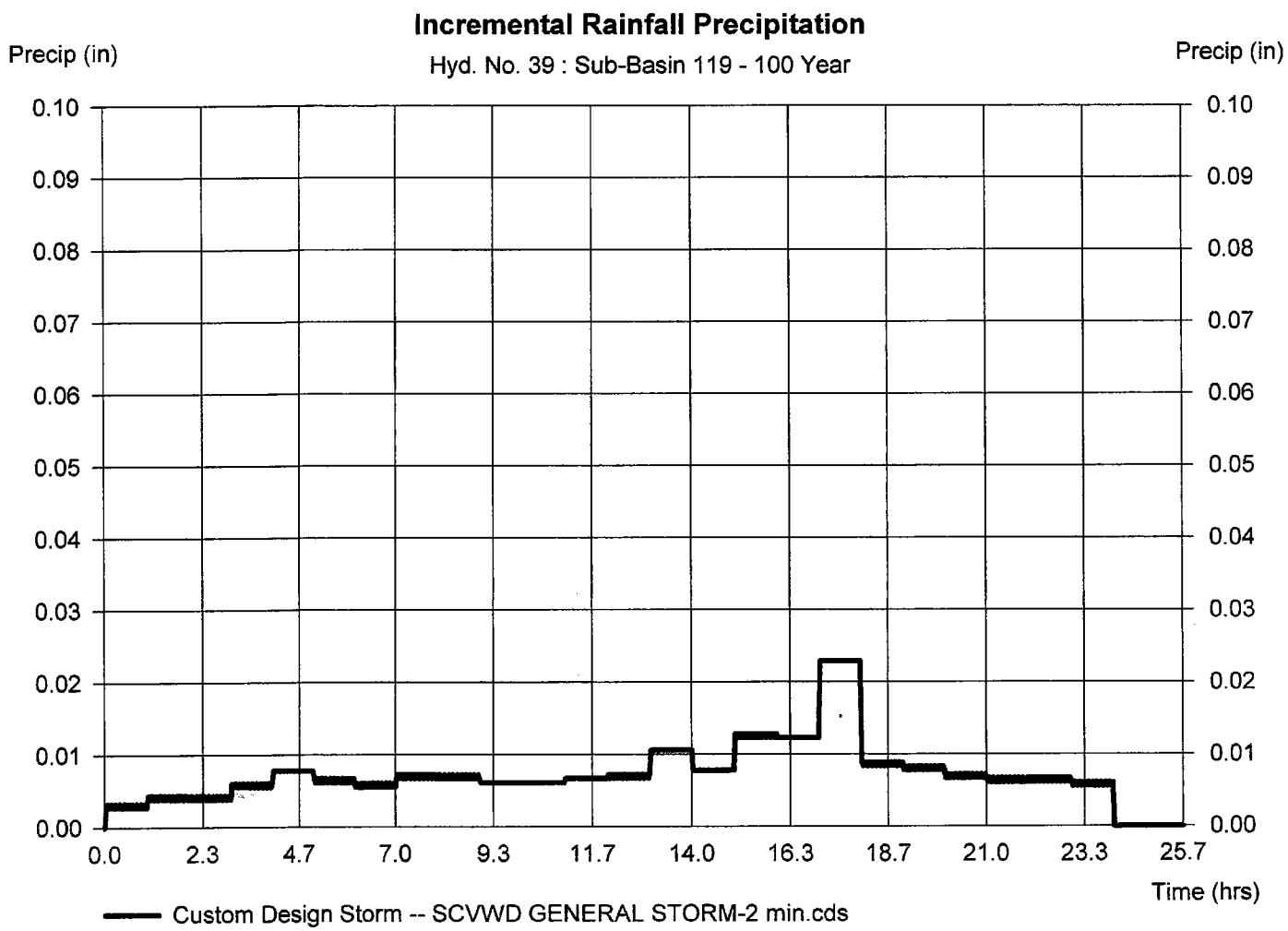
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 39

Sub-Basin 119

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



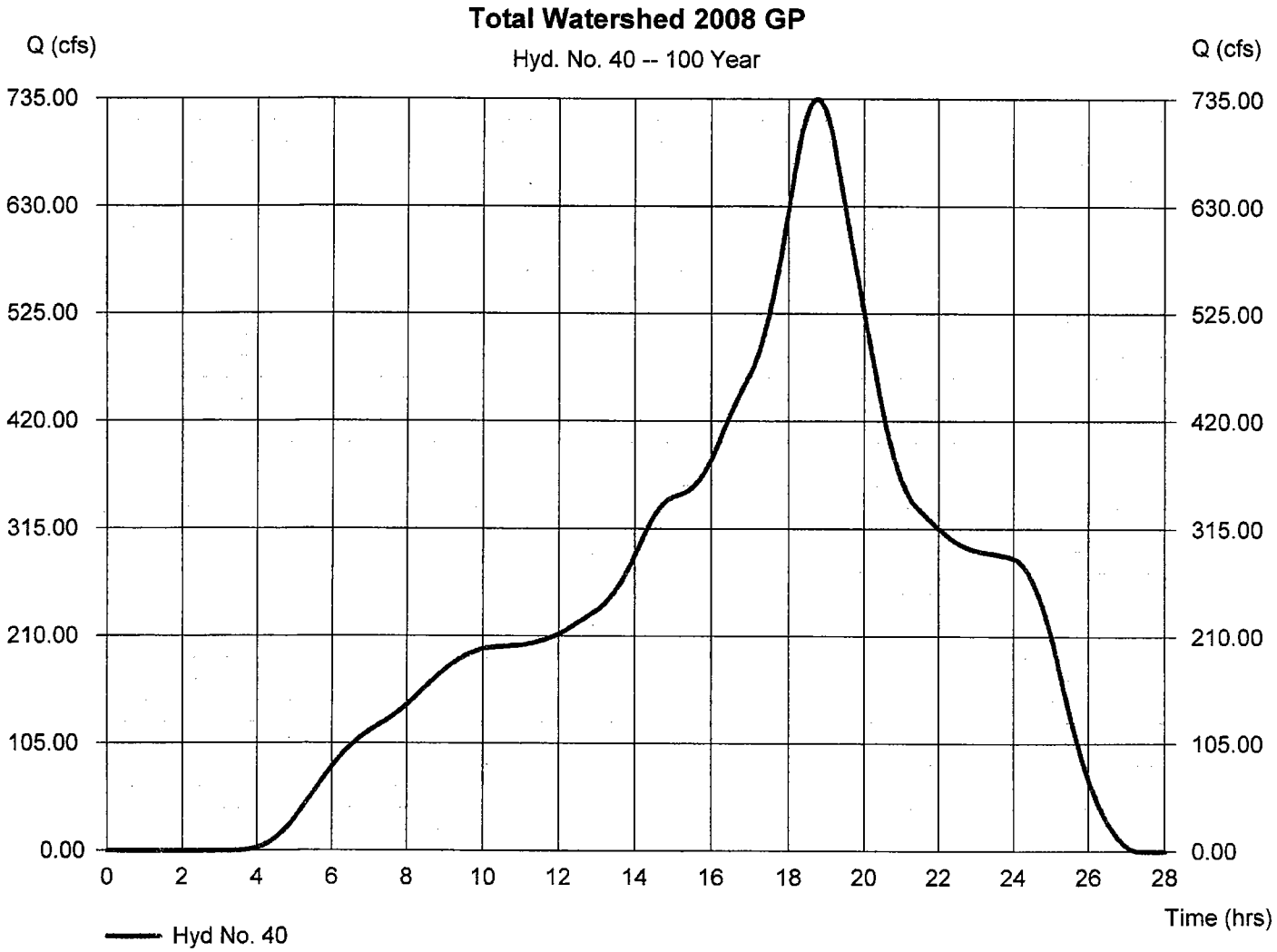
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 40

Total Watershed 2008 GP

Hydrograph type	= SCS Runoff	Peak discharge	= 734.74 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.73 hrs
Time interval	= 2 min	Hyd. volume	= 22,680,360 cuft
Drainage area	= 1608.800 ac	Curve number	= 84.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 126.00 min
Total precip.	= 5.59 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds	Shape factor	= 484



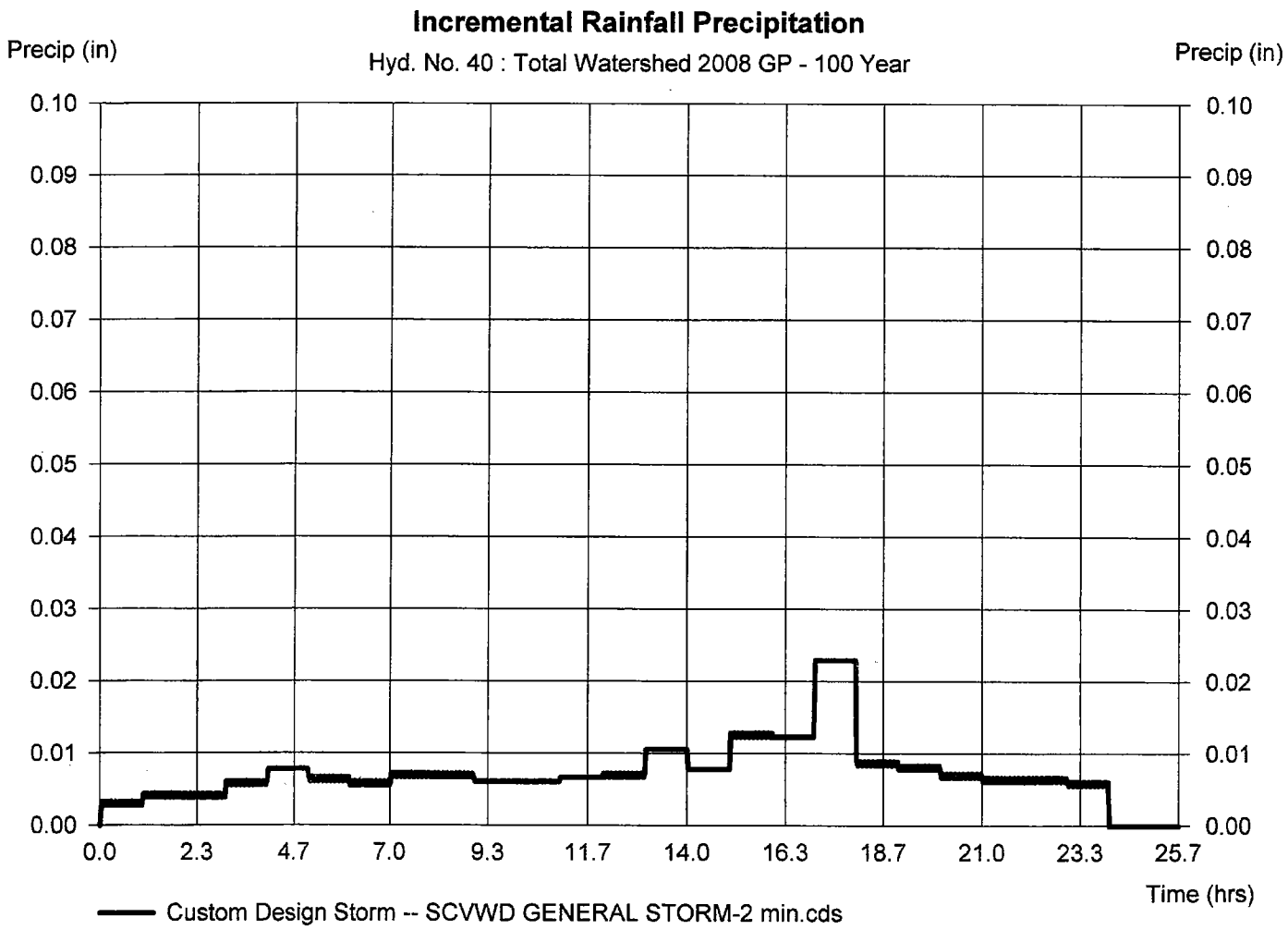
Precipitation Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 40

Total Watershed 2008 GP

Storm Frequency	= 100 yrs	Time interval	= 2 min
Total precip.	= 5.5900 in	Distribution	= Custom
Storm duration	= SCVWD GENERAL STORM-2 min.cds		



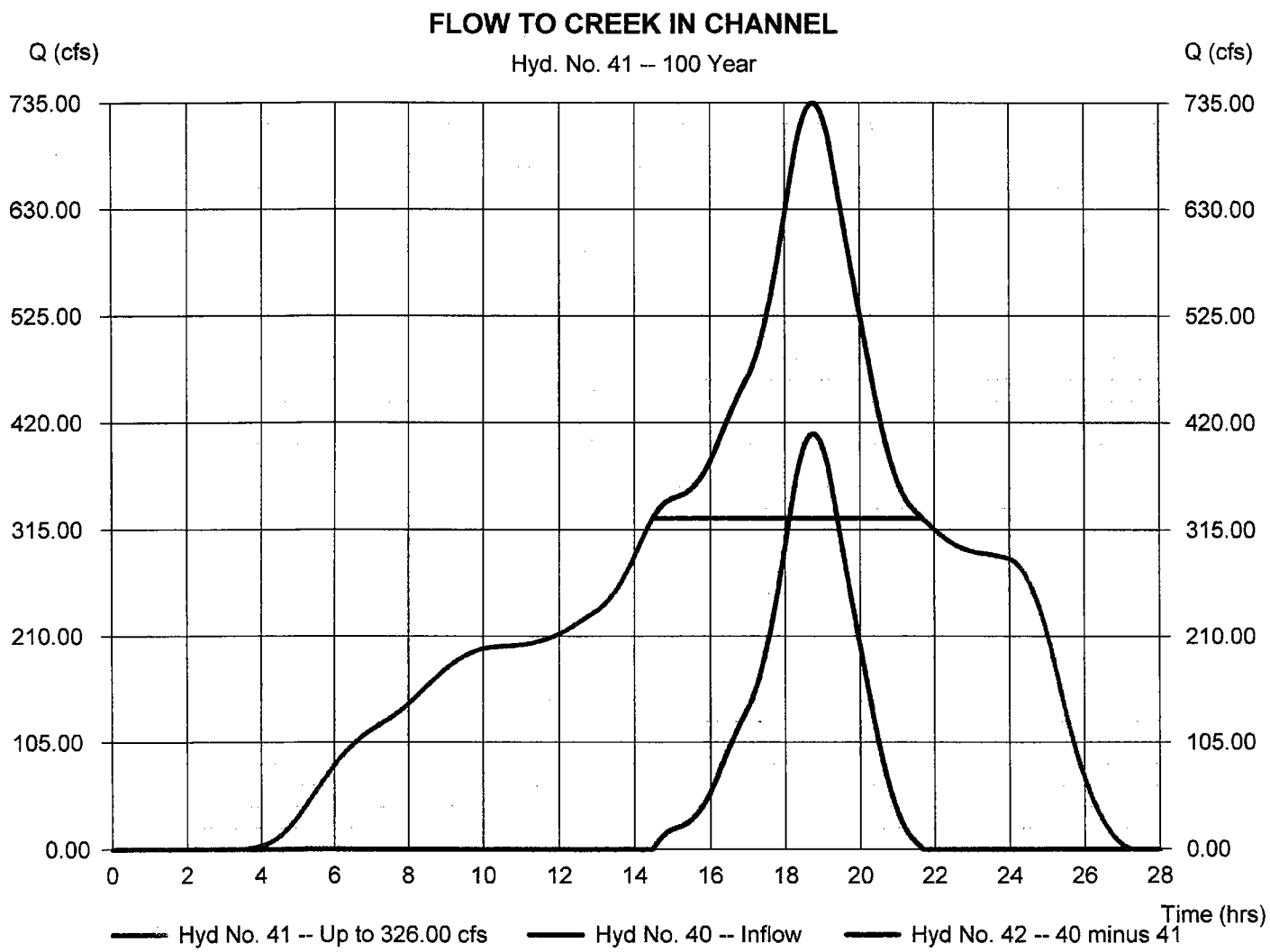
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 41

FLOW TO CREEK IN CHANNEL

Hydrograph type	= Diversion1	Peak discharge	= 326.00 cfs
Storm frequency	= 100 yrs	Time to peak	= 14.50 hrs
Time interval	= 2 min	Hyd. volume	= 18,563,100 cuft
Inflow hydrograph	= 40 - Total Watershed 2008 GP	2nd diverted hyd.	= 42
Diversion method	= Constant Q	Constant Q	= 326.00 cfs



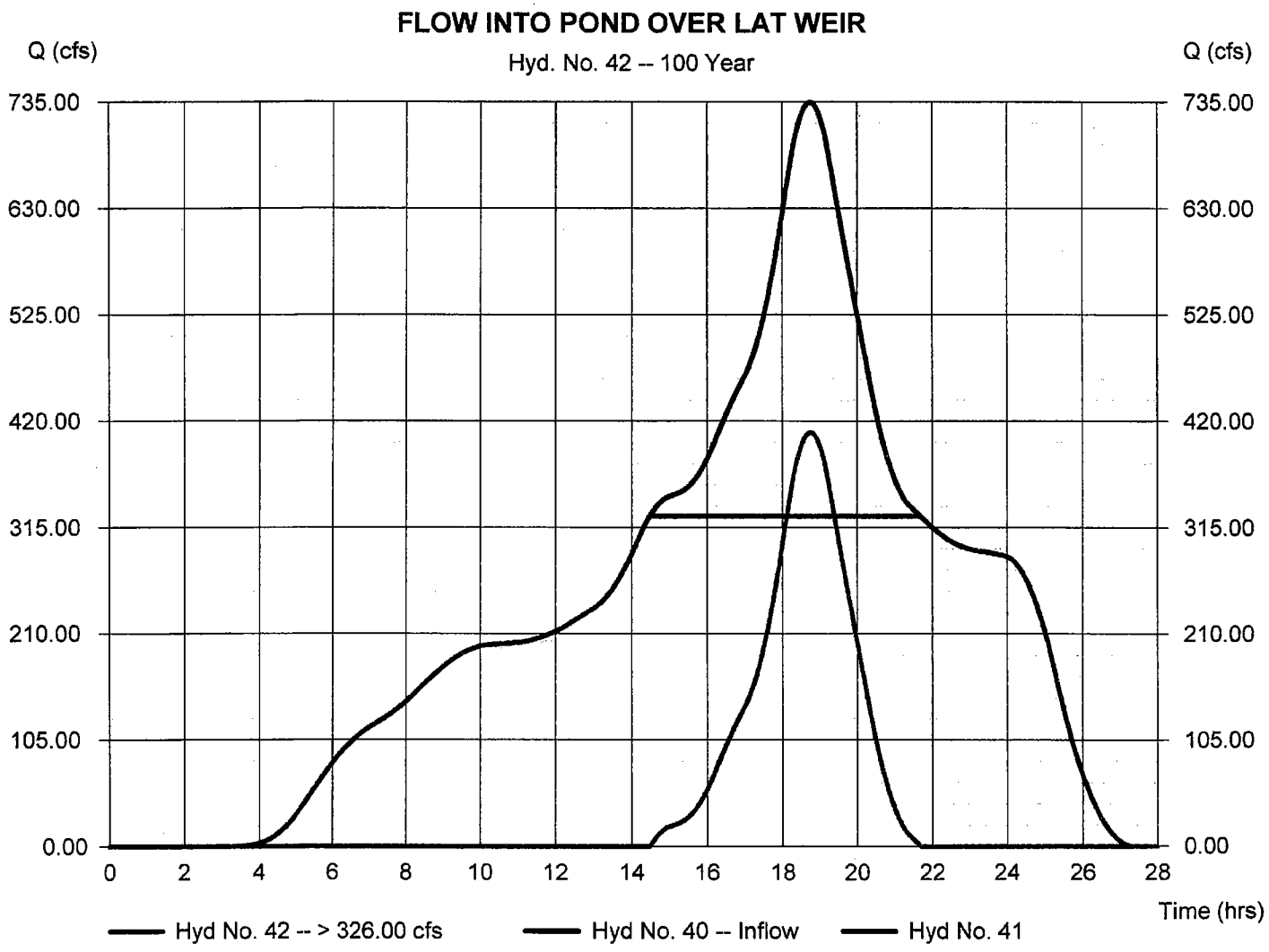
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 42

FLOW INTO POND OVER LAT WEIR

Hydrograph type	= Diversion2	Peak discharge	= 408.74 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.73 hrs
Time interval	= 2 min	Hyd. volume	= 4,117,261 cuft
Inflow hydrograph	= 40 - Total Watershed 2008 GP	2nd diverted hyd.	= 41
Diversion method	= Constant Q	Constant Q	= 326.00 cfs



Hydrograph Report

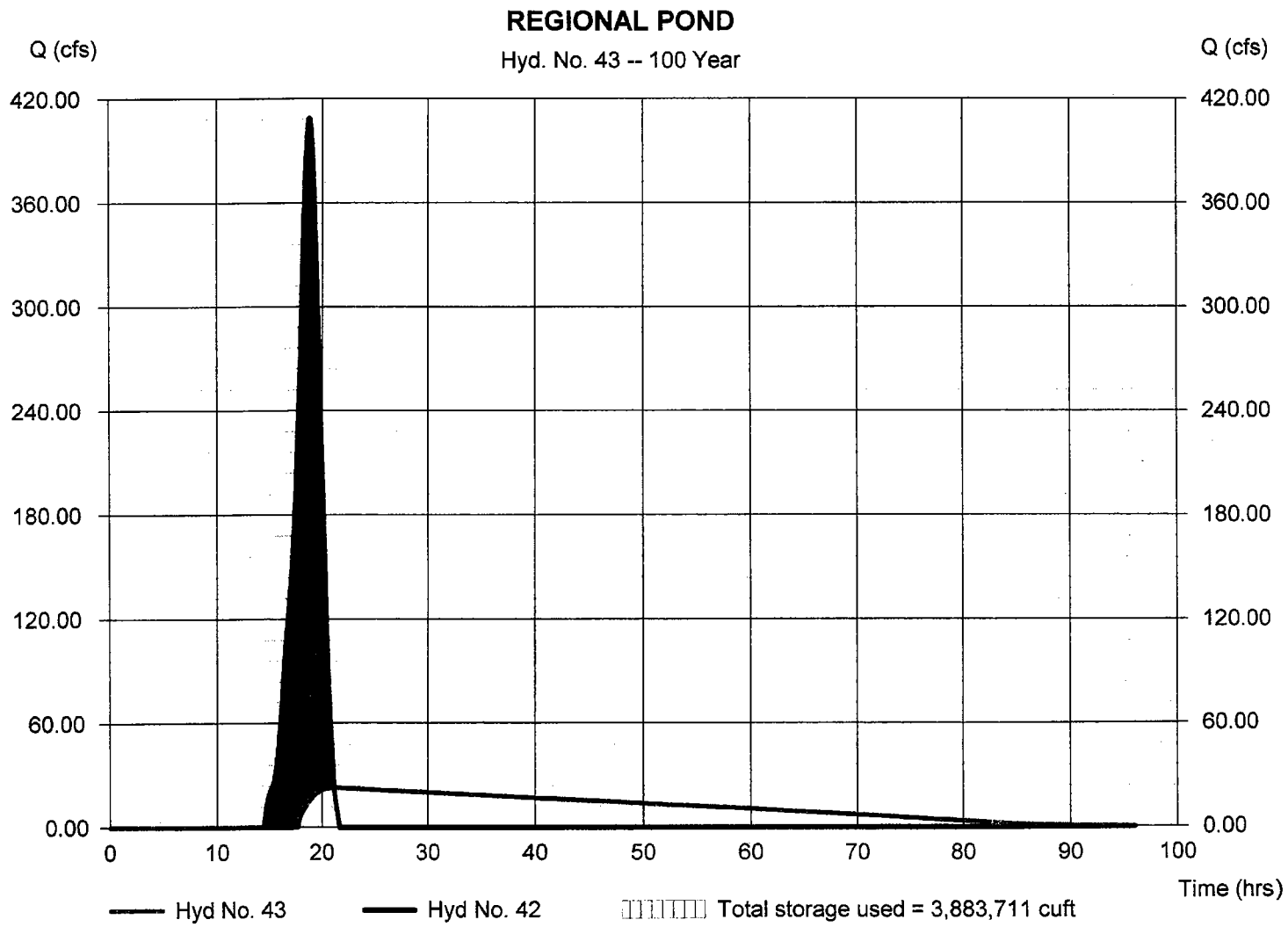
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 43

REGIONAL POND

Hydrograph type	= Reservoir	Peak discharge	= 22.77 cfs
Storm frequency	= 100 yrs	Time to peak	= 21.17 hrs
Time interval	= 2 min	Hyd. volume	= 3,163,038 cuft
Inflow hyd. No.	= 42 - FLOW INTO POND OVER LAT WEIR	Max. Elevation	= 312.93 ft
Reservoir name	= REGIONAL 1	Max. Storage	= 3,883,711 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Pond No. 2 - REGIONAL 1

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 306.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	306.50	275	0	0
0.50	307.00	14,385	2,775	2,775
1.00	307.50	97,051	24,798	27,572
1.50	308.00	238,940	81,370	108,943
2.00	308.50	395,819	157,033	265,976
2.50	309.00	564,653	238,848	504,823
3.00	309.50	719,567	320,242	825,065
3.50	310.00	832,265	387,578	1,212,643
4.00	310.50	901,224	433,214	1,645,857
4.50	311.00	912,478	453,378	2,099,235
5.00	311.50	919,953	458,060	2,557,295
5.50	312.00	927,452	461,804	3,019,099
6.00	312.50	934,976	465,559	3,484,658
6.50	313.00	942,526	469,327	3,953,985
7.00	313.50	950,100	473,108	4,427,093
7.50	314.00	957,700	476,901	4,903,994
8.00	314.50	965,325	480,707	5,384,701

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 306.50	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 309.69

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	306.50	0.00	---	---	---	---	---	---	---	---	---	0.000
0.05	277	306.55	0.00	---	---	---	---	---	---	---	---	---	0.000
0.10	555	306.60	0.00	---	---	---	---	---	---	---	---	---	0.000
0.15	832	306.65	0.00	---	---	---	---	---	---	---	---	---	0.000
0.20	1,110	306.70	0.00	---	---	---	---	---	---	---	---	---	0.000
0.25	1,387	306.75	0.00	---	---	---	---	---	---	---	---	---	0.000
0.30	1,665	306.80	0.00	---	---	---	---	---	---	---	---	---	0.000
0.35	1,942	306.85	0.00	---	---	---	---	---	---	---	---	---	0.000
0.40	2,220	306.90	0.00	---	---	---	---	---	---	---	---	---	0.000
0.45	2,497	306.95	0.00	---	---	---	---	---	---	---	---	---	0.000
0.50	2,775	307.00	0.00	---	---	---	---	---	---	---	---	---	0.000
0.55	5,254	307.05	0.00	---	---	---	---	---	---	---	---	---	0.000
0.60	7,734	307.10	0.00	---	---	---	---	---	---	---	---	---	0.000
0.65	10,214	307.15	0.00	---	---	---	---	---	---	---	---	---	0.000
0.70	12,694	307.20	0.00	---	---	---	---	---	---	---	---	---	0.000
0.75	15,173	307.25	0.00	---	---	---	---	---	---	---	---	---	0.000
0.80	17,653	307.30	0.00	---	---	---	---	---	---	---	---	---	0.000
0.85	20,133	307.35	0.00	---	---	---	---	---	---	---	---	---	0.000
0.90	22,613	307.40	0.00	---	---	---	---	---	---	---	---	---	0.000
0.95	25,092	307.45	0.00	---	---	---	---	---	---	---	---	---	0.000
1.00	27,572	307.50	0.00	---	---	---	---	---	---	---	---	---	0.000
1.05	35,709	307.55	0.00	---	---	---	---	---	---	---	---	---	0.000
1.10	43,846	307.60	0.00	---	---	---	---	---	---	---	---	---	0.000
1.15	51,983	307.65	0.00	---	---	---	---	---	---	---	---	---	0.000
1.20	60,120	307.70	0.00	---	---	---	---	---	---	---	---	---	0.000

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REGIONAL 1

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
1.25	68,257	307.75	0.00	—	—	—	—	—	—	—	—	—	0.000
1.30	76,394	307.80	0.00	—	—	—	—	—	—	—	—	—	0.000
1.35	84,531	307.85	0.00	—	—	—	—	—	—	—	—	—	0.000
1.40	92,668	307.90	0.00	—	—	—	—	—	—	—	—	—	0.000
1.45	100,806	307.95	0.00	—	—	—	—	—	—	—	—	—	0.000
1.50	108,943	308.00	0.00	—	—	—	—	—	—	—	—	—	0.000
1.55	124,646	308.05	0.00	—	—	—	—	—	—	—	—	—	0.000
1.60	140,349	308.10	0.00	—	—	—	—	—	—	—	—	—	0.000
1.65	156,053	308.15	0.00	—	—	—	—	—	—	—	—	—	0.000
1.70	171,756	308.20	0.00	—	—	—	—	—	—	—	—	—	0.000
1.75	187,459	308.25	0.00	—	—	—	—	—	—	—	—	—	0.000
1.80	203,162	308.30	0.00	—	—	—	—	—	—	—	—	—	0.000
1.85	218,866	308.35	0.00	—	—	—	—	—	—	—	—	—	0.000
1.90	234,569	308.40	0.00	—	—	—	—	—	—	—	—	—	0.000
1.95	250,272	308.45	0.00	—	—	—	—	—	—	—	—	—	0.000
2.00	265,976	308.50	0.00	—	—	—	—	—	—	—	—	—	0.000
2.05	289,860	308.55	0.00	—	—	—	—	—	—	—	—	—	0.000
2.10	313,745	308.60	0.00	—	—	—	—	—	—	—	—	—	0.000
2.15	337,630	308.65	0.00	—	—	—	—	—	—	—	—	—	0.000
2.20	361,515	308.70	0.00	—	—	—	—	—	—	—	—	—	0.000
2.25	385,400	308.75	0.00	—	—	—	—	—	—	—	—	—	0.000
2.30	409,284	308.80	0.00	—	—	—	—	—	—	—	—	—	0.000
2.35	433,169	308.85	0.00	—	—	—	—	—	—	—	—	—	0.000
2.40	457,054	308.90	0.00	—	—	—	—	—	—	—	—	—	0.000
2.45	480,939	308.95	0.00	—	—	—	—	—	—	—	—	—	0.000
2.50	504,823	309.00	0.00	—	—	—	—	—	—	—	—	—	0.000
2.55	536,848	309.05	0.00	—	—	—	—	—	—	—	—	—	0.000
2.60	568,872	309.10	0.00	—	—	—	—	—	—	—	—	—	0.000
2.65	600,896	309.15	0.00	—	—	—	—	—	—	—	—	—	0.000
2.70	632,920	309.20	0.00	—	—	—	—	—	—	—	—	—	0.000
2.75	664,944	309.25	0.00	—	—	—	—	—	—	—	—	—	0.000
2.80	696,968	309.30	0.00	—	—	—	—	—	—	—	—	—	0.000
2.85	728,992	309.35	0.00	—	—	—	—	—	—	—	—	—	0.000
2.90	761,016	309.40	0.00	—	—	—	—	—	—	—	—	—	0.000
2.95	793,041	309.45	0.00	—	—	—	—	—	—	—	—	—	0.000
3.00	825,065	309.50	0.00	—	—	—	—	—	—	—	—	—	0.000
3.05	863,823	309.55	0.00	—	—	—	—	—	—	—	—	—	0.000
3.10	902,580	309.60	0.00	—	—	—	—	—	—	—	—	—	0.000
3.15	941,338	309.65	0.00	—	—	—	—	—	—	—	—	—	0.000
3.20	980,096	309.70	1.27 oc	—	—	—	—	—	—	—	—	—	1.267
3.25	1,018,854	309.75	3.10 oc	—	—	—	—	—	—	—	—	—	3.099
3.30	1,057,611	309.80	4.20 oc	—	—	—	—	—	—	—	—	—	4.197
3.35	1,096,369	309.85	5.06 oc	—	—	—	—	—	—	—	—	—	5.063
3.40	1,135,127	309.90	5.80 oc	—	—	—	—	—	—	—	—	—	5.800
3.45	1,173,885	309.95	6.45 oc	—	—	—	—	—	—	—	—	—	6.454
3.50	1,212,643	310.00	7.05 oc	—	—	—	—	—	—	—	—	—	7.049
3.55	1,255,964	310.05	7.60 oc	—	—	—	—	—	—	—	—	—	7.596
3.60	1,299,286	310.10	8.11 oc	—	—	—	—	—	—	—	—	—	8.106
3.65	1,342,607	310.15	8.59 oc	—	—	—	—	—	—	—	—	—	8.586
3.70	1,385,929	310.20	9.04 oc	—	—	—	—	—	—	—	—	—	9.041
3.75	1,429,250	310.25	9.47 oc	—	—	—	—	—	—	—	—	—	9.473
3.80	1,472,572	310.30	9.89 oc	—	—	—	—	—	—	—	—	—	9.887
3.85	1,515,893	310.35	10.28 oc	—	—	—	—	—	—	—	—	—	10.28
3.90	1,559,215	310.40	10.67 oc	—	—	—	—	—	—	—	—	—	10.67
3.95	1,602,536	310.45	11.04 oc	—	—	—	—	—	—	—	—	—	11.04
4.00	1,645,857	310.50	11.39 oc	—	—	—	—	—	—	—	—	—	11.39
4.05	1,691,195	310.55	11.74 oc	—	—	—	—	—	—	—	—	—	11.74
4.10	1,736,533	310.60	12.08 oc	—	—	—	—	—	—	—	—	—	12.08
4.15	1,781,871	310.65	12.40 oc	—	—	—	—	—	—	—	—	—	12.40
4.20	1,827,208	310.70	12.72 oc	—	—	—	—	—	—	—	—	—	12.72
4.25	1,872,546	310.75	13.03 oc	—	—	—	—	—	—	—	—	—	13.03
4.30	1,917,884	310.80	13.34 oc	—	—	—	—	—	—	—	—	—	13.34
4.35	1,963,222	310.85	13.63 oc	—	—	—	—	—	—	—	—	—	13.63
4.40	2,008,559	310.90	13.93 oc	—	—	—	—	—	—	—	—	—	13.93
4.45	2,053,897	310.95	14.21 oc	—	—	—	—	—	—	—	—	—	14.21
4.50	2,099,235	311.00	14.49 oc	—	—	—	—	—	—	—	—	—	14.49
4.55	2,145,041	311.05	14.76 oc	—	—	—	—	—	—	—	—	—	14.76
4.60	2,190,847	311.10	15.03 oc	—	—	—	—	—	—	—	—	—	15.03
4.65	2,236,653	311.15	15.30 oc	—	—	—	—	—	—	—	—	—	15.30
4.70	2,282,459	311.20	15.56 oc	—	—	—	—	—	—	—	—	—	15.56
4.75	2,328,265	311.25	15.81 oc	—	—	—	—	—	—	—	—	—	15.81

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REGIONAL 1

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
4.80	2,374,071	311.30	16.06 oc	—	—	—	—	—	—	—	—	—	16.06
4.85	2,419,877	311.35	16.31 oc	—	—	—	—	—	—	—	—	—	16.31
4.90	2,465,683	311.40	16.55 oc	—	—	—	—	—	—	—	—	—	16.55
4.95	2,511,489	311.45	16.79 oc	—	—	—	—	—	—	—	—	—	16.79
5.00	2,557,295	311.50	17.03 oc	—	—	—	—	—	—	—	—	—	17.03
5.05	2,603,476	311.55	17.27 oc	—	—	—	—	—	—	—	—	—	17.27
5.10	2,649,656	311.60	17.50 oc	—	—	—	—	—	—	—	—	—	17.50
5.15	2,695,837	311.65	17.72 oc	—	—	—	—	—	—	—	—	—	17.72
5.20	2,742,017	311.70	17.95 oc	—	—	—	—	—	—	—	—	—	17.95
5.25	2,788,198	311.75	18.17 oc	—	—	—	—	—	—	—	—	—	18.17
5.30	2,834,378	311.80	18.39 oc	—	—	—	—	—	—	—	—	—	18.39
5.35	2,880,559	311.85	18.61 oc	—	—	—	—	—	—	—	—	—	18.61
5.40	2,926,739	311.90	18.82 oc	—	—	—	—	—	—	—	—	—	18.82
5.45	2,972,920	311.95	19.03 oc	—	—	—	—	—	—	—	—	—	19.03
5.50	3,019,099	312.00	19.24 oc	—	—	—	—	—	—	—	—	—	19.24
5.55	3,065,655	312.05	19.45 oc	—	—	—	—	—	—	—	—	—	19.45
5.60	3,112,211	312.10	19.65 oc	—	—	—	—	—	—	—	—	—	19.65
5.65	3,158,767	312.15	19.86 oc	—	—	—	—	—	—	—	—	—	19.86
5.70	3,205,323	312.20	20.06 oc	—	—	—	—	—	—	—	—	—	20.06
5.75	3,251,879	312.25	20.26 oc	—	—	—	—	—	—	—	—	—	20.26
5.80	3,298,435	312.30	20.45 oc	—	—	—	—	—	—	—	—	—	20.45
5.85	3,344,991	312.35	20.65 oc	—	—	—	—	—	—	—	—	—	20.65
5.90	3,391,547	312.40	20.84 oc	—	—	—	—	—	—	—	—	—	20.84
5.95	3,438,103	312.45	21.03 oc	—	—	—	—	—	—	—	—	—	21.03
6.00	3,484,658	312.50	21.22 oc	—	—	—	—	—	—	—	—	—	21.22
6.05	3,531,591	312.55	21.41 oc	—	—	—	—	—	—	—	—	—	21.41
6.10	3,578,524	312.60	21.60 oc	—	—	—	—	—	—	—	—	—	21.60
6.15	3,625,456	312.65	21.78 oc	—	—	—	—	—	—	—	—	—	21.78
6.20	3,672,389	312.70	21.96 oc	—	—	—	—	—	—	—	—	—	21.96
6.25	3,719,322	312.75	22.15 oc	—	—	—	—	—	—	—	—	—	22.15
6.30	3,766,255	312.80	22.33 oc	—	—	—	—	—	—	—	—	—	22.33
6.35	3,813,187	312.85	22.50 oc	—	—	—	—	—	—	—	—	—	22.50
6.40	3,860,120	312.90	22.68 oc	—	—	—	—	—	—	—	—	—	22.68
6.45	3,907,053	312.95	22.86 oc	—	—	—	—	—	—	—	—	—	22.86
6.50	3,953,985	313.00	23.03 oc	—	—	—	—	—	—	—	—	—	23.03
6.55	4,001,296	313.05	23.21 oc	—	—	—	—	—	—	—	—	—	23.21
6.60	4,048,607	313.10	23.38 oc	—	—	—	—	—	—	—	—	—	23.38
6.65	4,095,918	313.15	23.55 oc	—	—	—	—	—	—	—	—	—	23.55
6.70	4,143,228	313.20	23.72 oc	—	—	—	—	—	—	—	—	—	23.72
6.75	4,190,539	313.25	23.89 oc	—	—	—	—	—	—	—	—	—	23.89
6.80	4,237,850	313.30	24.05 oc	—	—	—	—	—	—	—	—	—	24.05
6.85	4,285,161	313.35	24.22 oc	—	—	—	—	—	—	—	—	—	24.22
6.90	4,332,472	313.40	24.38 oc	—	—	—	—	—	—	—	—	—	24.38
6.95	4,379,783	313.45	24.55 oc	—	—	—	—	—	—	—	—	—	24.55
7.00	4,427,093	313.50	24.71 oc	—	—	—	—	—	—	—	—	—	24.71
7.05	4,474,783	313.55	24.87 oc	—	—	—	—	—	—	—	—	—	24.87
7.10	4,522,473	313.60	25.03 oc	—	—	—	—	—	—	—	—	—	25.03
7.15	4,570,163	313.65	25.19 oc	—	—	—	—	—	—	—	—	—	25.19
7.20	4,617,853	313.70	25.35 oc	—	—	—	—	—	—	—	—	—	25.35
7.25	4,665,543	313.75	25.51 oc	—	—	—	—	—	—	—	—	—	25.51
7.30	4,713,233	313.80	25.67 oc	—	—	—	—	—	—	—	—	—	25.67
7.35	4,760,923	313.85	25.82 oc	—	—	—	—	—	—	—	—	—	25.82
7.40	4,808,613	313.90	25.98 oc	—	—	—	—	—	—	—	—	—	25.98
7.45	4,856,303	313.95	26.13 oc	—	—	—	—	—	—	—	—	—	26.13
7.50	4,903,994	314.00	26.28 oc	—	—	—	—	—	—	—	—	—	26.28
7.55	4,952,065	314.05	26.43 oc	—	—	—	—	—	—	—	—	—	26.43
7.60	5,000,135	314.10	26.59 oc	—	—	—	—	—	—	—	—	—	26.59
7.65	5,048,206	314.15	26.74 oc	—	—	—	—	—	—	—	—	—	26.74
7.70	5,096,276	314.20	26.89 oc	—	—	—	—	—	—	—	—	—	26.89
7.75	5,144,347	314.25	27.03 oc	—	—	—	—	—	—	—	—	—	27.03
7.80	5,192,417	314.30	27.18 oc	—	—	—	—	—	—	—	—	—	27.18
7.85	5,240,488	314.35	27.33 oc	—	—	—	—	—	—	—	—	—	27.33
7.90	5,288,558	314.40	27.48 oc	—	—	—	—	—	—	—	—	—	27.48
7.95	5,336,629	314.45	27.62 oc	—	—	—	—	—	—	—	—	—	27.62
8.00	5,384,701	314.50	27.77 oc	—	—	—	—	—	—	—	—	—	27.77

...End

Hydrograph Report

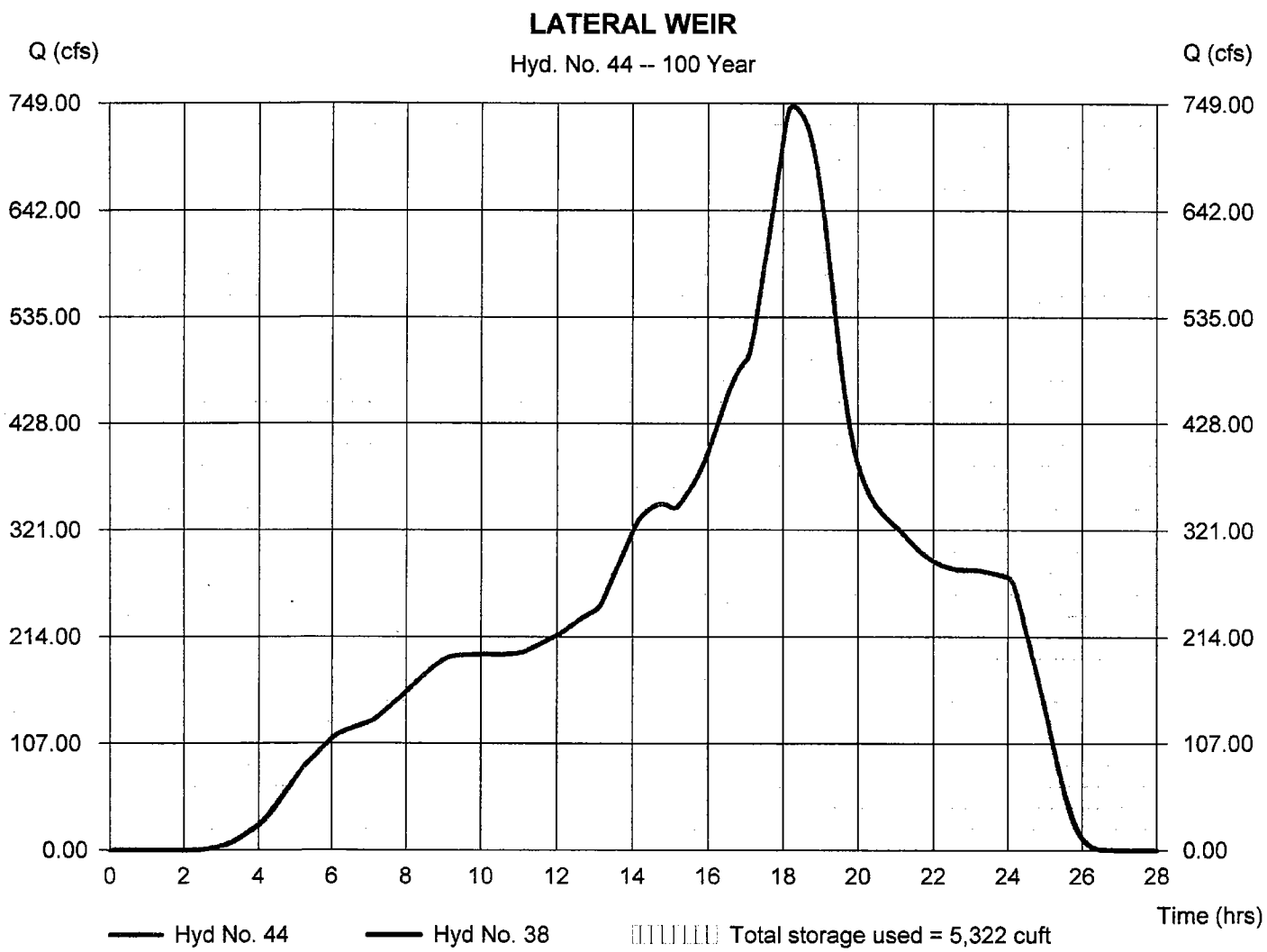
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 44

LATERAL WEIR

Hydrograph type	= Reservoir	Peak discharge	= 745.98 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.27 hrs
Time interval	= 2 min	Hyd. volume	= 22,228,080 cuft
Inflow hyd. No.	= 38 - Combine At Maple	Max. Elevation	= 311.29 ft
Reservoir name	= LATERAL WEIR VIRTUAL POND	Max. Storage	= 5,322 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Pond No. 1 - LATERAL WEIR VIRTUAL POND

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	308.07	n/a	0	0
1.00	309.07	n/a	4,356	4,356
2.00	310.07	n/a	436	4,792
3.00	311.07	n/a	436	5,227
4.00	312.07	n/a	436	5,663
5.00	313.07	n/a	436	6,098
6.00	314.07	n/a	436	6,534
6.50	314.57	n/a	436	6,970

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	Inactive	Inactive	Inactive
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 308.07	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	Inactive	300.00	Inactive
Crest El. (ft)	= 308.00	308.00	310.70	0.00
Weir Coeff.	= 0.68	3.33	2.60	3.33
Weir Type	= 30 degV	Rect	Broad	---
Multi-Stage	= Yes	Yes	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 308.10

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	308.07	0.00	---	---	---	---	0.00	0.00	---	---	---	0.000
0.10	436	308.17	0.04 oc	---	---	---	---	0.00	0.00	---	---	5.007	5.045
0.20	871	308.27	0.24 oc	---	---	---	---	0.00	0.00	---	---	10.01	10.25
0.30	1,307	308.37	0.55 ic	---	---	---	---	0.00	0.00	---	---	15.02	15.57
0.40	1,742	308.47	0.97 ic	---	---	---	---	0.00	0.00	---	---	20.03	20.99
0.50	2,178	308.57	1.48 ic	---	---	---	---	0.00	0.00	---	---	25.04	26.52
0.60	2,614	308.67	2.01 oc	---	---	---	---	0.00	0.00	---	---	30.04	32.05
0.70	3,049	308.77	2.56 oc	---	---	---	---	0.00	0.00	---	---	35.05	37.61
0.80	3,485	308.87	3.14 oc	---	---	---	---	0.00	0.00	---	---	40.06	43.19
0.90	3,920	308.97	3.74 oc	---	---	---	---	0.00	0.00	---	---	45.06	48.80
1.00	4,356	309.07	4.34 oc	---	---	---	---	0.00	0.00	---	---	50.07	54.41
1.10	4,400	309.17	4.94 oc	---	---	---	---	0.00	0.00	---	---	61.28	66.22
1.20	4,443	309.27	5.54 oc	---	---	---	---	0.00	0.00	---	---	72.50	78.04
1.30	4,487	309.37	6.12 oc	---	---	---	---	0.00	0.00	---	---	83.71	89.83
1.40	4,530	309.47	6.68 oc	---	---	---	---	0.00	0.00	---	---	94.92	101.60
1.50	4,574	309.57	7.21 oc	---	---	---	---	0.00	0.00	---	---	106.14	113.35
1.60	4,617	309.67	7.70 oc	---	---	---	---	0.00	0.00	---	---	117.35	125.04
1.70	4,661	309.77	8.12 oc	---	---	---	---	0.00	0.00	---	---	128.56	136.69
1.80	4,704	309.87	8.48 oc	---	---	---	---	0.00	0.00	---	---	139.77	148.25
1.90	4,748	309.97	8.72 oc	---	---	---	---	0.00	0.00	---	---	150.99	159.70
2.00	4,792	310.07	8.66 oc	---	---	---	---	0.00	0.00	---	---	162.20	170.86
2.10	4,835	310.17	10.25 oc	---	---	---	---	0.00	0.00	---	---	178.59	188.84
2.20	4,879	310.27	11.62 oc	---	---	---	---	0.00	0.00	---	---	194.98	206.60
2.30	4,922	310.37	12.85 oc	---	---	---	---	0.00	0.00	---	---	211.37	224.22
2.40	4,966	310.47	13.97 oc	---	---	---	---	0.00	0.00	---	---	227.76	241.73
2.50	5,009	310.57	15.01 oc	---	---	---	---	0.00	0.00	---	---	244.15	259.16
2.60	5,053	310.67	15.98 oc	---	---	---	---	0.00	0.00	---	---	260.54	276.52
2.70	5,097	310.77	16.89 oc	---	---	---	---	0.00	14.48	---	---	276.93	308.30
2.80	5,140	310.87	17.76 oc	---	---	---	---	0.00	54.71	---	---	293.32	365.79
2.90	5,184	310.97	18.58 oc	---	---	---	---	0.00	109.48	---	---	309.71	437.77
3.00	5,227	311.07	19.37 oc	---	---	---	---	0.00	175.55	---	---	326.10	521.02
3.10	5,271	311.17	20.13 oc	---	---	---	---	0.00	251.33	---	---	347.49	618.95
3.20	5,314	311.27	20.87 oc	---	---	---	---	0.00	335.65	---	---	368.88	725.39
3.30	5,358	311.37	21.57 oc	---	---	---	---	0.00	427.75	---	---	390.27	839.59

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LATERAL WEIR VIRTUAL POND

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
3.40	5,401	311.47	22.26 oc	---	---	---	---	0.00	527.01	---	---	411.66	960.93
3.50	5,445	311.57	22.92 oc	---	---	---	---	0.00	632.95	---	---	433.05	1088.92
3.60	5,489	311.67	23.57 oc	---	---	---	---	0.00	745.17	---	---	454.44	1223.18
3.70	5,532	311.77	24.20 oc	---	---	---	---	0.00	863.44	---	---	475.83	1363.47
3.80	5,576	311.87	24.81 oc	---	---	---	---	0.00	987.22	---	---	497.22	1509.25
3.90	5,619	311.97	25.41 oc	---	---	---	---	0.00	1116.46	---	---	518.61	1660.48
4.00	5,663	312.07	25.99 oc	---	---	---	---	0.00	1250.76	---	---	540.00	1816.75
4.10	5,706	312.17	26.56 oc	---	---	---	---	0.00	1390.18	---	---	566.40	1983.15
4.20	5,750	312.27	27.06 ic	---	---	---	---	0.00	1534.39	---	---	592.80	2154.24
4.30	5,793	312.37	27.48 ic	---	---	---	---	0.00	1683.30	---	---	619.20	2329.98
4.40	5,837	312.47	27.89 ic	---	---	---	---	0.00	1836.75	---	---	645.60	2510.24
4.50	5,881	312.57	28.30 ic	---	---	---	---	0.00	1994.60	---	---	672.00	2694.89
4.60	5,924	312.67	28.70 ic	---	---	---	---	0.00	2156.72	---	---	698.40	2883.82
4.70	5,968	312.77	29.09 ic	---	---	---	---	0.00	2323.17	---	---	724.80	3077.07
4.80	6,011	312.87	29.48 ic	---	---	---	---	0.00	2493.48	---	---	751.20	3274.17
4.90	6,055	312.97	29.87 ic	---	---	---	---	0.00	2667.82	---	---	777.60	3475.29
5.00	6,098	313.07	30.25 ic	---	---	---	---	0.00	2845.88	---	---	804.00	3680.12
5.10	6,142	313.17	30.63 ic	---	---	---	---	0.00	3027.89	---	---	835.50	3894.02
5.20	6,186	313.27	31.00 ic	---	---	---	---	0.00	3213.58	---	---	867.00	4111.57
5.30	6,229	313.37	31.36 ic	---	---	---	---	0.00	3402.96	---	---	898.50	4332.83
5.40	6,273	313.47	31.73 ic	---	---	---	---	0.00	3595.93	---	---	930.00	4557.66
5.50	6,316	313.57	32.08 ic	---	---	---	---	0.00	3792.42	---	---	961.50	4786.00
5.60	6,360	313.67	32.44 ic	---	---	---	---	0.00	3992.36	---	---	993.00	5017.80
5.70	6,403	313.77	32.79 ic	---	---	---	---	0.00	4195.88	---	---	1024.50	5253.17
5.80	6,447	313.87	33.14 ic	---	---	---	---	0.00	4402.49	---	---	1056.00	5491.63
5.90	6,490	313.97	33.48 ic	---	---	---	---	0.00	4612.46	---	---	1087.50	5733.44
6.00	6,534	314.07	33.82 ic	---	---	---	---	0.00	4825.46	---	---	1119.00	5978.28
6.05	6,578	314.12	33.99 ic	---	---	---	---	0.00	4933.22	---	---	1155.30	6122.51
6.10	6,621	314.17	34.16 ic	---	---	---	---	0.00	5041.84	---	---	1191.60	6267.60
6.15	6,665	314.22	34.32 ic	---	---	---	---	0.00	5151.18	---	---	1227.90	6413.40
6.20	6,708	314.27	34.49 ic	---	---	---	---	0.00	5261.30	---	---	1264.20	6559.99
6.25	6,752	314.32	34.65 ic	---	---	---	---	0.00	5371.98	---	---	1300.50	6707.14
6.30	6,795	314.37	34.82 ic	---	---	---	---	0.00	5483.71	---	---	1336.80	6855.33
6.35	6,839	314.42	34.98 ic	---	---	---	---	0.00	5596.13	---	---	1373.10	7004.21
6.40	6,882	314.47	35.15 ic	---	---	---	---	0.00	5709.38	---	---	1409.40	7153.93
6.45	6,926	314.52	35.31 ic	---	---	---	---	0.00	5823.31	---	---	1445.70	7304.32
6.50	6,970	314.57	35.47 ic	---	---	---	---	0.00	5938.27	---	---	1482.00	7455.75

...End

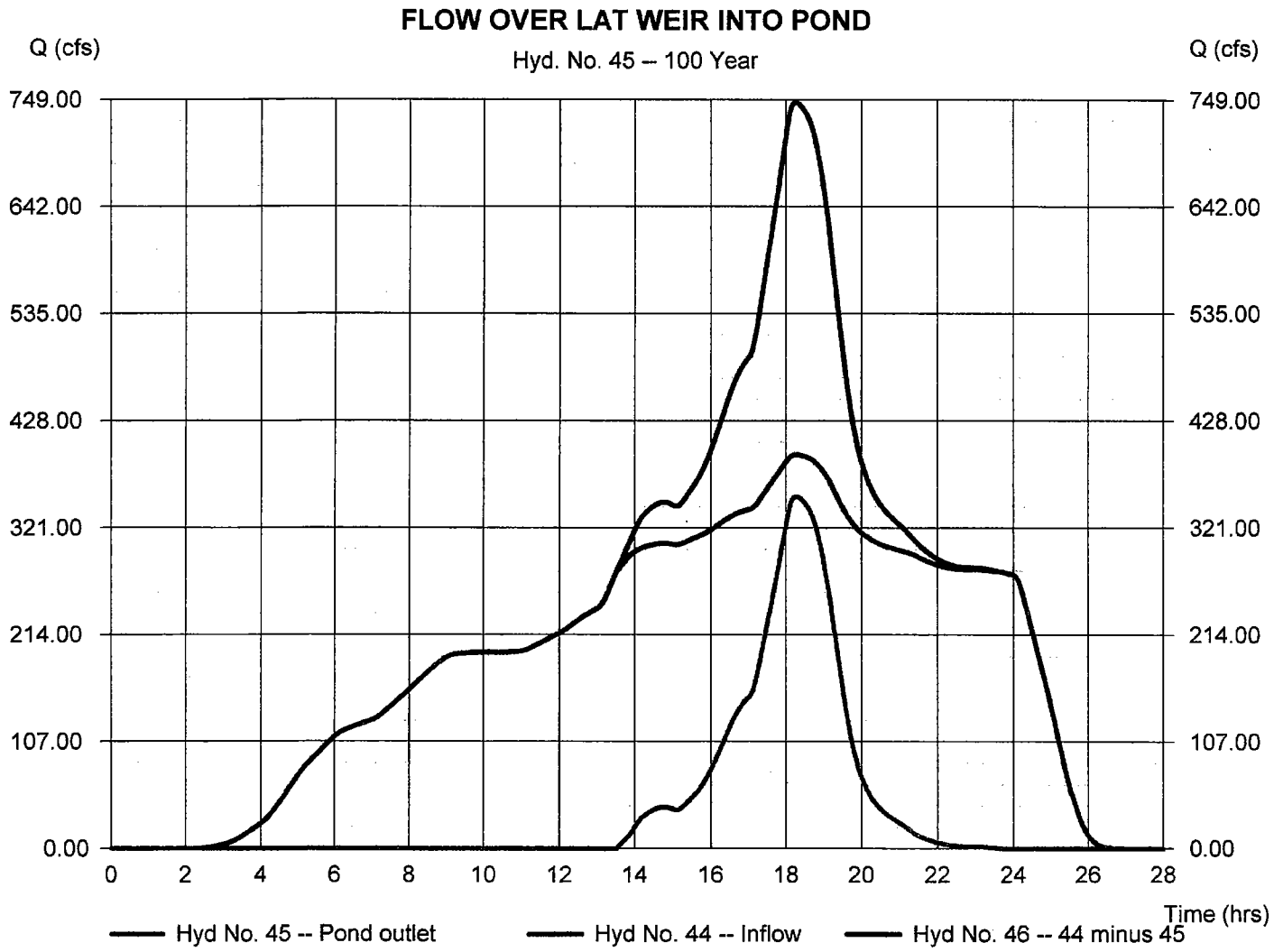
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 45

FLOW OVER LAT WEIR INTO POND

Hydrograph type	= Diversion1	Peak discharge	= 352.25 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.27 hrs
Time interval	= 2 min	Hyd. volume	= 3,619,515 cuft
Inflow hydrograph	= 44 - LATERAL WEIR	2nd diverted hyd.	= 46
Diversion method	= Pond - LATERAL WEIR VIRTUAL POND	Pond structure	= Weir C



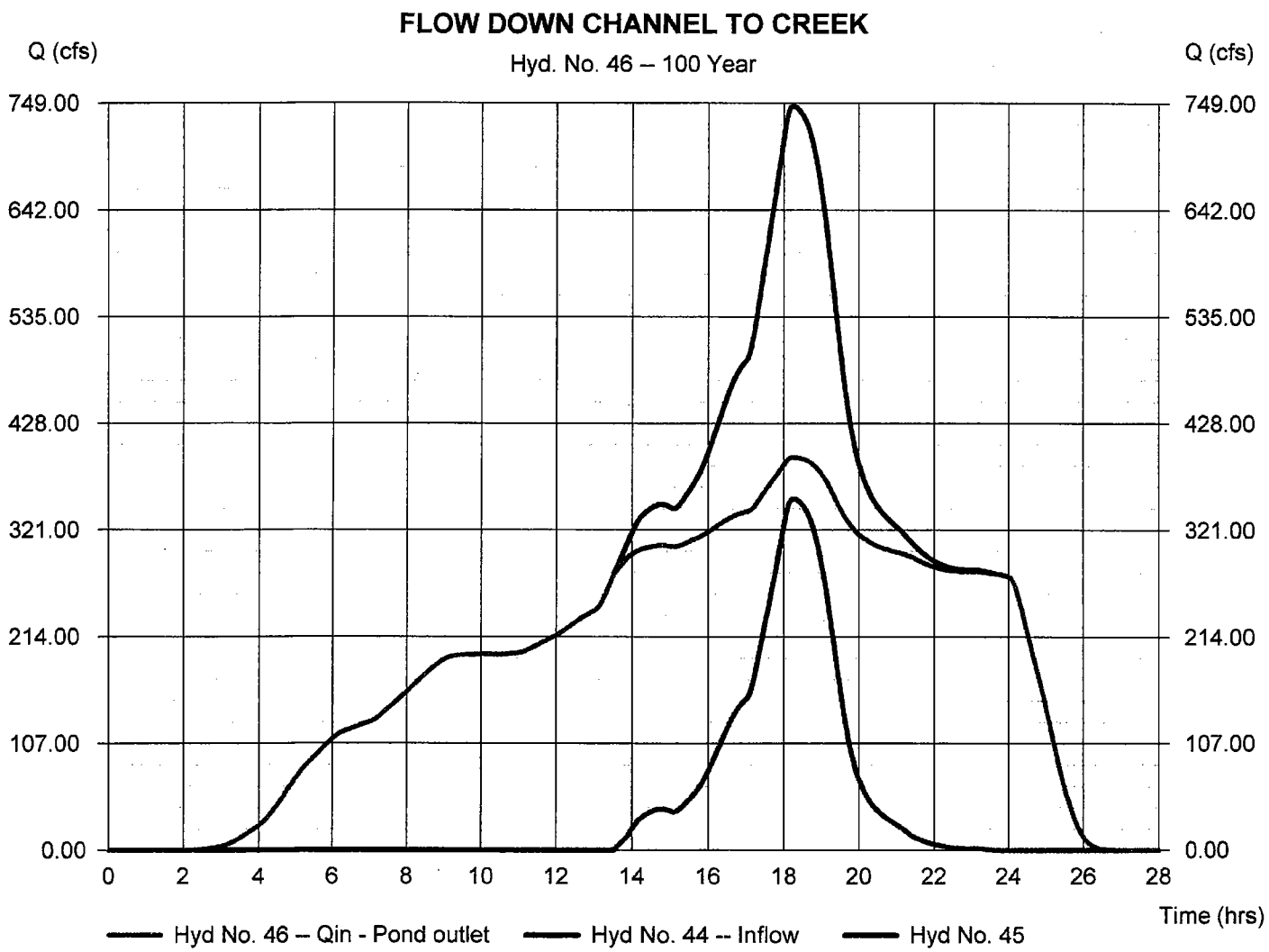
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 46

FLOW DOWN CHANNEL TO CREEK

Hydrograph type	= Diversion2	Peak discharge	= 393.73 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.27 hrs
Time interval	= 2 min	Hyd. volume	= 18,608,570 cuft
Inflow hydrograph	= 44 - LATERAL WEIR	2nd diverted hyd.	= 45
Diversion method	= Pond - LATERAL WEIR VIRTUAL POND	Pond structure	= Weir C



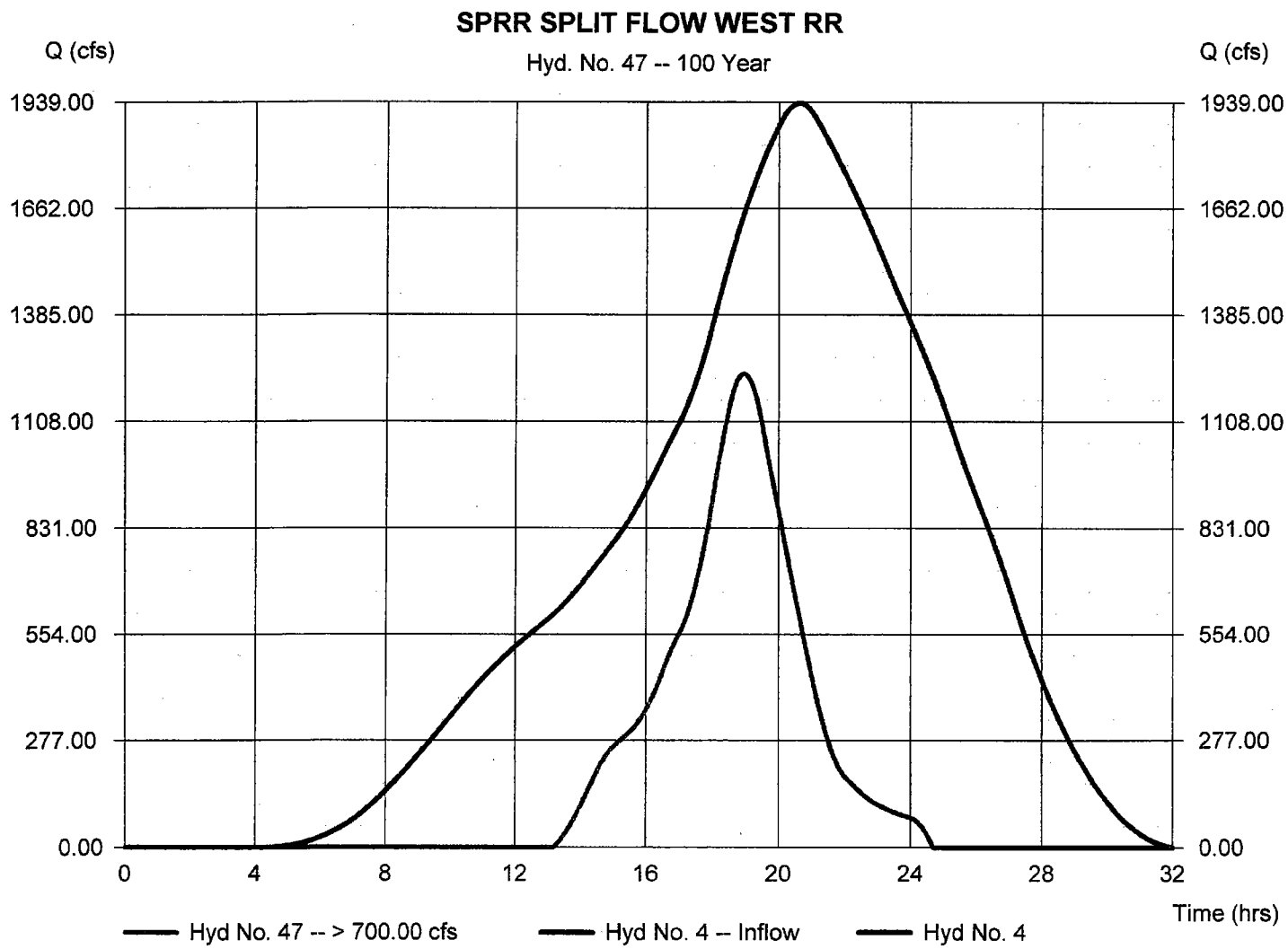
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 47

SPRR SPLIT FLOW WEST RR

Hydrograph type	= Diversion2	Peak discharge	= 1231.32 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.93 hrs
Time interval	= 2 min	Hyd. volume	= 18,347,320 cuft
Inflow hydrograph	= 4 - W. LITTLE LLAGAS CREEK	2nd diverted hyd.	= 4
Diversion method	= Constant Q	Constant Q	= 700.00 cfs



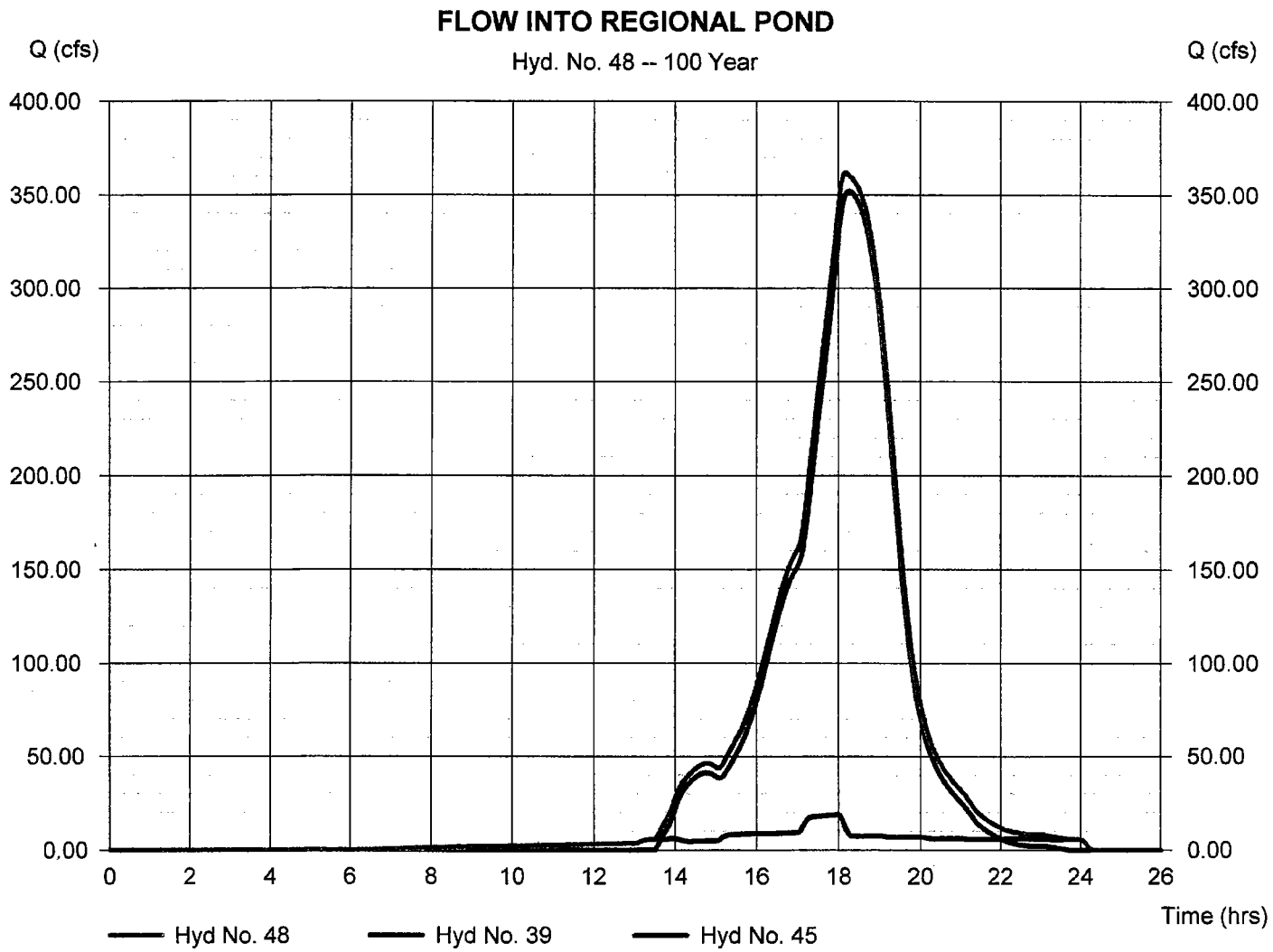
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 48

FLOW INTO REGIONAL POND

Hydrograph type	= Combine	Peak discharge	= 362.15 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.17 hrs
Time interval	= 2 min	Hyd. volume	= 3,971,498 cuft
Inflow hyds.	= 39, 45	Contrib. drain. area	= 40.700 ac



Hydrograph Report

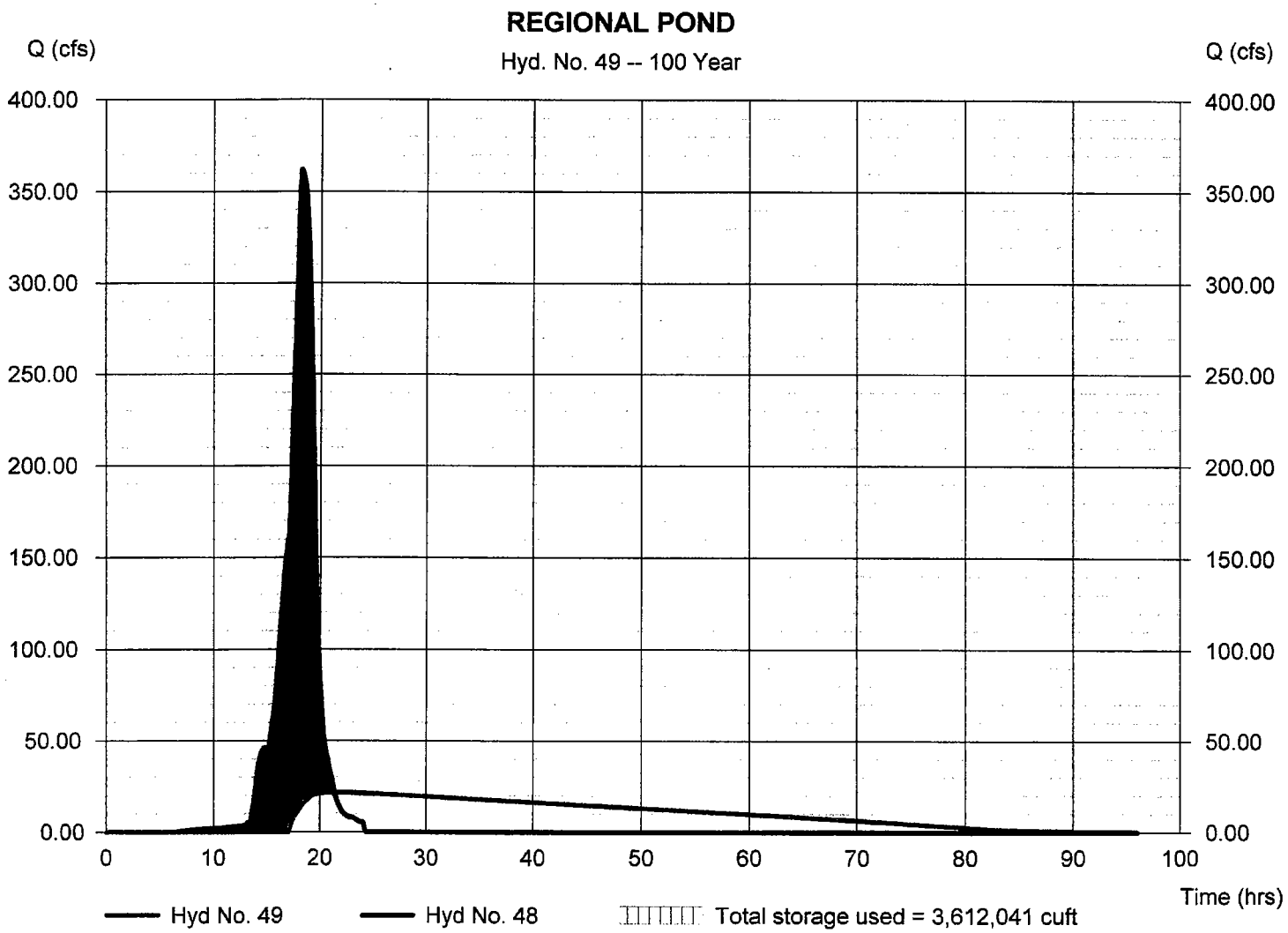
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 49

REGIONAL POND

Hydrograph type	= Reservoir	Peak discharge	= 21.73 cfs
Storm frequency	= 100 yrs	Time to peak	= 21.37 hrs
Time interval	= 2 min	Hyd. volume	= 3,020,176 cuft
Inflow hyd. No.	= 48 - FLOW INTO REGIONAL POND	Max. Elevation	= 312.64 ft
Reservoir name	= REGIONAL 1	Max. Storage	= 3,612,041 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Pond No. 2 - REGIONAL 1

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 306.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	306.50	275	0	0
0.50	307.00	14,385	2,775	2,775
1.00	307.50	97,051	24,798	27,572
1.50	308.00	238,940	81,370	108,943
2.00	308.50	395,819	157,033	265,976
2.50	309.00	564,653	238,848	504,823
3.00	309.50	719,567	320,242	825,065
3.50	310.00	832,265	387,578	1,212,643
4.00	310.50	901,224	433,214	1,645,857
4.50	311.00	912,478	453,378	2,099,235
5.00	311.50	919,953	458,060	2,557,295
5.50	312.00	927,452	461,804	3,019,099
6.00	312.50	934,976	465,559	3,484,658
6.50	313.00	942,526	469,327	3,953,985
7.00	313.50	950,100	473,108	4,427,093
7.50	314.00	957,700	476,901	4,903,994
8.00	314.50	965,325	480,707	5,384,701

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 306.50	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 309.69

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	306.50	0.00	---	---	---	---	---	---	---	---	---	0.000
0.05	277	306.55	0.00	---	---	---	---	---	---	---	---	---	0.000
0.10	555	306.60	0.00	---	---	---	---	---	---	---	---	---	0.000
0.15	832	306.65	0.00	---	---	---	---	---	---	---	---	---	0.000
0.20	1,110	306.70	0.00	---	---	---	---	---	---	---	---	---	0.000
0.25	1,387	306.75	0.00	---	---	---	---	---	---	---	---	---	0.000
0.30	1,665	306.80	0.00	---	---	---	---	---	---	---	---	---	0.000
0.35	1,942	306.85	0.00	---	---	---	---	---	---	---	---	---	0.000
0.40	2,220	306.90	0.00	---	---	---	---	---	---	---	---	---	0.000
0.45	2,497	306.95	0.00	---	---	---	---	---	---	---	---	---	0.000
0.50	2,775	307.00	0.00	---	---	---	---	---	---	---	---	---	0.000
0.55	5,254	307.05	0.00	---	---	---	---	---	---	---	---	---	0.000
0.60	7,734	307.10	0.00	---	---	---	---	---	---	---	---	---	0.000
0.65	10,214	307.15	0.00	---	---	---	---	---	---	---	---	---	0.000
0.70	12,694	307.20	0.00	---	---	---	---	---	---	---	---	---	0.000
0.75	15,173	307.25	0.00	---	---	---	---	---	---	---	---	---	0.000
0.80	17,653	307.30	0.00	---	---	---	---	---	---	---	---	---	0.000
0.85	20,133	307.35	0.00	---	---	---	---	---	---	---	---	---	0.000
0.90	22,613	307.40	0.00	---	---	---	---	---	---	---	---	---	0.000
0.95	25,092	307.45	0.00	---	---	---	---	---	---	---	---	---	0.000
1.00	27,572	307.50	0.00	---	---	---	---	---	---	---	---	---	0.000
1.05	35,709	307.55	0.00	---	---	---	---	---	---	---	---	---	0.000
1.10	43,846	307.60	0.00	---	---	---	---	---	---	---	---	---	0.000
1.15	51,983	307.65	0.00	---	---	---	---	---	---	---	---	---	0.000
1.20	60,120	307.70	0.00	---	---	---	---	---	---	---	---	---	0.000

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REGIONAL 1

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
1.25	68,257	307.75	0.00	---	---	---	---	---	---	---	---	---	0.000
1.30	76,394	307.80	0.00	---	---	---	---	---	---	---	---	---	0.000
1.35	84,531	307.85	0.00	---	---	---	---	---	---	---	---	---	0.000
1.40	92,668	307.90	0.00	---	---	---	---	---	---	---	---	---	0.000
1.45	100,806	307.95	0.00	---	---	---	---	---	---	---	---	---	0.000
1.50	108,943	308.00	0.00	---	---	---	---	---	---	---	---	---	0.000
1.55	124,646	308.05	0.00	---	---	---	---	---	---	---	---	---	0.000
1.60	140,349	308.10	0.00	---	---	---	---	---	---	---	---	---	0.000
1.65	156,053	308.15	0.00	---	---	---	---	---	---	---	---	---	0.000
1.70	171,756	308.20	0.00	---	---	---	---	---	---	---	---	---	0.000
1.75	187,459	308.25	0.00	---	---	---	---	---	---	---	---	---	0.000
1.80	203,162	308.30	0.00	---	---	---	---	---	---	---	---	---	0.000
1.85	218,866	308.35	0.00	---	---	---	---	---	---	---	---	---	0.000
1.90	234,569	308.40	0.00	---	---	---	---	---	---	---	---	---	0.000
1.95	250,272	308.45	0.00	---	---	---	---	---	---	---	---	---	0.000
2.00	265,976	308.50	0.00	---	---	---	---	---	---	---	---	---	0.000
2.05	289,860	308.55	0.00	---	---	---	---	---	---	---	---	---	0.000
2.10	313,745	308.60	0.00	---	---	---	---	---	---	---	---	---	0.000
2.15	337,630	308.65	0.00	---	---	---	---	---	---	---	---	---	0.000
2.20	361,515	308.70	0.00	---	---	---	---	---	---	---	---	---	0.000
2.25	385,400	308.75	0.00	---	---	---	---	---	---	---	---	---	0.000
2.30	409,284	308.80	0.00	---	---	---	---	---	---	---	---	---	0.000
2.35	433,169	308.85	0.00	---	---	---	---	---	---	---	---	---	0.000
2.40	457,054	308.90	0.00	---	---	---	---	---	---	---	---	---	0.000
2.45	480,939	308.95	0.00	---	---	---	---	---	---	---	---	---	0.000
2.50	504,823	309.00	0.00	---	---	---	---	---	---	---	---	---	0.000
2.55	536,848	309.05	0.00	---	---	---	---	---	---	---	---	---	0.000
2.60	568,872	309.10	0.00	---	---	---	---	---	---	---	---	---	0.000
2.65	600,896	309.15	0.00	---	---	---	---	---	---	---	---	---	0.000
2.70	632,920	309.20	0.00	---	---	---	---	---	---	---	---	---	0.000
2.75	664,944	309.25	0.00	---	---	---	---	---	---	---	---	---	0.000
2.80	696,968	309.30	0.00	---	---	---	---	---	---	---	---	---	0.000
2.85	728,992	309.35	0.00	---	---	---	---	---	---	---	---	---	0.000
2.90	761,016	309.40	0.00	---	---	---	---	---	---	---	---	---	0.000
2.95	793,041	309.45	0.00	---	---	---	---	---	---	---	---	---	0.000
3.00	825,065	309.50	0.00	---	---	---	---	---	---	---	---	---	0.000
3.05	863,823	309.55	0.00	---	---	---	---	---	---	---	---	---	0.000
3.10	902,580	309.60	0.00	---	---	---	---	---	---	---	---	---	0.000
3.15	941,338	309.65	0.00	---	---	---	---	---	---	---	---	---	0.000
3.20	980,096	309.70	1.27 oc	---	---	---	---	---	---	---	---	---	1.267
3.25	1,018,854	309.75	3.10 oc	---	---	---	---	---	---	---	---	---	3.099
3.30	1,057,611	309.80	4.20 oc	---	---	---	---	---	---	---	---	---	4.197
3.35	1,096,369	309.85	5.06 oc	---	---	---	---	---	---	---	---	---	5.063
3.40	1,135,127	309.90	5.80 oc	---	---	---	---	---	---	---	---	---	5.800
3.45	1,173,885	309.95	6.45 oc	---	---	---	---	---	---	---	---	---	6.454
3.50	1,212,643	310.00	7.05 oc	---	---	---	---	---	---	---	---	---	7.049
3.55	1,255,964	310.05	7.60 oc	---	---	---	---	---	---	---	---	---	7.596
3.60	1,299,286	310.10	8.11 oc	---	---	---	---	---	---	---	---	---	8.106
3.65	1,342,607	310.15	8.59 oc	---	---	---	---	---	---	---	---	---	8.586
3.70	1,385,929	310.20	9.04 oc	---	---	---	---	---	---	---	---	---	9.041
3.75	1,429,250	310.25	9.47 oc	---	---	---	---	---	---	---	---	---	9.473
3.80	1,472,572	310.30	9.89 oc	---	---	---	---	---	---	---	---	---	9.887
3.85	1,515,893	310.35	10.28 oc	---	---	---	---	---	---	---	---	---	10.28
3.90	1,559,215	310.40	10.67 oc	---	---	---	---	---	---	---	---	---	10.67
3.95	1,602,536	310.45	11.04 oc	---	---	---	---	---	---	---	---	---	11.04
4.00	1,645,857	310.50	11.39 oc	---	---	---	---	---	---	---	---	---	11.39
4.05	1,691,195	310.55	11.74 oc	---	---	---	---	---	---	---	---	---	11.74
4.10	1,736,533	310.60	12.08 oc	---	---	---	---	---	---	---	---	---	12.08
4.15	1,781,871	310.65	12.40 oc	---	---	---	---	---	---	---	---	---	12.40
4.20	1,827,208	310.70	12.72 oc	---	---	---	---	---	---	---	---	---	12.72
4.25	1,872,546	310.75	13.03 oc	---	---	---	---	---	---	---	---	---	13.03
4.30	1,917,884	310.80	13.34 oc	---	---	---	---	---	---	---	---	---	13.34
4.35	1,963,222	310.85	13.63 oc	---	---	---	---	---	---	---	---	---	13.63
4.40	2,008,559	310.90	13.93 oc	---	---	---	---	---	---	---	---	---	13.93
4.45	2,053,897	310.95	14.21 oc	---	---	---	---	---	---	---	---	---	14.21
4.50	2,099,235	311.00	14.49 oc	---	---	---	---	---	---	---	---	---	14.49
4.55	2,145,041	311.05	14.76 oc	---	---	---	---	---	---	---	---	---	14.76
4.60	2,190,847	311.10	15.03 oc	---	---	---	---	---	---	---	---	---	15.03
4.65	2,236,653	311.15	15.30 oc	---	---	---	---	---	---	---	---	---	15.30
4.70	2,282,459	311.20	15.56 oc	---	---	---	---	---	---	---	---	---	15.56
4.75	2,328,265	311.25	15.81 oc	---	---	---	---	---	---	---	---	---	15.81

Continues on next page...

REGIONAL 1

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
4.80	2,374,071	311.30	16.06 oc	---	---	---	---	---	---	---	---	---	16.06
4.85	2,419,877	311.35	16.31 oc	---	---	---	---	---	---	---	---	---	16.31
4.90	2,465,683	311.40	16.55 oc	---	---	---	---	---	---	---	---	---	16.55
4.95	2,511,489	311.45	16.79 oc	---	---	---	---	---	---	---	---	---	16.79
5.00	2,557,295	311.50	17.03 oc	---	---	---	---	---	---	---	---	---	17.03
5.05	2,603,476	311.55	17.27 oc	---	---	---	---	---	---	---	---	---	17.27
5.10	2,649,656	311.60	17.50 oc	---	---	---	---	---	---	---	---	---	17.50
5.15	2,695,837	311.65	17.72 oc	---	---	---	---	---	---	---	---	---	17.72
5.20	2,742,017	311.70	17.95 oc	---	---	---	---	---	---	---	---	---	17.95
5.25	2,788,198	311.75	18.17 oc	---	---	---	---	---	---	---	---	---	18.17
5.30	2,834,378	311.80	18.39 oc	---	---	---	---	---	---	---	---	---	18.39
5.35	2,880,559	311.85	18.61 oc	---	---	---	---	---	---	---	---	---	18.61
5.40	2,926,739	311.90	18.82 oc	---	---	---	---	---	---	---	---	---	18.82
5.45	2,972,920	311.95	19.03 oc	---	---	---	---	---	---	---	---	---	19.03
5.50	3,019,099	312.00	19.24 oc	---	---	---	---	---	---	---	---	---	19.24
5.55	3,065,655	312.05	19.45 oc	---	---	---	---	---	---	---	---	---	19.45
5.60	3,112,211	312.10	19.65 oc	---	---	---	---	---	---	---	---	---	19.65
5.65	3,158,767	312.15	19.86 oc	---	---	---	---	---	---	---	---	---	19.86
5.70	3,205,323	312.20	20.06 oc	---	---	---	---	---	---	---	---	---	20.06
5.75	3,251,879	312.25	20.26 oc	---	---	---	---	---	---	---	---	---	20.26
5.80	3,298,435	312.30	20.45 oc	---	---	---	---	---	---	---	---	---	20.45
5.85	3,344,991	312.35	20.65 oc	---	---	---	---	---	---	---	---	---	20.65
5.90	3,391,547	312.40	20.84 oc	---	---	---	---	---	---	---	---	---	20.84
5.95	3,438,103	312.45	21.03 oc	---	---	---	---	---	---	---	---	---	21.03
6.00	3,484,658	312.50	21.22 oc	---	---	---	---	---	---	---	---	---	21.22
6.05	3,531,591	312.55	21.41 oc	---	---	---	---	---	---	---	---	---	21.41
6.10	3,578,524	312.60	21.60 oc	---	---	---	---	---	---	---	---	---	21.60
6.15	3,625,456	312.65	21.78 oc	---	---	---	---	---	---	---	---	---	21.78
6.20	3,672,389	312.70	21.96 oc	---	---	---	---	---	---	---	---	---	21.96
6.25	3,719,322	312.75	22.15 oc	---	---	---	---	---	---	---	---	---	22.15
6.30	3,766,255	312.80	22.33 oc	---	---	---	---	---	---	---	---	---	22.33
6.35	3,813,187	312.85	22.50 oc	---	---	---	---	---	---	---	---	---	22.50
6.40	3,860,120	312.90	22.68 oc	---	---	---	---	---	---	---	---	---	22.68
6.45	3,907,053	312.95	22.86 oc	---	---	---	---	---	---	---	---	---	22.86
6.50	3,953,985	313.00	23.03 oc	---	---	---	---	---	---	---	---	---	23.03
6.55	4,001,296	313.05	23.21 oc	---	---	---	---	---	---	---	---	---	23.21
6.60	4,048,607	313.10	23.38 oc	---	---	---	---	---	---	---	---	---	23.38
6.65	4,095,918	313.15	23.55 oc	---	---	---	---	---	---	---	---	---	23.55
6.70	4,143,228	313.20	23.72 oc	---	---	---	---	---	---	---	---	---	23.72
6.75	4,190,539	313.25	23.89 oc	---	---	---	---	---	---	---	---	---	23.89
6.80	4,237,850	313.30	24.05 oc	---	---	---	---	---	---	---	---	---	24.05
6.85	4,285,161	313.35	24.22 oc	---	---	---	---	---	---	---	---	---	24.22
6.90	4,332,472	313.40	24.38 oc	---	---	---	---	---	---	---	---	---	24.38
6.95	4,379,783	313.45	24.55 oc	---	---	---	---	---	---	---	---	---	24.55
7.00	4,427,093	313.50	24.71 oc	---	---	---	---	---	---	---	---	---	24.71
7.05	4,474,783	313.55	24.87 oc	---	---	---	---	---	---	---	---	---	24.87
7.10	4,522,473	313.60	25.03 oc	---	---	---	---	---	---	---	---	---	25.03
7.15	4,570,163	313.65	25.19 oc	---	---	---	---	---	---	---	---	---	25.19
7.20	4,617,853	313.70	25.35 oc	---	---	---	---	---	---	---	---	---	25.35
7.25	4,665,543	313.75	25.51 oc	---	---	---	---	---	---	---	---	---	25.51
7.30	4,713,233	313.80	25.67 oc	---	---	---	---	---	---	---	---	---	25.67
7.35	4,760,923	313.85	25.82 oc	---	---	---	---	---	---	---	---	---	25.82
7.40	4,808,613	313.90	25.98 oc	---	---	---	---	---	---	---	---	---	25.98
7.45	4,856,303	313.95	26.13 oc	---	---	---	---	---	---	---	---	---	26.13
7.50	4,903,994	314.00	26.28 oc	---	---	---	---	---	---	---	---	---	26.28
7.55	4,952,065	314.05	26.43 oc	---	---	---	---	---	---	---	---	---	26.43
7.60	5,000,135	314.10	26.59 oc	---	---	---	---	---	---	---	---	---	26.59
7.65	5,048,206	314.15	26.74 oc	---	---	---	---	---	---	---	---	---	26.74
7.70	5,096,276	314.20	26.89 oc	---	---	---	---	---	---	---	---	---	26.89
7.75	5,144,347	314.25	27.03 oc	---	---	---	---	---	---	---	---	---	27.03
7.80	5,192,417	314.30	27.18 oc	---	---	---	---	---	---	---	---	---	27.18
7.85	5,240,488	314.35	27.33 oc	---	---	---	---	---	---	---	---	---	27.33
7.90	5,288,558	314.40	27.48 oc	---	---	---	---	---	---	---	---	---	27.48
7.95	5,336,629	314.45	27.62 oc	---	---	---	---	---	---	---	---	---	27.62
8.00	5,384,701	314.50	27.77 oc	---	---	---	---	---	---	---	---	---	27.77

...End

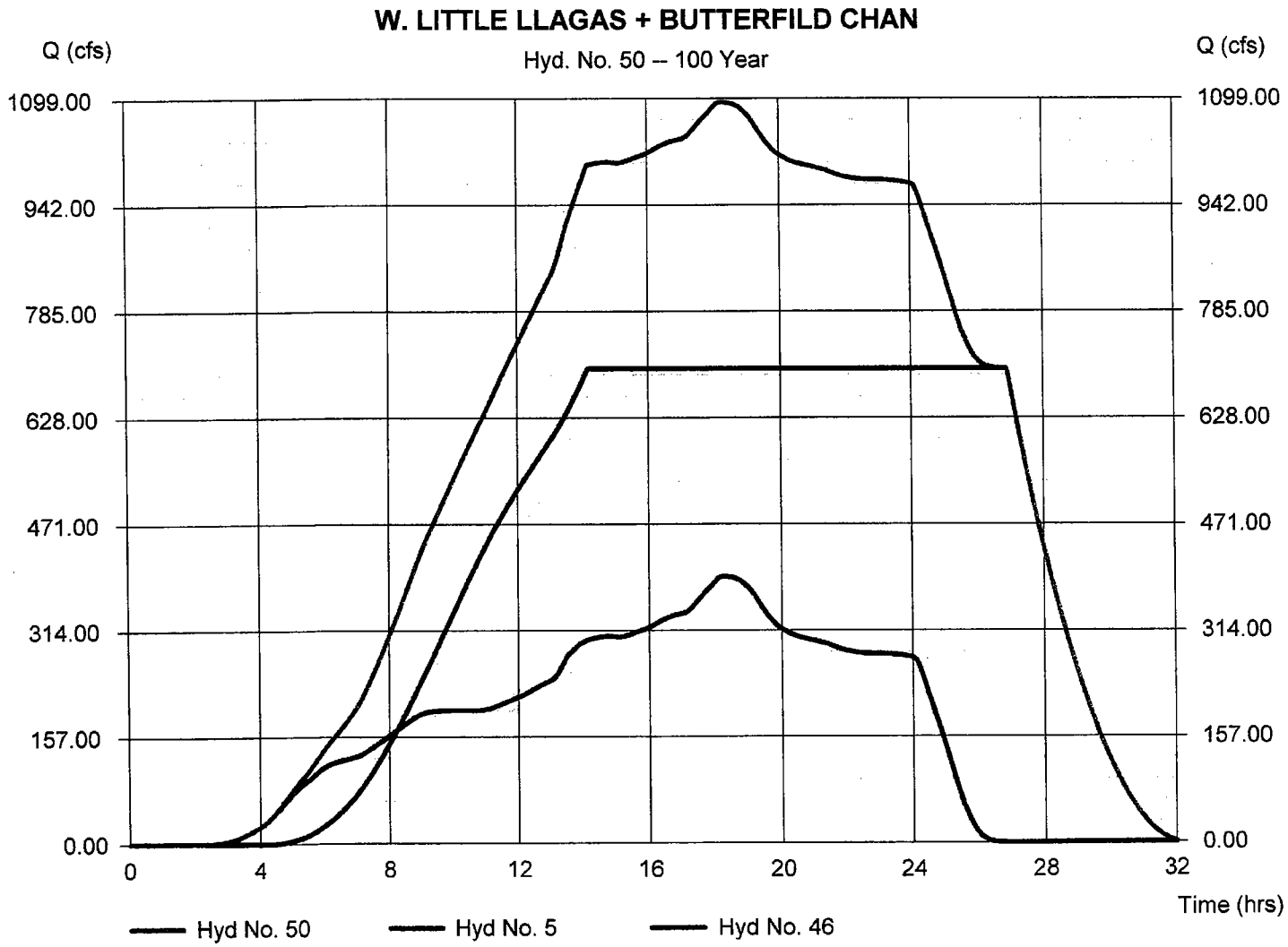
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 50

W. LITTLE LLAGAS + BUTTERFILD CHAN

Hydrograph type	= Combine	Peak discharge	= 1093.73 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.27 hrs
Time interval	= 2 min	Hyd. volume	= 65,293,140 cuft
Inflow hyds.	= 5, 46	Contrib. drain. area	= 0.000 ac



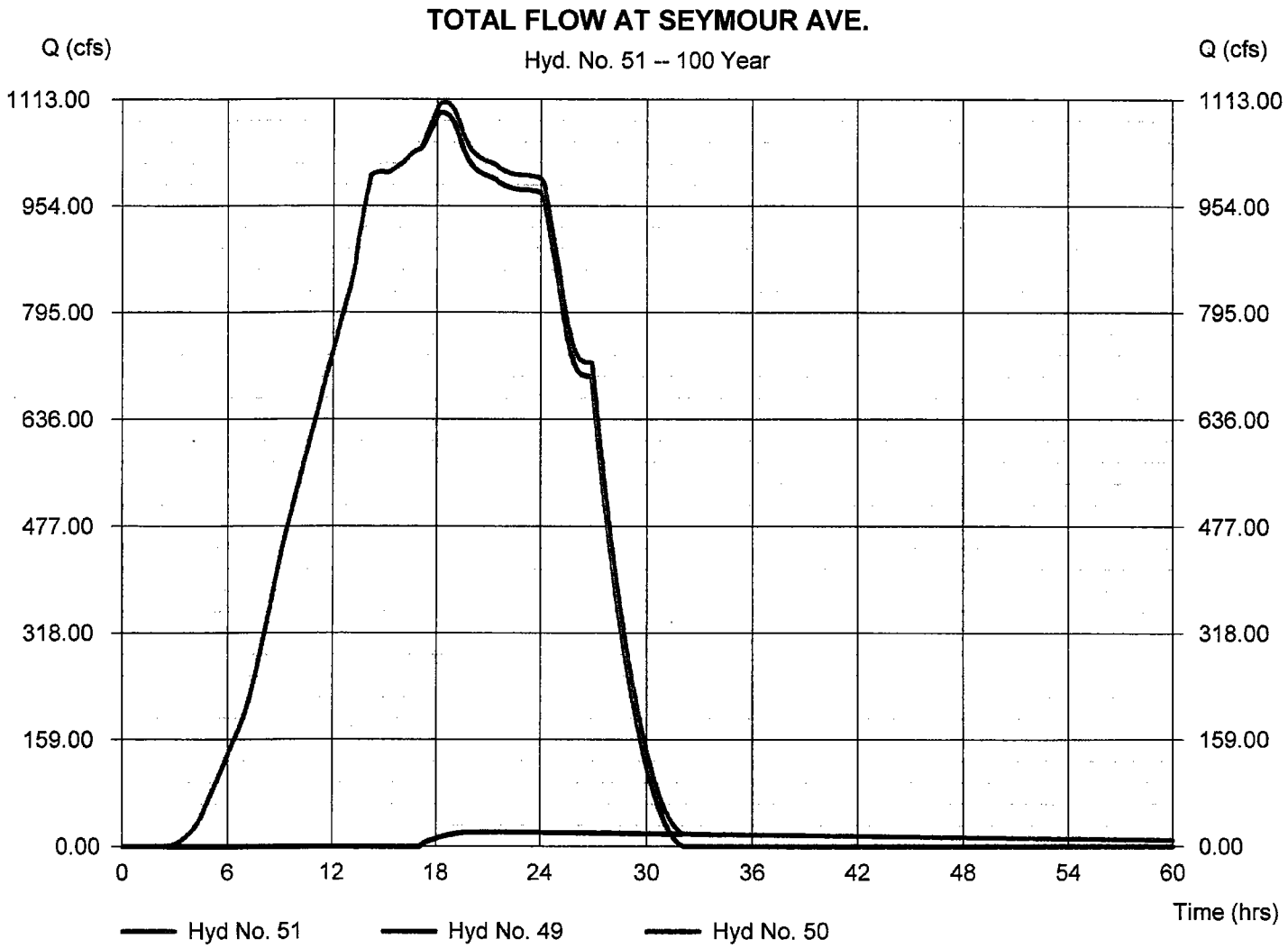
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Nov 18, 2009

Hyd. No. 51

TOTAL FLOW AT SEYMOUR AVE.

Hydrograph type	= Combine	Peak discharge	= 1108.67 cfs
Storm frequency	= 100 yrs	Time to peak	= 18.37 hrs
Time interval	= 2 min	Hyd. volume	= 68,313,460 cuft
Inflow hyds.	= 49, 50	Contrib. drain. area	= 0.000 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	-------
2	0.0000	0.0000	0.0000	-------
3	0.0000	0.0000	0.0000	-------
5	7.0453	18.8000	0.5714	-------
10	9.3905	18.9000	0.5598	-------
25	0.0000	0.0000	0.0000	-------
50	0.0000	0.0000	0.0000	-------
100	11.5407	17.6000	0.5048	-------

File name: Morgan Hill City.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	1.15	1.03	0.94	0.87	0.81	0.76	0.72	0.69	0.66	0.63	0.60	0.58
10	1.59	1.43	1.31	1.21	1.13	1.06	1.01	0.96	0.92	0.88	0.84	0.81
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	2.39	2.16	1.99	1.85	1.74	1.64	1.56	1.49	1.43	1.38	1.33	1.28

Tc = time in minutes. Values may exceed 60.

Precip. file name: MORGAN HILL SCS.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	2.65	0.00	0.00	4.17	4.79	5.20	5.59
SCS 6-Hr	0.00	1.44	0.00	0.00	2.30	2.65	2.88	3.09
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	4.17	0.00	0.00	5.59

Appendix "C"

Hydraulics

Section 1

Butterfield Channel Calculation Sheets

CALCULATIONS FOR BUTTERFIELD CHANNEL

PROJ: BUTTERFIELD CHANNEL WITH POND

PLAN: POST DEVELOP WITH WITH POND & ORIGINAL FLOWS

HEC-RAS Profile: PF 1

Reach	River Sta	Profile	Plan	Cum Ch Len	Length Chnl	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(ft)	(ft)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
BUTTERFIELD CHAN	132	PF 1	PND-ORIG FLO	4627.10	998.00	746.00	318.90	324.91		325.40	0.003207	5.64	132.36	34.04	0.50
BUTTERFIELD CHAN	132	PF 1	hydro	4627.10	998.00	634.00	318.90	324.46		324.91	0.003214	5.41	117.28	32.22	0.50
BUTTERFIELD CHAN	130	PF 1	PND-ORIG FLO	3629.10	397.00	746.00	315.66	321.58		322.09	0.003426	5.78	129.17	33.67	0.52
BUTTERFIELD CHAN	130	PF 1	hydro	3629.10	397.00	634.00	315.66	321.14		321.62	0.003389	5.51	115.01	31.94	0.51
BUTTERFIELD CHAN	128	PF 1	PND-ORIG FLO	3232.10	20.00	746.00	314.36	319.86		320.51	0.004652	6.47	115.38	31.98	0.60
BUTTERFIELD CHAN	128	PF 1	hydro	3232.10	20.00	634.00	314.36	319.23		319.91	0.005514	6.59	96.14	29.48	0.64
BUTTERFIELD CHAN	126	PF 1	PND-ORIG FLO	3212.10	134.50	746.00	314.26	319.83	317.54	320.40	0.003533	6.06	123.20	22.28	0.45
BUTTERFIELD CHAN	126	PF 1	hydro	3212.10	134.50	634.00	314.26	319.26	317.20	319.77	0.003504	5.74	110.45	22.20	0.45
BUTTERFIELD CHAN	125			Culvert		FISCHER	AVE								
BUTTERFIELD CHAN	124	PF 1	PND-ORIG FLO	3077.60	20.00	746.00	313.60	317.95		318.89	0.007287	7.76	96.14	22.17	0.66
BUTTERFIELD CHAN	124	PF 1	hydro	3077.60	20.00	665.00	313.60	317.72		318.55	0.006816	7.31	91.02	22.17	0.64
BUTTERFIELD CHAN	122	PF 1	PND-ORIG FLO	3057.60	685.00	746.00	313.55	318.24		318.64	0.002756	5.07	147.27	40.77	0.47
BUTTERFIELD CHAN	122	PF 1	hydro	3057.60	685.00	665.00	313.55	317.96		318.33	0.002754	4.89	135.86	39.63	0.47
BUTTERFIELD CHAN	120	PF 1	PND-ORIG FLO	2372.60	185.60	746.00	311.66	316.36		316.76	0.002737	5.05	147.64	40.81	0.47
BUTTERFIELD CHAN	120	PF 1	hydro	2372.60	185.60	665.00	311.66	316.09		316.45	0.002716	4.87	136.52	39.70	0.46
BUTTERFIELD CHAN	118	PF 1	PND-ORIG FLO	2187.00	686.00	746.00	311.16	315.85		316.25	0.002769	5.07	147.04	40.75	0.47
BUTTERFIELD CHAN	118	PF 1	hydro	2187.00	686.00	665.00	311.16	315.58		315.95	0.002731	4.88	136.25	39.67	0.46
BUTTERFIELD CHAN	116	PF 1	PND-ORIG FLO	1501.00	192.00	746.00	309.26	313.86		314.28	0.002963	5.20	143.56	40.40	0.49
BUTTERFIELD CHAN	116	PF 1	hydro	1501.00	192.00	665.00	309.26	313.90		314.22	0.002285	4.58	145.08	40.55	0.43
BUTTERFIELD CHAN	114	PF 1	PND-ORIG FLO	1309.00	20.00	746.00	308.77	313.21		313.67	0.003376	5.44	137.11	39.76	0.52
BUTTERFIELD CHAN	114	PF 1	hydro	1309.00	20.00	665.00	308.77	313.48		313.79	0.002158	4.49	148.04	40.85	0.42
BUTTERFIELD CHAN	112	PF 1	PND-ORIG FLO	1289.00	105.00	746.00	308.63	313.13	311.30	313.60	0.003200	5.51	135.46	30.18	0.46
BUTTERFIELD CHAN	112	PF 1	hydro	1289.00	105.00	665.00	308.63	313.42	311.10	313.75	0.002106	4.61	144.15	30.19	0.37
BUTTERFIELD CHAN	111			Culvert		MAPLE	AVENUE								
BUTTERFIELD CHAN	110	PF 1	PND-ORIG FLO	1184.00	21.00	746.00	308.10	312.38		312.90	0.003740	5.80	128.64	30.17	0.49
BUTTERFIELD CHAN	110	PF 1	hydro	1184.00	21.00	694.00	308.10	312.31		312.78	0.003396	5.48	126.66	30.17	0.47
BUTTERFIELD CHAN	108	PF 1	PND-ORIG FLO	1163.00	163.00	746.00	308.00	312.49		312.77	0.001902	4.26	174.98	47.96	0.39
BUTTERFIELD CHAN	108	PF 1	hydro	1163.00	163.00	694.00	308.00	312.41		312.66	0.001757	4.06	171.08	47.63	0.38
BUTTERFIELD CHAN	106	PF 1	PND-ORIG FLO	1000.00	151.00	746.00	307.84	312.11		312.43	0.002272	4.53	164.59	47.08	0.43
BUTTERFIELD CHAN	106	PF 1	hydro	1000.00	151.00	694.00	307.84	312.07		312.35	0.002034	4.27	162.67	46.92	0.40
BUTTERFIELD CHAN	104	PF 1	PND-ORIG FLO	849.00	349.00	746.00	307.69	311.65		312.03	0.002971	4.97	150.12	45.84	0.48
BUTTERFIELD CHAN	104	PF 1	hydro	849.00	349.00	694.00	307.69	311.68		312.01	0.002493	4.57	151.72	45.98	0.44
BUTTERFIELD CHAN	102.8			Lat Struct											
BUTTERFIELD CHAN	102	PF 1	PND-ORIG FLO	500.00	500.00	0.75	307.34	311.70		311.70	0.000000	0.00	168.82	50.40	0.00
BUTTERFIELD CHAN	102	PF 1	hydro	500.00	500.00	299.69	307.34	311.45		311.50	0.000421	1.91	156.98	48.32	0.18

CALCULATIONS FOR BUTTERFIELD CHANNEL

PROJ: BUTTERFIELD CHANNEL WITH POND

PLAN: POST DEVELOP WITH WITH POND & ORIGINAL FLOWS

HEC-RAS Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	Crit W.S. Elev (ft)	Depth Crit (ft)	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
BUTTERFIELD CHAN	100	PF 1	POND & FLO			0.75	306.85	311.70	306.87	311.70	0.000000	0.00	192.55	54.78	0.00
BUTTERFIELD CHAN	100	PF 1	hydro 6			299.69	306.85	311.27	308.26	311.32	0.000324	1.75	171.67	51.34	0.16

Original Butterfield Channel Calcs.

HYDRAULIC REPORT FOR

SUTTER BOULEVARD CHANNEL

DRAINAGE STUDY FOR Q100

CITY OF MORGAN HILL

DECEMBER 17,1991

MH ENGINEERING CO.

16075 VINEYARD BLVD

MORGAN HILL, CA. 95020

PH (408) 779-7381

Q100 Flow

SUMMARY SCREEN

91102.OPC — 38 Sections

SEC	WS ELEV	DEPTH	TOP WID	V LOB	V CHA	V ROB	Q LOB	Q CHA	Q ROB
1	311.50	5.20	49.00	0.0	5.7	0.0	0.0	1140.0	0.0
2	315.19	7.19	57.00	0.0	3.7	0.0	0.0	1131.0	0.0
3	315.07	6.97	29.00	0.0	5.6	0.0	0.0	1131.0	0.0
4	315.47	7.05	29.00	0.0	5.5	0.0	0.0	1131.0	0.0
5	315.67	7.15	51.00	0.0	4.4	0.0	0.0	1098.0	0.0
6	319.11	5.61	44.00	0.0	5.9	0.0	0.0	1098.0	0.0
7	318.59	4.99	21.00	0.0	10.5	0.0	0.0	1098.0	0.0
8	319.29	5.37	21.00	0.0	9.7	0.0	0.0	1098.0	0.0
9	319.22	5.20	31.00	0.0	10.3	0.0	0.0	1054.0	0.0
10	326.27	6.77	37.00	0.0	6.7	0.0	0.0	1054.0	0.0
11	326.23	6.63	21.00	0.0	7.6	0.0	0.0	1054.0	0.0
12	326.63	6.46	21.00	0.0	7.8	0.0	0.0	1054.0	0.0
13	326.86	6.59	36.00	0.0	6.9	0.0	0.0		

[Nat Channel [Bridge [Culvert

Profile factor = 1 / Tolerance (ft/100) = .01 / Average Friction Slope

1) Screen 2) Printer 3) Plot [PgUp] upstrm [PgDn] downstrm [Esc] Menu

SUMMARY SCREEN

91102.OPC — 38 Sections

SEC	WS ELEV	DEPTH	TOP WID	V LOB	V CHA	V ROB	Q LOB	Q CHA	Q ROB
14	331.46	6.46	36.00	0.0	6.6	0.0	0.0	985.0	0.0
15	331.44	6.34	21.00	0.0	7.4	0.0	0.0	985.0	0.0
16	331.84	6.42	21.00	0.0	7.3	0.0	0.0	985.0	0.0
17	332.02	6.50	36.00	0.0	6.6	0.0	0.0	985.0	0.0
18	337.22	6.72	37.00	0.0	5.6	0.0	0.0	890.0	0.0
19	337.19	6.59	21.00	0.0	6.4	0.0	0.0	890.0	0.0
20	337.49	6.57	21.00	0.0	6.4	0.0	0.0	890.0	0.0
21	337.64	6.62	36.00	0.0	5.8	0.0	0.0	890.0	0.0
22	340.94	6.44	36.00	0.0	5.3	0.0	0.0	777.0	0.0
23	340.86	6.26	19.00	0.0	6.5	0.0	0.0	777.0	0.0
24	341.16	5.99	19.00	0.0	6.8	0.0	0.0	777.0	0.0
25	341.41	6.14	35.00	0.0	5.7	0.0	0.0	777.0	0.0
26	342.61	6.11	34.00	0.0	4.9	0.0	0.0	668.0	0.0

[Nat Channel [Bridge [Culvert

Profile factor = 1 / Tolerance (ft/100) = .01 / Average Friction Slope

1) Screen 2) Printer 3) Plot [PgUp] upstrm [PgDn] downstrm [Esc] Menu

SUMMARY SCREEN

91102.OPC — 38 Sections

SEC	WS ELEV	DEPTH	TOP WID	V LOB	V CHA	V ROB	Q LOB	Q CHA	Q ROB
27	342.57	5.97	19.00	0.0	5.9	0.0	0.0	668.0	0.0
28	342.87	5.92	19.00	0.0	5.9	0.0	0.0	668.0	0.0
29	343.04	5.99	34.00	0.0	5.1	0.0	0.0	668.0	0.0
30	347.49	4.99	31.00	0.0	5.1	0.0	0.0	517.0	0.0
31	347.50	4.90	19.00	0.0	5.6	0.0	0.0	517.0	0.0
32	348.00	4.92	19.00	0.0	5.5	0.0	0.0	517.0	0.0
33	348.25	5.07	40.00	0.0	4.1	0.0	0.0	517.0	0.0
34	349.50	5.00	40.00	0.0	3.6	0.0	0.0	452.0	0.0
35	349.44	4.84	19.00	0.0	4.9	0.0	0.0	452.0	0.0
36	350.04	5.12	19.00	0.0	4.6	0.0	0.0	452.0	0.0
37	350.22	5.20	41.00	0.0	3.4	0.0	0.0	452.0	0.0
38	351.72	4.42	36.00	0.0	3.2	0.0	0.0	327.0	0.0

Σ Nat Channel   Σ Bridge   Σ Culvert

Profile factor = 1 / Tolerance (ft/100) = .01 / Average Friction Slope

1) Screen 2) Printer 3) Plot [PgUp] upstrm [PgDn] downstrm [Esc] Menu

Q10 FLOW

SUMMARY SCREEN

38 Sections

91102.OPC

SEC	WS ELEV	DEPTH	TOP WID	V LOB	V CHA	V ROB	Q LOB	Q CHA	Q ROB
1	311.50	5.20	49.00	0.0	4.3	0.0	0.0	855.0	0.0
2	313.93	5.93	52.00	0.0	3.6	0.0	0.0	848.3	0.0
3	313.85	5.75	29.00	0.0	5.1	0.0	0.0	848.3	0.0
4	314.05	5.63	29.00	0.0	5.2	0.0	0.0	848.3	0.0
5	314.16	5.64	45.00	0.0	4.5	0.0	0.0	848.3	0.0
6	316.75	3.25	35.00	0.0	8.9	0.0	0.0	823.5	0.0
7	317.30	3.70	21.00	0.0	10.6	0.0	0.0	823.5	0.0
8	318.20	4.28	21.00	0.0	9.2	0.0	0.0	823.5	0.0
9	318.52	4.50	28.00	0.0	9.6	0.0	0.0	823.5	0.0
10	325.44	5.94	34.00	0.0	6.1	0.0	0.0	790.5	0.0
11	325.47	5.87	21.00	0.0	6.4	0.0	0.0	790.5	0.0
12	325.77	5.60	21.00	0.0	6.7	0.0	0.0	790.5	0.0
13	325.77	5.50	32.00	0.0	6.8	0.0	0.0	790.5	0.0

[Nat Channel [Bridge [Culvert

Profile factor = .75 / Tolerance (ft/100) = .01 / Average Friction Slope

1) Screen 2) Printer 3) Plot [PgUp] upstrm [PgDn] downstrm [Esc] Menu

SUMMARY SCREEN

38 Sections

91102.OPC

SEC	WS ELEV	DEPTH	TOP WID	V LOB	V CHA	V ROB	Q LOB	Q CHA	Q ROB
14	330.62	5.62	32.00	0.0	6.2	0.0	0.0	738.8	0.0
15	330.67	5.57	21.00	0.0	6.3	0.0	0.0	738.8	0.0
16	330.97	5.55	21.00	0.0	6.3	0.0	0.0	738.8	0.0
17	330.97	5.45	32.00	0.0	6.5	0.0	0.0	738.8	0.0
18	336.26	5.76	33.00	0.0	5.4	0.0	0.0	667.5	0.0
19	336.29	5.69	21.00	0.0	5.6	0.0	0.0	667.5	0.0
20	336.49	5.57	21.00	0.0	5.7	0.0	0.0	667.5	0.0
21	336.49	5.47	32.00	0.0	5.8	0.0	0.0	667.5	0.0
22	340.01	5.51	32.00	0.0	5.0	0.0	0.0	582.8	0.0
23	340.00	5.40	19.00	0.0	5.7	0.0	0.0	582.8	0.0
24	340.30	5.13	19.00	0.0	6.0	0.0	0.0	582.8	0.0
25	340.37	5.10	30.00	0.0	5.7	0.0	0.0	582.8	0.0
26	341.77	5.27	31.00	0.0	4.6	0.0	0.0	501.0	0.0

[Nat Channel [Bridge [Culvert

Profile factor = .75 / Tolerance (ft/100) = .01 / Average Friction Slope

1) Screen 2) Printer 3) Plot [PgUp] upstrm [PgDn] downstrm [Esc] Menu

MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMS SUMMARY SCREEN FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM;

38 Sections:

91102.OPC

SEC	WS ELEV	DEPTH	TOP WID	V LOB	V CHA	V ROB	Q LOB	Q CHA	Q ROB
27	341.77	5.17	19.00	0.0	5.1	0.0	0.0	501.0	0.0
28	341.97	5.02	19.00	0.0	5.3	0.0	0.0	501.0	0.0
29	342.01	4.96	30.00	0.0	5.1	0.0	0.0	501.0	0.0
30	345.50	3.00	22.00	0.0	8.0	0.0	0.0	387.8	0.0
31	346.22	3.62	19.00	0.0	5.6	0.0	0.0	387.8	0.0
32	346.52	3.44	19.00	0.0	5.9	0.0	0.0	387.8	0.0
33	346.60	3.42	31.00	0.0	5.6	0.0	0.0	387.8	0.0
34	348.64	4.14	35.00	0.0	3.7	0.0	0.0	339.0	0.0
35	348.62	4.02	19.00	0.0	4.4	0.0	0.0	339.0	0.0
36	348.82	3.90	19.00	0.0	4.6	0.0	0.0	339.0	0.0
37	348.91	3.89	33.00	0.0	4.0	0.0	0.0	339.0	0.0
38	351.24	3.74	32.00	0.0	3.1	0.0	0.0	245.3	0.0

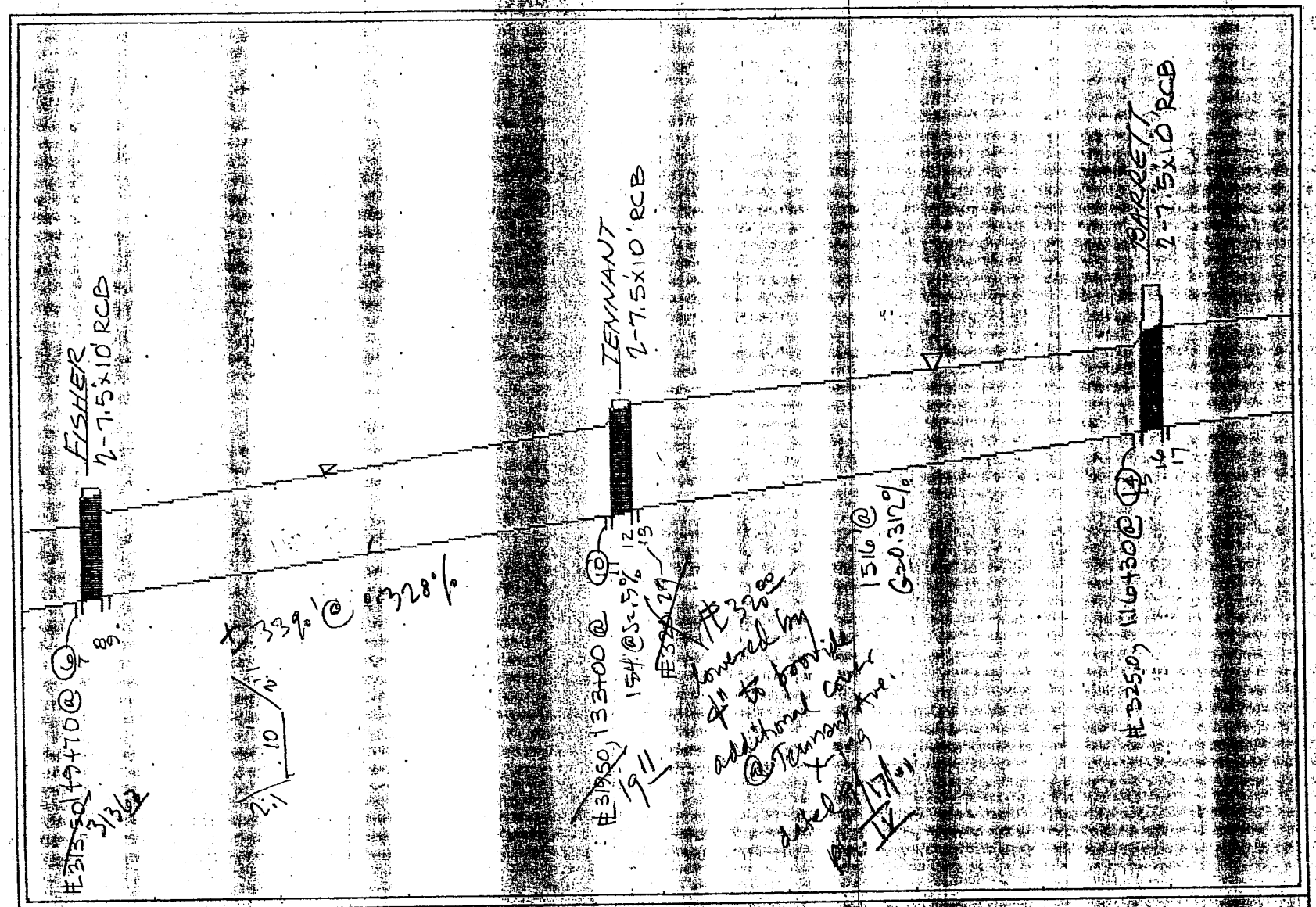
Nat Channel   Bridge   Culvert

Profile factor = .75 / Tolerance (ft/100) = .01 / Average Friction Slope

MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMK

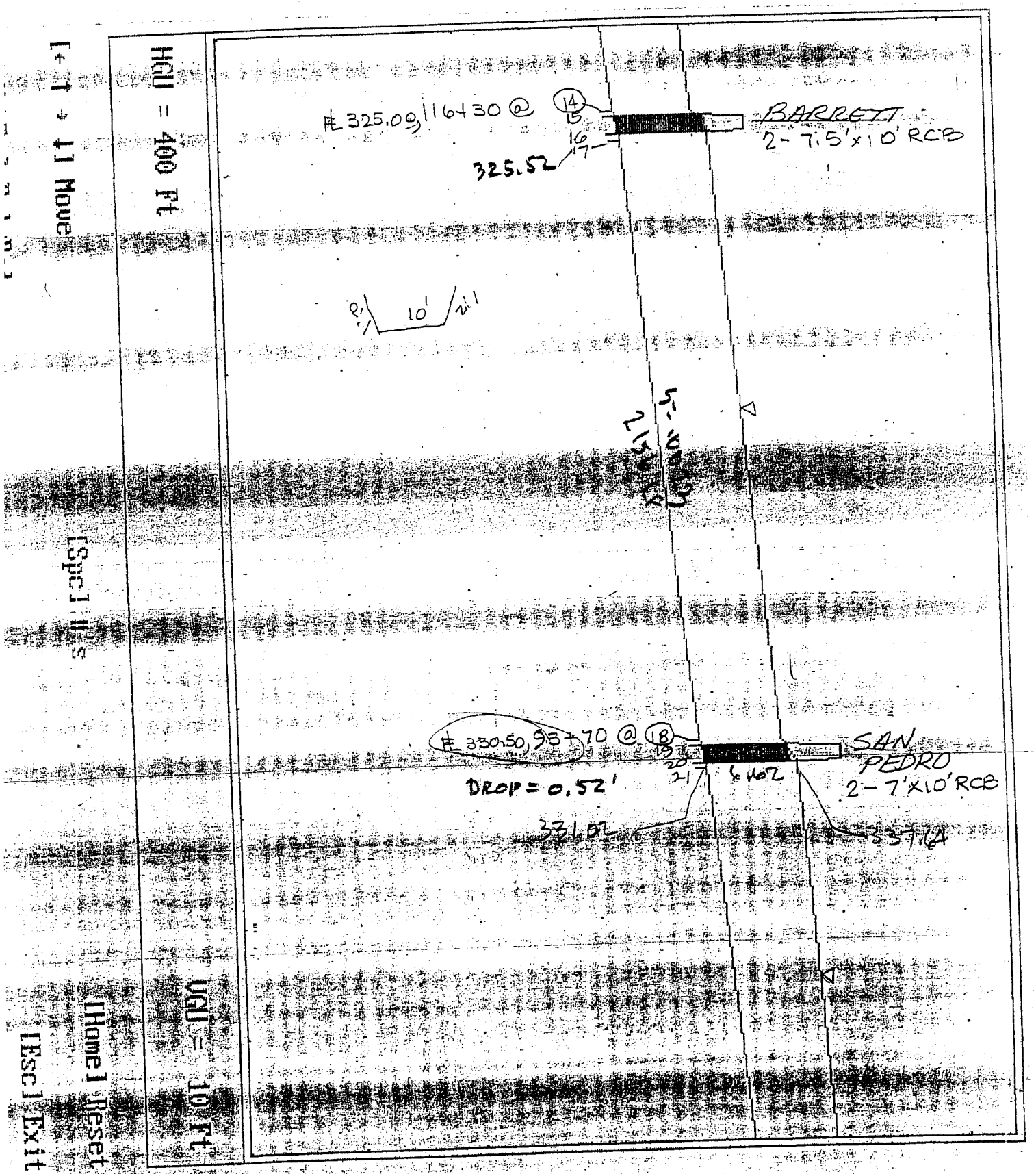
1) Screen 2) Printer 3) Plot [PgUp] upstrm / [PgDn] downstrm [Esc] Menu

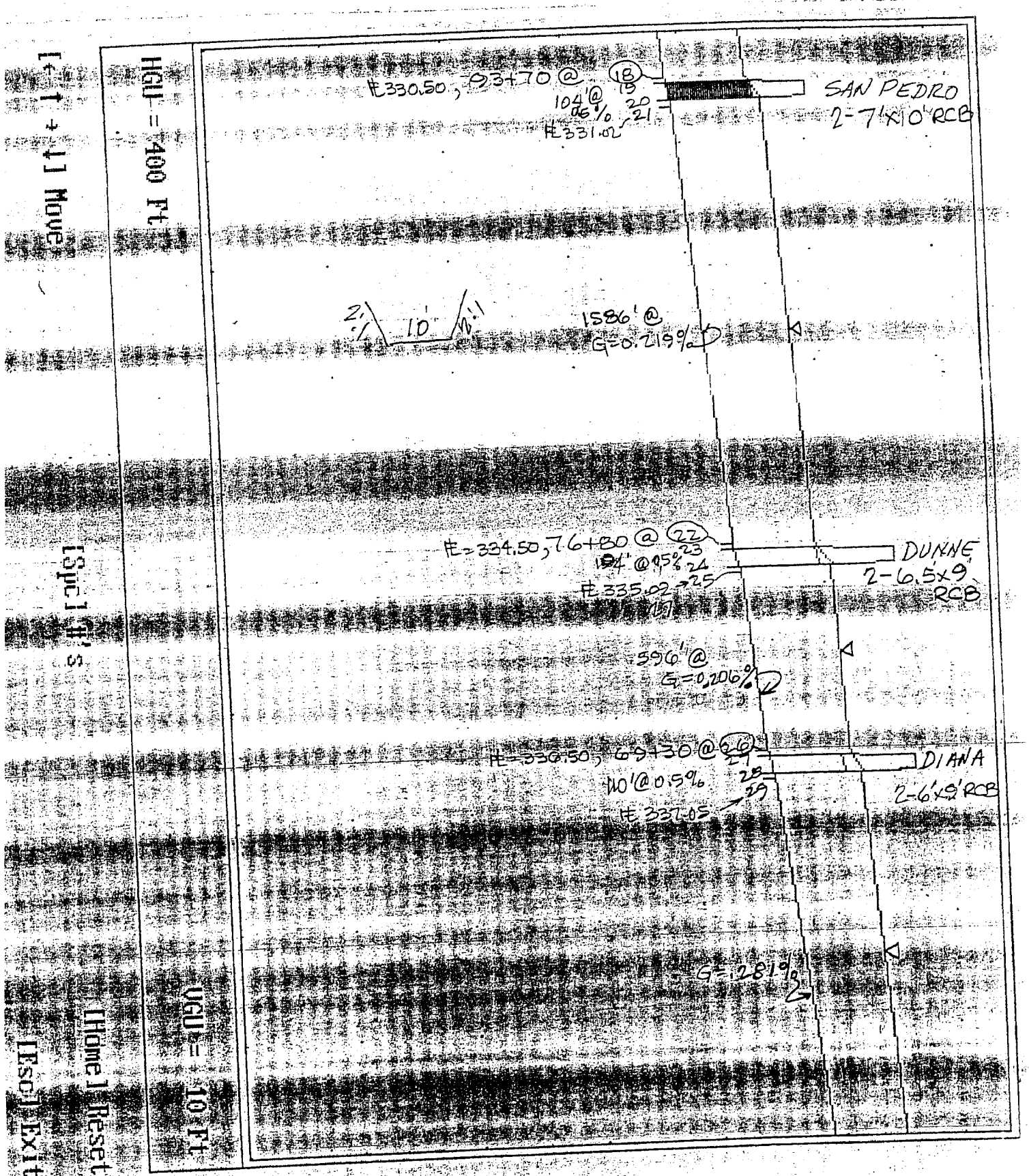
Sec 1
STA 18400
E 306.30
Hg 317°
POLLARD @ CREEK
HWs = 311.5
E 308.00
166+30 @ 2
Hg 315°
MAPLE
2-6x14 RCB
Hold 308.00
Hg 323°
E 313.50
145+70 @ 6
FISHER
2-7.5x10 RCB
28'
10'
HGU = 400 Ft
VGU = 10 Ft
[←↑→↓] Move
[Spc] #'s
[Home] Reset
[Esc] Exit

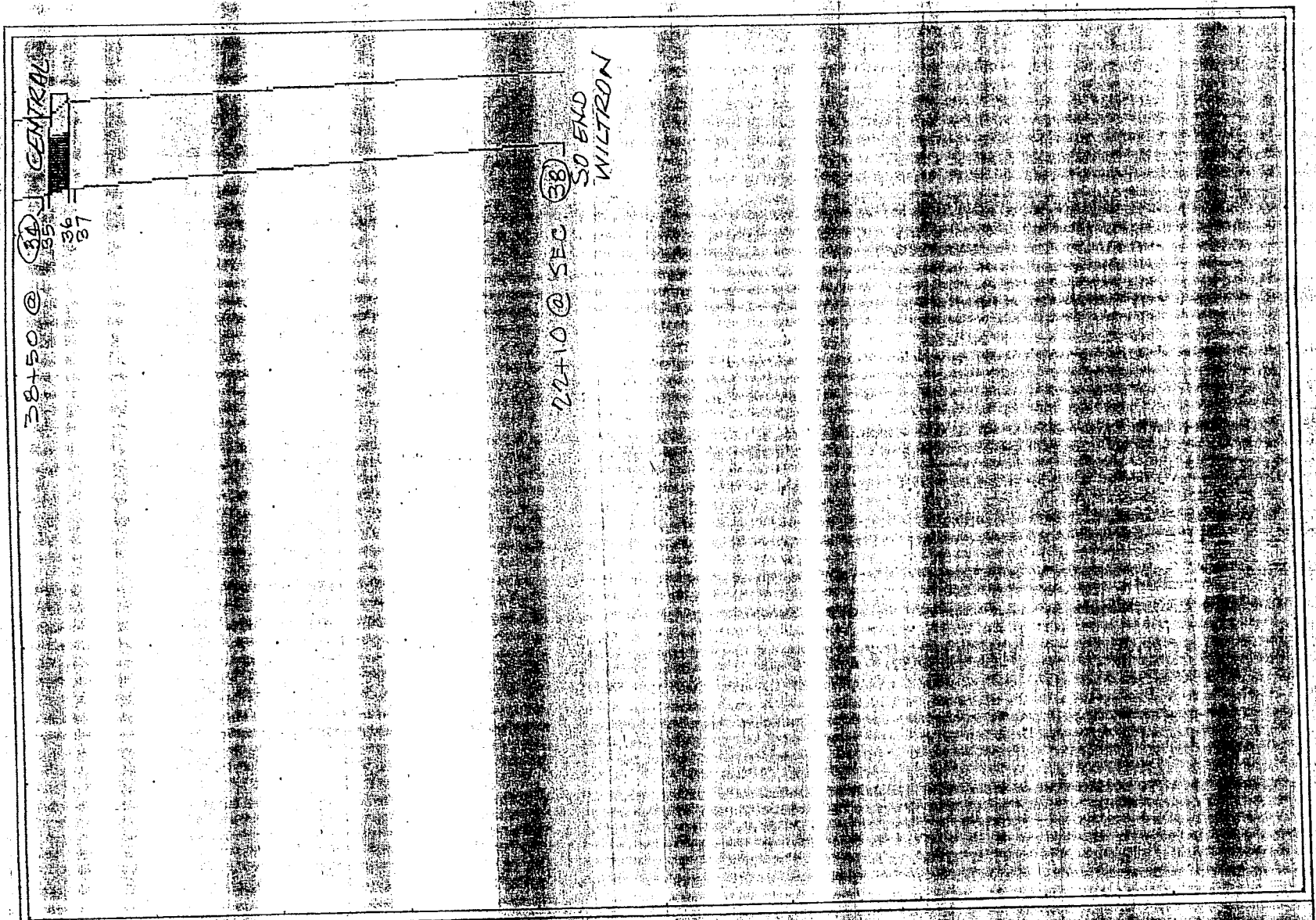


[← ↑ → ↓] Move [Spc] #'s [Home] Reset

[Pgdn/Pgup] Enl/Red [Esc] Exit


HGU = 400 Ft
VGU = 10 Ft
[←↑↓→] Move
[Spc] Hide
[Home] Reset
[Esc] Exit
℄ 325.09, 1164+30 @
14
15
16
17
325.52
BARRETT
2-7.5'x10' RCB
10'
2:1
2:1
5.4
℄ 330.50, 93+70 @
18
19
20
21
6.402
DROP = 0.52'
331.02
337.6
SAN PEDRO
2-7'x10' RCB


HGU = 400 Ft
VGU = 10 Ft
[←↑→↓] Move
[Space] #'s
[Home] Reset
[Esc] Exit
℄ 330.50, 93+70 @ 18
104' @ 0.6% 19 20 21
℄ 331.02
SAN PEDRO
2-7'x10' RCB
2:1
10'
2:1
1586' @
G=0.219%
℄ = 334.50, 76+80 @ 22
194' @ 0.5% 23 24
℄ 335.02 25
DUNNE
2-6.5x9'
RCB
596' @
G=0.206%
℄ = 336.50, 69+30 @ 26
110' @ 0.5% 27 28 29
℄ 337.05
DIANA
2-6'x9' RCB
G=.2819%



HGU = 400 Ft

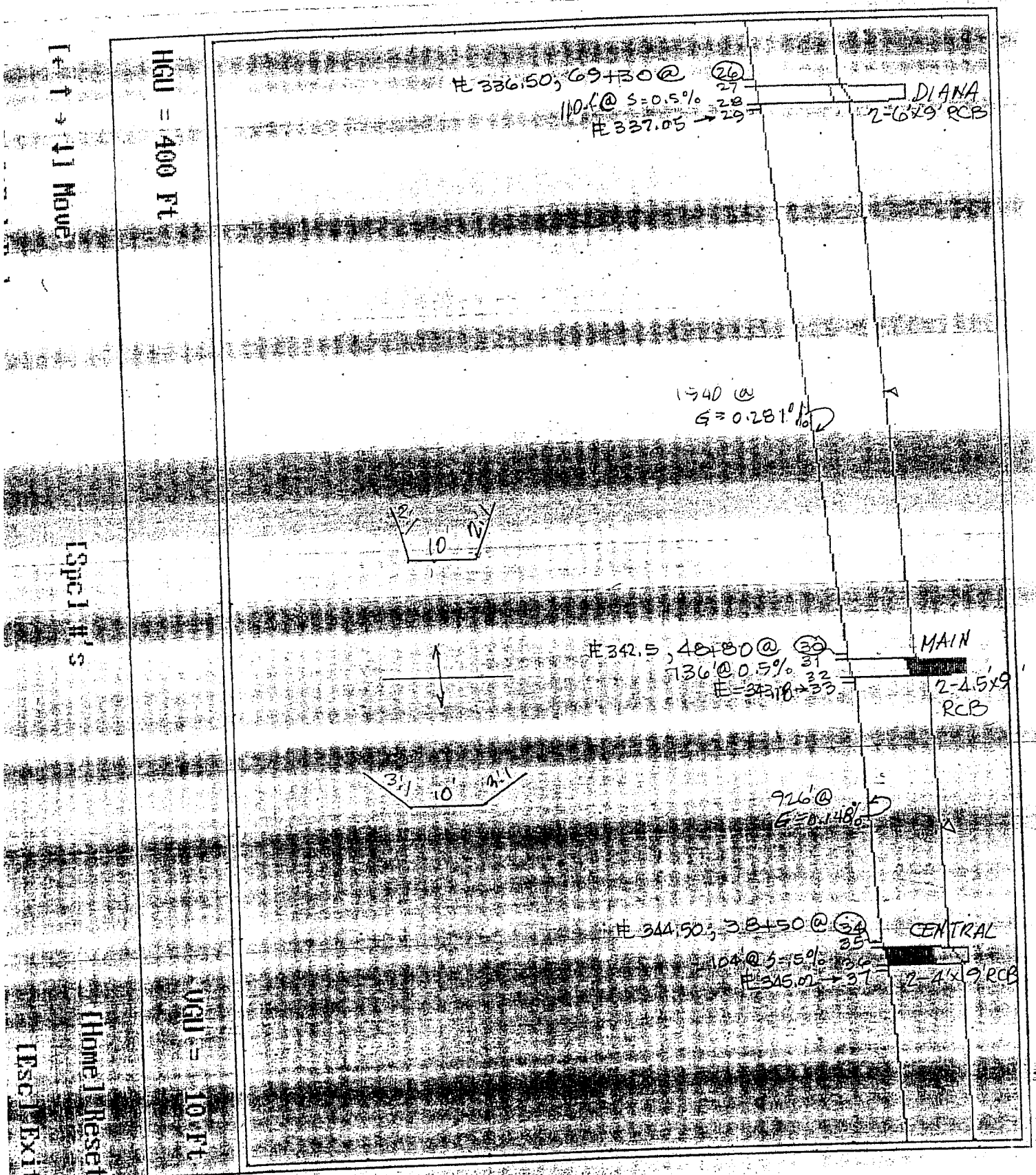
VGU = 10 Ft

[←↑→↓] Move

[Spc] #'s

[Home] Reset

[Esc] Exit


HGU = 400 Ft
VGU = 10 Ft
[←↑→↓] Move
[Spc] #,$
[Home] Reset
[Esc] Exit
℄ 336.50, 69+30 @ 26
27
110.4' @ S=0.5% 28
℄ 337.05 → 29
DIANA
2-6'x9' RCB
1540 @
G=0.281'/100'
2'
10'
2'
℄ 342.5, 48+80 @ 30
31
736' @ 0.5% 32
℄=343.18 → 33
MAIN
2-4.5'x9'
RCB
3'
10'
3'
926' @
G=0.148'/100'
℄ 344.50, 38+50 @ 34
35
104' @ S=5% 36
℄ 345.02 → 37
CENTRAL
2-4'x9' RCB

Section 2

West Little Llagas Creek
HECRAS Model 100 Year Storm

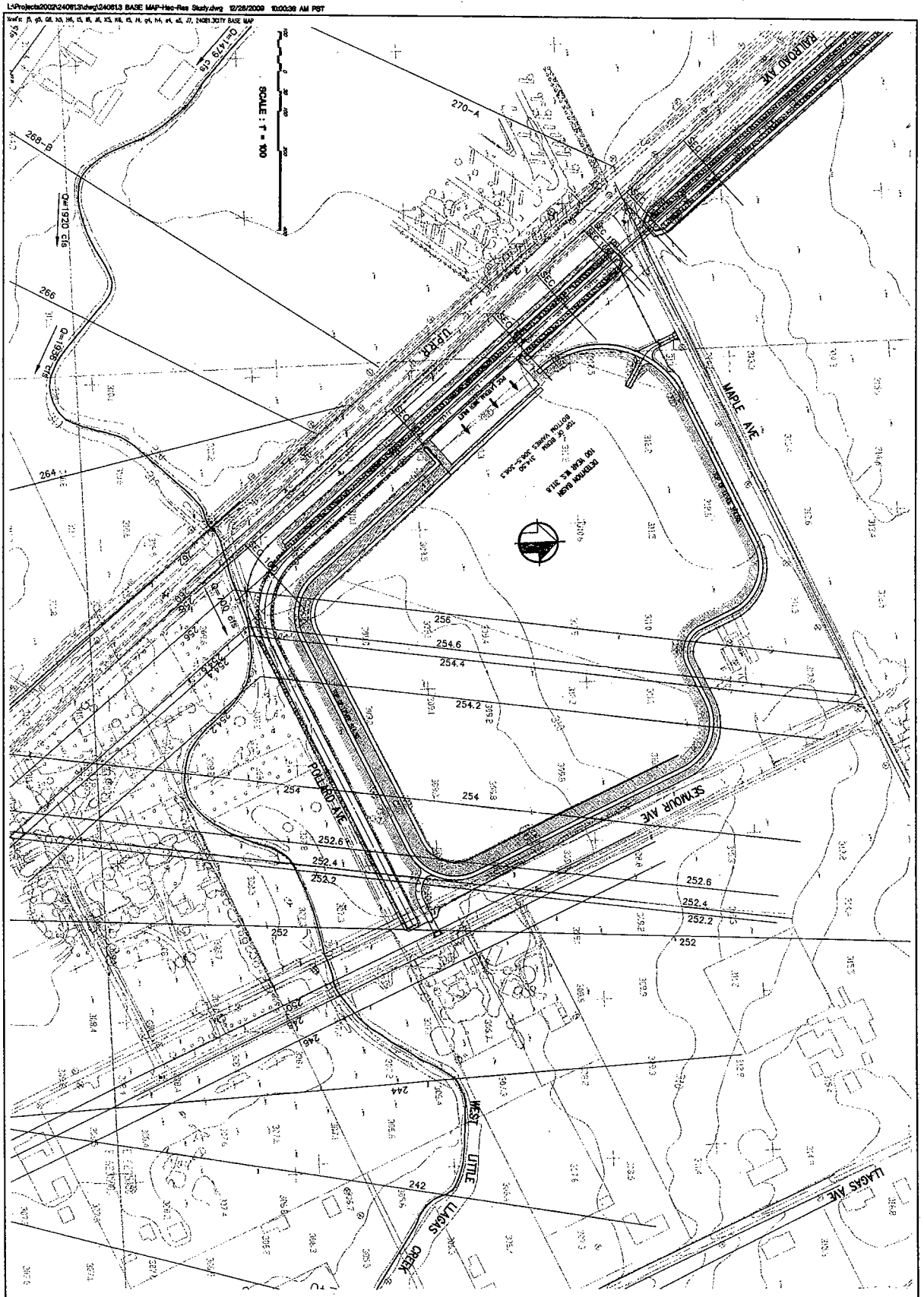
2a. Original FEMA FIS Model

2b. Calculations for Watsonville Road Crossing

2c. Calculations for Floodplain Encroachment at Maple Ave. Regional Storm Water Detention Pond

WATSONVILLE ROAD
CULVERT STUDY W/HEC-RAS
MH engineering Co.
1971 Tropical Boulevard
Moraga, CA. 94556
240613
SHEET 01 OF 02
SUBMITTED BY
APPROVED BY
FILE:240613 BASE
SCALE: 1" = 100'
Q=1479 cfs
Q=441 cfs
MHE Study
Q=518 cfs
MHE Study
Q=504 cfs
MHE Study
Q=1018 cfs
MHE Study
Q=1180 cfs
MHE Study
Q=162 cfs
MHE Study
Q=915 cfs
Q=1180 cfs
Ngita Study
Q=673 cfs
from FS
Q=1936 cfs
from FS
WEST LITTLE LLAGAS CREEK
MONTEREY ROAD
WATSONVILLE ROAD
24030 Oakwood School Flood Study
270-A
272
274
284
290
292
292.2
294
294.4
296
296.2
298
300
SCALE : 1" = 100'

L:\Projects\2002\240513\dwg\240513 BASE MAP-Hec-Ras Study.dwg 12/28/2009 10:00:38 AM PST



SHEET 02 OF 02	JOB NO. 240513	WEST LITTLE LLAGAS CREEK FLOOD PLAIN STUDY W/HEC-RAS	MH engineering Co. 19575 Vineyard Boulevard Morgan Hill, CA 95037	SUPERVISED BY APPROVED BY	FILE: 240513 BASE SCRIPT DATE 12/09 SCALE(S) SHOWN DRAWN BY RS CHECKED BY MJM

ORIGINAL FEMA FIS MODEL

PROJ: ORIGINAL W/ 2009 FLOWS

PLAN: ORIGINAL FIS

HEC-RAS Plan: ORIGINAL Profile: PF 1

Reach	River Sta	Profile	Cum Ch Len	Length Chnl	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(ft)	(ft)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	310	PF 1	10677.30	60.00	1936.00	313.70	321.30	316.94	321.60	0.000707	4.37	443.20	58.37	0.28
Reach-1	307		Culvert	LACROSSE DRIVE										
Reach-1	304	PF 1	10617.30	50.00	1936.00	313.10	321.23		321.49	0.000572	4.08	478.18	116.40	0.25
Reach-1	302	PF 1	10567.30	360.00	1936.00	312.90	321.26		321.41	0.000657	3.16	733.51	513.91	0.22
Reach-1	300	PF 1	10207.30	390.10	1936.00	312.50	321.28		321.29	0.000110	1.24	3085.56	1721.45	0.09
Reach-1	298	PF 1	9817.20	383.50	1936.00	311.50	321.26		321.26	0.000043	0.94	4165.81	2109.69	0.06
Reach-1	296	PF 1	9433.70	510.00	1936.00	311.40	321.23		321.24	0.000128	1.40	3072.42	2245.43	0.10
Reach-1	294	PF 1	8923.70	462.10	1936.00	311.20	321.20		321.20	0.000036	0.79	5232.70	2898.46	0.05
Reach-1	292	PF 1	8461.60	300.00	1936.00	311.20	321.20		321.20	0.000006	0.32	9790.01	2977.66	0.02
Reach-1	290	PF 1	8161.60	30.00	1936.00	311.20	321.18	317.90	321.19	0.000108	1.69	3426.00	1131.82	0.09
Reach-1	287		Culvert	WATSONVILLE ROAD										
Reach-1	284	PF 1	8131.60	130.00	1936.00	311.20	321.16		321.17	0.000114	1.74	3373.13	1130.34	0.10
Reach-1	282	PF 1	8001.60	50.20	1936.00	311.20	321.11		321.14	0.000379	2.13	1887.53	674.75	0.13
Reach-1	280	PF 1	7951.40	65.00	1936.00	311.20	321.08	317.64	321.12	0.000305	2.43	1574.56	792.40	0.14
Reach-1	279		Culvert	MONTEREY ROAD										
Reach-1	278	PF 1	7886.40	91.70	1936.00	311.00	317.68	317.68	318.96	0.009038	10.16	252.39	96.53	0.69
Reach-1	276	PF 1	7794.70	524.80	1936.00	310.90	317.05		317.30	0.004268	6.06	764.51	932.48	0.51
Reach-1	274	PF 1	7269.90	476.80	1936.00	310.70	316.59		316.61	0.000550	2.16	1909.26	1422.90	0.19
Reach-1	272	PF 1	6793.10	467.10	1936.00	310.20	316.50		316.51	0.000095	1.00	3567.93	1788.47	0.08
Reach-1	270	PF 1	6326.00	637.00	1936.00	310.00	316.46		316.46	0.000090	1.04	3062.57	1174.66	0.08
Reach-1	268	PF 1	5689.00	440.80	1936.00	309.70	316.44		316.44	0.000021	0.53	4621.02	1142.84	0.04
Reach-1	266	PF 1	5248.20	337.50	1936.00	309.40	316.43		316.43	0.000027	0.56	4784.13	1920.44	0.04
Reach-1	264	PF 1	4910.70	422.70	1936.00	308.60	316.42		316.42	0.000012	0.42	6304.78	1570.50	0.03
Reach-1	262	PF 1	4488.00	60.00	1936.00	308.10	316.42		316.42	0.000002	0.17	15692.65	3468.10	0.01
Reach-1	260	PF 1	4428.00	16.00	1936.00	307.90	316.37	315.61	316.41	0.000451	2.94	1815.45	2009.70	0.18
Reach-1	259		Culvert	UPRR										
Reach-1	258	PF 1	4412.00	73.60	1936.00	307.70	316.00	316.00	316.31	0.003343	6.82	798.05	2114.60	0.42
Reach-1	256	PF 1	4338.40	586.90	1936.00	307.70	312.23		312.24	0.000493	2.02	2133.81	1853.59	0.19
Reach-1	254	PF 1	3751.50	463.30	3246.00	307.10	311.40		311.50	0.003080	4.77	1409.32	1224.57	0.48
Reach-1	252	PF 1	3288.20	65.30	3246.00	305.80	310.21		310.30	0.002211	4.67	1635.59	1574.64	0.43
Reach-1	250	PF 1	3222.90	20.00	3246.00	304.90	310.20	308.93	310.22	0.000320	2.00	3786.98	2544.52	0.15
Reach-1	249		Culvert	SEYMOUR										
Reach-1	248	PF 1	3202.90	55.00	3246.00	304.90	310.19		310.21	0.000999	3.09	3745.24	2539.77	0.24
Reach-1	246	PF 1	3147.90	379.40	3246.00	304.50	309.86		310.04	0.006062	6.37	1980.39	2346.00	0.61
Reach-1	244	PF 1	2768.50	304.70	3246.00	303.60	308.81		308.91	0.001701	4.60	1610.81	1396.14	0.39
Reach-1	242	PF 1	2463.80	350.00	3246.00	303.10	308.48		308.54	0.000854	3.42	2066.91	1359.32	0.28
Reach-1	240	PF 1	2113.80	138.70	3246.00	302.50	308.13	307.13	308.19	0.001180	3.94	2160.75	1854.48	0.32
Reach-1	235		Culvert											
Reach-1	230	PF 1	1975.10	372.00	3246.00	302.10	308.13		308.17	0.002241	3.66	2274.81	2566.59	0.36
Reach-1	222	PF 1	1603.10	53.70	3246.00	301.60	307.16		307.28	0.002237	5.40	1604.43	1325.27	0.44
Reach-1	220.2	PF 1	1549.40	1.00	3246.00	301.10	307.09		307.13	0.001692	3.64	2191.62	1972.74	0.27
Reach-1	220	PF 1	1548.40	25.00	3246.00	301.10	307.09	306.46	307.13	0.001701	3.65	2187.65	1971.10	0.27
Reach-1	217		Culvert											
Reach-1	214	PF 1	1523.40	63.00	3246.00	301.20	306.36		306.48	0.006499	6.59	1507.33	2021.25	0.51
Reach-1	212	PF 1	1460.40	164.90	3246.00	300.90	306.24		306.29	0.001407	3.73	1971.08	1726.41	0.33

ORIGINAL FEMA FIS MODEL

PROJ: ORIGINAL W/ 2009 FLOWS

PLAN: ORIGINAL FIS

HEC-RAS Plan: ORIGINAL Profile: PF 1 (Continued)

Reach	River Sta	Profile	Cum Ch Len	Length Chnl	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(ft)	(ft)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	210	PF 1	1295.50	10.00	3246.00	300.90	305.97	305.38	306.03	0.001389	3.75	1924.83	1722.96	0.29
Reach-1	209		Culvert											
Reach-1	208	PF 1	1285.50	333.00	3246.00	300.90	305.96		306.02	0.001413	3.78	1913.38	1718.96	0.30
Reach-1	206	PF 1	952.50	365.40	3246.00	299.50	305.76		305.78	0.000410	2.02	2899.18	1719.88	0.18
Reach-1	204	PF 1	587.10	223.50	3246.00	298.80	305.69		305.70	0.000126	1.55	3643.37	1234.53	0.11
Reach-1	202	PF 1	363.60	63.60	3246.00	297.30	305.65		305.67	0.000129	1.69	3068.78	873.98	0.12
Reach-1	200	PF 1	300.00	300.00	3246.00	296.90	305.65	303.62	305.66	0.000064	1.38	5267.86	1964.18	0.08
Reach-1	199		Culvert											
Reach-1	198	PF 1			3246.00	296.10	304.96	303.04	305.03	0.000321	3.13	1953.30	573.70	0.19

CALCULATIONS FOR WATSONVILLE ROAD CROSSING

POST: WATSONVILLE ROAD DEVELOPMENT

PROJ: WATSONVILLE ROAD CULVERT

HEC-RAS River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Plan	Cum Ch Len	Length Chnl	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(ft)	(ft)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	292	Q100	2 10X4.7 BD	8442.60	300.00	1936.00	311.20	319.60	316.83	319.61	0.000068	0.91	3001.05	2632.55	0.06
Reach-1	292	Q100	PREDEV WSF	8442.60	300.00	1936.00	311.20	319.73	316.48	319.73	0.000028	0.59	5707.04	2664.93	0.04
Reach-1	292	Q2	2 10X4.7 BD	8442.60	300.00	917.70	311.20	318.79	316.45	318.80	0.000035	0.60	2288.33	2432.97	0.04
Reach-1	292	Q2	PREDEV WSF	8442.60	300.00	917.70	311.20	318.77	316.05	318.77	0.000025	0.51	3255.64	2422.44	0.04
Reach-1	292	Q5	2 10X4.7 BD	8442.60	300.00	1252.60	311.20	319.15	316.60	319.16	0.000044	0.70	2600.17	2549.13	0.05
Reach-1	292	Q5	PREDEV WSF	8442.60	300.00	1252.60	311.20	319.07	316.22	319.07	0.000030	0.56	3990.76	2541.35	0.04
Reach-1	292	Q10	2 10X4.7 BD	8442.60	300.00	1444.30	311.20	319.31	316.68	319.31	0.000050	0.75	2733.93	2563.36	0.05
Reach-1	292	Q10	PREDEV WSF	8442.60	300.00	1444.30	311.20	319.24	316.30	319.24	0.000030	0.58	4435.25	2556.70	0.04
Reach-1	292	Q25	2 10X4.7 BD	8442.60	300.00	1659.20	311.20	319.44	316.75	319.44	0.000058	0.82	2850.68	2592.31	0.06
Reach-1	292	Q25	PREDEV WSF	8442.60	300.00	1659.20	311.20	319.45	316.38	319.45	0.000030	0.59	4966.18	2594.85	0.04
Reach-1	292	Q50	2 10X4.7 BD	8442.60	300.00	1800.50	311.20	319.51	316.80	319.51	0.000064	0.87	2916.02	2609.99	0.06
Reach-1	292	Q50	PREDEV WSF	8442.60	300.00	1800.50	311.20	319.58	316.43	319.58	0.000029	0.59	5318.30	2628.39	0.04
Reach-1	290	Q100	2 10X4.7 BD	8142.60	30.00	1936.00	311.20	319.54	317.32	319.57	0.000167	2.21	1904.09	872.81	0.13
Reach-1	290	Q100	PREDEV WSF	8142.60	30.00	1936.00	311.20	319.69	317.50	319.71	0.000186	1.99	1938.59	890.25	0.12
Reach-1	290	Q2	2 10X4.7 BD	8142.60	30.00	917.70	311.20	318.76	314.58	318.77	0.000097	1.58	1260.00	772.56	0.10
Reach-1	290	Q2	PREDEV WSF	8142.60	30.00	917.70	311.20	318.74	316.93	318.75	0.000151	1.66	1153.05	764.18	0.11
Reach-1	290	Q5	2 10X4.7 BD	8142.60	30.00	1252.60	311.20	319.11	316.59	319.13	0.000115	1.77	1543.32	818.17	0.11
Reach-1	290	Q5	PREDEV WSF	8142.60	30.00	1252.60	311.20	319.03	317.18	319.05	0.000185	1.88	1378.81	802.44	0.12
Reach-1	290	Q10	2 10X4.7 BD	8142.60	30.00	1444.30	311.20	319.26	316.92	319.28	0.000128	1.89	1665.74	837.11	0.12
Reach-1	290	Q10	PREDEV WSF	8142.60	30.00	1444.30	311.20	319.20	317.31	319.22	0.000193	1.95	1519.25	825.35	0.12
Reach-1	290	Q25	2 10X4.7 BD	8142.60	30.00	1659.20	311.20	319.39	317.14	319.41	0.000146	2.04	1770.52	852.99	0.13
Reach-1	290	Q25	PREDEV WSF	8142.60	30.00	1659.20	311.20	319.41	317.41	319.43	0.000194	1.99	1692.08	852.70	0.12
Reach-1	290	Q50	2 10X4.7 BD	8142.60	30.00	1800.50	311.20	319.45	317.26	319.48	0.000160	2.14	1827.60	861.52	0.13
Reach-1	290	Q50	PREDEV WSF	8142.60	30.00	1800.50	311.20	319.54	317.48	319.56	0.000193	2.01	1808.31	870.60	0.12
Reach-1	287			Culvert											
Reach-1	284	Q100	2 10X4.7 BD	8112.60	130.00	1936.00	311.20	319.50		319.53	0.000175	2.25	1866.25	867.24	0.14
Reach-1	284	Q100	PREDEV WSF	8112.60	130.00	1936.00	311.20	319.62		319.65	0.000217	2.14	1846.90	881.72	0.13
Reach-1	284	Q2	2 10X4.7 BD	8112.60	130.00	917.70	311.20	318.26		318.30	0.000185	2.08	932.83	540.59	0.14
Reach-1	284	Q2	PREDEV WSF	8112.60	130.00	917.70	311.20	318.26		318.29	0.000371	2.49	805.40	531.37	0.17
Reach-1	284	Q5	2 10X4.7 BD	8112.60	130.00	1252.60	311.20	319.03		319.06	0.000127	1.85	1478.70	808.00	0.12
Reach-1	284	Q5	PREDEV WSF	8112.60	130.00	1252.60	311.20	318.88		318.91	0.000255	2.18	1230.21	783.38	0.14
Reach-1	284	Q10	2 10X4.7 BD	8112.60	130.00	1444.30	311.20	319.19		319.21	0.000141	1.97	1601.64	827.25	0.12
Reach-1	284	Q10	PREDEV WSF	8112.60	130.00	1444.30	311.20	319.14		319.16	0.000231	2.12	1437.61	817.77	0.13
Reach-1	284	Q25	2 10X4.7 BD	8112.60	130.00	1659.20	311.20	319.34		319.37	0.000154	2.09	1731.38	847.09	0.13
Reach-1	284	Q25	PREDEV WSF	8112.60	130.00	1659.20	311.20	319.35		319.37	0.000228	2.15	1609.22	845.17	0.13
Reach-1	284	Q50	2 10X4.7 BD	8112.60	130.00	1800.50	311.20	319.41		319.44	0.000168	2.19	1788.46	855.68	0.13
Reach-1	284	Q50	PREDEV WSF	8112.60	130.00	1800.50	311.20	319.48		319.50	0.000227	2.17	1717.17	861.96	0.13
Reach-1	282	Q100	2 10X4.7 BD	7982.60	50.20	1936.00	311.20	319.06		319.37	0.006047	6.00	656.79	523.33	0.38
Reach-1	282	Q100	PREDEV WSF	7982.60	50.20	1936.00	311.20	319.23		319.50	0.003447	5.33	754.49	546.29	0.39
Reach-1	282	Q2	2 10X4.7 BD	7982.60	50.20	917.70	311.20	317.20		317.99	0.012860	7.26	140.66	68.80	0.53
Reach-1	282	Q2	PREDEV WSF	7982.60	50.20	917.70	311.20	317.41	315.61	318.00	0.006758	6.18	165.22	87.70	0.52
Reach-1	282	Q5	2 10X4.7 BD	7982.60	50.20	1252.60	311.20	317.71	316.26	318.71	0.015435	8.42	201.93	196.01	0.59
Reach-1	282	Q5	PREDEV WSF	7982.60	50.20	1252.60	311.20	318.01		318.63	0.006964	6.70	268.63	197.77	0.53
Reach-1	282	Q10	2 10X4.7 BD	7982.60	50.20	1444.30	311.20	318.12	318.12	318.91	0.012774	7.98	281.90	197.11	0.54
Reach-1	282	Q10	PREDEV WSF	7982.60	50.20	1444.30	311.20	318.40		318.92	0.006011	6.47	356.69	328.23	0.50
Reach-1	282	Q25	2 10X4.7 BD	7982.60	50.20	1659.20	311.20	318.50		319.12	0.010506	7.51	384.78	388.25	0.50
Reach-1	282	Q25	PREDEV WSF	7982.60	50.20	1659.20	311.20	318.71		319.16	0.005311	6.26	490.11	491.31	0.47
Reach-1	282	Q50	2 10X4.7 BD	7982.60	50.20	1800.50	311.20	318.72		319.22	0.008970	7.08	485.29	491.38	0.46
Reach-1	282	Q50	PREDEV WSF	7982.60	50.20	1800.50	311.20	318.97		319.32	0.004310	5.78	619.69	504.23	0.43

CALCULATIONS FOR WATSONVILLE ROAD CROSSING

POST: WATSONVILLE ROAD DEVELOPMENT

PROJ: WATSONVILLE ROAD CULVERT

HEC-RAS River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Plan	Cum Ch Len	Length Chnl	Q Total	Min Ch El	W.S. Elev	Crit W.S	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(ft)	(ft)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	280.2			Lat Struct											
Reach-1	280	Q100	2 10X4.7 BD	7932.40	65.00	773.39	311.20	319.07	314.77	319.12	0.000476	2.18	470.03	144.40	0.14
Reach-1	280	Q100	PREDEV WSF	7932.40	65.00	709.73	311.20	319.27	314.42	319.31	0.000276	2.02	508.19	191.07	0.13
Reach-1	280	Q2	2 10X4.7 BD	7932.40	65.00	604.73	311.20	317.29	314.23	317.43	0.001681	3.44	237.99	115.56	0.25
Reach-1	280	Q2	PREDEV WSF	7932.40	65.00	502.05	311.20	317.56	313.76	317.64	0.000627	2.60	275.63	120.41	0.18
Reach-1	280	Q5	2 10X4.7 BD	7932.40	65.00	694.80	311.20	317.95	314.53	318.05	0.001084	2.97	318.06	127.22	0.20
Reach-1	280	Q5	PREDEV WSF	7932.40	65.00	576.80	311.20	318.19	314.00	318.25	0.000452	2.35	354.98	131.05	0.16
Reach-1	280	Q10	2 10X4.7 BD	7932.40	65.00	714.14	311.20	318.19	314.59	318.27	0.000903	2.77	348.61	130.95	0.19
Reach-1	280	Q10	PREDEV WSF	7932.40	65.00	628.08	311.20	318.54	314.17	318.59	0.000393	2.26	401.89	136.37	0.15
Reach-1	280	Q25	2 10X4.7 BD	7932.40	65.00	780.21	311.20	318.61	314.79	318.68	0.000725	2.59	405.01	137.36	0.17
Reach-1	280	Q25	PREDEV WSF	7932.40	65.00	652.22	311.20	318.82	314.24	318.87	0.000334	2.14	440.92	140.65	0.14
Reach-1	280	Q50	2 10X4.7 BD	7932.40	65.00	787.89	311.20	318.78	314.82	318.85	0.000631	2.45	429.59	140.06	0.16
Reach-1	280	Q50	PREDEV WSF	7932.40	65.00	680.09	311.20	319.04	314.33	319.09	0.000304	2.08	472.30	143.99	0.13
Reach-1	279			Culvert											
Reach-1	278	Q100	2 10X4.7 BD	7867.40	91.70	0.81	311.00	316.66		316.66	0.000000	0.01	164.13	75.71	0.00
Reach-1	278	Q100	PREDEV WSF	7867.40	91.70	0.81	311.00	317.24		317.24	0.000000	0.00	211.94	88.41	0.00
Reach-1	278	Q2	2 10X4.7 BD	7867.40	91.70	72.43	311.00	315.94		315.95	0.000058	0.66	118.49	50.20	0.05
Reach-1	278	Q2	PREDEV WSF	7867.40	91.70	0.39	311.00	316.60		316.60	0.000000	0.00	159.70	73.76	0.00
Reach-1	278	Q5	2 10X4.7 BD	7867.40	91.70	0.53	311.00	316.07		316.07	0.000000	0.00	125.34	54.83	0.00
Reach-1	278	Q5	PREDEV WSF	7867.40	91.70	0.53	311.00	316.88		316.88	0.000000	0.00	181.51	81.77	0.00
Reach-1	278	Q10	2 10X4.7 BD	7867.40	91.70	0.61	311.00	316.18		316.18	0.000000	0.01	131.55	58.70	0.00
Reach-1	278	Q10	PREDEV WSF	7867.40	91.70	0.61	311.00	316.97		316.97	0.000000	0.00	189.00	83.45	0.00
Reach-1	278	Q25	2 10X4.7 BD	7867.40	91.70	0.70	311.00	316.18		316.18	0.000000	0.01	131.64	58.76	0.00
Reach-1	278	Q25	PREDEV WSF	7867.40	91.70	0.70	311.00	317.12		317.12	0.000000	0.00	201.55	86.20	0.00
Reach-1	278	Q50	2 10X4.7 BD	7867.40	91.70	0.76	311.00	316.30		316.30	0.000000	0.01	138.92	63.00	0.00
Reach-1	278	Q50	PREDEV WSF	7867.40	91.70	0.76	311.00	317.19		317.19	0.000000	0.00	207.16	87.40	0.00
Reach-1	276	Q100	2 10X4.7 BD	7775.70	524.80	0.81	310.90	316.66		316.66	0.000000	0.00	426.54	795.76	0.00
Reach-1	276	Q100	PREDEV WSF	7775.70	524.80	1226.27	310.90	316.98		317.11	0.002124	4.23	695.94	906.41	0.36
Reach-1	276	Q2	2 10X4.7 BD	7775.70	524.80	72.43	310.90	315.93		315.94	0.000100	0.77	116.00	107.10	0.08
Reach-1	276	Q2	PREDEV WSF	7775.70	524.80	415.65	310.90	316.42		316.54	0.001437	3.16	240.80	705.26	0.29
Reach-1	276	Q5	2 10X4.7 BD	7775.70	524.80	0.53	310.90	316.07		316.07	0.000000	0.01	131.64	116.38	0.00
Reach-1	276	Q5	PREDEV WSF	7775.70	524.80	675.80	310.90	316.68	315.27	316.80	0.001650	3.55	439.09	801.25	0.32
Reach-1	276	Q10	2 10X4.7 BD	7775.70	524.80	0.61	310.90	316.18		316.18	0.000000	0.01	144.76	123.63	0.00
Reach-1	276	Q10	PREDEV WSF	7775.70	524.80	816.22	310.90	316.67	316.56	316.85	0.002488	4.35	430.90	797.67	0.39
Reach-1	276	Q25	2 10X4.7 BD	7775.70	524.80	0.70	310.90	316.18		316.18	0.000000	0.01	144.96	123.73	0.00
Reach-1	276	Q25	PREDEV WSF	7775.70	524.80	1006.98	310.90	316.68	316.68	316.94	0.003690	5.30	437.26	800.45	0.47
Reach-1	276	Q50	2 10X4.7 BD	7775.70	524.80	0.76	310.90	316.30		316.30	0.000000	0.01	174.13	409.87	0.00
Reach-1	276	Q50	PREDEV WSF	7775.70	524.80	1120.41	310.90	316.74	316.74	316.99	0.003757	5.41	486.06	821.49	0.48
Reach-1	274	Q100	2 10X4.7 BD	7250.90	476.80	1162.61	310.70	316.58		316.59	0.000201	1.31	1899.57	1422.28	0.11
Reach-1	274	Q100	PREDEV WSF	7250.90	476.80	1226.27	310.70	316.90		316.91	0.000115	1.04	2363.67	1451.81	0.09
Reach-1	274	Q2	2 10X4.7 BD	7250.90	476.80	385.40	310.70	315.09		315.30	0.003985	4.29	185.73	557.32	0.47
Reach-1	274	Q2	PREDEV WSF	7250.90	476.80	415.65	310.70	315.12		315.34	0.004147	4.41	200.92	582.36	0.48
Reach-1	274	Q5	2 10X4.7 BD	7250.90	476.80	557.80	310.70	315.29		315.48	0.003935	4.48	301.38	776.00	0.47
Reach-1	274	Q5	PREDEV WSF	7250.90	476.80	675.80	310.70	315.38		315.55	0.003694	4.45	381.52	875.53	0.46
Reach-1	274	Q10	2 10X4.7 BD	7250.90	476.80	730.16	310.70	315.47		315.59	0.003006	4.08	454.53	951.08	0.42
Reach-1	274	Q10	PREDEV WSF	7250.90	476.80	816.22	310.70	315.64		315.71	0.001790	3.27	636.53	1117.30	0.32
Reach-1	274	Q25	2 10X4.7 BD	7250.90	476.80	878.99	310.70	315.78		315.83	0.001205	2.77	804.65	1251.32	0.27

CALCULATIONS FOR WATSONVILLE ROAD CROSSING

POST: WATSONVILLE ROAD DEVELOPMENT

PROJ: WATSONVILLE ROAD CULVERT

HEC-RAS River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Plan	Cum Ch Len	Length Chnl	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(ft)	(ft)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	274	Q25	PREDEV WSF	7250.90	476.80	1006.98	310.70	316.07		316.09	0.000592	2.05	1185.77	1375.61	0.19
Reach-1	274	Q50	2 10X4.7 BD	7250.90	476.80	1012.61	310.70	316.07		316.09	0.000591	2.05	1190.92	1375.95	0.19
Reach-1	274	Q50	PREDEV WSF	7250.90	476.80	1120.41	310.70	316.41		316.42	0.000277	1.49	1664.40	1407.07	0.13

CALCULATIONS FOR FLOOD PLAIN AT REGIONAL POND

PROJ: BUTTERFIELD CHANNEL WITH POND

HEC-RAS Profile: PF 1

Reach	River Sta	Profile	Plan	Cum Ch Len	Length Chnl	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(ft)	(ft)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	310	PF 1	PND-ORIG FLO	10659.30	60.00	1269.00	313.70	321.22	316.15	321.35	0.000315	2.90	438.14	58.37	0.19
Reach-1	310	PF 1	PREDEV	10658.30	60.00	1269.00	313.70	321.22	316.15	321.35	0.000315	2.90	438.14	58.37	0.19
Reach-1	310	PF 1	hydro	10659.30	60.00	1269.00	313.70	321.23	316.15	321.36	0.000314	2.89	438.63	58.37	0.19
Reach-1	307			Culvert		LA CROSSE DRVE									
Reach-1	304	PF 1	PND-ORIG FLO	10599.30	50.00	1269.00	313.10	321.19		321.30	0.000251	2.69	473.20	96.25	0.17
Reach-1	304	PF 1	PREDEV	10598.30	50.00	1269.00	313.10	321.19		321.30	0.000251	2.69	473.20	96.25	0.17
Reach-1	304	PF 1	hydro	10599.30	50.00	1269.00	313.10	321.20		321.31	0.000250	2.69	474.05	100.00	0.17
Reach-1	302	PF 1	PND-ORIG FLO	10549.30	360.00	1269.00	312.90	321.20		321.26	0.000295	2.11	702.25	506.60	0.15
Reach-1	302	PF 1	PREDEV	10548.30	360.00	1269.00	312.90	321.20		321.26	0.000295	2.11	702.25	506.60	0.15
Reach-1	302	PF 1	hydro	10549.30	360.00	1269.00	312.90	321.21		321.27	0.000293	2.10	706.73	507.65	0.15
Reach-1	300	PF 1	PND-ORIG FLO	10189.30	390.10	1269.00	312.50	321.20		321.21	0.000053	0.85	2960.01	1696.85	0.06
Reach-1	300	PF 1	PREDEV	10188.30	390.10	1269.00	312.50	321.20		321.21	0.000053	0.85	2960.01	1696.85	0.06
Reach-1	300	PF 1	hydro	10189.30	390.10	1269.00	312.50	321.21		321.22	0.000052	0.85	2975.36	1699.88	0.06
Reach-1	298	PF 1	PND-ORIG FLO	9799.20	383.50	1269.00	311.50	321.19		321.20	0.000020	0.64	4036.43	2071.21	0.04
Reach-1	298	PF 1	PREDEV	9798.20	383.50	1269.00	311.50	321.19		321.20	0.000020	0.64	4036.43	2071.21	0.04
Reach-1	298	PF 1	hydro	9799.20	383.50	1269.00	311.50	321.20		321.21	0.000019	0.64	4055.42	2076.90	0.04
Reach-1	296	PF 1	PND-ORIG FLO	9415.70	510.00	1269.00	311.40	321.18		321.18	0.000059	0.95	2969.71	2217.97	0.06
Reach-1	296	PF 1	PREDEV	9414.70	510.00	1269.00	311.40	321.18		321.18	0.000059	0.95	2969.71	2217.97	0.06
Reach-1	296	PF 1	hydro	9415.70	510.00	1269.00	311.40	321.19		321.19	0.000058	0.94	2990.52	2223.56	0.06
Reach-1	294	PF 1	PND-ORIG FLO	8905.70	462.10	1269.00	311.20	321.17		321.17	0.000016	0.53	5141.98	2868.51	0.03
Reach-1	294	PF 1	PREDEV	8904.70	462.10	1269.00	311.20	321.17		321.17	0.000016	0.53	5141.98	2868.51	0.03
Reach-1	294	PF 1	hydro	8905.70	462.10	1269.00	311.20	321.18		321.18	0.000016	0.53	5169.34	2877.58	0.03
Reach-1	292	PF 1	PND-ORIG FLO	8443.60	300.00	1269.00	311.20	321.17		321.17	0.000003	0.21	9702.98	2975.71	0.01
Reach-1	292	PF 1	PREDEV	8442.60	300.00	1269.00	311.20	321.17		321.17	0.000003	0.21	9702.98	2975.71	0.01
Reach-1	292	PF 1	hydro	8443.60	300.00	1269.00	311.20	321.18		321.18	0.000003	0.21	9731.41	2976.35	0.01
Reach-1	290	PF 1	PND-ORIG FLO	8143.60	30.00	1936.00	311.20	321.15	317.89	321.16	0.000111	1.71	3393.71	1129.18	0.10
Reach-1	290	PF 1	PREDEV	8142.60	30.00	1936.00	311.20	321.15	317.89	321.16	0.000111	1.71	3393.71	1129.18	0.10
Reach-1	290	PF 1	hydro	8143.60	30.00	1936.00	311.20	321.16	317.89	321.17	0.000110	1.70	3404.64	1130.07	0.10
Reach-1	287			Culvert		WATSONVILLE ROAD									
Reach-1	284	PF 1	PND-ORIG FLO	8113.60	130.00	1936.00	311.20	321.13		321.14	0.000117	1.76	3335.54	1127.27	0.10
Reach-1	284	PF 1	PREDEV	8112.60	130.00	1936.00	311.20	321.13		321.14	0.000117	1.76	3335.54	1127.27	0.10
Reach-1	284	PF 1	hydro	8113.60	130.00	1936.00	311.20	321.15		321.16	0.000115	1.75	3358.34	1129.13	0.10
Reach-1	282	PF 1	PND-ORIG FLO	7983.60	50.20	1936.00	311.20	321.08		321.11	0.000392	2.16	1864.03	669.00	0.14
Reach-1	282	PF 1	PREDEV	7982.60	50.20	1936.00	311.20	321.08		321.11	0.000392	2.16	1864.03	669.00	0.14
Reach-1	282	PF 1	hydro	7983.60	50.20	1936.00	311.20	321.10		321.13	0.000384	2.14	1878.28	672.49	0.14
Reach-1	280	PF 1	PND-ORIG FLO	7933.40	65.00	1936.00	311.20	321.04	317.64	321.08	0.000318	2.48	1545.39	792.40	0.14
Reach-1	280	PF 1	PREDEV	7932.40	65.00	1936.00	311.20	321.04	317.64	321.08	0.000318	2.48	1545.39	792.40	0.14
Reach-1	280	PF 1	hydro	7933.40	65.00	1936.00	311.20	321.07	317.64	321.10	0.000310	2.45	1563.12	792.40	0.14
Reach-1	279			Culvert		MONTEREY ROAD									

CALCULATIONS FOR FLOOD PLAIN AT REGIONAL POND

PROJ: BUTTERFIELD CHANNEL WITH POND

HEC-RAS Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	Cum Ch Len (ft)	Length Chnl (ft)	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	278	PF 1	PND-ORIG FLO	7868.40	91.70	813.00	311.00	316.82		317.28	0.003461	5.74	176.54	80.63	0.42
Reach-1	278	PF 1	PREDEV	7867.40	91.70	813.00	311.00	316.82		317.28	0.003461	5.74	176.54	80.63	0.42
Reach-1	278	PF 1	hydro	7868.40	91.70	813.00	311.00	316.81		317.27	0.003512	5.77	175.29	80.34	0.42
Reach-1	276	PF 1	PND-ORIG FLO	7776.70	524.80	813.00	310.90	316.69	316.56	316.85	0.002304	4.20	447.84	805.06	0.37
Reach-1	276	PF 1	PREDEV	7775.70	524.80	813.00	310.90	316.69	316.56	316.85	0.002304	4.20	447.84	805.06	0.37
Reach-1	276	PF 1	hydro	7776.70	524.80	813.00	310.90	316.56	316.56	316.83	0.003549	5.10	344.47	758.85	0.46
Reach-1	274	PF 1	PND-ORIG FLO	7251.90	476.80	813.00	310.70	315.60		315.68	0.002068	3.49	595.18	1081.80	0.35
Reach-1	274	PF 1	PREDEV	7250.90	476.80	813.00	310.70	315.60		315.68	0.002068	3.49	595.18	1081.80	0.35
Reach-1	274	PF 1	hydro	7251.90	476.80	813.00	310.70	316.25		316.26	0.000224	1.30	1437.58	1392.25	0.12
Reach-1	272	PF 1	PND-ORIG FLO	6775.10	467.10	975.00	310.20	315.44		315.44	0.000207	1.24	1731.65	1578.64	0.11
Reach-1	272	PF 1	PREDEV	6774.10	467.10	975.00	310.20	315.44		315.44	0.000207	1.24	1731.65	1578.64	0.11
Reach-1	272	PF 1	hydro	6775.10	467.10	975.00	310.20	316.22		316.22	0.000039	0.61	3062.53	1773.48	0.05
Reach-1	270	PF 1	PND-ORIG FLO	6308.00	637.00	1479.00	310.00	315.31		315.32	0.000282	1.56	1784.30	1064.08	0.14
Reach-1	270	PF 1	PREDEV	6307.00	637.00	1479.00	310.00	315.31		315.32	0.000282	1.56	1784.30	1064.08	0.14
Reach-1	270	PF 1	hydro	6308.00	637.00	1479.00	310.00	316.19		316.19	0.000073	0.90	2752.14	1144.78	0.07
Reach-1	268	PF 1	PND-ORIG FLO	5671.00	440.80	1936.00	309.70	315.25		315.26	0.000058	0.74	3323.98	1052.32	0.06
Reach-1	268	PF 1	PREDEV	5670.00	440.80	1936.00	309.70	315.25		315.26	0.000058	0.74	3323.98	1052.32	0.06
Reach-1	268	PF 1	hydro	5671.00	440.80	1936.00	309.70	316.17		316.17	0.000026	0.57	4316.50	1120.85	0.04
Reach-1	266.2			Lat Struct	UPRR SPLIT										
Reach-1	266	PF 1	PND-ORIG FLO	5230.20	337.50	1260.00	309.40	315.23		315.24	0.000039	0.58	3010.38	1136.82	0.05
Reach-1	266	PF 1	PREDEV	5229.20	337.50	1260.00	309.40	315.23		315.24	0.000039	0.58	3010.38	1136.82	0.05
Reach-1	266	PF 1	hydro	5230.20	337.50	1260.00	309.40	316.16		316.16	0.000015	0.40	4295.54	1747.60	0.03
Reach-1	264	PF 1	PND-ORIG FLO	4892.70	422.70	1260.00	308.60	315.23		315.23	0.000015	0.41	4433.73	1565.19	0.03
Reach-1	264	PF 1	PREDEV	4891.70	422.70	1260.00	308.60	315.23		315.23	0.000015	0.41	4433.73	1565.19	0.03
Reach-1	264	PF 1	hydro	4892.70	422.70	1260.00	308.60	316.16		316.16	0.000006	0.30	5890.12	1569.33	0.02
Reach-1	262	PF 1	PND-ORIG FLO	4470.00	60.00	1260.00	308.10	315.23		315.23	0.000002	0.16	11552.80	3468.10	0.01
Reach-1	262	PF 1	PREDEV	4469.00	60.00	1260.00	308.10	315.23		315.23	0.000002	0.16	11552.80	3468.10	0.01
Reach-1	262	PF 1	hydro	4470.00	60.00	1260.00	308.10	316.16		316.16	0.000001	0.12	14777.47	3468.10	0.01
Reach-1	260	PF 1	PND-ORIG FLO	4410.00	16.00	700.00	307.90	314.89	312.38	315.15	0.001681	4.99	278.75	285.65	0.33
Reach-1	260	PF 1	PREDEV	4409.00	16.00	700.00	307.90	314.89	312.38	315.15	0.001681	4.99	278.75	285.65	0.33
Reach-1	260	PF 1	hydro	4410.00	16.00	700.00	307.90	316.15	312.37	316.15	0.000099	1.36	1436.18	1437.49	0.08
Reach-1	259			Culvert	UPRR CULVERT										
Reach-1	258	PF 1	PND-ORIG FLO	4394.00	73.60	700.00	307.70	312.18	312.18	314.40	0.015885	11.98	58.42	13.11	1.00
Reach-1	258	PF 1	PREDEV	4393.00	73.60	700.00	307.70	312.17	312.17	314.40	0.015898	11.99	58.41	13.11	1.00
Reach-1	258	PF 1	hydro	4394.00	73.60	1400.00	307.70	315.86	315.86	316.15	0.002699	6.09	616.24	1120.37	0.38
Reach-1	256	PF 1	PND-ORIG FLO	4320.40	100.00	1446.00	306.68	311.29		311.35	0.001101	2.88	898.68	842.88	0.29
Reach-1	256	PF 1	PREDEV	4319.40	100.00	1770.00	306.68	311.29		311.32	0.001153	2.94	1393.63	1495.09	0.29
Reach-1	256	PF 1	hydro	4320.40	100.00	1400.00	306.68	311.26		311.32	0.001099	2.86	873.81	839.23	0.29

CALCULATIONS FOR FLOOD PLAIN AT REGIONAL POND

PROJ: BUTTERFIELD CHANNEL WITH POND

HEC-RAS Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	Cum Ch Len	Length Chnl	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(ft)	(ft)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	254.6	PF 1	PND-ORIG FLO	4220.40	23.00	1446.00	307.01	311.12		311.21	0.001665	3.41	743.34	854.31	0.36
Reach-1	254.6	PF 1	PREDEV	4219.40	23.00	1770.00	307.01	311.16	310.62	311.20	0.001281	3.02	1311.20	1546.47	0.31
Reach-1	254.6	PF 1	hydro	4220.40	23.00	1400.00	307.01	311.09		311.18	0.001670	3.39	717.99	823.94	0.36
Reach-1	254.4	PF 1	PND-ORIG FLO	4197.40	91.00	1446.00	307.09	311.09		311.17	0.001765	2.40	762.09	887.01	0.33
Reach-1	254.4	PF 1	PREDEV	4196.40	91.00	1770.00	307.09	311.14		311.17	0.001270	2.07	1345.84	1609.70	0.28
Reach-1	254.4	PF 1	hydro	4197.40	91.00	1400.00	307.09	311.06		311.14	0.001776	2.38	738.96	839.91	0.33
Reach-1	254.2	PF 1	PND-ORIG FLO	4106.40	290.00	1446.00	307.35	310.95		311.02	0.001482	2.88	747.48	932.93	0.33
Reach-1	254.2	PF 1	PREDEV	4105.40	290.00	1770.00	307.35	311.02	310.37	311.06	0.001156	2.59	1317.77	1811.38	0.29
Reach-1	254.2	PF 1	hydro	4106.40	290.00	1400.00	307.35	310.92		310.99	0.001469	2.85	729.79	863.70	0.33
Reach-1	254	PF 1	PND-ORIG FLO	3816.40	144.00	1446.00	306.94	310.43		310.48	0.001463	2.35	776.01	633.86	0.31
Reach-1	254	PF 1	PREDEV	3815.40	144.00	1770.00	306.94	310.54		310.58	0.001383	2.39	1204.45	1126.14	0.31
Reach-1	254	PF 1	hydro	3816.40	144.00	1400.00	306.94	310.40		310.46	0.001444	2.31	760.38	628.40	0.31
Reach-1	252.6	PF 1	PND-ORIG FLO	3672.40	54.00	1446.00	306.60	310.21		310.27	0.001545	2.85	1045.12	1238.49	0.34
Reach-1	252.6	PF 1	PREDEV	3671.40	54.00	1770.00	306.60	310.36		310.40	0.001135	2.53	1407.77	1433.22	0.29
Reach-1	252.6	PF 1	hydro	3672.40	54.00	1400.00	306.60	310.19		310.24	0.001590	2.87	1010.17	1232.37	0.34
Reach-1	252.4	PF 1	PND-ORIG FLO	3618.40	15.00	1446.00	306.33	310.19		310.21	0.000463	1.57	1538.08	1308.18	0.18
Reach-1	252.4	PF 1	PREDEV	3617.40	15.00	1770.00	306.33	310.34		310.36	0.000489	1.66	1743.41	1352.90	0.19
Reach-1	252.4	PF 1	hydro	3618.40	15.00	1400.00	306.33	310.17		310.19	0.000464	1.56	1501.78	1303.11	0.18
Reach-1	252.2	PF 1	PND-ORIG FLO	3603.40	249.50	1446.00	306.17	310.18		310.21	0.000364	1.66	1565.69	1270.20	0.17
Reach-1	252.2	PF 1	PREDEV	3602.40	249.50	1770.00	306.17	310.33		310.35	0.000407	1.82	1747.67	1328.46	0.18
Reach-1	252.2	PF 1	hydro	3603.40	249.50	1400.00	306.17	310.16		310.18	0.000362	1.65	1530.62	1263.94	0.17
Reach-1	252	PF 1	PND-ORIG FLO	3353.90	130.00	1446.00	305.27	310.05		310.09	0.000672	2.38	1317.08	1496.84	0.23
Reach-1	252	PF 1	PREDEV	3352.90	130.00	1770.00	305.27	310.18		310.22	0.000737	2.56	1492.16	1573.80	0.25
Reach-1	252	PF 1	hydro	3353.90	130.00	1400.00	305.27	310.03		310.06	0.000676	2.37	1283.34	1481.10	0.23
Reach-1	250	PF 1	PND-ORIG FLO	3223.90	20.00	1446.00	305.02	309.93	309.49	309.98	0.001000	3.48	1124.61	1051.17	0.29
Reach-1	250	PF 1	PREDEV	3222.90	20.00	1770.00	305.02	310.04	309.57	310.10	0.001119	3.75	1245.64	1051.17	0.31
Reach-1	250	PF 1	hydro	3223.90	20.00	1400.00	305.02	309.89	309.49	309.95	0.001018	3.49	1092.08	1051.17	0.30
Reach-1	249			Culvert		SEYMOUR									
Reach-1	248	PF 1	PND-ORIG FLO	3203.90	55.00	1446.00	304.65	309.69		309.96	0.004139	6.14	782.66	936.12	0.52
Reach-1	248	PF 1	PREDEV	3202.90	55.00	1770.00	304.65	309.78		310.10	0.005050	6.87	866.82	946.87	0.58
Reach-1	248	PF 1	hydro	3203.90	55.00	1400.00	304.65	309.68		309.94	0.004006	6.02	769.81	934.47	0.51
Reach-1	246	PF 1	PND-ORIG FLO	3148.90	379.40	1446.00	304.50	309.49	309.49	309.68	0.004692	5.19	1121.68	2346.00	0.53
Reach-1	246	PF 1	PREDEV	3147.90	379.40	1770.00	304.50	309.56	309.56	309.76	0.005230	5.57	1288.14	2346.00	0.56
Reach-1	246	PF 1	hydro	3148.90	379.40	1400.00	304.50	309.48	309.48	309.67	0.004597	5.13	1097.49	2346.00	0.52
Reach-1	244	PF 1	PND-ORIG FLO	2769.50	304.70	1446.00	303.60	308.07		308.18	0.001645	3.99	775.90	819.71	0.37
Reach-1	244	PF 1	PREDEV	2768.50	304.70	1770.00	303.60	308.25		308.35	0.001682	4.17	928.63	936.97	0.38
Reach-1	244	PF 1	hydro	2769.50	304.70	1400.00	303.60	308.05		308.15	0.001626	3.95	756.90	803.93	0.37
Reach-1	242	PF 1	PND-ORIG FLO	2464.80	350.00	1446.00	303.10	307.85		307.88	0.000561	2.51	1284.47	1102.71	0.22
Reach-1	242	PF 1	PREDEV	2463.80	350.00	1770.00	303.10	308.00		308.04	0.000615	2.70	1459.62	1171.48	0.23
Reach-1	242	PF 1	hydro	2464.80	350.00	1400.00	303.10	307.83		307.86	0.000545	2.47	1265.44	1092.51	0.22

CALCULATIONS FOR FLOOD PLAIN AT REGIONAL POND

PROJ: BUTTERFIELD CHANNEL WITH POND

HEC-RAS Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	Cum Ch Len	Length Chnl	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(ft)	(ft)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	PF 1	PND-ORIG FLO	2114.80	138.70	1446.00	302.50	307.64	306.58	307.67	0.000655	2.73	1343.32	1315.43	0.23
Reach-1	240	PF 1	PREDEV	2113.80	138.70	1770.00	302.50	307.77	306.70	307.80	0.000754	2.98	1522.06	1537.27	0.25
Reach-1	240	PF 1	hydro	2114.80	138.70	1400.00	302.50	307.63	306.56	307.66	0.000627	2.66	1330.72	1305.87	0.23
Reach-1	235			Culvert											
Reach-1	230	PF 1	PND-ORIG FLO	1976.10	372.00	1446.00	302.10	307.56	307.44	307.66	0.004954	4.78	968.51	2181.36	0.52
Reach-1	230	PF 1	PREDEV	1975.10	372.00	1770.00	302.10	307.69	307.54	307.76	0.003746	4.29	1247.12	2288.96	0.46
Reach-1	230	PF 1	hydro	1976.10	372.00	1400.00	302.10	307.55	307.45	307.65	0.004977	4.77	942.94	2166.97	0.52
Reach-1	222	PF 1	PND-ORIG FLO	1604.10	53.70	1446.00	301.60	306.67		306.75	0.001339	3.88	1004.79	1161.13	0.34
Reach-1	222	PF 1	PREDEV	1603.10	53.70	1770.00	301.60	306.78		306.86	0.001553	4.25	1127.36	1196.48	0.36
Reach-1	222	PF 1	hydro	1604.10	53.70	1400.00	301.60	306.63		306.71	0.001417	3.96	949.41	1144.80	0.35
Reach-1	220.2	PF 1	PND-ORIG FLO	1550.40	1.00	1446.00	301.10	306.62		306.65	0.001331	3.06	1363.52	1638.53	0.23
Reach-1	220.2	PF 1	PREDEV	1549.40	1.00	1770.00	301.10	306.72		306.75	0.001437	3.21	1524.43	1674.37	0.24
Reach-1	220.2	PF 1	hydro	1550.40	1.00	1400.00	301.10	306.57		306.60	0.001510	3.23	1276.82	1626.35	0.25
Reach-1	220	PF 1	PND-ORIG FLO	1549.40	25.00	1446.00	301.10	306.62	306.18	306.65	0.001339	3.06	1360.97	1638.17	0.23
Reach-1	220	PF 1	PREDEV	1548.40	25.00	1770.00	301.10	306.72	306.26	306.75	0.001445	3.22	1521.57	1672.97	0.24
Reach-1	220	PF 1	hydro	1549.40	25.00	1400.00	301.10	306.57	306.17	306.60	0.001519	3.24	1273.95	1625.94	0.25
Reach-1	217			Culvert											
Reach-1	214	PF 1	PND-ORIG FLO	1524.40	63.00	1446.00	301.20	306.03	306.03	306.17	0.006633	6.37	839.67	1863.96	0.51
Reach-1	214	PF 1	PREDEV	1523.40	63.00	1702.00	301.20	306.07	306.07	306.22	0.007282	6.71	916.73	1911.66	0.54
Reach-1	214	PF 1	hydro	1524.40	63.00	1400.00	301.20	306.02	306.02	306.17	0.006579	6.33	821.82	1852.74	0.51
Reach-1	212	PF 1	PND-ORIG FLO	1461.40	164.90	1446.00	300.90	305.86		305.89	0.000910	2.80	1315.40	1697.35	0.26
Reach-1	212	PF 1	PREDEV	1460.40	164.90	1702.00	300.90	305.91		305.95	0.001049	3.04	1405.24	1719.65	0.28
Reach-1	212	PF 1	hydro	1461.40	164.90	1400.00	300.90	305.85		305.88	0.000881	2.75	1299.88	1692.58	0.26
Reach-1	210	PF 1	PND-ORIG FLO	1296.50	10.00	1446.00	300.90	305.74	305.11	305.76	0.000512	2.21	1540.48	1583.46	0.18
Reach-1	210	PF 1	PREDEV	1295.50	10.00	1702.00	300.90	305.76	305.18	305.79	0.000666	2.53	1575.86	1596.81	0.20
Reach-1	210	PF 1	hydro	1296.50	10.00	1400.00	300.90	305.74	305.10	305.75	0.000485	2.15	1534.79	1581.30	0.17
Reach-1	209			Culvert											
Reach-1	208	PF 1	PND-ORIG FLO	1286.50	333.00	1446.00	300.90	305.73		305.75	0.000527	2.24	1525.29	1577.70	0.18
Reach-1	208	PF 1	PREDEV	1285.50	333.00	1702.00	300.90	305.75		305.78	0.000681	2.55	1563.94	1592.33	0.20
Reach-1	208	PF 1	hydro	1286.50	333.00	1400.00	300.90	305.73		305.74	0.000500	2.18	1518.84	1575.24	0.17
Reach-1	206	PF 1	PND-ORIG FLO	953.50	365.40	1446.00	299.50	305.68		305.68	0.000095	0.96	2757.18	1719.50	0.09
Reach-1	206	PF 1	PREDEV	952.50	365.40	1702.00	299.50	305.68		305.69	0.000131	1.13	2767.35	1719.53	0.10
Reach-1	206	PF 1	hydro	953.50	365.40	1400.00	299.50	305.68		305.68	0.000090	0.93	2755.44	1719.50	0.08
Reach-1	204	PF 1	PND-ORIG FLO	588.10	223.50	1446.00	298.80	305.66		305.67	0.000026	0.70	3610.07	1234.35	0.05
Reach-1	204	PF 1	PREDEV	587.10	223.50	1702.00	298.80	305.66		305.67	0.000036	0.82	3610.41	1234.35	0.06
Reach-1	204	PF 1	hydro	588.10	223.50	1400.00	298.80	305.66		305.67	0.000024	0.67	3610.00	1234.35	0.05
Reach-1	202	PF 1	PND-ORIG FLO	364.60	63.60	1080.00	297.30	305.66		305.66	0.000014	0.56	3076.12	874.11	0.04
Reach-1	202	PF 1	PREDEV	363.60	63.60	1080.00	297.30	305.66		305.66	0.000014	0.56	3076.14	874.11	0.04

CALCULATIONS FOR FLOOD PLAIN AT REGIONAL POND

PROJ: BUTTERFIELD CHANNEL WITH POND

HEC-RAS Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	Cum Ch Len	Length Chnl	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(ft)	(ft)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	202	PF 1	hydro	364.60	63.60	1080.00	297.30	305.66		305.66	0.000014	0.56	3076.12	874.11	0.04
Reach-1	200	PF 1	PND ORIG FLO	301.00	300.00	1080.00	296.90	305.66	300.04	305.66	0.000007	0.46	5282.11	1964.79	0.03
Reach-1	200	PF 1	PREDEV	300.00	300.00	1080.00	296.90	305.66	300.04	305.66	0.000007	0.46	5282.17	1964.79	0.03
Reach-1	200	PF 1	hydro	301.00	300.00	1080.00	296.90	305.66	300.04	305.66	0.000007	0.46	5282.11	1964.79	0.03
Reach-1	199			Culvert											
Reach-1	198	PF 1	PND ORIG FLO	1.00	1.00	1080.00	296.10	305.20		305.21	0.000029	0.96	2091.02	573.70	0.06
Reach-1	198	PF 1	PREDEV			1080.00	296.10	305.20	299.24	305.21	0.000029	0.96	2091.00	573.70	0.06
Reach-1	198	PF 1	hydro	1.00	1.00	1080.00	296.10	305.20		305.21	0.000029	0.96	2091.02	573.70	0.06
Reach-1	197	PF 1	PND ORIG FLO			1080.00	296.10	305.20	299.24	305.21	0.000029	0.96	2091.00	573.70	0.06
Reach-1	197	PF 1	hydro			1080.00	296.10	305.20	299.24	305.21	0.000029	0.96	2091.00	573.70	0.06

Section 3
Rating Curves

3a. Butterfield Channel

3b. Split Flow at Monterey Road Culvert

3c. Split Flow at UPRR Culvert

Table
Rating Table for Trapezoidal Channel

Project Description	
Worksheet	BUTTERFIELD Cha
Flow Element	Trapezoidal Channe
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coeffic	0.035	
Depth	6.00	ft
Left Side Slope	2.00	V : H
Right Side Slope	2.00	V : H

Attribute	Minimum	Maximum	Increment
Slope (ft/ft)	0.001500	0.003500	0.000500
Bottom Width (ft)	10.00	30.00	2.00

Slope (ft/ft)	Bottom Width (ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.001500	10.00	286.06	3.67	78.0	23.42	16.00
0.002000	10.00	330.31	4.23	78.0	23.42	16.00
0.002500	10.00	369.30	4.73	78.0	23.42	16.00
0.003000	10.00	404.54	5.19	78.0	23.42	16.00
0.003500	10.00	436.96	5.60	78.0	23.42	16.00
0.001500	12.00	343.80	3.82	90.0	25.42	18.00
0.002000	12.00	396.98	4.41	90.0	25.42	18.00
0.002500	12.00	443.84	4.93	90.0	25.42	18.00
0.003000	12.00	486.20	5.40	90.0	25.42	18.00
0.003500	12.00	525.16	5.84	90.0	25.42	18.00
0.001500	14.00	402.69	3.95	102.0	27.42	20.00
0.002000	14.00	464.98	4.56	102.0	27.42	20.00
0.002500	14.00	519.86	5.10	102.0	27.42	20.00
0.003000	14.00	569.48	5.58	102.0	27.42	20.00
0.003500	14.00	615.11	6.03	102.0	27.42	20.00
0.001500	16.00	462.47	4.06	114.0	29.42	22.00
0.002000	16.00	534.02	4.68	114.0	29.42	22.00
0.002500	16.00	597.05	5.24	114.0	29.42	22.00
0.003000	16.00	654.04	5.74	114.0	29.42	22.00
0.003500	16.00	706.44	6.20	114.0	29.42	22.00
0.001500	18.00	522.98	4.15	126.0	31.42	24.00
0.002000	18.00	603.89	4.79	126.0	31.42	24.00
0.002500	18.00	675.17	5.36	126.0	31.42	24.00
0.003000	18.00	739.61	5.87	126.0	31.42	24.00
0.003500	18.00	798.87	6.34	126.0	31.42	24.00
0.001500	20.00	584.07	4.23	138.0	33.42	26.00
0.002000	20.00	674.43	4.89	138.0	33.42	26.00
0.002500	20.00	754.03	5.46	138.0	33.42	26.00
0.003000	20.00	826.00	5.99	138.0	33.42	26.00
0.003500	20.00	892.18	6.47	138.0	33.42	26.00
0.001500	22.00	645.64	4.30	150.0	35.42	28.00
0.002000	22.00	745.52	4.97	150.0	35.42	28.00
0.002500	22.00	833.51	5.56	150.0	35.42	28.00
0.003000	22.00	913.07	6.09	150.0	35.42	28.00
0.003500	22.00	986.23	6.57	150.0	35.42	28.00

Table
Rating Table for Trapezoidal Channel

Slope (ft/ft)	Bottom Width (ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)
0.001500	24.00	707.60	4.37	162.0	37.42	30.00
0.002000	24.00	817.07	5.04	162.0	37.42	30.00
0.002500	24.00	913.51	5.64	162.0	37.42	30.00
0.003000	24.00	1,000.70	6.18	162.0	37.42	30.00
0.003500	24.00	1,080.88	6.67	162.0	37.42	30.00
0.001500	26.00	769.90	4.42	174.0	39.42	32.00
0.002000	26.00	889.01	5.11	174.0	39.42	32.00
0.002500	26.00	993.94	5.71	174.0	39.42	32.00
0.003000	26.00	1,088.81	6.26	174.0	39.42	32.00
0.003500	26.00	1,176.05	6.76	174.0	39.42	32.00
0.001500	28.00	832.49	4.48	186.0	41.42	34.00
0.002000	28.00	961.28	5.17	186.0	41.42	34.00
0.002500	28.00	1,074.74	5.78	186.0	41.42	34.00
0.003000	28.00	1,177.32	6.33	186.0	41.42	34.00
0.003500	28.00	1,271.65	6.84	186.0	41.42	34.00
0.001500	30.00	895.32	4.52	198.0	43.42	36.00
0.002000	30.00	1,033.83	5.22	198.0	43.42	36.00
0.002500	30.00	1,155.85	5.84	198.0	43.42	36.00
0.003000	30.00	1,266.18	6.39	198.0	43.42	36.00
0.003500	30.00	1,367.63	6.91	198.0	43.42	36.00

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Thursday, Oct 22 2009

BUTTERFIELD CHANNEL

Circular

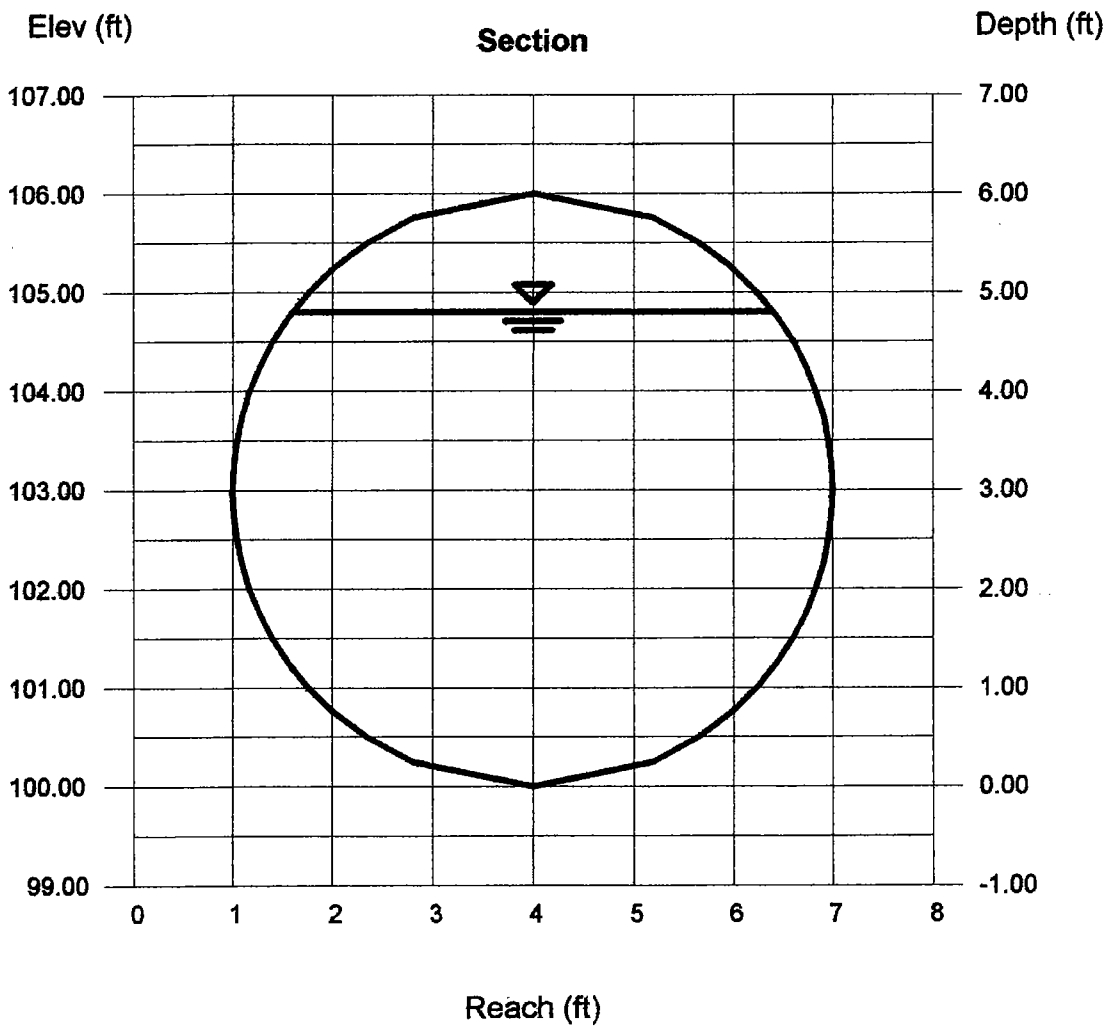
Diameter (ft)	= 6.00
Invert Elev (ft)	= 100.00
Slope (%)	= 0.20
N-Value	= 0.013

Calculations

Compute by:	Q vs Depth
No. Increments	= 10

Highlighted

Depth (ft)	= 4.80
Q (cfs)	= 185.23
Area (sqft)	= 24.26
Velocity (ft/s)	= 7.64
Wetted Perim (ft)	= 13.29
Crit Depth, Yc (ft)	= 3.42
Top Width (ft)	= 4.80
EGL (ft)	= 5.71



Depth	Q	Area	Veloc	Wp	Yc	TopWidth	Energy
(ft)	(cfs)	(sqft)	(ft/s)	(ft)	(ft)	(ft)	(ft)
0.60	3.990	1.481	2.69	3.87	0.01	3.61	0.71
1.20	16.77	4.057	4.13	5.58	0.52	4.81	1.47
1.80	37.17	7.145	5.20	6.96	1.07	5.50	2.22
2.40	63.91	10.57	6.05	8.22	1.60	5.88	2.97
3.00	95.39	14.21	6.71	9.45	2.13	6.00	3.70
3.60	127.7	17.76	7.19	10.65	2.63	5.88	4.40
4.20	159.0	21.18	7.51	11.91	3.06	5.49	5.08
4.80	185.2	24.26	7.64	13.29	3.42	4.80	5.71
5.40	202.0	26.82	7.53	15.00	3.72	3.59	6.28
6.00	189.4	28.27	6.70	18.85	3.89	0.00	6.70

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Sunday, Nov 1 2009

BUTTERFIELD CHANNEL W/ 10' BOTTOM S=.0028

Trapezoidal

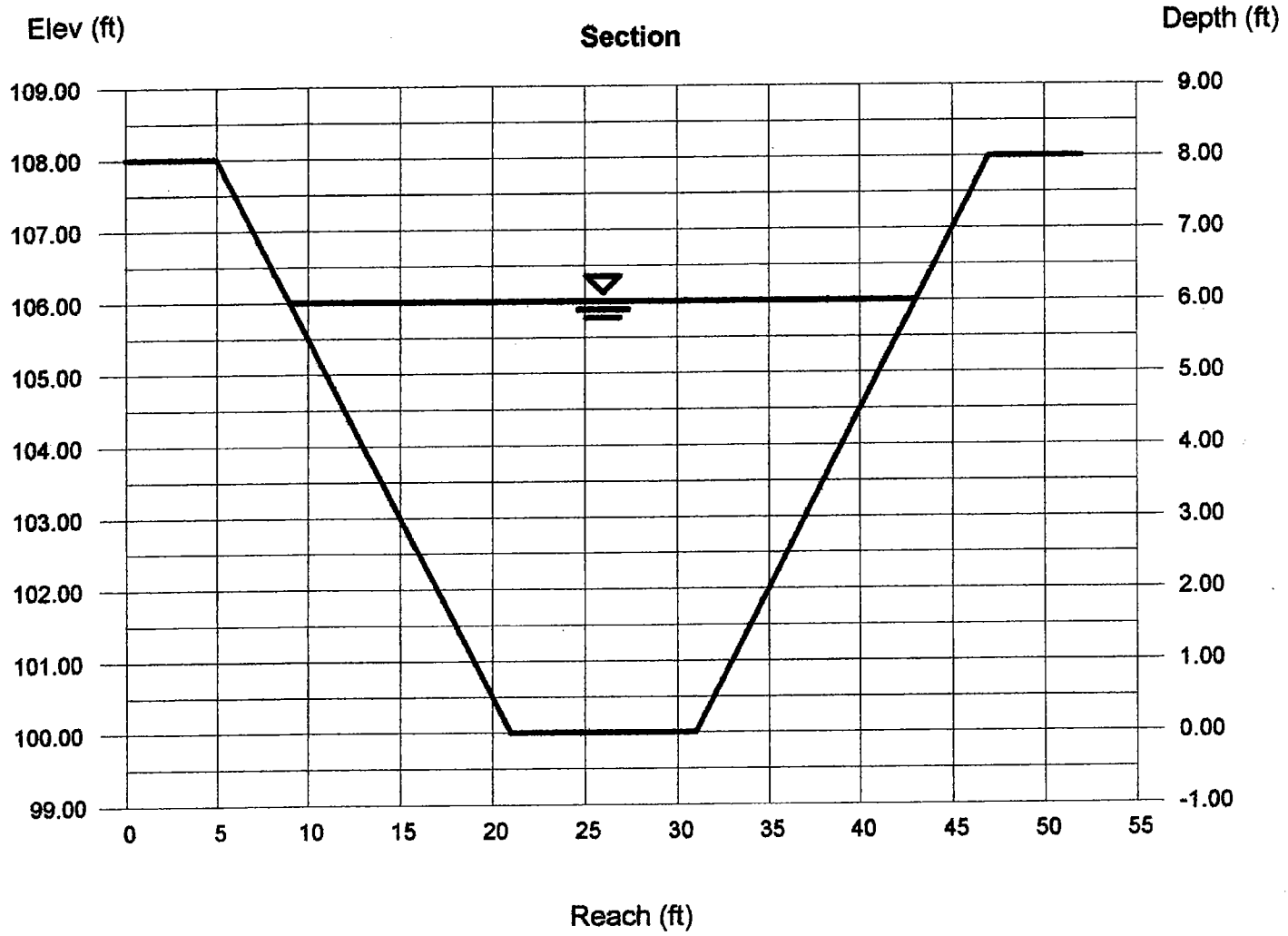
Bottom Width (ft)	=	10.00
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	8.00
Invert Elev (ft)	=	100.00
Slope (%)	=	0.28
N-Value	=	0.035

Calculations

Compute by:		Q vs Depth
No. Increments	=	8

Highlighted

Depth (ft)	=	6.00
Q (cfs)	=	694.78
Area (sqft)	=	132.00
Velocity (ft/s)	=	5.26
Wetted Perim (ft)	=	36.83
Crit Depth, Yc (ft)	=	3.30
Top Width (ft)	=	34.00
EGL (ft)	=	6.43



Depth	Q	Area	Veloc	Wp	Yc	TopWidth	Energy
(ft)	(cfs)	(sqft)	(ft/s)	(ft)	(ft)	(ft)	(ft)
1.00	23.79	12.00	1.98	14.47	0.01	14.00	1.06
2.00	81.63	28.00	2.92	18.94	0.54	18.00	2.13
3.00	174.1	48.00	3.63	23.42	1.18	22.00	3.20
4.00	304.5	72.00	4.23	27.89	1.86	26.00	4.28
5.00	476.8	100.0	4.77	32.36	2.57	30.00	5.35
6.00	694.8	132.0	5.26	36.83	3.30	34.00	6.43
7.00	962.2	168.0	5.73	41.30	4.05	38.00	7.51
8.00	1,283	208.0	6.17	45.78	4.82	42.00	8.59

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Sunday, Nov 1 2009

BUTTERFIELD CHANNEL W/ 10' BOTTOM S=.0015

Trapezoidal

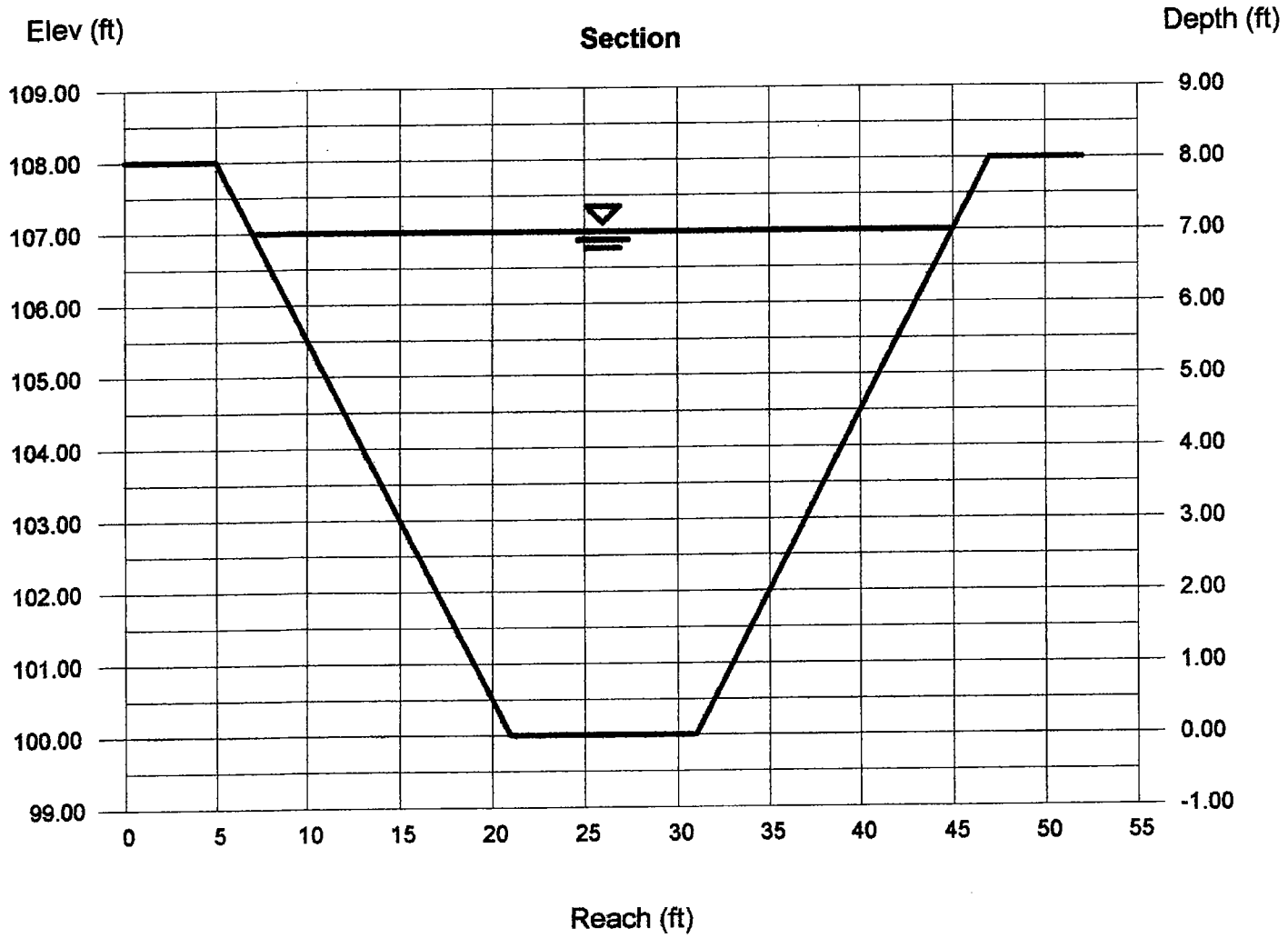
Bottom Width (ft)	=	10.00
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	8.00
Invert Elev (ft)	=	100.00
Slope (%)	=	0.15
N-Value	=	0.035

Calculations

Compute by:		Q vs Depth
No. Increments	=	8

Highlighted

Depth (ft)	=	7.00
Q (cfs)	=	704.23
Area (sqft)	=	168.00
Velocity (ft/s)	=	4.19
Wetted Perim (ft)	=	41.30
Crit Depth, Yc (ft)	=	3.42
Top Width (ft)	=	38.00
EGL (ft)	=	7.27



Depth	Q	Area	Veloc	Wp	Yc	TopWidth	Energy
(ft)	(cfs)	(sqft)	(ft/s)	(ft)	(ft)	(ft)	(ft)
1.00	17.41	12.00	1.45	14.47	0.01	14.00	1.03
2.00	59.75	28.00	2.13	18.94	0.45	18.00	2.07
3.00	127.4	48.00	2.65	23.42	0.97	22.00	3.11
4.00	222.9	72.00	3.10	27.89	1.54	26.00	4.15
5.00	349.0	100.0	3.49	32.36	2.15	30.00	5.19
6.00	508.5	132.0	3.85	36.83	2.78	34.00	6.23
7.00	704.2	168.0	4.19	41.30	3.42	38.00	7.27
8.00	938.8	208.0	4.51	45.78	4.08	42.00	8.32

Hydraflow Express - BUTTERFIELD CHANNEL W/ 10' BOTTOM S=.0015 - 11/1/09

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Sunday, Nov 1 2009

BUTTERFIELD CHANNEL W/ 22' BOTTOM S=.0015

Trapezoidal

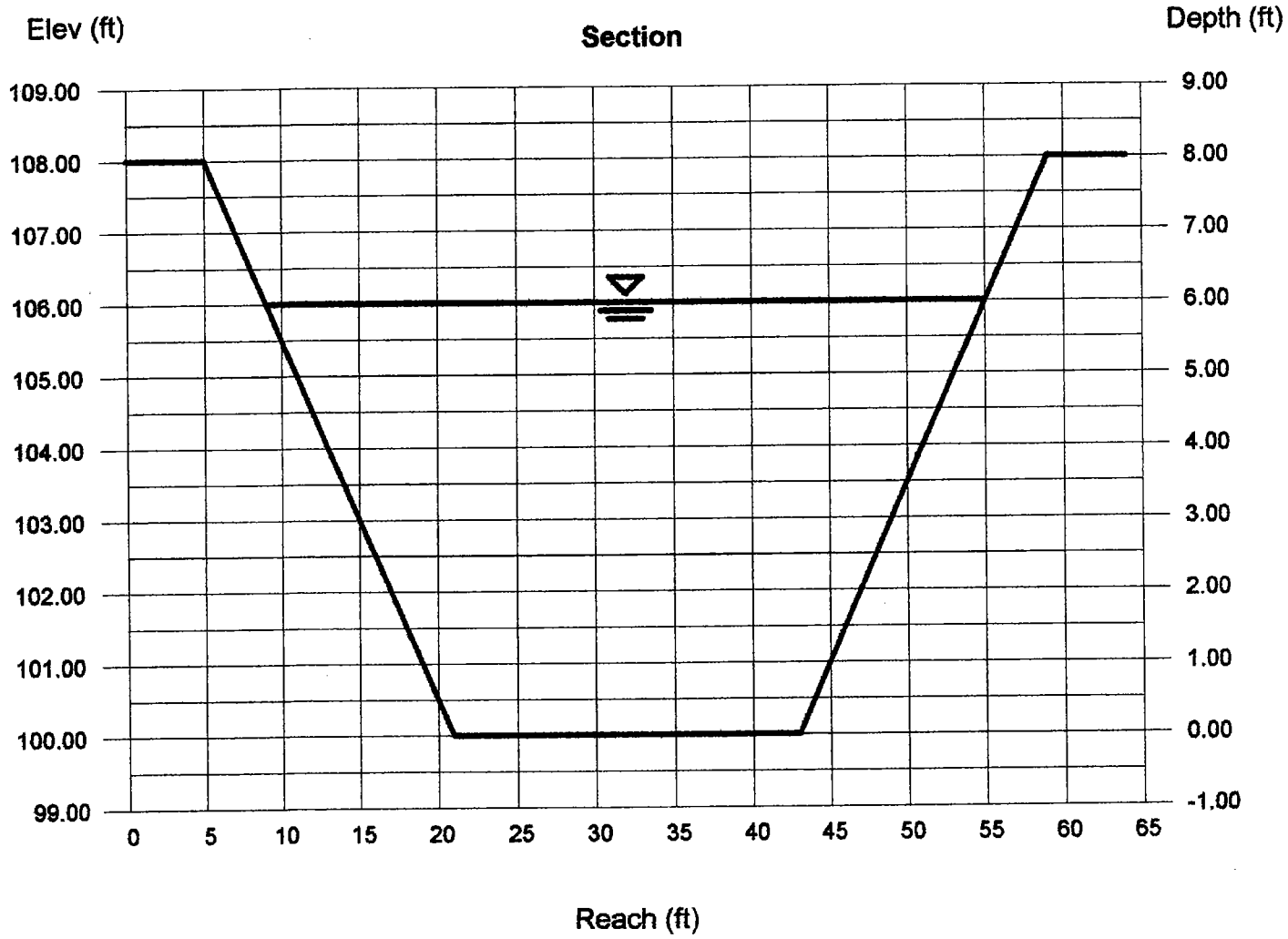
Bottom Width (ft)	= 22.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 8.00
Invert Elev (ft)	= 100.00
Slope (%)	= 0.15
N-Value	= 0.035

Calculations

Compute by:	Q vs Depth
No. Increments	= 8

Highlighted

Depth (ft)	= 6.00
Q (cfs)	= 870.52
Area (sqft)	= 204.00
Velocity (ft/s)	= 4.27
Wetted Perim (ft)	= 48.83
Crit Depth, Yc (ft)	= 2.68
Top Width (ft)	= 46.00
EGL (ft)	= 6.28



Depth	Q	Area	Veloc	Wp	Yc	TopWidth	Energy
(ft)	(cfs)	(sqft)	(ft/s)	(ft)	(ft)	(ft)	(ft)
1.00	36.97	24.00	1.54	26.47	0.01	26.00	1.04
2.00	120.9	52.00	2.32	30.94	0.44	30.00	2.08
3.00	245.7	84.00	2.93	35.42	0.96	34.00	3.13
4.00	411.4	120.0	3.43	39.89	1.50	38.00	4.18
5.00	619.0	160.0	3.87	44.36	2.08	42.00	5.23
6.00	870.5	204.0	4.27	48.83	2.68	46.00	6.28
7.00	1,168	252.0	4.63	53.30	3.29	50.00	7.33
8.00	1,513	304.0	4.98	57.78	3.92	54.00	8.39

Hydraflow Express - BUTTERFIELD CHANNEL W/ 22' BOTTOM S=.0015 - 11/1/09

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Saturday, Oct 31 2009

BUTTERFIELD CHANNEL-RS 104-30' BOTTOM

Trapezoidal

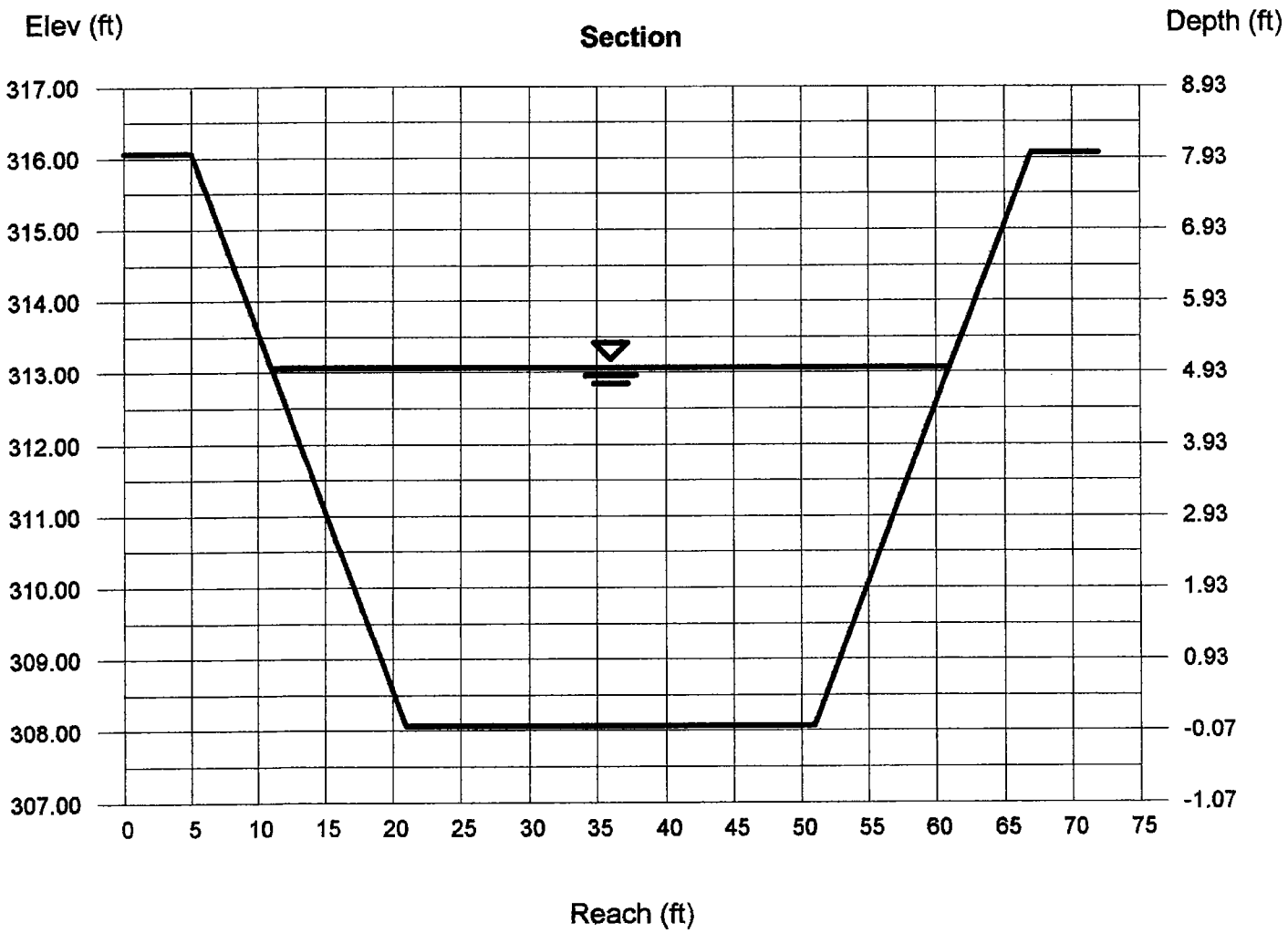
Bottom Width (ft)	=	30.00
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	8.00
Invert Elev (ft)	=	308.07
Slope (%)	=	0.15
N-Value	=	0.035

Calculations

Compute by:		Q vs Depth
No. Increments	=	8

Highlighted

Depth (ft)	=	5.00
Q (cfs)	=	803.96
Area (sqft)	=	200.00
Velocity (ft/s)	=	4.02
Wetted Perim (ft)	=	52.36
Crit Depth, Yc (ft)	=	2.06
Top Width (ft)	=	50.00
EGL (ft)	=	5.25



Depth	Q	Area	Veloc	Wp	Yc	TopWidth	Energy
(ft)	(cfs)	(sqft)	(ft/s)	(ft)	(ft)	(ft)	(ft)
1.00	50.07	32.00	1.56	34.47	0.01	34.00	1.04
2.00	162.2	68.00	2.38	38.94	0.44	38.00	2.09
3.00	326.1	108.0	3.02	43.42	0.95	42.00	3.14
4.00	540.0	152.0	3.55	47.89	1.50	46.00	4.20
5.00	804.0	200.0	4.02	52.36	2.06	50.00	5.25
6.00	1,119	252.0	4.44	56.83	2.65	54.00	6.31
7.00	1,486	308.0	4.83	61.30	3.26	58.00	7.36
8.00	1,908	368.0	5.19	65.78	3.88	62.00	8.42

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Saturday, Oct 31 2009

BUTTERFIELD CHANNEL-RS 104-30' BOTTOM

Trapezoidal

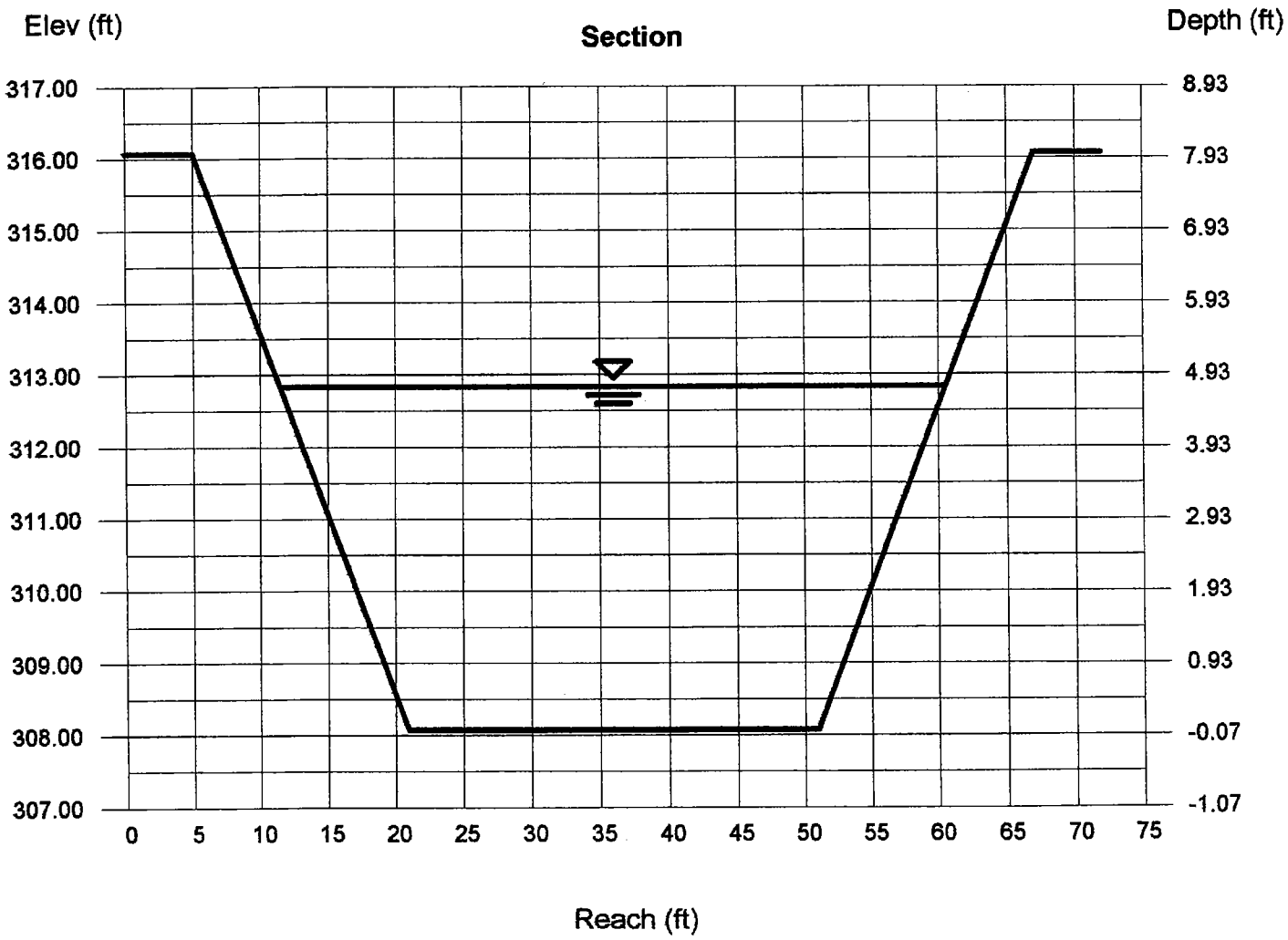
Bottom Width (ft)	= 30.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 8.00
Invert Elev (ft)	= 308.07
Slope (%)	= ~~0.15~~ 1.0
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 735.00

Highlighted

Depth (ft)	= 4.76
Q (cfs)	= 735.00
Area (sqft)	= 188.12
Velocity (ft/s)	= 3.91
Wetted Perim (ft)	= 51.29
Crit Depth, Yc (ft)	= 2.51
Top Width (ft)	= 49.04
EGL (ft)	= 5.00



12/9/09

Culvert Report

SPLIT FLOW @ MONTEREY CULVERT

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc.

D/S WATSONVILLE

Wednesday, Dec 9 2009

MONTEREY ROAD EX. DBL 10' X 4' RCBC

Invert Elev Dn (ft)	=	310.90
Pipe Length (ft)	=	63.00
Slope (%)	=	0.48
Invert Elev Up (ft)	=	311.20
Rise (in)	=	48.0
Shape	=	Box
Span (in)	=	120.0
No. Barrels	=	2
n-Value	=	0.012
Inlet Edge	=	Sq Edge
Coeff. K,M,c,Y,k	=	0.061, 0.75, 0.04, 0.8, 0.5

Embankment

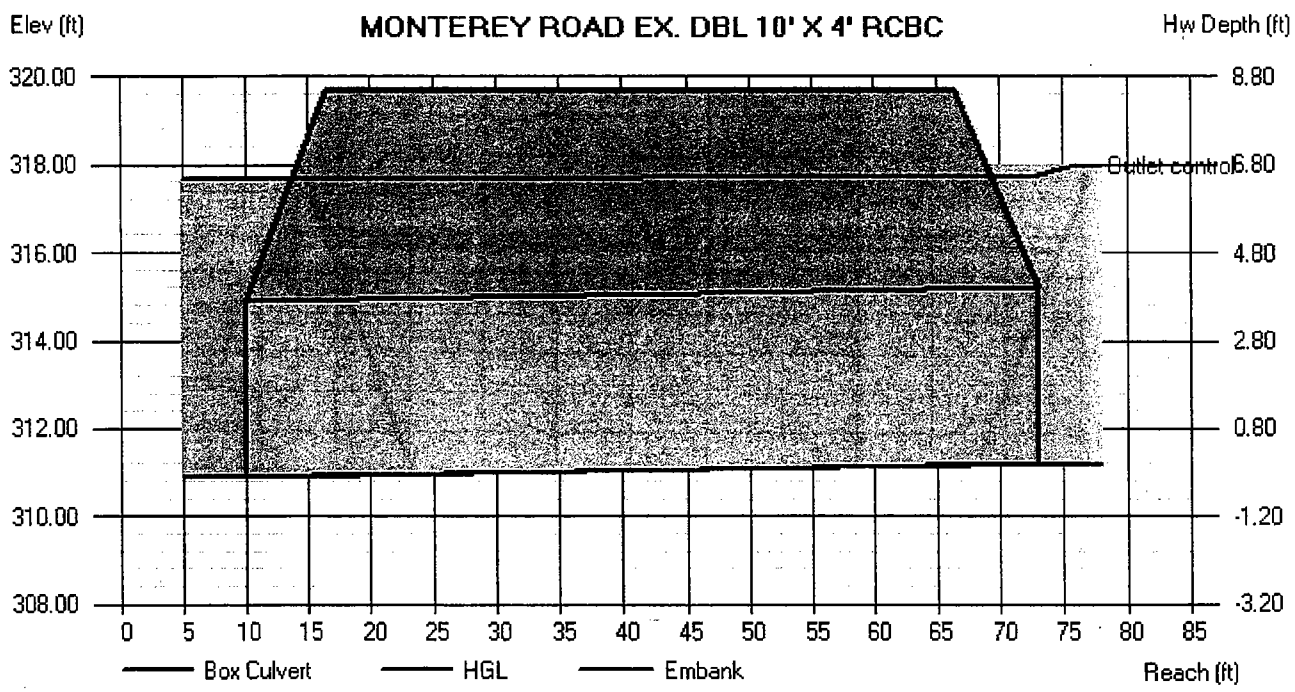
Top Elevation (ft)	=	319.70
Top Width (ft)	=	50.00
Crest Width (ft)	=	500.00

Calculations

Qmin (cfs)	=	400.00
Qmax (cfs)	=	2000.00
Tailwater Elev (ft)	=	317.68

Highlighted

Qtotal (cfs)	=	400.00
Qpipe (cfs)	=	400.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.00
Veloc Up (ft/s)	=	5.00
HGL Dn (ft)	=	317.68
HGL Up (ft)	=	317.74
Hw Elev (ft)	=	317.94
Hw/D (ft)	=	1.68
Flow Regime	=	Outlet Control



Q			Veloc		Depth		HGL			
Total	Pipe	Over	Dn	Up	Dn	Up	Dn	Up	Hw	Hw/D
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)	
400.00	400.00	0.00	5.00	5.00	48.00	48.00	317.68	317.74	317.94	1.68
600.00	600.00	0.00	7.50	7.50	48.00	48.00	317.68	317.82	318.26	1.77
800.00	800.00	0.00	10.00	10.00	48.00	48.00	317.68	317.94	318.71	1.88
1000.00	931.82	68.18	11.65	11.65	48.00	48.00	317.68	317.68	319.82	2.15
1200.00	945.99	254.01	11.82	11.82	48.00	48.00	317.68	317.68	319.98	2.20
1400.00	956.65	443.35	11.96	11.96	48.00	48.00	317.68	317.68	320.11	2.23
1600.00	966.57	633.43	12.08	12.08	48.00	48.00	317.68	317.68	320.23	2.26
1800.00	974.17	825.83	12.18	12.18	48.00	48.00	317.68	317.68	320.32	2.28
2000.00	985.82	1014.18	12.32	12.32	48.00	48.00	317.68	317.68	320.46	2.32

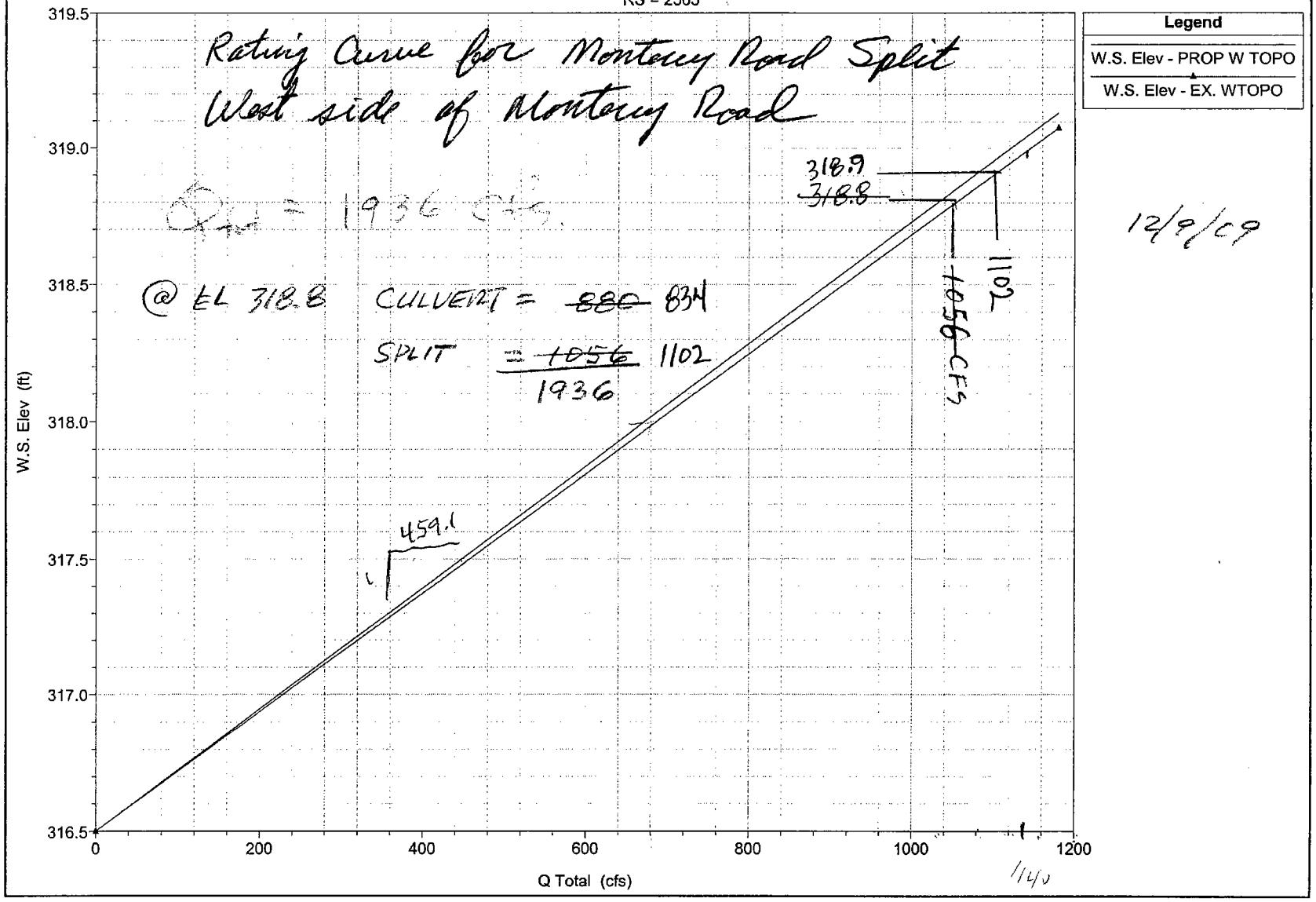
34/0

318.9

319.15

MHE FLOODWAY STUDY- WESTSIDE OF MONTEREY Plan: 1) PROP W TOPO 10/7/2009 2) EX. WTOPO 10/7/2009

RS = 2565



12/9/09

1/4/0

Culvert Report

SPLIT FLOW CALCULATION @ SPRR CULVERT

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Oct 7 2009

SPRR CULVERT 13X5.4

Invert Elev Dn (ft)	=	306.90
Pipe Length (ft)	=	14.00
Slope (%)	=	0.14
Invert Elev Up (ft)	=	306.92
Rise (in)	=	65.0
Shape	=	Box
Span (in)	=	132.0
No. Barrels	=	1
n-Value	=	0.012
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0145, 1.75, 0.0419, 0.64, 0.5

Embankment

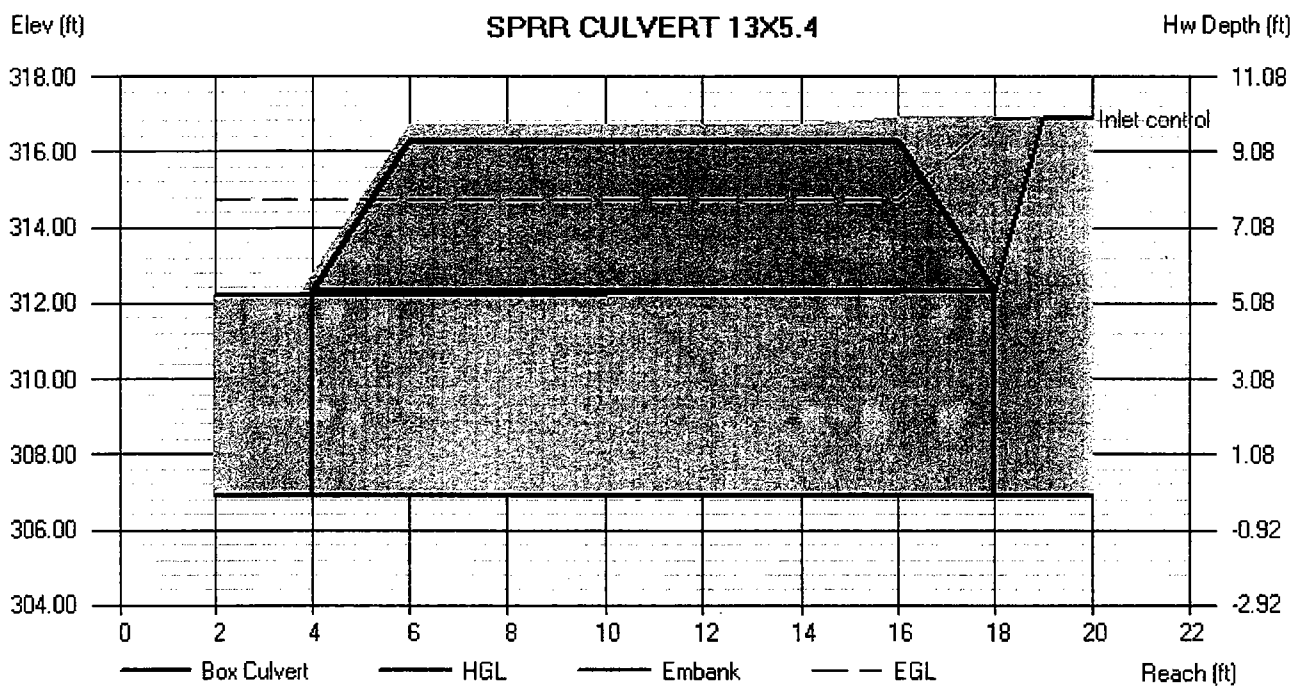
Top Elevation (ft)	=	316.30
Top Width (ft)	=	10.00
Crest Width (ft)	=	200.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	1000.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	1000.00
Qpipe (cfs)	=	741.06
Qovertop (cfs)	=	258.94
Veloc Dn (ft/s)	=	12.69
Veloc Up (ft/s)	=	12.46
HGL Dn (ft)	=	312.21
HGL Up (ft)	=	312.33
Hw Elev (ft)	=	316.86
Hw/D (ft)	=	1.84
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Oct 7 2009

SPRR CULVERT 13X5.4

Invert Elev Dn (ft)	=	306.90
Pipe Length (ft)	=	14.00
Slope (%)	=	0.14
Invert Elev Up (ft)	=	306.92
Rise (in)	=	65.0
Shape	=	Box
Span (in)	=	132.0
No. Barrels	=	1
n-Value	=	0.012
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0145, 1.75, 0.0419, 0.64, 0.5

Embankment

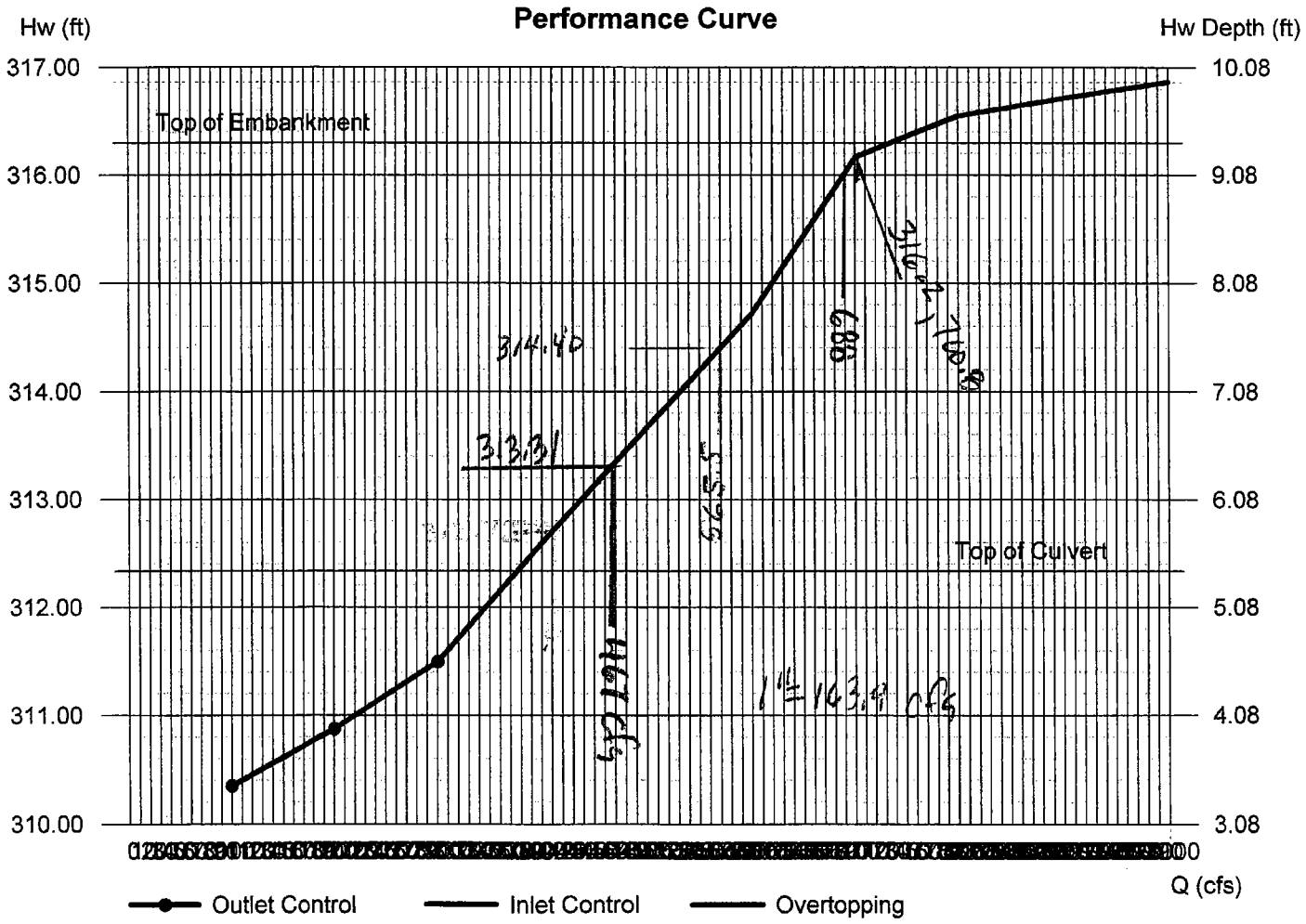
Top Elevation (ft)	=	316.30
Top Width (ft)	=	10.00
Crest Width (ft)	=	200.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	1000.00
Tailwater Elev (ft)	=	(dc+D)/2

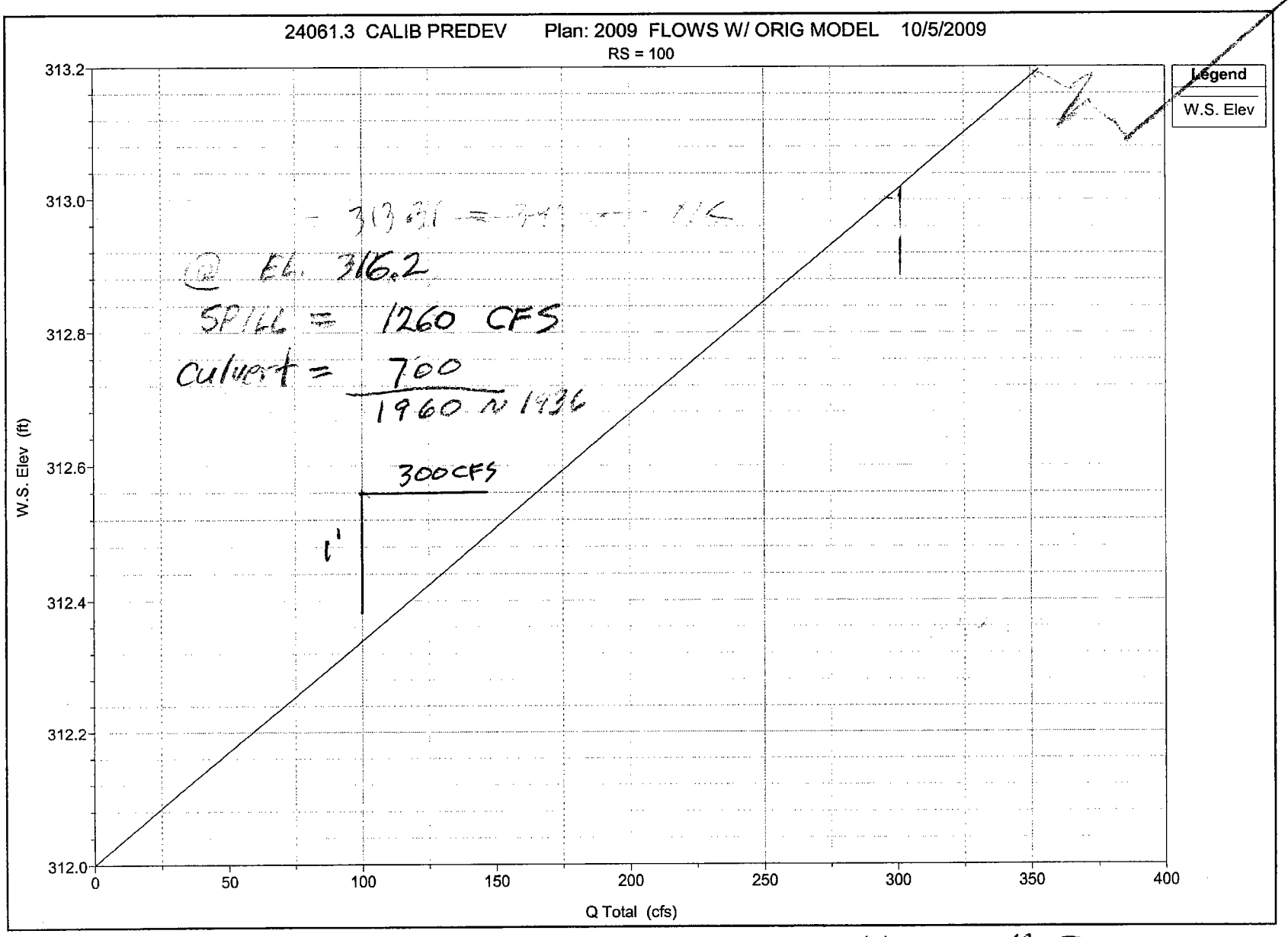
Highlighted

Qtotal (cfs)	=	1000.00
Qpipe (cfs)	=	741.06
Qovertop (cfs)	=	258.94
Veloc Dn (ft/s)	=	12.69
Veloc Up (ft/s)	=	12.46
HGL Dn (ft)	=	312.21
HGL Up (ft)	=	312.33
Hw Elev (ft)	=	316.86
Hw/D (ft)	=	1.84
Flow Regime	=	Inlet Control



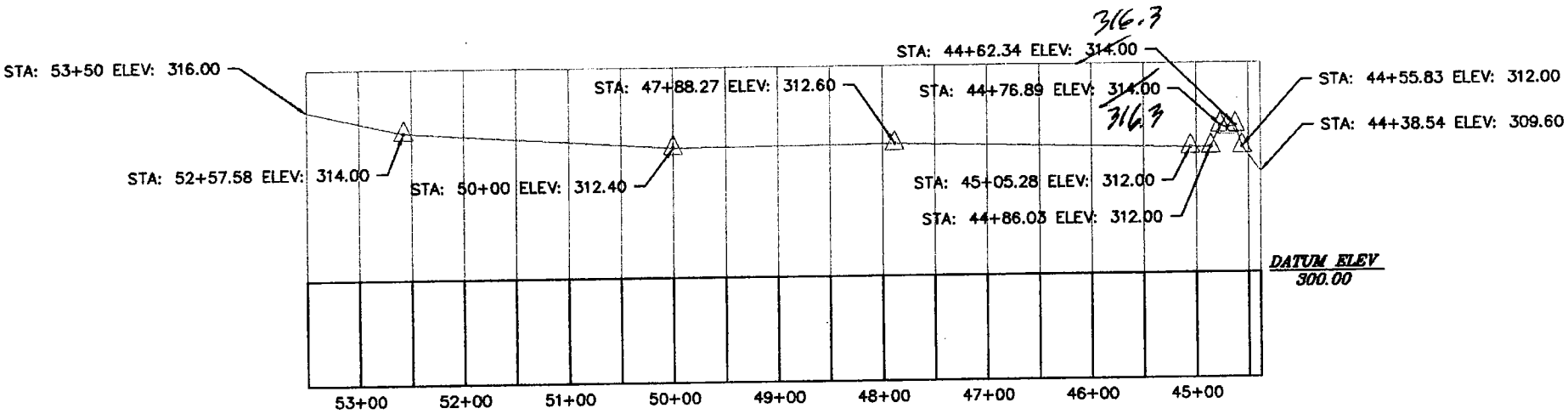
LAT. WEIR FOR SPILL [illegible]

316.3



1290 CFS

FLOW BETWEEN SPRR AND MONTEREY ROAD



SPRR LAT WEIR

Lat weir 264.8 Upst. dist = 20'

APPENDIX "D"

25% Improvement Plans (sheets pertaining to drainage only)

Improvement Plans for Butterfield Boulevard South Extension

VICINITY MAP: SCALE: NONE

INDEX OF SHEETS:

SHEET NO.	DESCRIPTION
01	TITLE SHEET
02	GENERAL NOTE, GRADING NOTES & TYPICAL SECTIONS
03	SITE TOPO / DEMOLITION PLAN STA. 155+00 TO 170+00
04	SITE TOPO / DEMOLITION PLAN STA. 170+00 TO 182+00
05	SITE TOPO / DEMOLITION PLAN STA. 182+00 TO 207+00
06	HORIZONTAL CONTROL BUTTERFIELD STA. 156+00 TO 170+00
07	HORIZONTAL CONTROL BUTTERFIELD STA. 170+00 TO 182+00
08	HORIZONTAL CONTROL BUTTERFIELD STA. 182+00 TO 207+00
09	PLAN/PROFILE BUTTERFIELD BLVD. STA. 155+00 TO 166+00
10	PLAN/PROFILE BUTTERFIELD BLVD. STA. 166+00 TO 174+00
11	PLAN/PROFILE BUTTERFIELD BLVD. STA. 174+00 TO 186+00
12	PLAN/PROFILE BUTTERFIELD BLVD. STA. 186+00 TO 198+00
13	PLAN/PROFILE BUTTERFIELD BLVD. STA. 198+00 TO 207+00
14	PLAN/PROFILE FISHER AVENUE REALIGNMENT
15	PLAN/PROFILE MONTEREY ROAD
16	SEWER & WATER PLAN/PROFILE – FISHER AVENUE
17	SEWER & WATER PLAN/PROFILE – BUTTERFIELD BLVD
18	UTILITY BORE AND JACK AT U.P.R.R.
19	PLAN/PROFILE BUTTERFIELD CHANNEL STA. 8+50 TO 21+00
20	PLAN/PROFILE BUTTERFIELD CHANNEL STA. 21+00 TO 34+00
21	PLAN/PROFILE BUTTERFIELD CHANNEL STA. 34+00 TO 45+00
22	PLAN/PROFILE BUTTERFIELD CHANNEL STA. 45+00 TO 58+00
23	PLAN/PROFILE BUTTERFIELD CHANNEL STA. 58+00 TO 67+00
24	FISHER AVENUE CULVERT CROSSING PLAN
25	MAPLE AVENUE CULVERT CROSSING PLAN
26	WATSONVILLE & MONTEREY ROAD CULVERT CROSSING PLAN
27	GRADING PLAN– REGIONAL DETENTION BASIN
28	GRADING SECTIONS– REGIONAL DETENTION BASIN
29	STREET CROSS SECTIONS STA. 157+50 – 169+50
30	STREET CROSS SECTIONS STA. 170+00 – 175+50
31	STREET CROSS SECTIONS STA. 176+00 – 178+50
32	STREET CROSS SECTIONS STA. 182+00 – 187+00
33	STREET CROSS SECTIONS STA. 187+50 – 196+00

REVIEWED BY:

MARK THOMAS & COMPANY, INC.
Providing Engineering, Surveying and Mapping Services

SIGNATURE DATE

25% SUBMITTAL
NOT FOR CONSTRUCTION

REGISTERED PROFESSIONAL ENGINEER
No. 049717
EXP. 9-30-10
CIVIL
STATE OF CALIFORNIA

NO.	DESCRIPTION	DATE	BY

REVISIONS

WORK ACCEPTED: INSPECTOR:
AS-BUILT CORRECTIONS
BY: DATE:

City of Morgan Hill
Public Works Department
17575 PEAK AVE. MORGAN HILL, CA 95037
(408) 776-6400 FAX (408) 779-7236

DRAWN: TH DESIGN: HKS
CHECKED: DATE: VERIFY:
APPROVED: DATE: JOB NO. 24061.3

SUPERVISED BY: WARNER SINGH REGISTERED CIVIL ENGINEER WCE 43717 EXP. DATE: 9-30-10

MH engineering Co.
SUBDIVISIONS – LAND PLANNING – LAND SURVEYS
16075 VINEYARD BOULEVARD MORGAN HILL, CA 95037
(408) 779-7381 FAX: (408) 226-5712

COVER SHEET
IMPROVEMENT PLANS FOR
BUTTERFIELD BLVD SOUTH EXTENSION
MORGAN HILL CALIFORNIA

QTY. FILE NO.
PLAN SET 12/09
DRAWING 01 OF 35

COVER SHEET
BUTTERFIELD BLVD. SOUTH EXTENSION

L:\Projects\2002\240613\dwg\240613-501-502- Cover Sheet, Sections, Details.dwg 12/22/2009 2:57:02 PM PST
Xref: 240613-3D

GENERAL NOTES:

1. TEMPORARY BENCH MARK - BASED ON A CITY APPROVED BENCHMARK AS SHOWN ON THESE PLANS.
2. ALL EXISTING ELEVATIONS SHALL BE FIELD VERIFIED BY CONTRACTOR UNLESS OTHERWISE NOTED.
3. ALL SURVEY MONUMENTS SHALL BE INSTALLED AT LOCATIONS SHOWN ON THE CORRESPONDING FINAL MAP BEFORE ACCEPTANCE OF THE SUBDIVISION.
4. CONTRACTOR SHALL NOT DESTROY EXISTING PERMANENT SURVEY MONUMENTS.
5. ALL WORK SHALL CONFORM TO THE LATEST EDITION OF THE CITY OF MORGAN HILL STANDARD DETAILS FOR CONSTRUCTION WHICH ARE HEREBY MADE A PART OF THESE PLANS. DEVIATIONS FROM THE STANDARD DETAILS MUST BE APPROVED BY THE CITY ENGINEER.
6. DEVELOPER SHALL ARRANGE FOR A PRE-CONSTRUCTION MEETING WITH THE CITY ENGINEER (MUNICIPAL CODE 17.32.250b) PRIOR TO COMMENCING ANY CONSTRUCTION. AN ENCROACHMENT PERMIT SHALL BE OBTAINED FROM THE PUBLIC WORKS DEPARTMENT UPON COMPLETION OF SAID MEETING AND PRIOR TO CONSTRUCTION OF ANY IMPROVEMENTS WITHIN AN EXISTING OR OFFERED FOR DEDICATION RIGHT-OF-WAY, PUBLIC UTILITY EASEMENT OR PUBLIC SERVICE EASEMENT.
7. A GRADING PERMIT SHALL BE OBTAINED FROM THE CITY OF MORGAN HILL BUILDING DIVISION PRIOR TO ANY GRADING OF BUILDING PADS. APPLICANT FOR THE GRADING PERMIT SHALL PROVIDE A PLAN REVIEW LETTER FROM THE SOILS ENGINEER. A GRADING PERMIT DOES NOT GIVE CONTRACTOR PERMISSION TO COMMENCE OFF-SITE (STREET) GRADING. ONLY UPON CITY APPROVAL OF THE IMPROVEMENT PLANS AND COMPLETION OF A PRE-CONSTRUCTION MEETING SHALL CONTRACTOR COMMENCE OFF-SITE GRADING.
8. CONTRACTOR SHALL NOTIFY THE PUBLIC WORKS DEPARTMENT 48 HOURS PRIOR TO COMMENCEMENT OF ANY WORK PHASE. AT THAT TIME, AN "INSPECTION REQUEST FORM" SHALL BE COMPLETED TO ENSURE PROPER SCHEDULING OF AN INSPECTION WITH THE CITY ENGINEER'S REPRESENTATIVE.
9. CONTRACTOR SHALL PRESERVE ALL SURROUNDING PROPERTY BY CONFINING OPERATIONS TO WITHIN THE "LIMITS OF WORK". CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ACCESS FOR ALL ADJOINING RESIDENTS, PLACES OF BUSINESS, AND PROPERTIES AT ALL TIMES AND IN A SAFE MANNER. CONTRACTOR SHALL MAKE PROPER NOTIFICATION AT LEAST 24 HOURS IN ADVANCE OF ANY INTERRUPTION IN ACCESS OR SERVICE TO THE ABOVE PROPERTY OWNERS AS WELL AS TO THE CITY ENGINEER'S REPRESENTATIVE.
10. CONTRACTOR SHALL ONLY USE EQUIPMENT PROVIDED WITH A SPARK ARRESTOR DEVICE TO REDUCE A POTENTIAL FIRE HAZARD.

RIGHT OF MODIFICATION:
11. APPROVAL OF THIS PLAN DOES NOT RELEASE SUBDIVIDER OF THE RESPONSIBILITY FOR CORRECTION OF MISTAKES, ERRORS, OR OMISSIONS CONTAINED THEREIN. IF DURING THE COURSE OF CONSTRUCTION, PUBLIC INTEREST REQUIRES A MODIFICATION OF OR A DEPARTURE FROM THESE IMPROVEMENT PLANS OR THE CITY STANDARD DETAILS FOR CONSTRUCTION, THE CITY ENGINEER SHALL HAVE THE AUTHORITY TO REQUIRE SUCH MODIFICATIONS AND DEPARTURES AND TO SPECIFY THE MANNER IN WHICH THE SAME IS TO BE MADE.

OFF-SITE WATER & DUST CONTROL:
12. CONTRACTOR SHALL PROVIDE A WATER TRUCK ONSITE AT ALL TIMES. CONTRACTOR WILL BE ALLOWED TO DRAW WATER FROM THE CITY OF MORGAN HILL WATER DISTRIBUTION SYSTEM ONLY AFTER OBTAINING A HYDRANT METER FROM THE PUBLIC WORKS DEPARTMENT AND AN INSPECTION OF THE WATER TRUCK FOR A PROPER BACKFLOW DEVICE OR "AIR GAP" FILLING PIPE. DEVELOPER HAS PAID FOR "OFF-SITE" CONSTRUCTION WATER WHICH SHALL NOT BE USED FOR BUILDING CONSTRUCTION. CONTRACTOR SHALL KEEP DOWN DUST FROM CONSTRUCTION ACTIVITY TO THE MAXIMUM EXTENT POSSIBLE. CONTRACTOR SHALL CLEAN ALL EXISTING STREETS, CURBS, GUTTERS, AND SIDEWALKS AFFECTED BY THE PROJECT AT THE END OF EACH WORKING DAY.

MATERIAL STORAGE:
13. NO MATERIAL SHALL BE STORED NEAR THE EDGE OF PAVEMENT, TRAVELED WAY, SIDEWALK, DRIVEWAY, OR SHOULDER LINE WHICH MAY CREATE A HAZARD FOR VEHICULAR AND PEDESTRIAN TRAFFIC.

TRAFFIC CONTROL:
14. CONTRACTOR SHALL SUBMIT A TRAFFIC CONTROL PLAN FOR APPROVAL TO THE PUBLIC WORKS DEPARTMENT A MINIMUM OF 5 DAYS PRIOR TO ANY WORK WITHIN AN EXISTING PUBLIC STREET. THE PLAN SHALL BE SIGNED BY A LICENSED TRAFFIC ENGINEER WHEN IT INVOLVES AN ARTERIAL STREET. CONTRACTOR SHALL PROVIDE ALL NECESSARY TRAFFIC CONTROL IN ACCORDANCE WITH THE LATEST EDITION OF CALTRANS "MANUAL OF WARNING SIGNS, LIGHTS, AND DEVICES FOR USE IN PERFORMANCE OF WORK UPON HIGHWAYS". WHILE WORKING WITHIN THE PUBLIC RIGHT-OF-WAY, TWO TRAFFIC LANES (10' MIN.) SHALL BE OPEN TO VEHICULAR TRAFFIC DURING ALL HOURS, WEEKENDS, AND HOLIDAYS. ONE LANE, TWO WAY TRAFFIC MAY BE PERMITTED UNDER THE CONTROL OF NOT LESS THAN 2 (TWO) COMPETENT FLAGMEN DURING CONSTRUCTION OPERATIONS. STREET CLOSURES AND DETOURS SHALL ONLY TAKE PLACE UPON CITY ENGINEER APPROVAL AND POLICE DEPARTMENT COORDINATION.

TRENCH EXCAVATION:
15. CONTRACTOR SHALL EXERCISE DILIGENCE IN REVIEWING THE APPROVED SOILS REPORT AND OTHER AVAILABLE RESOURCES TO FAMILIARIZE HIMSELF/HERSELF WITH THE SOIL CONDITIONS TO BE ENCOUNTERED IN THE COURSE OF WORK IDENTIFIED IN THESE PLANS. CONTRACTOR SHALL NOT CAUSE DAMAGE TO ADJACENT TREES OR EXISTING STRUCTURES ABOVE OR BELOW GRADE DURING TRENCH EXCAVATION. ALL ROCKS, BOULDERS, AND LARGE STONES ENCOUNTERED SHALL BE REMOVED TO PROVIDE A CLEARANCE OF 6 INCHES AROUND THE PIPE. THE TRENCH BOTTOM SHALL BE REFILLED TO GRADE WITH SAND, PEA GRAVEL, OR OTHER APPROVED GRANULAR MATERIAL. CLEAN 1/4" OR 1/2" PEA GRAVEL SHALL BE USED IN AREAS OF MOIST CONDITION, OR WHERE THE SOIL HAS A HISTORY OF SUB-SURFACE WATER. IF THE BOTTOM OF THE TRENCH IS FOUND TO CONSIST OF WET OR UNSTABLE MATERIAL INCAPABLE OF PROPERLY SUPPORTING THE PIPE, THE MATERIAL SHALL BE REMOVED TO A MINIMUM DEPTH OF 12 INCHES BELOW THE UNSTABLE LAYER FOR THE FULL WIDTH OF THE TRENCH AND REPLACED WITH APPROVED GRANULAR MATERIAL. TRENCH EXCAVATION MATERIAL DEPOSITED ADJACENT TO THE TRENCH SHALL BE PLACED AND LOCATED TO PREVENT SPILLAGE INTO THE OPEN TRENCH.

TRENCH SAFETY:
16. IT SHALL BE CONTRACTOR'S RESPONSIBILITY TO PROVIDE ALL NECESSARY TRENCH SAFETY MEASURES FOR EXCAVATION. ALL TRENCH SAFETY MEASURES SHALL BE IN ACCORDANCE WITH THE LATEST CAL-OSHA GUIDELINES. CONTRACTOR SHALL PROVIDE EVIDENCE OF A CAL-OSHA TRENCHING PERMIT AT THE PRE-CONSTRUCTION MEETING.
17. EXCAVATIONS WITHIN THE PUBLIC RIGHT-OF-WAY SHALL BE BACKFILLED, COMPACTED, AND TEMPORARILY PAVED WITH COLD MIX "CUT BACK" TYPE A.C. TO ALLOW FOR VEHICULAR AND PEDESTRIAN TRAFFIC PRIOR TO 4:00 P.M. THE USE OF TRENCH PLATES IS ALLOWED, PROVIDED THE CONTRACTOR COVERS ALL EDGES OF THE PLATES WITH COLD MIX MATERIAL. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO MAINTAIN ON A DAILY BASIS, INCLUDING WEEKENDS, THE AMOUNT OF MATERIAL NECESSARY TO MAINTAIN THE TRENCH SURFACE FLUSH WITH THE EXISTING STREET OR SIDEWALK. IN ADDITION, THE CONTRACTOR SHALL RESPOND TO AND CORRECT SHIFTING TRENCH PLATES REGARDLESS OF THE TIME OF DAY. IF CONTRACTOR FAILS TO CORRECT SINKING BACKFILL MATERIAL OR SHIFTING TRENCH PLATES IN A TIMELY MANNER, CITY SHALL RESERVE THE RIGHT TO CORRECT THE PROBLEM AND BACK CHARGE THE CONTRACTOR.

JOINING EXISTING PAVEMENT:
18. EXISTING PAVEMENT WHICH IS TO BE JOINED BY NEW PAVEMENT SHALL BE SAW CUT VERTICAL TO PROVIDE STRAIGHT, TRUE AND NEAT JOINTS. OVERLAPPING OF EXISTING PAVEMENT WITHOUT SAW CUTTING OR GRINDING SHALL NOT BE PERMITTED. THE VERTICAL EDGES SHALL BE TACKED PRIOR TO PAVING. TERMINALS OF ALL SURFACING INDICATED ON THE PLANS SHALL JOIN ANY EXISTING SURFACE IN A SMOOTH BUTT JOINT. CONFORM PAVING BY METHOD OF ABRASIVE GRINDING WILL BE ALLOWED UPON APPROVAL OF THE CITY ENGINEER.

SANITARY SEWERS:
19. ALL MANHOLES, SEWER MAINS, AND LATERALS MUST PASS A LEAKAGE TEST AS DESCRIBED IN THE CITY OF MORGAN HILL STANDARD DETAILS FOR CONSTRUCTION. AFTER ALL BACKFILL, TESTING, AND PAVEMENT RESTORATION HAS BEEN COMPLETED, THE CONTRACTOR SHALL FLUSH AND CLEAN ALL SEWER LINES 24 INCHES OR LESS IN DIAMETER BY THE "WAYNE BALL METHOD". AFTER THE LEAKAGE TEST, BUT PRIOR TO PAVING, A TELEVISED INSPECTION SHALL BE PERFORMED AT ALL LOCATIONS OF NEWLY INSTALLED SEWER MAINS AT CONTRACTOR'S EXPENSE. THE UNDERGROUND CONTRACTOR MUST KEEP AN ACCURATE RECORD OF MANHOLES AND THE DISTANCE BETWEEN THEM AND EACH WYE BRANCH LATERAL, AND THEIR DIRECTION.
20. BEFORE ANY UPSTREAM SEWERS ARE CONSTRUCTED, THE CONTRACTOR SHALL FIELD VERIFY THE ELEVATION AND LOCATION OF EXISTING SEWER LINES TO BE CONNECTED.
21. THE END OF EACH NEW LATERAL SHALL BE MARKED AS SHOWN IN DETAIL S-2. THE CONCRETE CONTRACTOR SHALL STAMP AN "S" ON THE FACE OF CURB DIRECTLY ABOVE THE LATERAL.

WATER LINES:
22. CONTRACTOR SHALL NOT TURN OFF OR ON ANY VALVES BELONGING TO THE CITY'S WATER SYSTEM. ONLY DEPARTMENT OF PUBLIC WORKS PERSONNEL SHALL OPEN THE NECESSARY VALVES TO CONNECT NEW LINES. FAILURE TO FOLLOW THIS REQUIREMENT SHALL BE CONSIDERED AN "UNLAWFUL CONNECTION" AND MAY RESULT IN ISSUING OF A CITATION AND FINES AS SPECIFIED IN SECTION 13.04 OF THE MORGAN HILL MUNICIPAL CODE.
23. CONNECTIONS REQUIRING SHUT DOWN OF THE SYSTEM SHALL BE DONE BETWEEN THE HOURS OF 12:00 MIDNIGHT AND 6:00 A.M., AND ONLY UPON COORDINATION WITH THE DEPARTMENT OF PUBLIC WORKS.
24. ALL WATER LINES SHALL BE TESTED AFTER COMPLETION OF THE TRENCH BACKFILL AND COMPACTION OF THE FINAL BASE MATERIAL, BUT PRIOR TO PLACEMENT OF THE FINAL ROADWAY SURFACE.
25. CONTRACTOR SHALL PLACE MARKER POSTS ADJACENT TO ALL AIR RELIEF VALVES AND BLOW OFF ASSEMBLIES ALONG WATER MAINS LOCATED IN UNIMPROVED AREAS OR FIELDS. THE POSTS SHALL BE PRESSURE TREATED REDWOOD 4"x4"x8', PAINTED WHITE, BURIED 3'-6", AND INSCRIBED WITH "A/R.V." (FOR AIR RELIEF VALVES) OR "B.O." (FOR BLOW OFF ASSEMBLIES), IN 3 INCH HIGH CARVED LETTERS PAINTED BLUE.
26. THE CONCRETE CONTRACTOR SHALL STAMP A LETTER "W" ON THE FACE OF CURB DIRECTLY ABOVE THE WATER SERVICE.

BACKFILL AND COMPACTION:
27. BACKFILL MATERIAL SHALL BE HAND PLACED AND COMPACTED UP TO AT LEAST 6" ABOVE THE PIPE. WHEN USING NATIVE SOIL AS TRENCH BACKFILL, THE MINIMUM SAND COVER SHALL BE 12".
28. JETTING AND/OR FLOODING OF TRENCH BACKFILL MATERIAL WILL BE PERMITTED ONLY IF APPROVED BY THE SOILS ENGINEER AND CITY ENGINEER.
29. ANY EXCESS EXCAVATION MATERIAL MAY BE DEPOSITED ONSITE IN AREAS AND AT DEPTHS DESIGNATED BY THE OWNER, AND WITH APPROVAL OF THE CITY ENGINEER.
30. THE MINIMUM RELATIVE COMPACTION FOR TRENCH BACKFILL, SUBGRADE AND BASE MATERIAL SHALL BE 95% THROUGHOUT THE PROJECT UNLESS RECOMMENDED OTHERWISE IN THE SOILS REPORT AND APPROVED BY THE CITY ENGINEER.
31. IF TRENCH BACKFILL IS 100% SAND, THE CITY SHALL CONDUCT COMPACTION TESTS OF THE LIFTS SPECIFIED. IF THE TRENCH BACKFILL MATERIAL IS NATIVE SOIL, CONTRACTOR SHALL PROVIDE COMPACTION TEST RESULTS OF THE LIFTS SPECIFIED IN THE SOILS REPORT TO THE CITY ENGINEER FROM A CERTIFIED TESTING LABORATORY AT CONTRACTOR'S EXPENSE.
32. ANY AGGREGATE BASE THAT BECOMES CONTAMINATED DURING CONSTRUCTION SHALL BE REMOVED AND REPLACED WITH UNCONTAMINATED BASE.

EROSION AND SEDIMENT CONTROL:
33. AN EROSION AND SEDIMENT CONTROL PLAN SHALL BE REQUIRED PRIOR TO ANY PHYSICAL DEVELOPMENT OF A PROPERTY. EROSION CONTROL SHALL BE PLANNED BETWEEN OCTOBER 15TH AND MAY 1ST, AND SEDIMENT CONTROL SHALL BE PLANNED YEAR ROUND FOR THE LIFE OF THE PROJECT. SAID PLANS SHALL MEET THE MINIMUM STANDARDS AND SPECIFICATIONS OF THE CALIFORNIA STORMWATER QUALITY ASSOCIATION (CASQA) FOR STORMWATER BEST MANAGEMENT PRACTICES (BMPs). CONTRACTOR SHALL BE RESPONSIBLE FOR INITIATING THE REQUIRED CONTROL MEASURES. CASQA BMP INFORMATION CAN BE VIEWED AND DOWNLOADED AT HTTP://WWW.CABMPHANDBOOKS.COM/CONSTRUCTION.ASP

CURB INLET STENCILING:
34. ALL CURB INLETS SHALL HAVE THERMOPLASTIC STENCILING: NO DUMPING, FLOWS TO CREEK/RIVER.

ELECTROLIERS:
35. ALL ELECTROLIERS SHALL BE INSTALLED BY THE DEVELOPER (RATE SCHEDULE LS-2C, 120V, HIGH PRESSURE SODIUM, AT THE LOCATIONS SHOWN ON THESE PLANS). SEE ELECTRICAL SECTION OF THE STANDARD DETAILS.

ABBREVIATIONS:

AB	AGGREGATE BASE	GV	GATE VALVE
AC	ASPHALT CONCRETE	HP	HIGH POINT
ACCP	ASPHALT CONCRETE PIPE	INV	INVERT
ARV	AIR RELIEF VALVE	IP	IRON PIPE
BC	BEGINNING OF CURVE	JP	JOINT POLE
BLDG	BUILDING	LP	LOW POINT
BO	BLOW OFF VALVE	MAX	MAXIMUM
BVCE	BEG. VERTICAL CURVE EL	MIN	MINIMUM
BVCS	BEG. VERTICAL CURVE STA	NG	NATURAL GROUND
BW	BACK OF SIDEWALK	N.I.C.	NOT IN CONTRACT
BWF	BARB WIRE FENCE	PB	PULL BOX
C SH	CORNER SHED	ℙ	PROPERTY LINE
CATV	CABLE TELEVISION	P.S.E.	PUBLIC SERVICE EASEMENT
CB	CATCH BASIN	P.S.D.E.	PRIVATE STORM DRAIN EASEMENT
CI	CURB INLET	PVI	POINT OF VERTICAL INTERSECTION
C.I.P.	CAST IRON PIPE	RCP	REINFORCED CONCRETE PIPE
℄	CENTERLINE	R/W	RIGHT OF WAY
CL D/W	CENTERLINE OF DRIVEWAY	RWF	REDWOOD FENCE
CMP	CORRUGATED METAL PIPE	SB	SIGNAL BOX
CO	CLEAN OUT	SDMH	STORM DRAIN MANHOLE
CONC	CONCRETE	SLB	SLAB CONCRETE
COR	CORNER	SNS	STREET NAME SIGN
DI	DROP INLET	SPK	SPIKE
D.I.P.	DUCTILE IRON PIPE	SPOLE	SERVICE POLE
DWY	DRIVEWAY	SSMH	SANITARY SEWER MANHOLE
EC	END OF CURVE	STD.	STANDARD
EG	EXISTING GRADE	SW	SIDEWALK
ELCT	ELECTROLIER	TB	THRUST BLOCK
EP	EDGE OF PAVEMENT	TBM	TEMPORARY BENCH MARK
ER	END OF RETURN	TC	TOP OF CURB
EVCE	END VERTICAL CURVE EL	TOB	TOP OF BANK
EVCS	END VERTICAL CURVE STA	TOE	TOE OF SLOPE
EX, EXIST	EXISTING	TYP	TYPICAL
FF	FINISH FLOOR	T.F.	TOP OF FOUNDATION
FG	FINISH GRADE	UG	UNDERGROUND GAS LINE
FH	FIRE HYDRANT	UT	UNDERGROUND TELEPHONE LINE
FI	FIELD INLET	UW	UNDERGROUND WATER LINE
FL	FLOW LINE	WM	WATER METER
GB	GRADE BREAK	WRF	WOOD RAIL FENCE
GFF	GARAGE FINISH FLOOR	WV	WATER VALVE

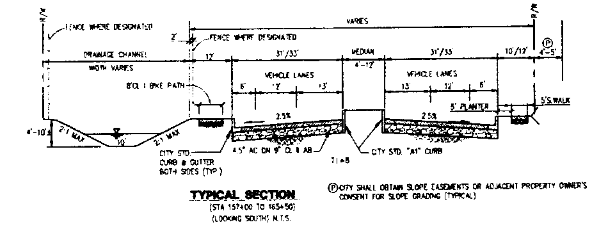
LEGEND

PROPOSED	EXISTING	DESCRIPTION
		PROPERTY LINE
		CENTER LINE
		LIMIT OF WORK LINE
		CITY LIMIT LINE
		EDGE OF PAVEMENT
		CURB AND GUTTER
		DRIVEWAY APPROACH
	—SD—	STORM DRAIN
	—SS—	SANITARY SEWER
		WATER MAIN
		GAS
		ELECTRIC
		TELEPHONE
	—JT—	JOINT TRENCH
		FENCE, TYPE AS SHOWN
		STREET BARRICADE (STD. A-3")
		BENCH MARK
		CONTROL POINT
		MONUMENT, TYPE AS SHOWN (STD. A-30)
		REVISION
		SECTION - DETAIL SHEET NO
		STREET NAME SIGN (STD. A-28)
		STREET SIGN, TYPE AS SHOWN
		TOP OF SLOPE
		SWALE
		SLOPE / FLOW LINE
		STORM DRAIN MANHOLE (STD. SD-1)
		CURB INLET (STD. SD-5)
		GALLERY INLET
		DROP INLET (STD. SD-4)
		SANITARY SEWER MANHOLE (STD. S-4)
		FIRE HYDRANT (STD. W-9)
		BLOW OFF VALVE (STD. W-15)
		CLEAN OUT (STD. S-1)
		AIR RELIEF VALVE
		GATE VALVE
		JOINT POWER POLE
		ELECTROLIER (STD. E-2)
		ELECTROLIER WITH SIGN
		SEWER SERVICE
		WATER SERVICE
		P. G. & E. CONNECTION POINT

NOTE:

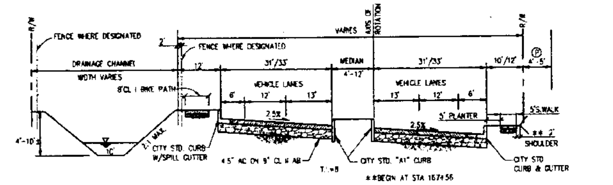
CONTRACTOR AGREES THAT HE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE OWNER AND THE ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER OR THE ENGINEER.

THE STANDARD SPECIFICATIONS AND DETAILS, LATEST EDITION, OF THE CITY OF MORGAN HILL SHALL GOVERN UNLESS OTHERWISE SPECIFIED HEREIN.



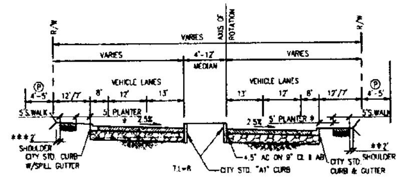
TYPICAL SECTION
(STA 157+00 TO 165+50)
(LOOKING SOUTH) N.T.S.

(P) CITY SHALL OBTAIN SLOPE EASEMENTS OR ADJACENT PROPERTY OWNER'S CONSENT FOR SLOPE GRADING (TYPICAL)



TYPICAL SECTION
(STA 165+50 TO 171+50)
(LOOKING SOUTH) N.T.S.
(SECTION IN TRANSITION: 165+50 TO 168+00)

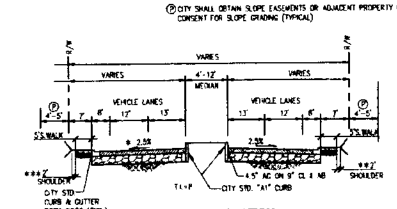
(P) CITY SHALL OBTAIN SLOPE EASEMENTS OR ADJACENT PROPERTY OWNER'S CONSENT FOR SLOPE GRADING (TYPICAL)



TYPICAL SECTION
(STA 172+50 TO 186+20)
(LOOKING SOUTH) N.T.S.
(SECTION IN TRANSITION: 168+00 TO 186+20)

* NO PLANTER STA 173+00 TO 189+00
**BEGIN AT STA 167+56
***BEGIN AT STA 172+50

(P) CITY SHALL OBTAIN SLOPE EASEMENTS OR ADJACENT PROPERTY OWNER'S CONSENT FOR SLOPE GRADING (TYPICAL)



TYPICAL SECTION
(STA 186+20 TO 189+00)
(LOOKING SOUTH) N.T.S.

**BEGIN AT STA 167+56
***BEGIN AT STA 172+50

(P) CITY SHALL OBTAIN SLOPE EASEMENTS OR ADJACENT PROPERTY OWNER'S CONSENT FOR SLOPE GRADING (TYPICAL)

GRADING QUANTITIES

SITE EARTHWORK SUMMARY			
ITEM DESCRIPTION	CUT (C.Y.)	FILL (C.Y.) (Incl. 10% Shrinkage)	NET (C.Y.)
STREET/CHANNEL GRADING	39,371	214,724	175,353(F)
MAPLE BASIN GRADING	103,448	17,232	86,216 (C)
STRIPPINGS (3" DEEP)		19,540	19,540 (F)
SHORTAGE (IMPORT)	108,677 C.Y.		

GRADING AND SITE PREPARATION NOTES

1. ALL AREAS TO RECEIVE FILL SHALL BE STRIPPED TO A DEPTH TO BE DETERMINED BY THE SOILS ENGINEER. ANY A.C. OR P.C.C. PAVING SHALL BE SCARIFIED & REMOVED & SUBGRADE PREPARED & COMPACTED PER SOIL ENGINEER'S RECOMMENDATIONS PRIOR TO ANY FILLING.
2. ALL MATERIAL TO BE USED AS FILL WITHIN THE ROAD FOOT PRINT TO BE FREE OF ALL VEGETATION & FOREIGN MATTER AND SHALL BE APPROVED BY SOILS ENGINEER.
3. ALL ROAD SURFACES TO BE COMPACTED TO 95% RELATIVE COMPACTION AS PER ASTM D1557-91.
4. STRIPPING MAY BE PLACED IN PLANTING AREA OR BURIED IN DESIGNATED PARK AREAS. ALL EXCESS STRIPPING SHALL BE HAULED AWAY. PAVING DEBRIS SHALL BE HAULED AWAY TO AN APPROVED DISPOSAL SITE.
5. ALL WORK SHOWN OR NOTED ON THESE PLANS SHALL BE DONE IN STRICT ACCORDANCE WITH THE RECOMMENDATIONS OF THE SOILS ENGINEER, ALL LOCAL, STATE, AND FEDERAL MINIMUM STANDARDS AND THE LATEST EDITION OF THE UNIFORM BUILDING CODE. NOTIFY SOILS ENGINEER 2 WORKING DAYS PRIOR TO BEGINNING OF ANY GRADING. THE SOIL ENGINEER IS PACIFIC GEOTECHNICAL ENGINEERING PROJECT NO 2309E DATED DEC 11, 2009.
6. CONNECTIONS TO EXISTING PUBLIC UTILITIES SHALL BE DONE WITH APPROVAL & IN ACCORDANCE WITH THE UTILITY COMPANY'S REQUIREMENTS.
7. CONTRACTORS SHALL PROTECT ALL EXISTING SITE IMPROVEMENTS NOT SCHEDULED FOR REMOVAL DURING CONSTRUCTION. THEY SHALL REPAIR ANY DAMAGE TO NEW CONDITION AT THEIR EXPENSE.
8. VERIFY ALL EXISTING SITE CONDITIONS, SITE DIMENSIONS AND GRADES PRIOR TO START OF WORK.
9. CONFORM TO THE RECOMMENDATIONS OF THE DRAWINGS, DETAILS AND SITE SOILS REPORT FOR COMPACTION, STRIPPING, GRADING, PAVING AND UTILITY TRENCHES.
10. SOIL COMPACTION TESTS SHALL BE PAID FOR BY THE CITY AS A DEVELOPER OF THE ROAD PROJECT AS INDICATED IN NOTE 3.
11. ALL GRADING AND RELATED WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OF THE CITY OF MORGAN HILL AND THE RECOMMENDATION OF THE SOILS ENGINEER.
12. CONTRACTOR SHALL VERIFY THE LOCATIONS OF ALL EXISTING SERVICES AND UNDERGROUND UTILITIES & SEWERS. LOCATIONS SHOWN ON THE PLAN ARE APPROXIMATE AND SHOWN FOR GENERAL INFORMATION ONLY. CONTRACTOR SHALL CALL U.S.A. AT 800-642-2444 48 HOURS PRIOR TO UNDERGROUND WORK FOR FIELD LOCATOR SERVICE.
13. FOUNDATIONS AND FOOTING DETAILS SHOWN ARE FOR GRADING RELATIONSHIPS ONLY. CONTRACTOR SHALL REFER TO DIMENSIONED STRUCTURAL OR ARCHITECTURAL PLANS FOR ACTUAL DIMENSIONED DETAILS.
14. ANY VOIDS CREATED BY STRUCTURE REMOVAL, TREE REMOVAL, SEPTIC TANK AND LEACH LINE REMOVAL MUST BE BACKFILLED WITH PROPERLY COMPACTED NATIVE SOILS THAT ARE FREE OF ORGANICS & OTHER DELETERIOUS MATERIALS OR WITH APPROVED IMPORT FILL & COMPACTED TO THE SOILS ENGINEER'S RECOMMENDATIONS.
15. IT SHALL BE THE RESPONSIBILITY OF THE GRADING CONTRACTOR, DURING THE GRADING OPERATION, IN COOPERATION WITH MH ENGINEERING TO VERIFY QUANTITIES WITHIN THIS PROPERTY. THE EARTHWORK QUANTITIES SHOWN HAVE BEEN DILIGENTLY ESTIMATED BY THE ENGINEER, BASED UPON AVAILABLE INFORMATION, IN ORDER TO ASSIST THE CONTRACTOR. THE GROUND TOPOGRAPHY ELEVATIONS & CONTOURS WERE FURNISHED BY MH ENGINEERING. DATE OF TOPOGRAPHY SURVEY IS OCT./NOV. 2009. MH ENGINEERING DOES NOT GUARANTEE CURRENT ACCURACY. CONTRACTOR SHALL FIELD VERIFY FOR HIMSELF THAT NO ADDITIONAL GRADING IMPORTING OR EXPORTING OF EARTH HAS TAKEN PLACE SINCE THE DATE OF THE TOPO SURVEY STATE.
16. THE EARTHWORK QUANTITIES SHOWN ARE PROVIDED AS A COURTESY AND CONVENIENCE TO THE CONTRACTOR. THE CUT & FILLS SHOWN ARE APPROXIMATE CALCULATED QUANTITIES BASED ON THE DIFFERENCE BETWEEN EXISTING GROUND ELEVATIONS (CONTOURS) & ROUGH GRADE ELEVATIONS. THE CALCULATION MAKES NO PROVISION FOR SCARIFICATION & COMPACTION WORK OR FILLS FOR THIS REASON & BECAUSE OF VARIABLES SUCH AS COMPACTION, SHRINKAGE & THE CONTRACTOR'S METHOD OF OPERATION, THE VOLUME OF DIRT ACTUALLY MOVED IN THE FIELD WILL PROBABLY VARY TO SOME EXTENT FROM THE CALCULATED VOLUME. FOR THE PURPOSE OF APPROXIMATING THE SHRINKAGE, 10% WAS USED FOR THE FILL VOLUMES.
17. THE CONTRACTOR'S EARTHWORK BID REFLECTS HIS OWN CALCULATION OF THE EARTHWORK COMPACTED & COMPLETE IN PLACE TO THE DETAILS, LINE, AND GRADE SHOWN ON THE PLANS.

NOTE: ALL EXISTING TREES ARE TO REMAIN UNLESS OTHERWISE APPROVED FOR REMOVAL BY THE CITY

TREE PROTECTION MEASURES

1. PRECONSTRUCTION CLEARANCE OF LIMBS OR TREE REMOVAL SHALL BE PERFORMED PRIOR TO ANY OTHER CONSTRUCTION WORK ON THE PROJECT SITE AS INDICATED IN THE ARBORIST REPORT.
2. AFTER THE COMPLETION OF PRUNING AND TREE REMOVALS, TEMPORARY CHAIN LINK OR WOOD FENCING SHALL BE ERECTED AROUND THE BASE OF ALL TREES TO BE PRESERVED AT DISTANCES INDICATED IN THE TREE REPORT.
3. NO GRADING SHALL OCCUR WITHIN THE PROTECTED ZONES AROUND THE BASES OF THE PROTECTED TREES. CUTS AND FILLS WITHIN THE DRIPLINE OF THESE TREES SHALL NOT EXCEED SIX INCHES. SOIL COMPACTION SHALL BE AVOIDED IN THESE AREAS.
4. LANDSCAPE PLANS SHALL ENSURE THAT DRAINAGE IS DIRECTED AWAY FOR THE TREES PRESERVED ON THE SITE. RESTRICTIONS SHALL BE INCORPORATED INTO THE C.C.& R'S FOR THE DEVELOPMENT; INFORMATIONAL MATERIALS SHALL BE PROVIDED TO FUTURE RESIDENTS TO FACILITATE COMPLIANCE WITH LANDSCAPING PROVISIONS.
5. TRENCHING SHALL BE EXCLUDED FROM THE DRIPLINE AREAS OF THE PRESERVED TREES. ROOTS 2.5 INCHES OR LARGER IN DIAMETER SHALL NOT BE SEVERED BY FOUNDATION OR UTILITY TRENCHES.

25% SUBMITTAL
NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	BY

REVISIONS

WORK ACCEPTED: AS-BUILT CORRECTIONS

City of Morgan Hill
Public Works Department
CITY OF MORGAN HILL
17575 PEAK AVE MORGAN HILL, CA 95037
(408) 776-6480 FAX (408) 779-7236

DRAWN: TH DESIGN: HKS JOB NO.: 24061.3

MH engineering Co.
SUBDIVISIONS - LAND PLANNING - LAND SURVEYS
16075 VINEYARD BOULEVARD MORGAN HILL, CA 95037
(408) 779-7381 FAX (408) 226-5?2

GENERAL NOTES & TYPICAL STREET SECTIONS
BUTTERFIELD BLVD SOUTH EXTENSION
MORGAN HILL CALIFORNIA

12/09
02

GENERAL NOTES, CONSTRUCTION DETAILS
BUTTERFIELD BLVD SOUTH EXTENSION

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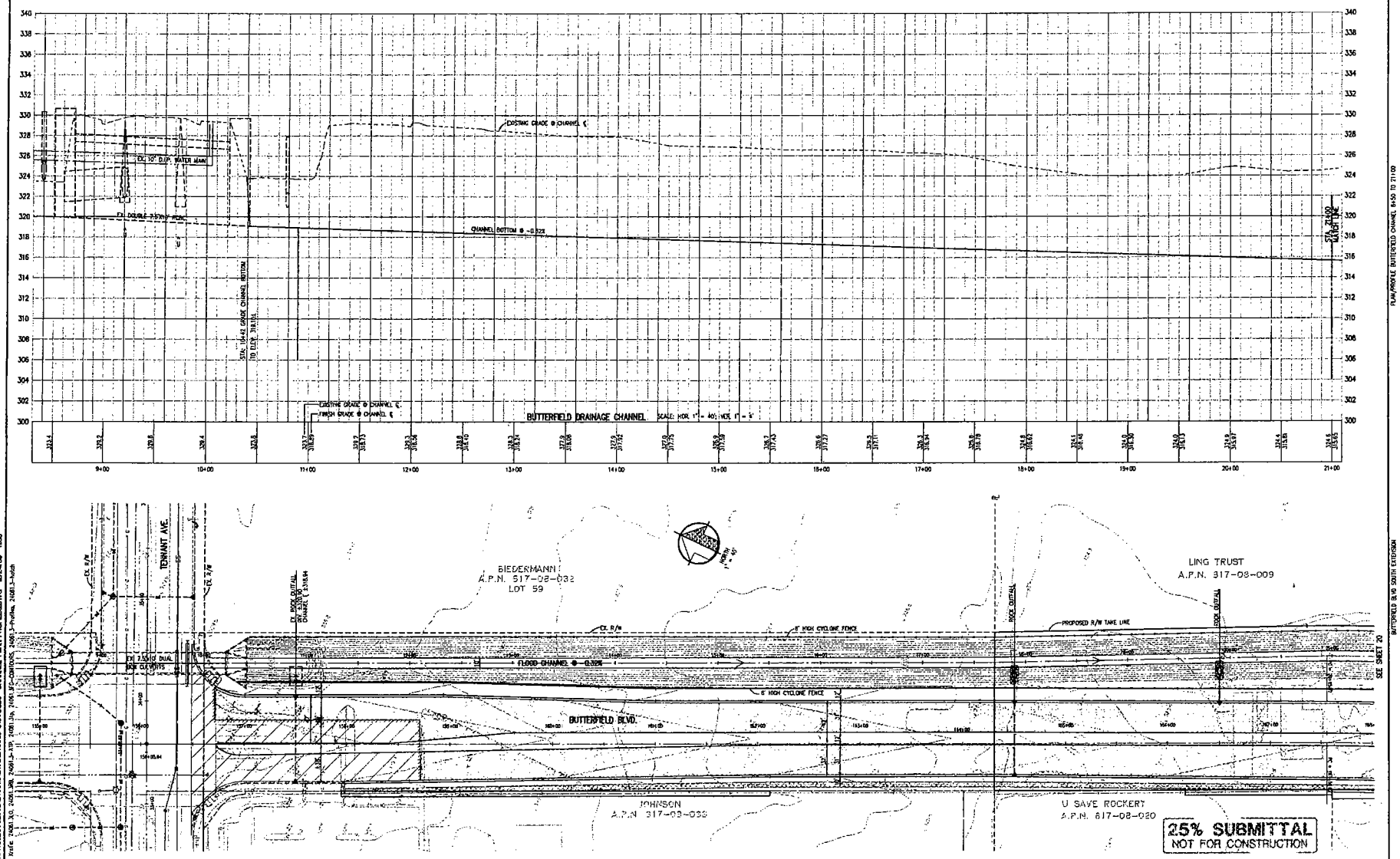


NO.	DESCRIPTION	DATE	BY

REVISIONS

WORK ACCEPTED: INSPECTOR:
AS-BUILT CORRECTIONS
BY: DATE:

City of Morgan Hill
Public Works Department
17575 PEAK AVE. MORGAN HILL, CA 95037
(408) 776-6480 FAX (408) 779-7236

DRAWN: TH SCALE: HOR. 1" = 40' VER. 1" = 5'
CHECKED: DATE:
APPROVED: DATE:
JOB NO. 24061.3

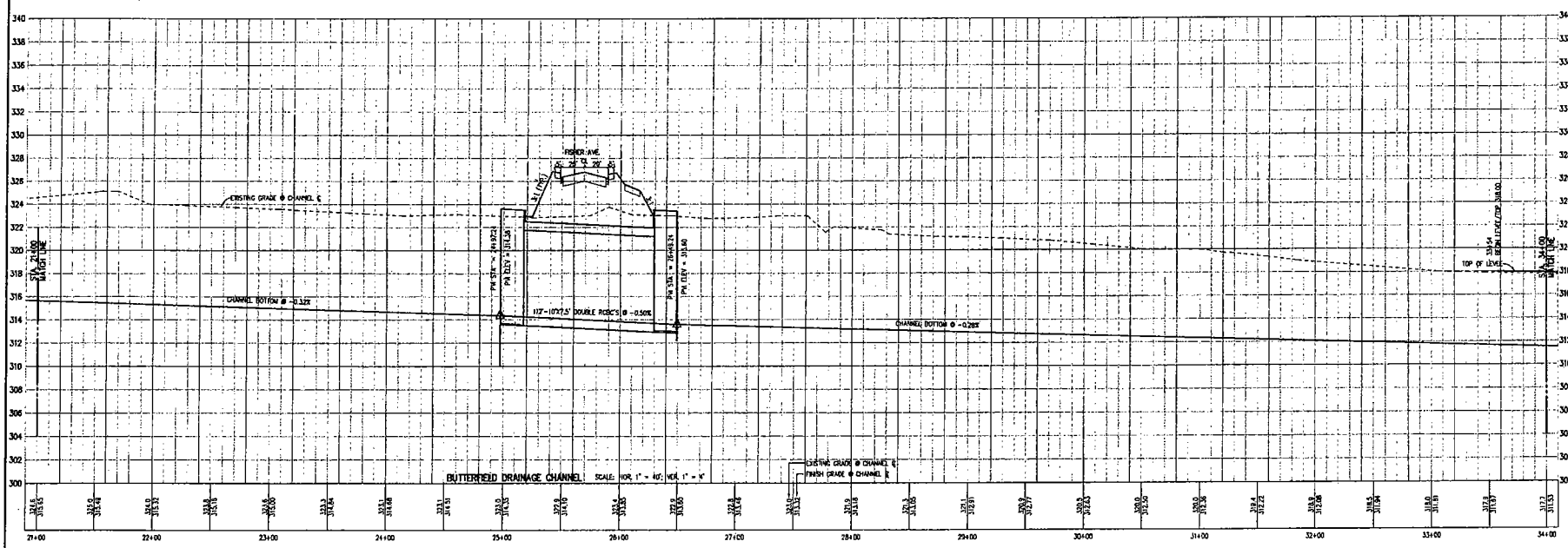
SUPERVISED BY: HARMEER SINGH REGISTERED CIVIL ENGINEER RCE 47757 EXP. DATE 9-30-10

MH engineering Co.
SUBDIVISIONS - LAND PLANNING - LAND SURVEYS
18075 VINEYARD BOULEVARD MORGAN HILL, CA 95037
(408) 779-7381 FAX (408) 226-5712

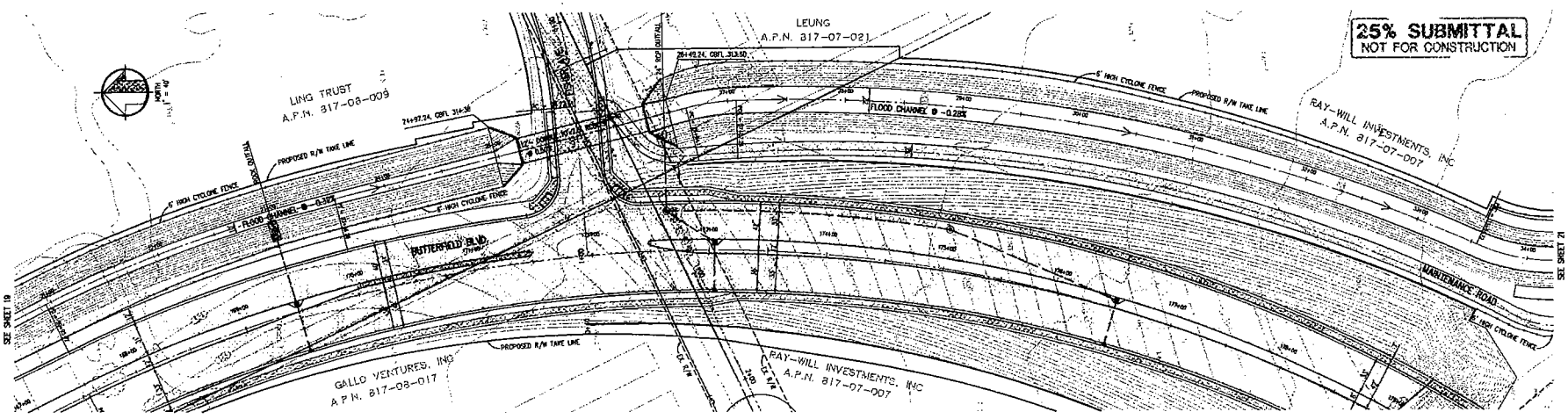
PLAN/PROFILE BUTTERFILD CHANNEL
STA. 8+50 TO 21+00
BUTTERFIELD BLVD SOUTH EXTENSION
MORGAN HILL CALIFORNIA

CITY FILE NO.
PLAN SET 12/09
DRAWING 19 OF XX

L:\PROJECTS\2002\24061\DWG\24061-PHBUTTCHANNEL PLAN PROFILE.DWG 12/24/09 11:50
Xrefs: 24061-XC, 24061-MB, 24061-Ja-Tit, 24061-Ja, 24061-BFC-CONTOURS, 24061-Ja-Prof-Ma, 24061-Ja-Hydr
PLAN/PROFILE BUTTERFIELD CHANNEL 8+50 TO 21+00
BUTTERFIELD BLVD SOUTH EXTENSION



PLAN/PROFILE BUTTERFIELD CHANNEL 21+00 TO 34+00



BUTTERFIELD BLVD SOUTH EXTENSION

L:\PROJECTS\2002\24061\DWG\24061-STOS25- CHANNEL PLAN PROFILE.DWG 12/24/09 15:56

NO.	DESCRIPTION	DATE	BY

REVISIONS

WORK ACCEPTED: INSPECTOR:
AS-BUILT CORRECTIONS
BY: DATE:

City of Morgan Hill
Public Works Department
17575 PEAK AVE. MORGAN HILL, CA 95037
(408) 776-6480 FAX (408) 779-7236

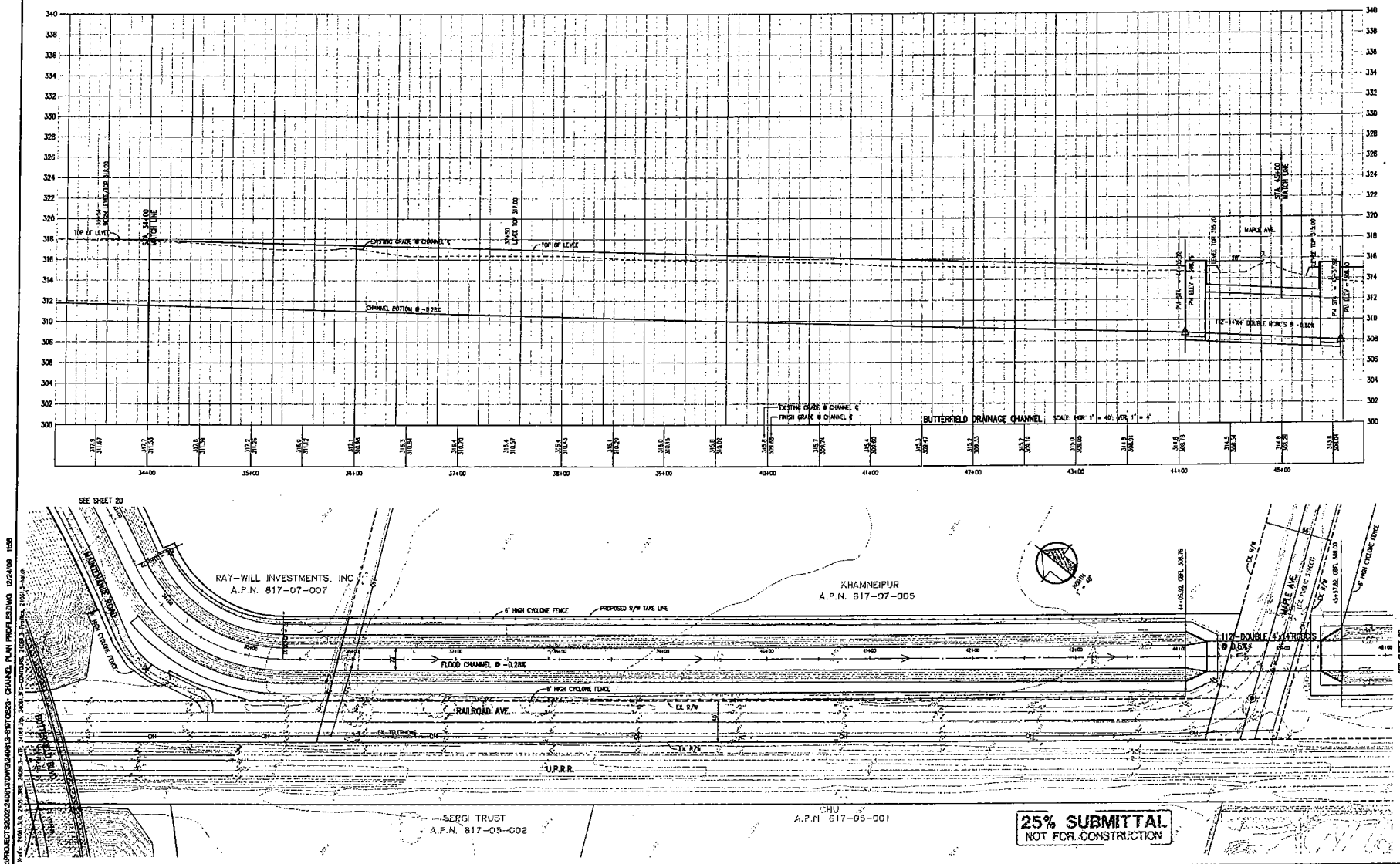
DRAWN: TH DESIGN: HKS
CHECKED: DATE:
APPROVED: DATE:
HOR. 1"=40' VERT. 1"=4'
JOB NO. 24061.3

SUPERVISED BY: HASHMEER SAYCE REGISTERED CIVIL ENGINEER RCE 46717 EXP. DATE 9-30-10

MH engineering Co.
SUBDIVISIONS – LAND PLANNING – LAND SURVEYS
16075 VINEYARD BOULEVARD MORGAN HILL, CA 95037
(408) 779-7381 FAX: (408) 226-5712

PLAN/PROFILE BUTTERFIELD CHANNEL STA. 21+00 TO 34+00
BUTTERFIELD BLVD SOUTH EXTENSION
MORGAN HILL CALIFORNIA

CITY FILE NO.
PLAN SET 12/09
DRAWING 20 OF XX



REVISIONS				
NO.	DESCRIPTION	DATE	BY	

SIGN ACCEPTED: INSPECTOR:
AS-BUILT CORRECTIONS
BY: DATE:

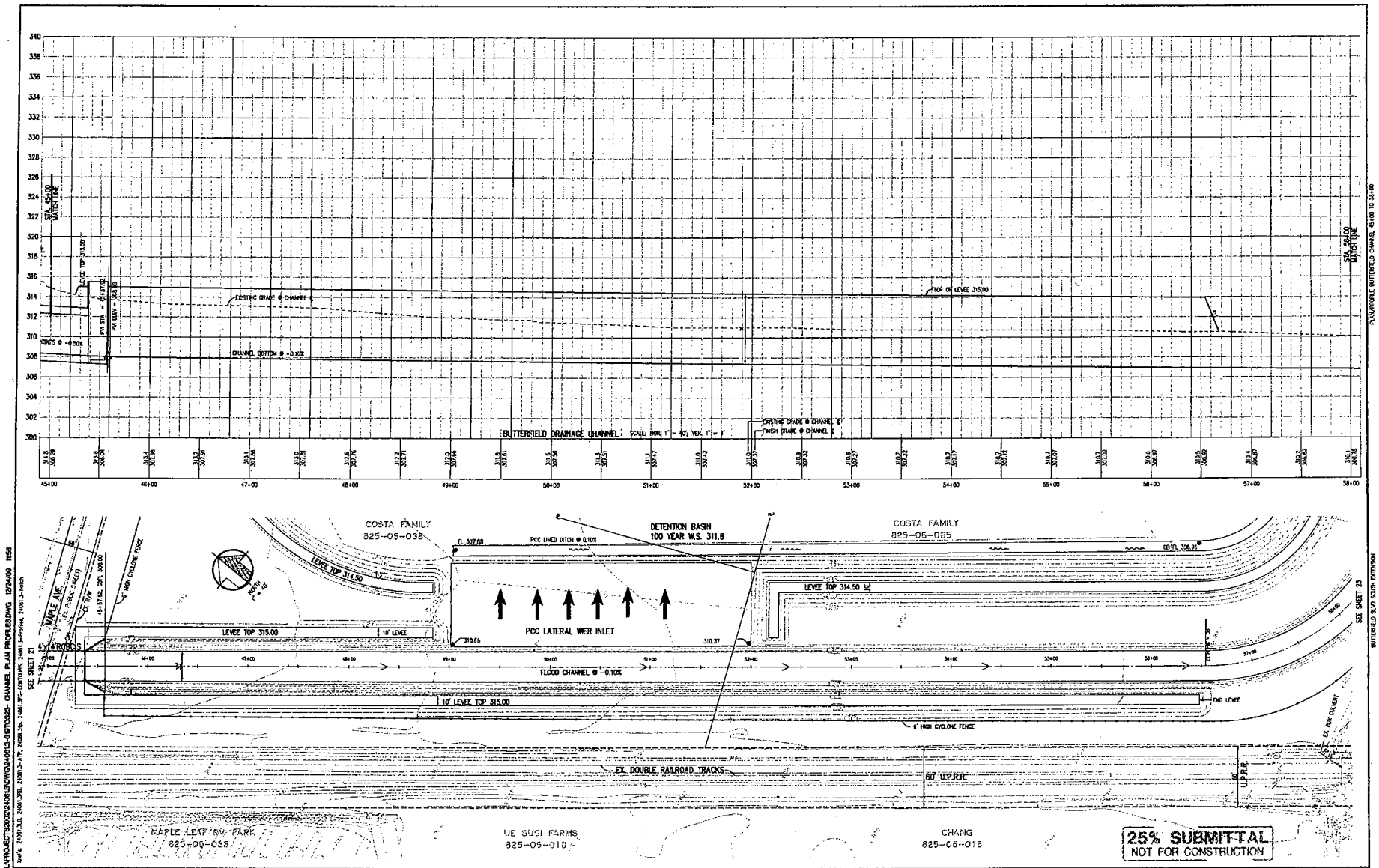
City of Morgan Hill
Public Works Department
17575 PEAK AVE. MORGAN HILL, CA 95037
(408) 776-8480 FAX (408) 779-7236

DRAWN: TH | DESIGN: HKS | HOR. 1"=40' | VER. 1"=4'
CHECKED: DATE: | SUPERVISED BY: HARVINDER MAGGI REGISTERED CIVIL ENGINEER RCE 43717 EXP. DATE 9-30-10
APPROVED: DATE: | JOB NO. 24051.3

MH engineering Co.
SUBDIVISIONS - LAND PLANNING - LAND SURVEYS
16075 VINEYARD BOULEVARD MORGAN HILL, CA 95037
(408) 779-7381 FAX: (408) 778-5712

PLAN/PROFILE BUTTERFIELD CHANNEL STA. 34+00 TO 45+00
BUTTERFIELD BLVD SOUTH EXTENSION
MORGAN HILL CALIFORNIA

PLAN DATE: 12/09
DRAWING 21 OF XX



NO.	DESCRIPTION	DATE	BY

REVISIONS

AS-BUILT CORRECTIONS

City of Morgan Hill
Public Works Department
17575 PEAK AVE. MORGAN HILL, CA 95037
(408) 776-6480 FAX (408) 779-7236

DRAWN: TH | DESIGN: HKS | HORI. 1"=40' | VERT. 1"=4' | JOB NO. 24061.3

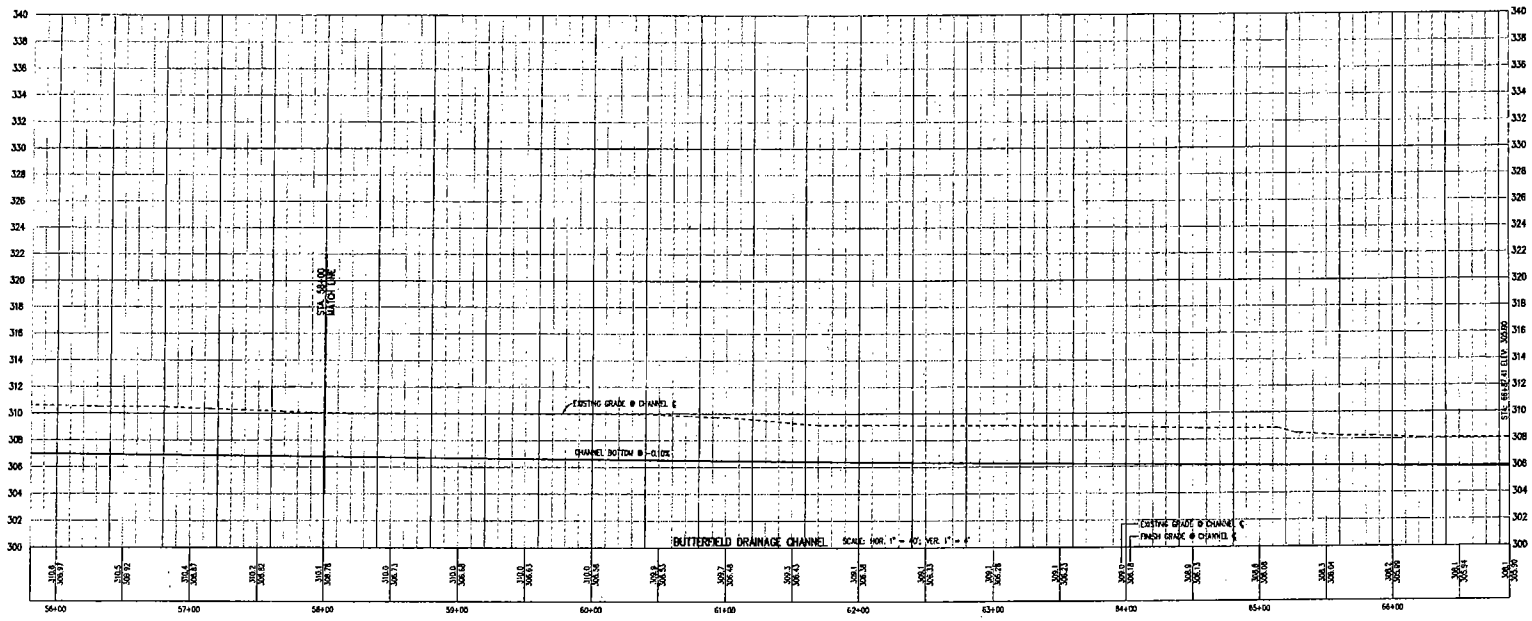
MH engineering Co.
SUBDIVISIONS - LAND PLANNING - LAND SURVEYS
16075 VINEYARD BOULEVARD MORGAN HILL, CA 95037
(408) 779-7381 FAX (408) 226-5712

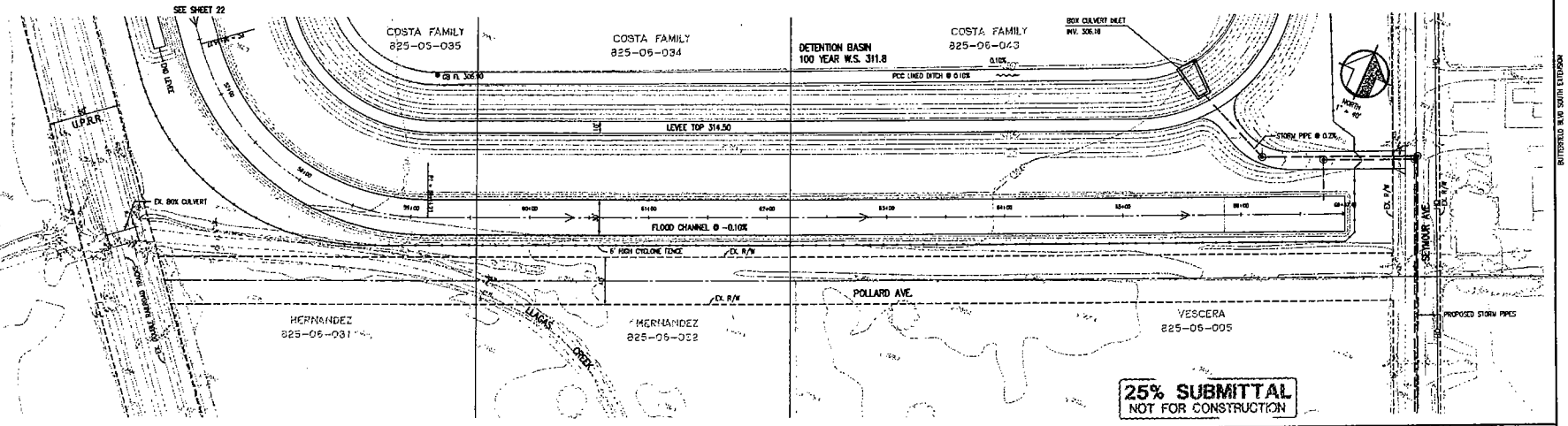
PLAN/PROFILE BUTTERFIELD CHANNEL STA. 45+00 TO 58+00
BUTTERFIELD BLVD SOUTH EXTENSION

MORGAN HILL CALIFORNIA

DATE: 12/09

DRAWING 22 OF XX





NO.	DESCRIPTION	DATE	BY

REVISIONS

WORK ACCEPTED | INSPECTOR
AS-BUILT CORRECTIONS
BY | DATE

City of Morgan Hill
Public Works Department
17575 PEAK AVE. MORGAN HILL, CA 95037
(408) 778-8480 FAX (408) 779-7236

DRAWN: TH | DESIGN: HKS | HOR. 1"=40' | VER. 1"=4'
CHECKED | DATE | JOB NO. 24061.3
APPROVED | DATE

SUPERVISED BY:
MARWOOD WARD A
REGISTERED CIVIL ENGINEER
R.C.E. 43717
EXP. DATE 9-30-10

MH engineering Co.
SUBDIVISIONS - LAND PLANNING - LAND SURVEYS
16075 VINEYARD BOULEVARD MORGAN HILL, CA 95037
(408) 779-7381 FAX (408) 226-5712.

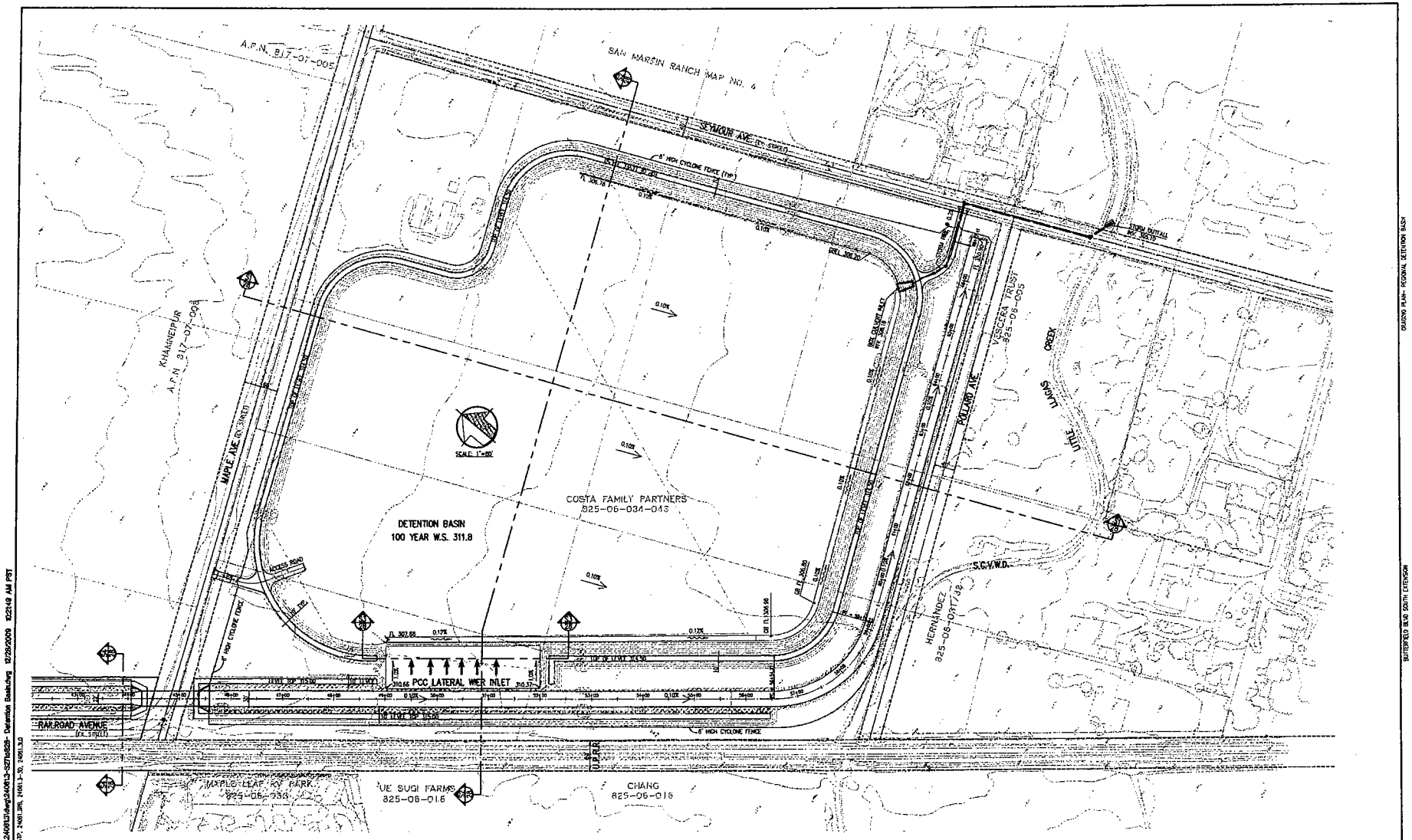
PLAN/PROFILE BUTTERFIELD CHANNEL
STA. 58+00 TO 67+00
BUTTERFIELD BLVD SOUTH EXTENSION
MORGAN HILL CALIFORNIA

CITY FILE NO.
PLAN DATE 12/09
DRAWING 23 OF XX

PLAN/PROFILE BUTTERFIELD CHANNEL 58+00 TO 67+00

BUTTERFIELD BLVD SOUTH EXTENSION

L:\PROJECTS2002\2406\SDWG\24061-3-SHT0523-CHANNEL PLAN PROFILES.DWG 02/24/09 11:56
Xrefs: 24061.3.0, 24061.3B0, 24061.3-XTP, 24061.3-Xs, 24061.3-CONTOURS, 24061.3-Profile, 24061.3-hatch



25% SUBMITTAL
NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	BY
	AS-BUILT CORRECTIONS		

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City of Morgan Hill
Public Works Department
17575 PEAK AVE. MORGAN HILL, CA 95037
(408) 776-5480 FAX (408) 779-7236

DRAWN: TH | DESIGN: HKS | HOR. 1"=80'
CHECKED: | DATE: | VERT.
APPROVED: | DATE: | JOB NO. 24061.3

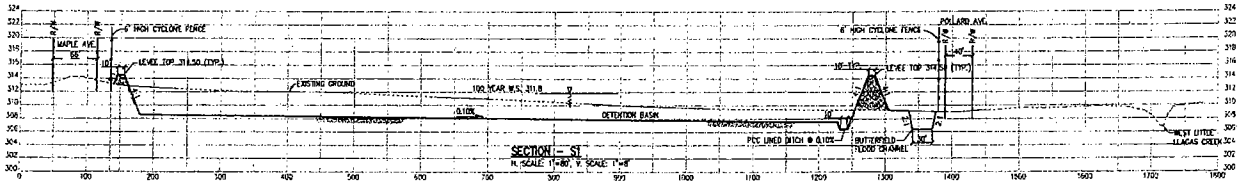
MH engineering Co.
SUBDIVISIONS – LAND PLANNING – LAND SURVEYS
16075 VINEYARD BOULEVARD MORGAN HILL, CA 95037
(408) 779-7381 FAX: (408) 726-3712

GRADING PLAN-
REGIONAL DETENTION BASIN
BUTTERFLIELD BLVD SOUTH EXTENSION
MORGAN HILL CALIFORNIA

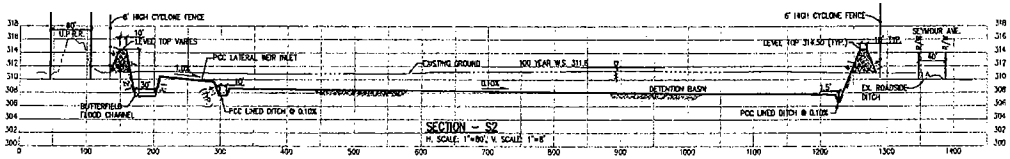
CITY FILE NO.
PLAN SET 12/09
DRAWING 27 OF XX

GRADING PLAN- REGIONAL DETENTION BASIN
BUTTERFIELD BLVD SOUTH EXTENSION

L:\Projects\2002\3\09\131\dwg\24061\3-027\b\B2B- Detention Basin.dwg 12/28/2009 10:22:48 AM PST
Xref: 24061.3-XP; 24061.3IR; 24061.3-3D; 24061.3-3D



SECTION – S1
H. SCALE: 1"=80', V. SCALE: 1"=8'



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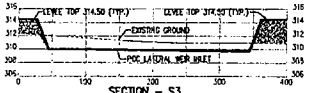

SECTION – S3
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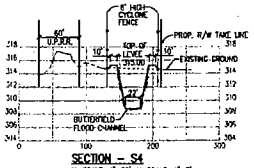


SECTION – S4
H. SCALE: 1"=80', V. SCALE: 1"=8'

25% SUBMITTAL
NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	BY	APP.

REVISIONS

NON JUDICIED | INSPECTOR
AS-BUILT CORRECTIONS
BY: DATE:

City of Morgan Hill
Public Works Department
CITY OF MORGAN HILL
17575 PEAK AVE. MORGAN HILL, CA 95037
(408) 778-6480 FAX (408) 779-7236

DRAWN: TH | DESIGN: HKS | HOR.: SHOWN | VERT.: SHOWN | JOB NO.: 24061.3
CHECKED: | DATE:
APPROVED: | DATE:

MH engineering Co.
SUBDIVISIONS – LAND PLANNING – LAND SURVEYS
18075 VINEYARD BOULEVARD MORGAN HILL, CA 95037
(408) 779-7381 FAX: (408) 226-5712

GRADING SECTIONS- REGIONAL DETENTION BASIN
BUTTERFIELD BLVD SOUTH EXTENSION
MORGAN HILL CALIFORNIA

CITY FILE NO.
PLAN DATE: 12/09
DRAWING: 28 OF XX

GRADING SECTIONS- REGIONAL DETENTION BASIN
BUTTERFIELD BLVD SOUTH EXTENSION

L:\Projects\2002\24061\dwg\24061-027\b528- Detention Basin.dwg 12/28/2009 10:21:49 AM PST
Xref's: 24061.XG, 24061-XTP, 24061.3BS, 24061.3TA, 24061.3-30

Appendix E

Monterey-Butterfield Detention Basin Study

JOB TITLE

Project Date: 5/8/2008
Project Engineer: Harry Singla
Project Title: Butterfield ph IV mitigation Hydrology Analysis
Project Comments:
Proposed Pond is to mitigate increased runoff for Butterfield improvements south of Railroad Avenue. Pond is to be excavated on the southerly SERGI parcel (APN817-06-003). Low flow release into existing creek.

MASTER DESIGN STORM SUMMARY

Network Storm Collection: SCVWD1959

Return Event	Total Depth in	Rainfall Type	RNF ID
Dev 10	4.1742	Synthetic Curve	SCVWD 1959 STORM
Dev 25	4.7748	Synthetic Curve	SCVWD 1959 STORM
Dev100	5.5956	Synthetic Curve	SCVWD 1959 STORM

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
DEVELOPED SITE	AREA	10	3.853		18.0000	8.99		
DEVELOPED SITE	AREA	25	4.882		18.0000	11.04		
DEVELOPED SITE	AREA	100	6.360		18.0000	13.88		
*OUT	JCT	10	3.671		18.1000	7.61		
*OUT	JCT	25	4.700		18.1000	9.33		
*OUT	JCT	100	6.178		18.1500	11.05		
POND IN	POND	10	3.853		18.0000	8.99		
POND IN	POND	25	4.882		18.0000	11.04		
POND IN	POND	100	6.360		18.0000	13.88		
POND OUT	POND	10	3.671		18.1000	7.61	314.61	.516
POND OUT	POND	25	4.700		18.1000	9.33	314.91	.610
POND OUT	POND	100	6.178		18.1500	11.05	315.35	.767

LEVEL POOL ROUTING DATA

HYG Dir = L:\Projects2002\24061\PondPack\
Inflow HYG file = work_pad.hyg - POND IN Dev 10
Outflow HYG file = work_pad.hyg - POND OUT Dev 10

Pond Node Data = POND
Pond Volume Data = POND
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 312.30 ft
Starting Volume = .000 ac-ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = .0500 hrs

Elevation ft	Outflow cfs	Storage ac-ft	Infilt. cfs	Q Total cfs	2S/t + O cfs
312.30	.00	.000	.00	.00	.00
312.50	.00	.000	.00	.00	.19
312.70	.00	.001	.00	.00	.39
312.80	.00	.001	.00	.00	.48
312.90	.00	.026	.00	.00	12.34
313.10	.00	.076	.00	.00	36.97
313.30	.00	.129	.00	.00	62.53
313.50	.00	.182	.00	.00	88.09
313.70	2.38	.237	.00	2.38	117.19
313.90	3.34	.292	.00	3.34	144.87
314.10	4.46	.352	.00	4.46	174.83
314.30	5.66	.416	.00	5.66	207.00
314.50	6.90	.480	.00	6.90	239.22
314.70	8.15	.544	.00	8.15	271.44
314.90	9.30	.608	.00	9.30	303.57
315.10	10.11	.676	.00	10.11	337.29
315.30	10.86	.748	.00	10.86	372.89
315.50	11.56	.820	.00	11.56	408.44

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = L:\Projects2002\24061\PondPack\
Inflow  HYG file = work_pad.hyg - POND         IN  Dev 10
Outflow HYG file = work_pad.hyg - POND         OUT Dev 10

Pond Node   Data = POND
Pond Volume Data = POND
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
---------------------------------
Starting WS Elev   =   312.30 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0500 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow        =      8.99 cfs    at   18.0000 hrs
Peak Outflow       =      7.61 cfs    at   18.1000 hrs
-----------------------------------------------------
Peak Elevation     =    314.61 ft
Peak Storage =            .516 ac-ft
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =       3.853
- Infiltration =        .000
- HYG Vol OUT  =       3.671
- Retained Vol =        .182
                 ----------
Unrouted Vol =         .000 ac-ft  (.000% of Inflow Volume)
```

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = L:\Projects2002\24061\PondPack\
Inflow  HYG file = work_pad.hyg - POND         IN  Dev 25
Outflow HYG file = work_pad.hyg - POND         OUT Dev 25

Pond Node   Data = POND
Pond Volume Data = POND
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =   312.30 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0500 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY
==================================================
Peak Inflow        =     11.04 cfs    at   18.0000 hrs
Peak Outflow       =      9.33 cfs    at   18.1000 hrs
--------------------------------------------------
Peak Elevation     =    314.91 ft
Peak Storage =            .610 ac-ft
==================================================

MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =       4.882
- Infiltration =        .000
- HYG Vol OUT  =       4.700
- Retained Vol =        .182
                 ----------
Unrouted Vol =        -.000 ac-ft  (.000% of Inflow Volume)
```

LEVEL POOL ROUTING SUMMARY

```
HYG Dir          = L:\Projects2002\24061\PondPack\
Inflow  HYG file = work_pad.hyg - POND         IN  Dev100
Outflow HYG file = work_pad.hyg - POND         OUT Dev100

Pond Node   Data = POND
Pond Volume Data = POND
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =   312.30 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0500 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
==================================================
Peak Inflow       =     13.88 cfs    at   18.0000 hrs
Peak Outflow      =     11.05 cfs    at   18.1500 hrs
--------------------------------------------------
Peak Elevation    =    315.35 ft
Peak Storage =           .767 ac-ft
==================================================


MASS BALANCE (ac-ft)
---------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =       6.360
- Infiltration =        .000
- HYG Vol OUT  =       6.178
- Retained Vol =        .182
                 ----------
Unrouted Vol =        .000 ac-ft  (.000% of Inflow Volume)
```

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = C0 (Culvert-Circular)

Mannings open channel maximum capacity: 11.30 cfs
Upstream ID = (Pond Water Surface)
DNstream ID = TW (Pond Outfall)

WS Elev,Device Q		Tail Water		Notes
WS Elev. ft	Q cfs	TW Elev ft	Converge +/-ft	Computation Messages
312.30	.00	REVERSE: Flow is closed off		
312.50	.00	REVERSE: Flow is closed off		
312.70	.00	REVERSE: Flow is closed off		
312.80	.00	REVERSE: Flow is closed off		
312.90	.00	REVERSE: Flow is closed off		
313.10	.00	REVERSE: Flow is closed off		
313.30	.00	REVERSE: Flow is closed off		
313.50	.00	313.50	.000	
		HW = TW elev		
313.70	2.38	313.50	.000	
		BACKWATER CONTROL.. Vh= .192ft hwDi= .612ft Lbw= 50.0ft Hev= .00ft		
313.90	3.34	313.50	.000	
		CRIT.DEPTH CONTROL Vh= .269ft Dcr= .697ft H.JUMP IN PIPE Hev= .00ft		
314.10	4.46	313.50	.000	
		CRIT.DEPTH CONTROL Vh= .326ft Dcr= .811ft H.JUMP IN PIPE Hev= .00ft		
314.30	5.66	313.50	.000	
		CRIT.DEPTH CONTROL Vh= .388ft Dcr= .918ft H.JUMP IN PIPE Hev= .00ft		
314.50	6.90	313.50	.000	
		CRIT.DEPTH CONTROL Vh= .455ft Dcr= 1.017ft H.JUMP IN PIPE Hev= .00ft		
314.70	8.15	313.50	.000	
		CRIT.DEPTH CONTROL Vh= .529ft Dcr= 1.106ft H.JUMP IN PIPE Hev= .00ft		
314.90	9.30	313.50	.000	
		INLET CONTROL... Submerged: HW =2.10		
315.10	10.11	313.50	.000	
		INLET CONTROL... Submerged: HW =2.30		
315.30	10.86	313.50	.000	
		INLET CONTROL... Submerged: HW =2.50		
315.50	11.56	313.50	.000	
		INLET CONTROL... Submerged: HW =2.70		

USER DEFINED VOLUME RATING TABLE

Elevation (ft)	Volume (ac-ft)
312.30	.000
312.80	.001
313.00	.050
313.50	.182
314.00	.320
314.50	.480
315.00	.640
315.50	.820

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 10 year storm
Duration = 23.0000 hrs Rain Depth = 4.1742 in
Rain Dir = L:\Projects2002\24061\PondPack\
Rain File -ID = - SCVWD 1959 STORM
Unit Hyd Type = Default Curvilinear
HYG Dir = L:\Projects2002\24061\PondPack\
HYG File - ID = work_pad.hyg - DEVELOPED SITE Dev 10
Tc = .2500 hrs
Drainage Area = 26.800 acres Runoff CN= 74
Calc.Increment= .03333 hrs Out.Incr.= .0500 hrs
HYG Volume = 3.853 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
6.0000	.00	.00	.00	.01	.02
6.2500	.03	.04	.05	.06	.08
6.5000	.09	.10	.11	.12	.14
6.7500	.15	.16	.17	.18	.20
7.0000	.21	.22	.24	.27	.29
7.2500	.32	.34	.36	.38	.40
7.5000	.41	.43	.45	.46	.48
7.7500	.50	.51	.53	.54	.56
8.0000	.57	.59	.60	.61	.63
8.2500	.64	.65	.66	.68	.69
8.5000	.70	.72	.73	.75	.76
8.7500	.77	.79	.80	.81	.83
9.0000	.84	.85	.85	.84	.83
9.2500	.83	.83	.83	.84	.85
9.5000	.86	.86	.87	.88	.89
9.7500	.90	.91	.92	.93	.94
10.0000	.95	.96	.97	.98	.99
10.2500	1.00	1.01	1.01	1.02	1.03
10.5000	1.04	1.05	1.06	1.07	1.08
10.7500	1.09	1.09	1.10	1.11	1.12
11.0000	1.13	1.14	1.16	1.19	1.23
11.2500	1.25	1.27	1.29	1.30	1.31
11.5000	1.32	1.33	1.34	1.35	1.36
11.7500	1.37	1.38	1.39	1.40	1.41
12.0000	1.42	1.43	1.45	1.48	1.50
12.2500	1.53	1.54	1.56	1.57	1.58
12.5000	1.59	1.60	1.61	1.62	1.63
12.7500	1.64	1.65	1.66	1.67	1.68
13.0000	1.69	1.73	1.85	2.04	2.24
13.2500	2.39	2.50	2.57	2.62	2.66

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
13.5000	2.69	2.71	2.74	2.76	2.78
13.7500	2.80	2.82	2.83	2.85	2.87
14.0000	2.89	2.88	2.80	2.65	2.49
14.2500	2.38	2.31	2.28	2.26	2.25
14.5000	2.25	2.25	2.26	2.26	2.27
14.7500	2.28	2.29	2.30	2.31	2.31
15.0000	2.32	2.39	2.58	2.90	3.23
15.2500	3.48	3.64	3.75	3.82	3.87
15.5000	3.91	3.95	3.98	4.00	4.02
15.7500	4.05	4.07	4.09	4.11	4.13
16.0000	4.14	4.16	4.16	4.15	4.15
16.2500	4.14	4.15	4.16	4.17	4.19
16.5000	4.20	4.22	4.23	4.25	4.27
16.7500	4.28	4.30	4.31	4.33	4.34
17.0000	4.36	4.52	5.01	5.85	6.70
17.2500	7.35	7.78	8.04	8.23	8.36
17.5000	8.46	8.54	8.61	8.67	8.72
17.7500	8.77	8.82	8.86	8.91	8.95
18.0000	8.99	8.82	8.16	6.98	5.79
18.2500	4.91	4.36	4.04	3.84	3.72
18.5000	3.65	3.61	3.58	3.57	3.57
18.7500	3.56	3.57	3.57	3.58	3.58
19.0000	3.59	3.58	3.55	3.49	3.43
19.2500	3.38	3.36	3.34	3.34	3.34
19.5000	3.34	3.34	3.34	3.34	3.35
19.7500	3.35	3.35	3.36	3.36	3.37
20.0000	3.37	3.36	3.30	3.21	3.11
20.2500	3.04	2.99	2.97	2.95	2.95
20.5000	2.94	2.94	2.94	2.94	2.95
20.7500	2.95	2.95	2.95	2.96	2.96
21.0000	2.96	2.96	2.93	2.88	2.83
21.2500	2.80	2.77	2.76	2.76	2.75
21.5000	2.75	2.75	2.75	2.75	2.76
21.7500	2.76	2.76	2.76	2.76	2.77
22.0000	2.77	2.77	2.79	2.81	2.83
22.2500	2.84	2.85	2.86	2.86	2.87
22.5000	2.87	2.88	2.88	2.88	2.88
22.7500	2.89	2.89	2.89	2.89	2.89
23.0000	2.90	2.89	2.87	2.84	2.81
23.2500	2.78	2.77	2.76	2.76	2.76
23.5000	2.75	2.76	2.76	2.76	2.76
23.7500	2.76	2.76	2.76	2.77	2.77
24.0000	2.77	2.67	2.33	1.74	1.14
24.2500	.70	.42	.26	.16	.10
24.5000	.06	.03	.02	.01	.01

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 23.0000 hrs Rain Depth = 4.7748 in
Rain Dir = L:\Projects2002\24061\PondPack\
Rain File -ID = - SCVWD 1959 STORM
Unit Hyd Type = Default Curvilinear
HYG Dir = L:\Projects2002\24061\PondPack\
HYG File - ID = work_pad.hyg - DEVELOPED SITE Dev 25
Tc = .2500 hrs
Drainage Area = 26.800 acres Runoff CN= 74
Calc.Increment= .03333 hrs Out.Incr.= .0500 hrs
HYG Volume = 4.882 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
5.4000	.00	.00	.01	.02	.03
5.6500	.05	.07	.09	.11	.13
5.9000	.15	.17	.19	.21	.22
6.1500	.23	.24	.26	.27	.28
6.4000	.30	.31	.33	.34	.36
6.6500	.37	.38	.40	.41	.43
6.9000	.44	.46	.47	.49	.52
7.1500	.56	.60	.64	.67	.69
7.4000	.72	.74	.76	.78	.80
7.6500	.82	.84	.86	.88	.90
7.9000	.92	.93	.95	.97	.98
8.1500	1.00	1.01	1.02	1.03	1.05
8.4000	1.07	1.08	1.10	1.11	1.13
8.6500	1.14	1.16	1.18	1.19	1.21
8.9000	1.22	1.24	1.25	1.26	1.26
9.1500	1.24	1.23	1.22	1.22	1.22
9.4000	1.23	1.23	1.24	1.25	1.26
9.6500	1.28	1.29	1.30	1.31	1.32
9.9000	1.33	1.34	1.35	1.36	1.37
10.1500	1.38	1.39	1.40	1.41	1.42
10.4000	1.44	1.45	1.46	1.47	1.48
10.6500	1.49	1.50	1.51	1.52	1.53
10.9000	1.54	1.54	1.55	1.57	1.60
11.1500	1.64	1.68	1.71	1.74	1.76
11.4000	1.77	1.79	1.80	1.81	1.82
11.6500	1.84	1.85	1.86	1.87	1.88
11.9000	1.89	1.90	1.91	1.92	1.95
12.1500	1.98	2.01	2.04	2.06	2.08
12.4000	2.10	2.11	2.12	2.13	2.14
12.6500	2.16	2.17	2.18	2.19	2.20

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
12.9000	2.21	2.22	2.23	2.28	2.43
13.1500	2.69	2.95	3.15	3.28	3.37
13.4000	3.43	3.47	3.51	3.54	3.57
13.6500	3.59	3.62	3.64	3.66	3.68
13.9000	3.70	3.72	3.74	3.72	3.61
14.1500	3.42	3.22	3.07	2.98	2.93
14.4000	2.91	2.90	2.89	2.89	2.90
14.6500	2.90	2.91	2.92	2.93	2.94
14.9000	2.95	2.96	2.97	3.05	3.29
15.1500	3.70	4.11	4.43	4.64	4.76
15.4000	4.86	4.92	4.97	5.01	5.04
15.6500	5.07	5.09	5.12	5.14	5.16
15.9000	5.18	5.20	5.22	5.24	5.24
16.1500	5.23	5.21	5.21	5.21	5.22
16.4000	5.23	5.25	5.26	5.28	5.30
16.6500	5.31	5.33	5.35	5.36	5.38
16.9000	5.40	5.42	5.43	5.63	6.23
17.1500	7.28	8.33	9.13	9.65	9.97
17.4000	10.20	10.35	10.47	10.56	10.63
17.6500	10.70	10.75	10.81	10.86	10.90
17.9000	10.95	11.00	11.04	10.82	10.01
18.1500	8.56	7.10	6.02	5.33	4.95
18.4000	4.69	4.55	4.46	4.41	4.38
18.6500	4.36	4.36	4.35	4.36	4.36
18.9000	4.37	4.37	4.38	4.37	4.33
19.1500	4.25	4.18	4.12	4.09	4.08
19.4000	4.07	4.06	4.06	4.06	4.07
19.6500	4.07	4.07	4.08	4.08	4.08
19.9000	4.09	4.09	4.10	4.08	4.01
20.1500	3.90	3.78	3.69	3.63	3.60
20.4000	3.59	3.58	3.57	3.57	3.57
20.6500	3.57	3.57	3.57	3.58	3.58
20.9000	3.58	3.59	3.59	3.58	3.55
21.1500	3.49	3.43	3.38	3.36	3.34
21.4000	3.34	3.33	3.33	3.33	3.33
21.6500	3.33	3.33	3.34	3.34	3.34
21.9000	3.34	3.34	3.35	3.35	3.37
22.1500	3.39	3.41	3.43	3.45	3.45
22.4000	3.46	3.46	3.47	3.47	3.47
22.6500	3.48	3.48	3.48	3.48	3.49
22.9000	3.49	3.49	3.49	3.49	3.47
23.1500	3.42	3.38	3.35	3.34	3.33
23.4000	3.32	3.32	3.32	3.32	3.32
23.6500	3.32	3.32	3.32	3.33	3.33
23.9000	3.33	3.33	3.33	3.21	2.80

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 23.0000 hrs Rain Depth = 5.5956 in
Rain Dir = L:\Projects2002\24061\PondPack\
Rain File -ID = - SCVWD 1959 STORM
Unit Hyd Type = Default Curvilinear
HYG Dir = L:\Projects2002\24061\PondPack\
HYG File - ID = work_pad.hyg - DEVELOPED SITE Dev100
Tc = .2500 hrs
Drainage Area = 26.800 acres Runoff CN= 74
Calc.Increment= .03333 hrs Out.Incr.= .0500 hrs
HYG Volume = 6.360 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
4.8000	.00	.00	.01	.02	.05
5.0500	.08	.11	.13	.16	.18
5.3000	.21	.24	.26	.29	.32
5.5500	.35	.37	.40	.42	.45
5.8000	.48	.50	.53	.55	.58
6.0500	.60	.61	.62	.62	.63
6.3000	.64	.66	.67	.69	.71
6.5500	.73	.74	.76	.78	.80
6.8000	.81	.83	.85	.86	.88
7.0500	.91	.95	1.02	1.08	1.14
7.3000	1.18	1.22	1.25	1.28	1.30
7.5500	1.33	1.35	1.38	1.40	1.42
7.8000	1.45	1.47	1.49	1.51	1.53
8.0500	1.55	1.57	1.58	1.59	1.61
8.3000	1.62	1.64	1.66	1.68	1.70
8.5500	1.71	1.73	1.75	1.77	1.79
8.8000	1.81	1.83	1.84	1.86	1.88
9.0500	1.89	1.88	1.85	1.82	1.80
9.3000	1.80	1.80	1.80	1.81	1.82
9.5500	1.84	1.85	1.86	1.87	1.88
9.8000	1.90	1.91	1.92	1.94	1.95
10.0500	1.96	1.97	1.98	2.00	2.01
10.3000	2.02	2.03	2.05	2.06	2.07
10.5500	2.08	2.09	2.10	2.11	2.13
10.8000	2.14	2.15	2.16	2.17	2.18
11.0500	2.20	2.24	2.29	2.35	2.39
11.3000	2.42	2.45	2.47	2.48	2.50
11.5500	2.51	2.53	2.54	2.55	2.56
11.8000	2.58	2.59	2.60	2.61	2.62
12.0500	2.64	2.67	2.71	2.76	2.79

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
12.3000	2.82	2.84	2.86	2.87	2.89
12.5500	2.90	2.91	2.93	2.94	2.95
12.8000	2.96	2.97	2.99	3.00	3.01
13.0500	3.08	3.28	3.62	3.97	4.23
13.3000	4.40	4.51	4.60	4.65	4.70
13.5500	4.73	4.76	4.79	4.82	4.84
13.8000	4.87	4.89	4.91	4.93	4.95
14.0500	4.92	4.78	4.52	4.25	4.05
14.3000	3.93	3.87	3.83	3.81	3.81
14.5500	3.81	3.81	3.82	3.82	3.83
14.8000	3.84	3.85	3.86	3.87	3.88
15.0500	3.99	4.30	4.83	5.37	5.78
15.3000	6.04	6.21	6.32	6.40	6.46
15.5500	6.50	6.54	6.57	6.60	6.63
15.8000	6.65	6.67	6.70	6.72	6.74
16.0500	6.76	6.75	6.73	6.71	6.70
16.3000	6.70	6.71	6.72	6.74	6.75
16.5500	6.77	6.79	6.81	6.82	6.84
16.8000	6.86	6.88	6.90	6.91	6.93
17.0500	7.18	7.94	9.27	10.60	11.61
17.3000	12.26	12.66	12.94	13.13	13.26
17.5500	13.37	13.45	13.52	13.58	13.64
17.8000	13.69	13.74	13.79	13.84	13.88
18.0500	13.60	12.58	10.75	8.91	7.55
18.3000	6.69	6.20	5.88	5.70	5.59
18.5500	5.52	5.48	5.46	5.45	5.45
18.8000	5.45	5.45	5.46	5.47	5.47
19.0500	5.46	5.41	5.31	5.22	5.15
19.3000	5.11	5.08	5.07	5.07	5.06
19.5500	5.07	5.07	5.07	5.07	5.08
19.8000	5.08	5.09	5.09	5.10	5.10
20.0500	5.08	4.99	4.85	4.70	4.59
20.3000	4.52	4.48	4.46	4.44	4.44
20.5500	4.43	4.43	4.44	4.44	4.44
20.8000	4.44	4.44	4.45	4.45	4.45
21.0500	4.44	4.40	4.33	4.25	4.20
21.3000	4.16	4.14	4.13	4.13	4.13
21.5500	4.13	4.13	4.13	4.13	4.13
21.8000	4.13	4.14	4.14	4.14	4.14
22.0500	4.15	4.17	4.20	4.22	4.25
22.3000	4.26	4.27	4.28	4.28	4.29
22.5500	4.29	4.29	4.30	4.30	4.30
22.8000	4.30	4.31	4.31	4.31	4.31
23.0500	4.31	4.28	4.23	4.18	4.14
23.3000	4.12	4.10	4.10	4.09	4.09

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 10 year storm
Duration = 23.0000 hrs Rain Depth = 4.1742 in
Rain Dir = L:\Projects2002\24061\PondPack\
Rain File -ID = - SCVWD 1959 STORM
Unit Hyd Type = Default Curvilinear
HYG Dir = L:\Projects2002\24061\PondPack\
HYG File - ID = work_pad.hyg - EXISTING SITE Pre 10
Tc = .3700 hrs
Drainage Area = 26.800 acres Runoff CN= 70
Calc.Increment= .04933 hrs Out.Incr.= .0500 hrs
HYG Volume = 3.232 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
7.2000	.00	.00	.00	.01	.02
7.4500	.03	.04	.05	.06	.08
7.7000	.09	.11	.12	.14	.15
7.9500	.16	.18	.19	.21	.22
8.2000	.24	.25	.26	.27	.29
8.4500	.30	.31	.33	.34	.35
8.7000	.37	.38	.39	.41	.42
8.9500	.43	.44	.46	.47	.47
9.2000	.48	.48	.48	.49	.49
9.4500	.50	.51	.51	.52	.53
9.7000	.54	.55	.56	.57	.58
9.9500	.59	.60	.60	.61	.62
10.2000	.63	.64	.65	.66	.67
10.4500	.68	.69	.69	.70	.71
10.7000	.72	.73	.74	.75	.75
10.9500	.76	.77	.78	.79	.81
11.2000	.83	.85	.87	.89	.90
11.4500	.91	.93	.94	.95	.96
11.7000	.97	.98	.99	1.00	1.01
11.9500	1.02	1.03	1.04	1.05	1.07
12.2000	1.08	1.10	1.12	1.14	1.15
12.4500	1.16	1.18	1.19	1.20	1.21
12.7000	1.22	1.23	1.24	1.25	1.26
12.9500	1.27	1.28	1.30	1.35	1.42
13.2000	1.53	1.64	1.74	1.84	1.91
13.4500	1.97	2.01	2.05	2.08	2.11
13.7000	2.14	2.16	2.19	2.21	2.23
13.9500	2.25	2.27	2.27	2.26	2.22
14.2000	2.15	2.07	2.00	1.94	1.90
14.4500	1.87	1.86	1.85	1.84	1.84

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
14.7000	1.85	1.85	1.86	1.86	1.87
14.9500	1.88	1.89	1.92	1.99	2.12
15.2000	2.30	2.49	2.67	2.83	2.95
15.4500	3.04	3.11	3.16	3.21	3.25
15.7000	3.29	3.32	3.34	3.37	3.39
15.9500	3.42	3.44	3.46	3.48	3.49
16.2000	3.49	3.50	3.50	3.51	3.52
16.4500	3.53	3.54	3.56	3.58	3.59
16.7000	3.61	3.63	3.64	3.66	3.68
16.9500	3.69	3.72	3.80	3.99	4.34
17.2000	4.81	5.33	5.82	6.23	6.55
17.4500	6.79	6.98	7.13	7.25	7.36
17.7000	7.44	7.52	7.59	7.65	7.71
17.9500	7.76	7.80	7.75	7.54	7.08
18.2000	6.44	5.74	5.08	4.53	4.13
18.4500	3.84	3.64	3.50	3.40	3.33
18.7000	3.28	3.25	3.23	3.21	3.20
18.9500	3.20	3.20	3.19	3.18	3.16
19.2000	3.12	3.09	3.05	3.03	3.01
19.4500	3.00	2.99	2.99	2.99	2.99
19.7000	2.99	3.00	3.00	3.00	3.01
19.9500	3.01	3.01	3.01	2.99	2.96
20.2000	2.90	2.84	2.79	2.74	2.71
20.4500	2.69	2.68	2.67	2.66	2.66
20.7000	2.66	2.66	2.66	2.66	2.66
20.9500	2.66	2.66	2.66	2.65	2.64
21.2000	2.61	2.58	2.55	2.53	2.52
21.4500	2.51	2.50	2.50	2.49	2.49
21.7000	2.49	2.49	2.50	2.50	2.50
21.9500	2.50	2.50	2.51	2.51	2.52
22.2000	2.54	2.55	2.56	2.57	2.58
22.4500	2.59	2.59	2.60	2.60	2.61
22.7000	2.61	2.61	2.62	2.62	2.62
22.9500	2.63	2.63	2.63	2.62	2.61
23.2000	2.59	2.57	2.55	2.54	2.53
23.4500	2.52	2.52	2.52	2.51	2.51
23.7000	2.52	2.52	2.52	2.52	2.52
23.9500	2.52	2.52	2.47	2.34	2.09
24.2000	1.75	1.37	1.02	.74	.52
24.4500	.38	.27	.19	.14	.10
24.7000	.07	.05	.03	.02	.02
24.9500	.01	.01	.00	.00	.00

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 23.0000 hrs Rain Depth = 4.7748 in
Rain Dir = L:\Projects2002\24061\PondPack\
Rain File -ID = - SCVWD 1959 STORM
Unit Hyd Type = Default Curvilinear
HYG Dir = L:\Projects2002\24061\PondPack\
HYG File - ID = work_pad.hyg - EXISTING SITE Pre 25
Tc = .3700 hrs
Drainage Area = 26.800 acres Runoff CN= 70
Calc.Increment= .04933 hrs Out.Incr.= .0500 hrs
HYG Volume = 4.178 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
6.4000	.00	.00	.00	.01	.02
6.6500	.02	.03	.05	.06	.07
6.9000	.08	.09	.11	.12	.14
7.1500	.15	.17	.20	.22	.24
7.4000	.26	.28	.30	.32	.34
7.6500	.36	.38	.39	.41	.43
7.9000	.45	.47	.48	.50	.52
8.1500	.53	.55	.56	.58	.59
8.4000	.61	.62	.64	.65	.67
8.6500	.69	.70	.72	.73	.75
8.9000	.76	.78	.79	.80	.81
9.1500	.82	.82	.82	.82	.82
9.4000	.83	.83	.84	.85	.86
9.6500	.87	.88	.89	.90	.91
9.9000	.92	.93	.94	.95	.96
10.1500	.97	.98	.99	1.00	1.01
10.4000	1.02	1.04	1.05	1.06	1.07
10.6500	1.08	1.09	1.10	1.11	1.12
10.9000	1.13	1.14	1.15	1.16	1.17
11.1500	1.19	1.22	1.24	1.27	1.29
11.4000	1.31	1.33	1.35	1.36	1.37
11.6500	1.39	1.40	1.41	1.42	1.43
11.9000	1.44	1.45	1.46	1.48	1.49
12.1500	1.51	1.53	1.56	1.58	1.60
12.4000	1.62	1.63	1.65	1.66	1.68
12.6500	1.69	1.70	1.71	1.72	1.73
12.9000	1.74	1.76	1.77	1.80	1.85
13.1500	1.96	2.10	2.25	2.39	2.51
13.4000	2.61	2.68	2.74	2.79	2.83
13.6500	2.87	2.90	2.93	2.95	2.98

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
13.9000	3.00	3.03	3.05	3.05	3.03
14.1500	2.96	2.87	2.76	2.67	2.58
14.4000	2.53	2.49	2.47	2.45	2.45
14.6500	2.44	2.45	2.45	2.45	2.46
14.9000	2.47	2.48	2.49	2.53	2.62
15.1500	2.79	3.02	3.27	3.50	3.70
15.4000	3.86	3.97	4.06	4.13	4.19
15.6500	4.23	4.28	4.31	4.34	4.37
15.9000	4.40	4.43	4.45	4.48	4.49
16.1500	4.50	4.51	4.51	4.51	4.51
16.4000	4.52	4.54	4.55	4.57	4.58
16.6500	4.60	4.62	4.64	4.66	4.67
16.9000	4.69	4.71	4.74	4.84	5.08
17.1500	5.52	6.12	6.76	7.38	7.90
17.4000	8.30	8.59	8.82	9.00	9.15
17.6500	9.27	9.37	9.46	9.54	9.61
17.9000	9.67	9.73	9.77	9.70	9.42
18.1500	8.85	8.05	7.17	6.34	5.65
18.4000	5.14	4.79	4.54	4.36	4.23
18.6500	4.14	4.08	4.04	4.01	3.99
18.9000	3.98	3.97	3.97	3.96	3.95
19.1500	3.92	3.87	3.83	3.79	3.75
19.4000	3.73	3.72	3.71	3.70	3.70
19.6500	3.70	3.70	3.70	3.71	3.71
19.9000	3.72	3.72	3.72	3.72	3.70
20.1500	3.65	3.58	3.51	3.44	3.38
20.4000	3.34	3.32	3.30	3.29	3.28
20.6500	3.27	3.27	3.27	3.27	3.27
20.9000	3.27	3.28	3.28	3.28	3.27
21.1500	3.24	3.21	3.17	3.14	3.11
21.4000	3.09	3.08	3.07	3.07	3.06
21.6500	3.06	3.06	3.06	3.06	3.06
21.9000	3.07	3.07	3.07	3.08	3.08
22.1500	3.09	3.11	3.13	3.14	3.15
22.4000	3.16	3.17	3.18	3.18	3.19
22.6500	3.19	3.20	3.20	3.20	3.21
22.9000	3.21	3.21	3.22	3.22	3.21
23.1500	3.19	3.17	3.14	3.12	3.10
23.4000	3.09	3.08	3.08	3.07	3.07
23.6500	3.07	3.07	3.07	3.07	3.07
23.9000	3.08	3.08	3.07	3.02	2.86
24.1500	2.55	2.13	1.67	1.25	.90
24.4000	.64	.46	.33	.24	.17
24.6500	.12	.08	.06	.04	.03
24.9000	.02	.01	.01	.00	.00

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 23.0000 hrs Rain Depth = 5.5956 in
Rain Dir = L:\Projects2002\24061\PondPack\
Rain File -ID = - SCVWD 1959 STORM
Unit Hyd Type = Default Curvilinear
HYG Dir = L:\Projects2002\24061\PondPack\
HYG File - ID = work_pad.hyg - EXISTING SITE Pre100
Tc = .3700 hrs
Drainage Area = 26.800 acres Runoff CN= 70
Calc.Increment= .04933 hrs Out.Incr.= .0500 hrs
HYG Volume = 5.557 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
5.6000	.00	.00	.01	.01	.03
5.8500	.04	.06	.07	.09	.12
6.1000	.14	.15	.17	.19	.20
6.3500	.22	.24	.25	.27	.29
6.6000	.30	.32	.34	.35	.37
6.8500	.39	.40	.42	.44	.46
7.1000	.48	.51	.54	.58	.62
7.3500	.65	.68	.71	.74	.76
7.6000	.79	.81	.84	.86	.88
7.8500	.90	.93	.95	.97	.99
8.1000	1.01	1.03	1.05	1.06	1.08
8.3500	1.10	1.11	1.13	1.15	1.17
8.6000	1.19	1.20	1.22	1.24	1.26
8.8500	1.28	1.30	1.31	1.33	1.35
9.1000	1.36	1.36	1.35	1.35	1.34
9.3500	1.34	1.34	1.34	1.35	1.36
9.6000	1.37	1.38	1.39	1.41	1.42
9.8500	1.43	1.44	1.45	1.47	1.48
10.1000	1.49	1.50	1.52	1.53	1.54
10.3500	1.55	1.57	1.58	1.59	1.60
10.6000	1.61	1.63	1.64	1.65	1.66
10.8500	1.67	1.69	1.70	1.71	1.72
11.1000	1.74	1.77	1.80	1.84	1.87
11.3500	1.91	1.93	1.95	1.97	1.99
11.6000	2.01	2.02	2.04	2.05	2.06
11.8500	2.08	2.09	2.10	2.11	2.13
12.1000	2.15	2.17	2.20	2.23	2.26
12.3500	2.29	2.31	2.33	2.35	2.36
12.6000	2.38	2.39	2.41	2.42	2.43
12.8500	2.45	2.46	2.47	2.49	2.52

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
13.1000	2.60	2.75	2.94	3.14	3.34
13.3500	3.50	3.63	3.73	3.81	3.87
13.6000	3.92	3.97	4.01	4.04	4.07
13.8500	4.10	4.13	4.16	4.18	4.18
14.1000	4.14	4.05	3.92	3.77	3.63
14.3500	3.52	3.44	3.39	3.35	3.33
14.6000	3.32	3.31	3.31	3.31	3.32
14.8500	3.33	3.33	3.34	3.36	3.41
15.1000	3.53	3.75	4.06	4.39	4.70
15.3500	4.97	5.16	5.31	5.43	5.52
15.6000	5.59	5.65	5.70	5.74	5.78
15.8500	5.81	5.84	5.87	5.90	5.93
16.1000	5.94	5.95	5.95	5.95	5.95
16.3500	5.95	5.96	5.97	5.98	6.00
16.6000	6.02	6.04	6.06	6.08	6.10
16.8500	6.12	6.14	6.16	6.19	6.32
17.1000	6.63	7.19	7.96	8.80	9.59
17.3500	10.25	10.76	11.14	11.42	11.65
17.6000	11.82	11.97	12.09	12.19	12.28
17.8500	12.36	12.43	12.50	12.53	12.44
18.1000	12.07	11.34	10.30	9.17	8.10
18.3500	7.22	6.57	6.12	5.79	5.56
18.6000	5.40	5.28	5.20	5.14	5.11
18.8500	5.08	5.06	5.05	5.05	5.04
19.1000	5.02	4.97	4.92	4.86	4.81
19.3500	4.76	4.73	4.71	4.70	4.69
19.6000	4.69	4.69	4.69	4.69	4.70
19.8500	4.70	4.70	4.71	4.71	4.70
20.1000	4.68	4.61	4.53	4.43	4.35
20.3500	4.27	4.22	4.19	4.17	4.15
20.6000	4.14	4.13	4.13	4.13	4.13
20.8500	4.13	4.13	4.13	4.13	4.13
21.1000	4.11	4.08	4.04	4.00	3.95
21.3500	3.92	3.89	3.88	3.86	3.86
21.6000	3.85	3.85	3.85	3.85	3.85
21.8500	3.85	3.85	3.86	3.86	3.86
22.1000	3.87	3.89	3.90	3.92	3.94
22.3500	3.96	3.97	3.98	3.99	3.99
22.6000	4.00	4.00	4.01	4.01	4.02
22.8500	4.02	4.02	4.02	4.03	4.03
23.1000	4.02	4.00	3.97	3.94	3.91
23.3500	3.88	3.87	3.85	3.85	3.84
23.6000	3.84	3.84	3.84	3.84	3.84
23.8500	3.84	3.84	3.85	3.84	3.77
24.1000	3.57	3.19	2.66	2.09	1.56

DRAINAGE MAP

1" = 200'

Developed Property

EX. DETENTION BASIN

FISHER AVE

MONTEREY

Watsonville Rd.

Proposed Stub-out

EX. Flow

SERGI

L.P. 315.4±

Proposed Detention Basin

Bottom 312.8

Low Top of Bank 315.5

Water depth ± 2.7'

Outlet Invert 309.3

W. Little Creek

SERGI

Zoning "RE"

Zoning "CS"

94

126

125

MAPLE AVE.

A = 26.8 acc.

T_c pre = 10 + .0078 $\left(\frac{1025^{3/4}}{6^{1/2}}\right)^{0.77}$

= 22 min (0.37 hr)

T_c post = 10 + $\frac{1192}{4 \times 60}$ (gutter length)

= 15 min (0.25 hr)

C_N pre = 70

C_N post = 74

Gutter field foot print weighted

$C_N = \frac{3.2(95) + 4.4(72)}{7.6}$

= 82

C_N post = $\frac{7.6(82) + 19.2(70)}{26.8}$

= 74

Appendix F

Butterfield Boulevard Extension Hydraulic Analysis

CITY OF MORGAN HILL

City of Morgan Hill

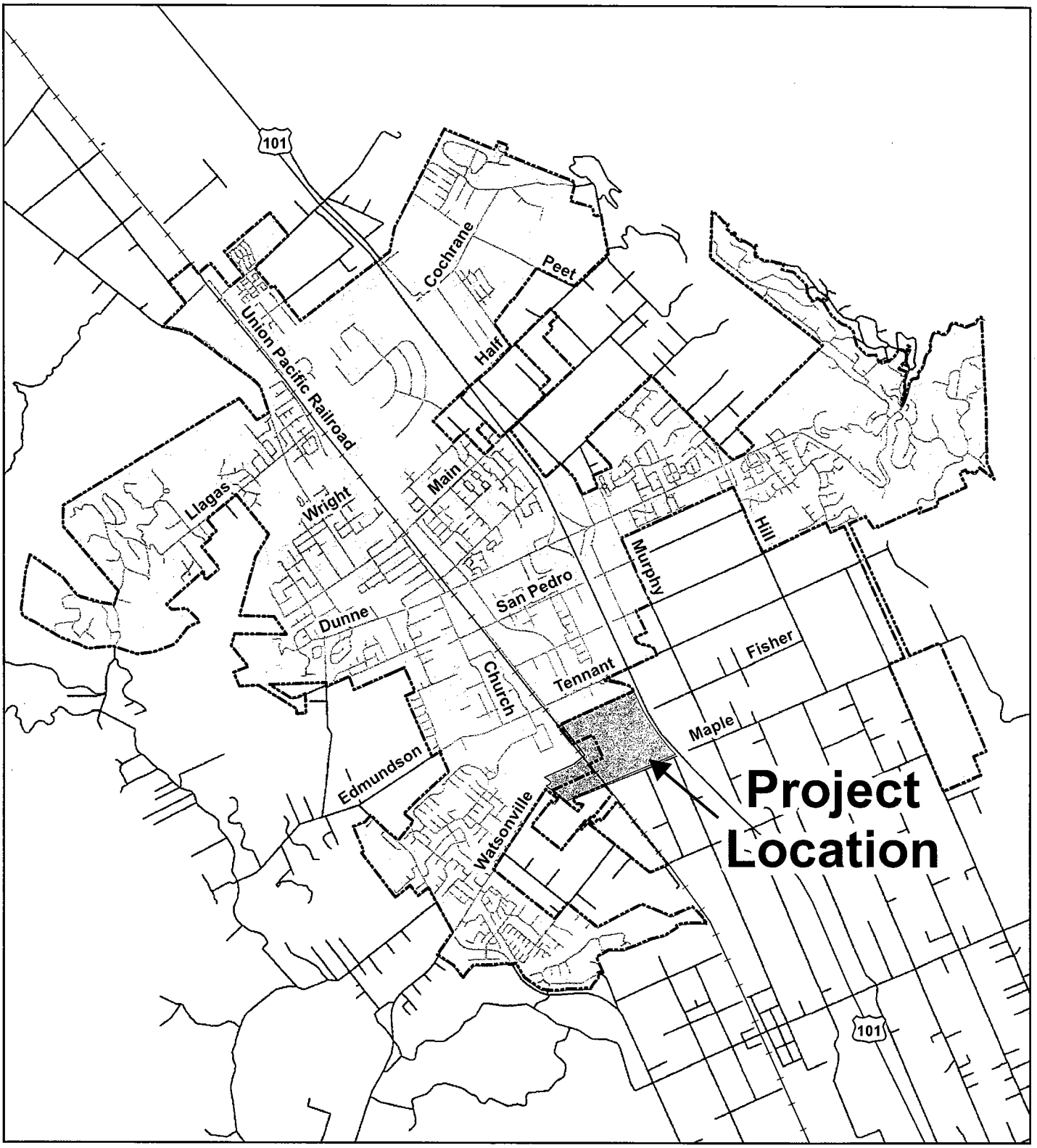
BUTTERFIELD BOULEVARD EXTENSION

HYDRAULIC ANALYSIS

Preliminary

February 2010

AKEL
ENGINEERING GROUP, INC.



Legend

- Study Area
- City Limits Boundary
- Roads
- Railroads

AKEL ENGINEERING GROUP, INC.

Updated: February 18, 2010

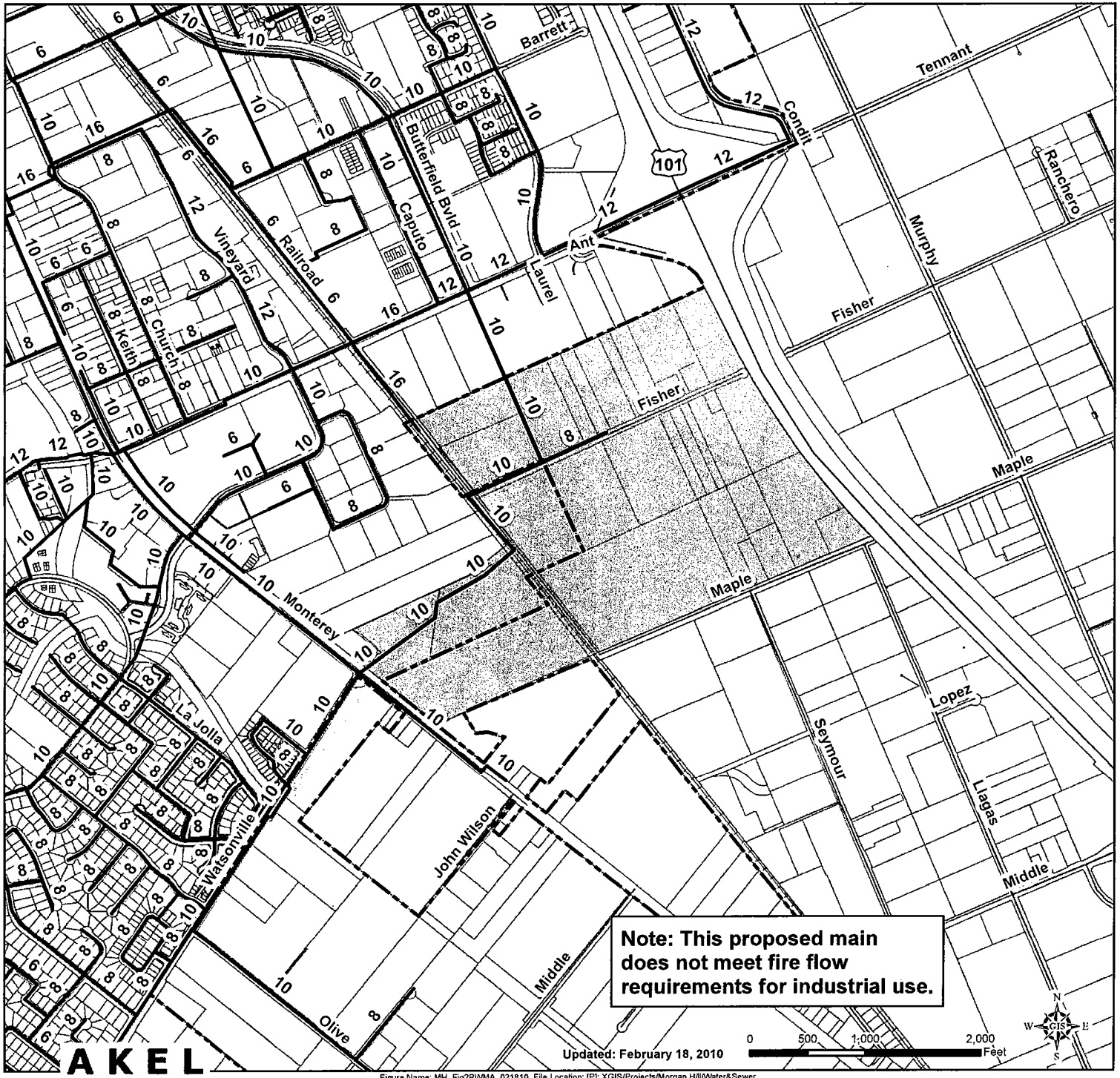
0 0.25 0.5 1 Mile

N W E S

File Name: MH_Fig1ProjLoc_021810 File Location: [P]: XGIS/Projects/Morgan Hill/Water&Sewer

Figure 1
Project Location
Butterfield Blvd
South Extension Project
City of Morgan Hill

CITY OF MORGAN HILL



Note: This proposed main does not meet fire flow requirements for industrial use.

Legend

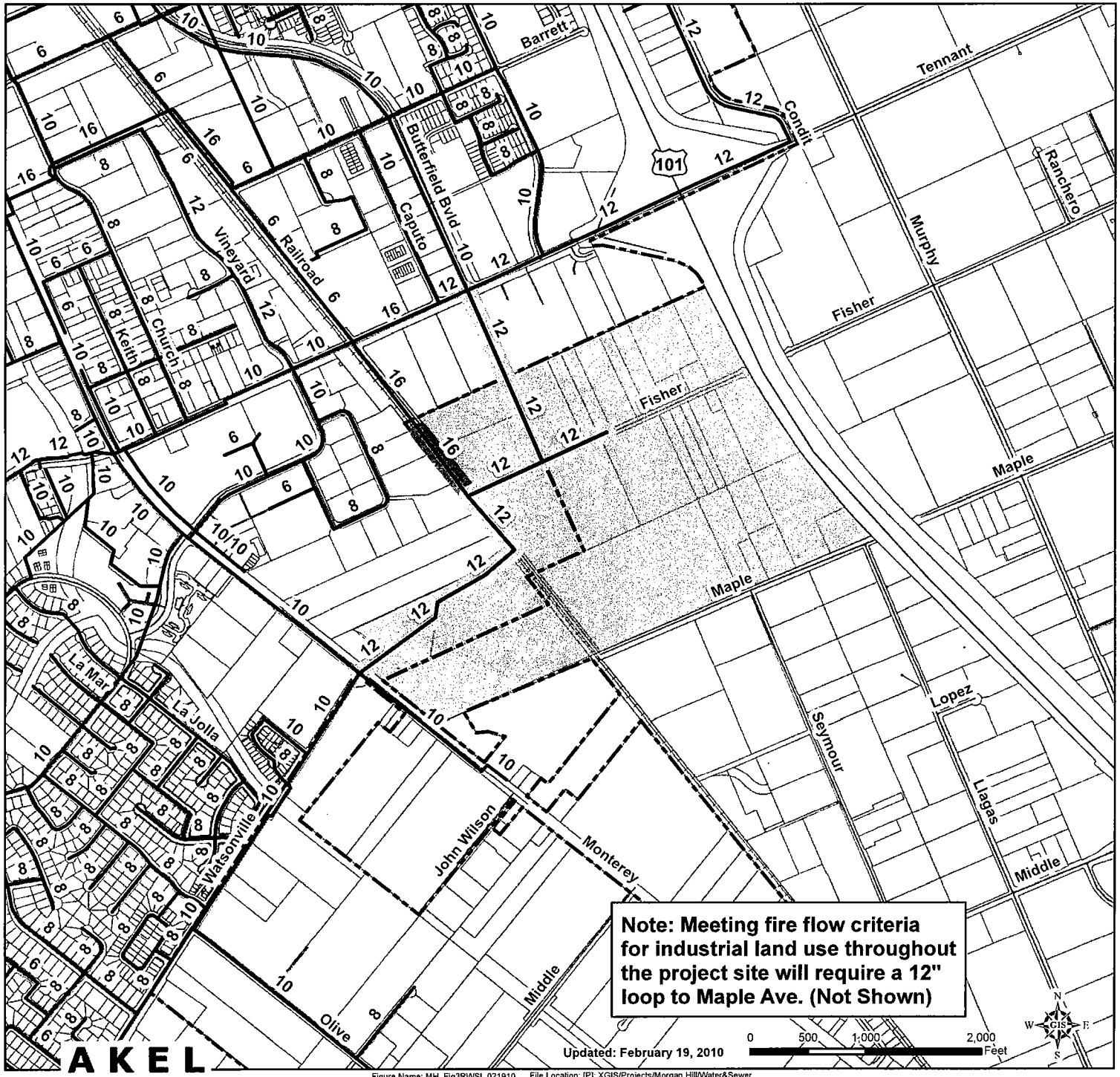
- Model Pipes
- Pipe Improvements
- City Limits
- Study Area
- Roads
- Base Map

Figure 2
Proposed Water Main and Alignment
Butterfield Blvd
South Extension Project
City of Morgan Hill

CITY OF MORGAN HILL

AKEL ENGINEERING GROUP, INC.

Figure Name: MH_Fig2PWMA_021810 File Location: [P]: XGIS/Projects/Morgan Hill/Water&Sewer



Note: Meeting fire flow criteria for industrial land use throughout the project site will require a 12" loop to Maple Ave. (Not Shown)

Legend

- Pipe Improvements
- Model Pipes
- Proposed Main and Alignment
- Additional Improvements to Meet Fire Flow
- Study Area
- City Limits
- Roads
- Base Map

Figure 3
Recommended Water System Improvements (Upsize Main)
Butterfield Blvd
South Extension Project
City of Morgan Hill

CITY OF MORGAN HILL

AKEL ENGINEERING GROUP, INC.

Figure Name: MH_Fig3RWSI_021910 File Location: [P]: XGIS/Projects/Morgan Hill/Water&Sewer

Legend

- Pipe Improvements
- Model Pipes
- Non Modeled Pipes
- Study Area
- City Limits
- Roads
- Base Map

Figure 4
Proposed Sewer Main and Alignment
Butterfield Blvd
South Extension Project
City of Morgan Hill

CITY OF MORGAN HILL

AKEL ENGINEERING GROUP, INC.

Figure Name: MH_Fig4PSMA_021810 File Location: [P]: XGIS/Projects/Morgan Hill/Water&Sewer

Legend

- Pipe Improvements
- Model Pipes
- Non Modeled Pipes
- Study Area
- City Limits
- Roads
- Base Map

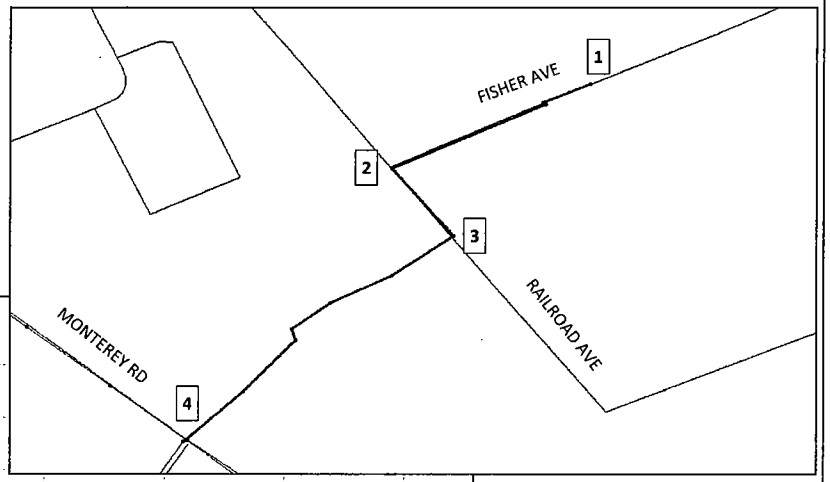
Figure 5
Recommended Sewer Main Improvements (Upsize Main)
Butterfield Blvd
South Extension Project
City of Morgan Hill

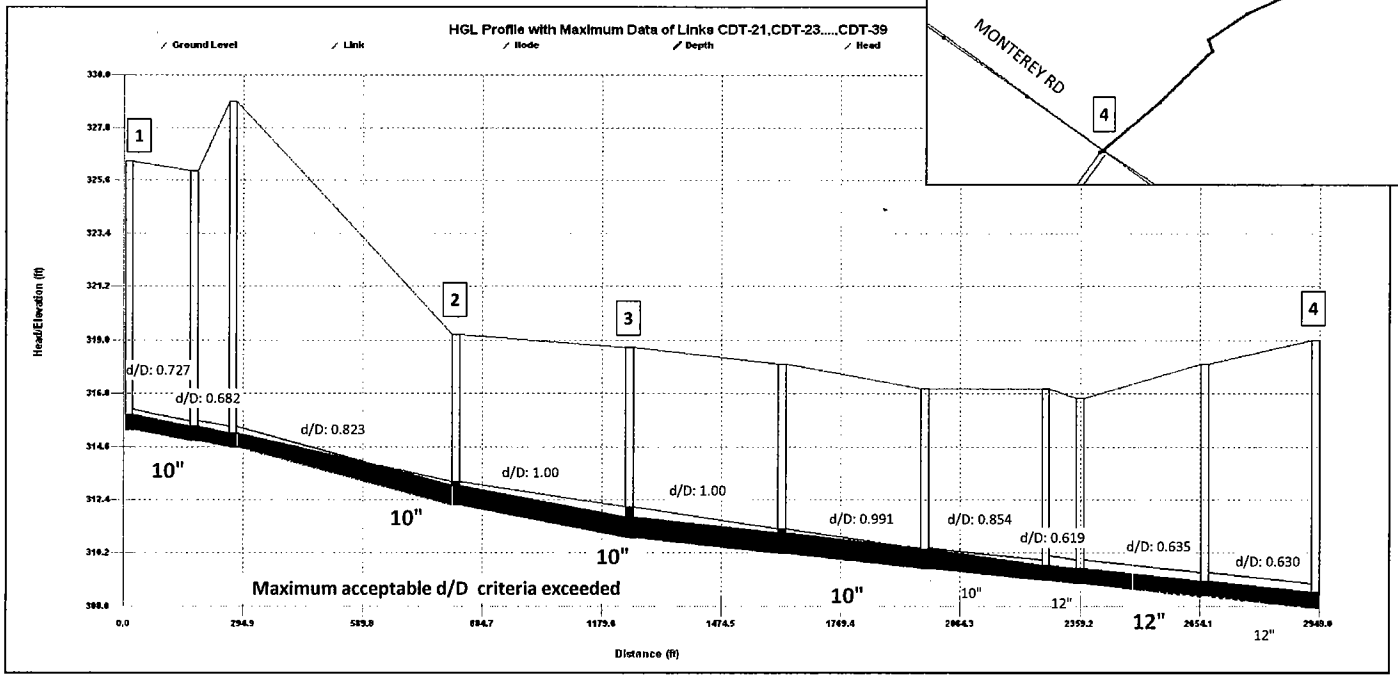
CITY OF MORGAN HILL

AKEL ENGINEERING GROUP, INC.

Updated: February 18, 2010

Figure Name: MH_Fig5RSMI_021810 File Location: [P]: XGIS/Projects/Morgan Hill/Water&Sewer





PRELIMINARY

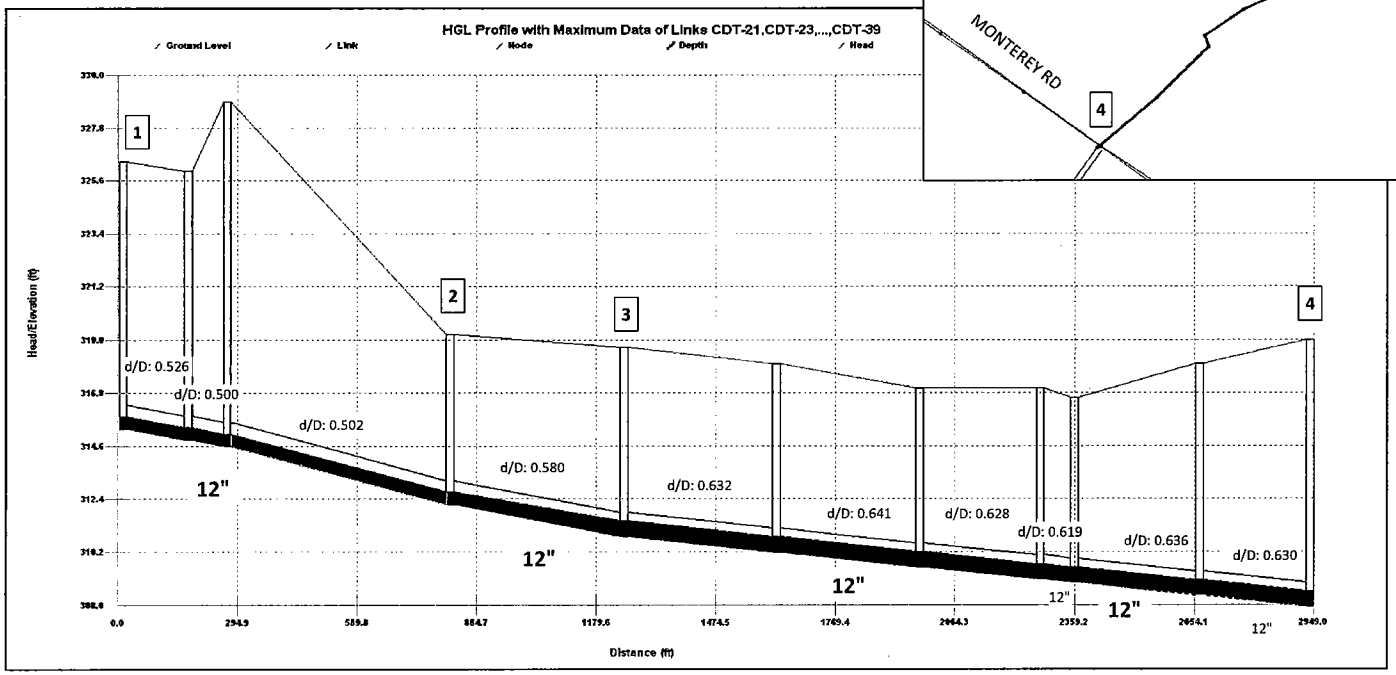
NOTES

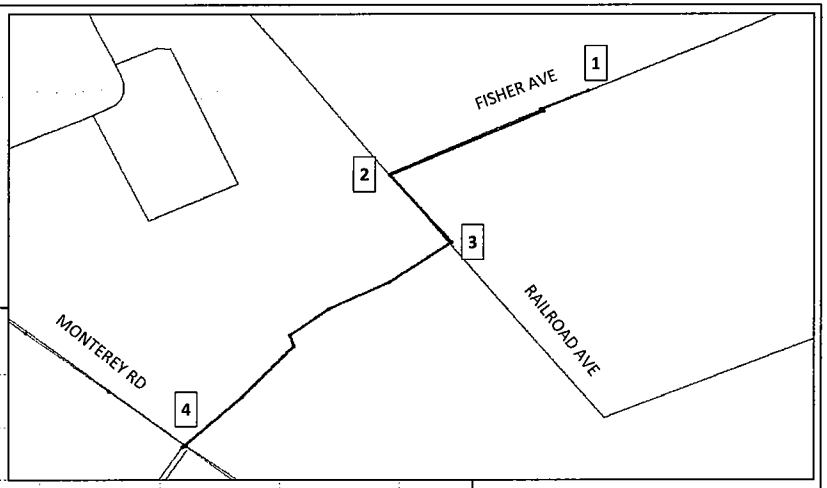
Note: Recommend raising the entire shown alignment so that the proposed new 12" trunk matches the soffit (not invert) of the existing 30" trunk.

February 12, 2010

Figure 6
Currently Proposed 10-inch Sewer Trunk
Butterfield Blvd. South Extension Project
Morgan Hill

AKEL ENGINEERING GROUP, INC.





PRELIMINARY

NOTES

Note: Recommend raising the entire shown alignment so that the proposed 12" trunk matches the soffit (not invert) of the existing 30" trunk.

February 12, 2010

Figure 7
Recommended
12-inch Sewer Trunk
Butterfield Blvd. South
Extension Project
Morgan Hill

AKEL ENGINEERING GROUP, INC.

Table 1 Domestic Water Demands and Sanitary Sewer Flows

Butterfield Blvd. South Extension Project

City of Morgan Hill

PRELIMINARY

Total Area Served			
Gross Area		Net Area[1]	
(acre)		(acre)	
188		170	
Domestic Water Demands		**Sanitary Sewer Flows**	
Average Annual Water Demand Coefficient[2]	(gpd/na)	Average Sewer Flow Coefficient[3]	(gpd/na)
Industrial	2,590	Industrial	1,650
Domestic Water Demands	(gpm)	Sanitary Sewer Flows	(gpm)
Average Day Demand	305	Average Dry Weather Flow	194
Maximum Day Demand	610	Design Flows	480
Peak Hour Demand	976		
Fire Flow	3,500		

Notes:

2/11/2010

1. Net area assumes 10% reduction for street right of ways.
2. Average Annual Water Demand coefficient and peaking factors per City of Morgan Hill Water System Master Plan, January 2002.
3. Average Sewer Flow coefficient and peaking factors per City of Morgan Hill Sewer System Master Plan, January 2002.
4. Flow crtieria will be updated during the analysis of the Joint Trunk Relief Study (February 2010)

Table 2 Water System Pressures and Water Main Headlosses and Velocities

Butterfield Blvd. South Extension Project

City of Morgan Hill

PRELIMINARY

Currently Proposed: Looped 10" main			
	Pressure (psi)	Headloss (ft/kft)	Velocity (fps)
MDD+FF	40	40.1	10.4
PHD	68	4.3	3.1
Recommended: Looped 12" and extended 16"on Railroad Ave			
	Pressure (psi)	Headloss (ft/kft)	Velocity (fps)
MDD+FF	63	9.4	5.3
PHD	70	0.9	1.5

2/18/2010