ORDINANCE NO. 256

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF UNIVERSITY PLACE, WASHINGTON, AMENDING CHAPTER 12.15 OF THE UNIVERSITY PLACE MUNICIPAL CODE (UPMC) BY AMENDING SECTIONS 12.15.032 FEES AND 12.15.034 CREDITS AND ADOPTING SECTIONS 12.15.037 LIEN FOR DELINQUENT CHARGES AND FORECLOSURES, 12.15.038 OVERPAYMENT REFUND REQUESTS AND 12.15.039 ADMINISTRATIVE REFUNDS OR ADJUSTMENTS

WHEREAS, upon incorporation the City of University Place established a storm drainage and surface water management utility and through Ordinance No. 57 and Ordinance No. 202, the City Council established storm water and surface water management services which the City provides; and

WHEREAS, the city's storm drainage and surface water management utility needs to accumulate further reserves to pay for necessary system improvements identified in the City's Comprehensive Storm Drainage Plan; and

WHEREAS, the listing of Coho Salmon in Puget Sound as an endangered species will inevitably require upgrading city owned surface water and storm water runoff facilities to improve water quality of runoff flowing into Puget Sound; and

WHEREAS, adoption of Phase II of the National Pollutant Discharge Elimination System rules which mandate storm water improvements for the city; and

WHEREAS, the storm drainage and surface water management fee needs to be adjusted to better reflect the costs of the facilities which the City needs to build to improve water quality; Now Therefore,

THE CITY COUNCIL OF THE CITY OF UNIVERSITY PLACE, WASHINGTON, DOES HEREBY ORDAIN AS FOLLOWS:

Section 1. Amending Section 12.15.032 Fees to Chapter 12.15 of the University Place Municipal Code. The University Place Municipal Code is hereby revised to amend Section 12.15.032 to Chapter 12.15 as follows:

Section 12.15.032 Fees

Storm drainage and surface water management fees shall be as follows:

Land Use Category	Annual Charge		Basis
Single Family Residential	~~$110.00~~	$120.00	Per dwelling unit
Duplex	~~$141.90~~	$154.80	Per duplex
Duplex/Condo	~~$141.90~~	$77.40	Per duplex/condo dwelling unit
Multi-Family			
Pavement and building rate	~~$0.0417~~	$0.045500	Per square foot impervious
Gravel Rate		$0.034125	Per square foot impervious
Minimum charge per parcel		$0.00	

Mobile Home Parks			
Pavement and building rate	~~$60.71~~ ~~$0.0417~~	$66.23 $0.0455	Per occupied site, plus Per square foot impervious
Gravel Rate		$66.23 $0.034125	Per occupied site, plus Per square foot impervious
Minimum charge per unit		$66.23 $0.034125	Per occupied site, plus Per square foot impervious
Office/Condo Conversions			
Per square foot impervious	~~$0.0417~~	$0.045500	Per square foot impervious
Minimum charge		$0.00	
Other Parcels			
Pavement and building rate	~~$0.0417~~	$0.045500	Per square foot impervious
Gravel rate		$0.034125	Per square foot impervious
Minimum charge		$0.00	
Vacant Undeveloped			
Pavement and building rate		$0.045500	Per square foot impervious
Gravel rate		$0.034125	Per square foot impervious
Area charge per acres		$0.00	
Minimum charge		$0.00	
Forest and Timberland			
Pavement and building rate		$0.045500	Per square foot impervious
Gravel rate		$0.034125	Per square foot impervious
Area charge per acres		$0.00	
Minimum charge		$0.00	
State & County Public Highways			
Pavement and building rate	~~$0.0125~~	$0.013600	Per square foot impervious
Gravel rate		$0.010200	Per square foot impervious

All parcels are subject to a service charge except the following exempt parcels:

- All parcels consisting of mineral rights only.
- All parcels consisting entirely of tidelands, rivers, lakes, creeks and/or streams.
- All vacant/undeveloped parcels less than two-tenths (2/10ths) of an acres (8,712 square feet) in total area.
- All parcels within national parks due to minuscule amount of impervious area compared to the pristine nature of total acreage projected for future generation.
- Cemetery parcels that are owned by a nonprofit corporation or an association which receive no profit from the sale of lots or crypts.

Section 2. Amending Section 12.15.034 Credits to Chapter 12.15 of the University Place Municipal Code. The University Place Municipal Code is hereby revised to amend Section 12.15.034 to Chapter 12.15 as follows:

Section 12.15.034 Credits

A. To qualify for a service charge credit, the following must be completed before October 1 of the year preceding the year for which the owner is requesting credit. Service charge credits as provided for in this Section will become effective January 1 of the following year.

1. Credit will apply to all categories listed in Section 12.15.034.

2. To qualify for a credit, the Owner of Record shall provide the City engineering calculations in accordance with design criteria acceptable to the City and "As Constructed Plans" stamped and signed by the Owner's Engineer to verify that the drainage system has adequate capacity to meet the design criteria for which the Owner is requesting a credit. The Owner's engineer shall prepare and stamp an operation and maintenance manual for the Owner to follow in maintaining any drainage pond. The City shall be provided a copy of the maintenance manual. New calculations, "As Constructed Plans", and a maintenance and operation manual shall be prepared and stamped by the Owner's engineer if the drainage pond is increased or decreased in size from the original credit request.

3. Annually, each Owner of Record shall provide a certified statement by October 1 of the year preceding the year for which the Owner of Record is requesting credit on a form provided by the City verifying that all specified maintenance has been performed in accordance with the operation and maintenance manual prepared by the Owner's engineer on the facility for the calendar year the credit is being requested. Once every five (5) years, the certified statement shall be stamped and signed by the Owner's Engineer.

4. Each Owner of Record shall provide a "hold harmless" statement on a form provided by the City that indemnifies the City from any loss incurred arising from the construction and maintenance and operation of the Owner's drainage facilities for both water quantity and quality runoff from the owner's property. This statement shall be signed by the Owner and will be recorded with the County Auditor by the Owner of Record. The Owner of Record shall provide the City a copy of the agreement with the County Auditor recording number stamped on it before the application will be deemed completed.

5. Each Owner of Record must enter into an agreement with the City that allows the City to enter onto the Owner's parcel to inspect the drainage facility and verify all information submitted by the owner and his/her Engineer. The agreement form will be provided by the City. This agreement will be recorded with the County Auditor by the Owner of Record. The Owner of Record shall provide the City a copy of the agreement with the County Auditor recording number stamped on it before the credit application will be deemed completed.

6. The following credits shall apply to on-site improvements which in the opinion of the City's Public Works Director meet or exceed the following guidelines:

CREDIT PERCENTAGES			
Retention Facility	Percent Credit	Detention Facility	Percent Credit
100 Year Storage	~~0~~ 25	100 Yr. Storage; Release rate of 50% of pre-developed discharge rate for a 2 year storm.	25
50 Year Storage	0	50 Year Storage; 2 Year Release	15
25 Year Storage	0	25 Year Storage; 2 Year Release	10
10 Year Storage	0	10 Year Storage; 2 Year Release	0

B. The annual service charge credit will be calculated by multiplying the annual service charge by the applicable credit percentages when all of the conditions established for a service charge credit have been met.

In order to determine the credit percentage for a retention/detention facility, the following shall apply:

1. For a retention/detention facility whose year storage is not listed in Section 12.15.034., the next lower year storage category will be used.
2. The release rate shall be equal to or less than a two-year release rate for a detention facility with a 10, 25, or 50-year storage. The release rate for a detention facility with a 100-year storage shall be equal to or less than 50 % of the predevelopment discharge rate for a 2-year storm.
3 No credit shall be given for a retention/detention facility with less than a 10-year storage.

C. The annual service charge shall be calculated based on impervious area and parcel status as of January 1 each year. The annual service charge shall be due and payable to the City of University Place on or before April 30 of each year and shall be paid together with payment of real property tax upon the parcel, if any, and shall be delinquent thereafter. Provided, that if real property tax upon the parcel payable in that year exceeds thirty dollars, and one-half of the tax, together with one-half of the annual service charge provided by this section are paid on or before April 30 of such year, the remaining one-half of the annual service charge shall be due and payable on October 30, next following, or at the time of payment of the remaining tax on the parcel, whichever is earlier, and shall be delinquent after that date. The service charge shall be incorporated on the Pierce County Real Property Tax Statement.

D. Parcel characteristics affecting the service charge which are altered after January 1 of any year shall not be the basis for recalculation of the service charge until the next year.

Section 3. Adopting a new section 12.15.037 Lien for Delinquent Charges and Foreclosures to Chapter 12.15 of the University Place Municipal Code. The University Place Municipal Code is hereby amended to add a new Section 12.15.037 to Chapter 12.15 as follows:

Section 12.15.037 Lien for Delinquent Charges and Foreclosures

A. Pursuant to RCW 36.89.090, the City of University Place shall place a lien on any parcel with a delinquent service charge, including interest thereon. Such liens shall be effective and shall be enforced and foreclosed in the same manner as provided for sewerage liens of cities and towns by RCW 35.67.200 through 35.67.290, except that the service charge lien shall be effective for a total not to exceed one year's delinquent service charges without the necessity of any writing or recording of the lien with the County Auditor, as provided for in RCW 36.89.093, in lieu of the provisions provided for in RCW 35.67.210. In accordance with RCW 36.89.094, the City may commence to foreclose a service charge lien after three (3) years from the date surface water management charges become delinquent, in lieu of the provisions provided from in RCW 35.67.230.

B. Delinquent service charges shall bear interest provided in RCW 36.89.090, RCW 36.89.092, and RCW 35.67.200 at the rate of twelve percent (12%) per annum, or such rate as may thereafter be authorized by law, computed on a monthly basis from the date of delinquency until paid. Interest shall be calculated at the rate in effect at the time of payment of the charges regardless of when the charges were first delinquent.

Section 4. Adopting a new section 12.15.038 Overpayment Refund Requests to Chapter 12.15 of the University Place Municipal Code. The University Place Municipal Code is hereby amended to add a new Section 12.15.038 to Chapter 12.15 as follows:

Section 12.15.038 Overpayment Refund Requests

Any person may request the refund of service charge overpayment(s) by doing so in writing to the Director of Public Works. The basis of the request explaining the nature of the overpayment should be clearly stated. The Director shall investigate the request and authorize a refund or credit if he or she finds an overpayment to have occurred. The Public Works Director will use best efforts to notify the requesting party of his/her decision in writing within sixty (60) days of receipt of the request. The Public Works Director will specify in the written decision the basis for authorizing or denying the refund request. No refund may be authorized for overpayment paid or levied more than three (3) years prior to the date the written request is received.

Section 5. Adopting a new section 12.15.039 Administrative Refunds or Adjustments to Chapter 12.15 of the University Place Municipal Code. The University Place Municipal Code is hereby amended to add a new Section 12.15.039 to Chapter 12.15 as follows:

Section 12.15.039 Administrative Refunds or Adjustments

The Public Works Director may authorize in writing, a refund credit, or adjustment for any amounts when he or she determines that an error, miscalculation, or mistake has occurred which affects any ratepayer(s). The nature of the error, miscalculation, or mistake should be documented together with steps taken to prevent future occurrences. No refunds, credits, or service charge adjustments may be authorized pursuant to this Section unless brought to the attention of the Public Works Director within three (3) years of the occurrence of the error,

miscalculation, or mistake. In any instance where a refund or credit is authorized by the Public Works Director, the amount shall not include any interest.

Section 6. Severability. If any provision of this Ordinance or its application to any person or circumstance is held invalid, the remainder of the Ordinance or the application of the provision to other persons or circumstances by a court of competent jurisdiction shall not be affected.

Section 7. Publication and Effective Date. A summary of this Ordinance consisting of its title shall be published in the official newspaper of the City. This Ordinance shall be effective five (5) days after its publication, with fees effective December 31, 1999.

Passed by the City Council on November 15, 1999.

Debbie Klosowski

Debbie Klosowski, Mayor

ATTEST:

Susan Matthew, City Clerk

APPROVED AS TO FORM:

Timothy X. Sullivan, City Attorney

Published: **November 19, 1999**
Effective Date: **November 24, 1999**

ordinance # 256

City of University Place

Comprehensive Storm Drainage Plan

August 1999

City of University Place

Comprehensive Storm Drainage Plan

August 1999

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Executive Summary

The Comprehensive Storm Drainage Plan provides a definitive evaluation of the City's storm drainage systems and surface water management program. The primary focus of the plan is the control and management of runoff quantity and quality.

The major elements of the plan include:

- Field inventory of existing drainage facilities
- Reconnaissance of identified problem areas
- Hydrologic computer modeling analyses of drainage systems within the City to simulate hydraulic conditions
- Assessment of water quality conditions in the City
- Analysis of relevant state and federal requirements
- Recommendation of a stormwater capital improvement program
- Recommendation of enhancements to the City's stormwater maintenance program
- Recommendation of operational elements to the City's stormwater program
- Forecast of future revenues under the current utility rate structure, analysis of revenue requirements, and funding recommendations

Existing problems in the natural and constructed surface water systems in the City have been identified based on direct field observations, prior studies, input from City staff, interviews with residents, and consultations with Pierce County and with regulating agencies. Identified problems include flooding, erosion, stream channel scour, sedimentation, and degraded fish habitat and water quality. Applying engineering analyses and hydrologic and hydraulic computer modeling, the impacts of growth on the drainage systems have been estimated.

Revenue requirements identified in the plan can be categorized into four areas of capital improvements, maintenance, and operations as outlined below:

- *Capital Improvements:* The plan recommends and aggressive stormwater capital improvement program (CIP) with a total cost of $9.9 million (in 1998 dollars) to be constructed over a period of 10 years. This schedule of improvements has been coordinated with planned roadway projects identified in the proposed Transportation Improvement Plan. Projects range from localized storm drain modifications to major detention, conveyance and treatment facilities.

- *Maintenance:* The plan recommends a stormwater facilities maintenance program to assure drainage system reliability, extend the useful life of the facilities, and enhance their performance in conveying and treating flows. It is recommended the City continue to perform the necessary maintenance with a mix of in-house forces and contractors. The recommended scope and frequency of maintenance activities is estimated to require annual revenues of $249,000 (in 1998 dollars) inclusive of direct and contracted maintenance expenditures, along with related supervision and administrative and technical support.

- *Operations:* Other operational activities are necessary to coordinate, monitor and administer efforts to achieve the City's stormwater objectives. These activities involve coordination of the CIP implementation and non-structural measures, including water quality monitoring, education and enforcement, regulatory compliance, interagency coordination (for cooperative efforts on Leach Creek restoration) and drainage-related investigations and studies. Estimated costs for these operational activities are $90,000 annually (in 1998 dollars).

- *System Administration:* A number of administrative and surface water program support services are performed by City staff and funded by the general fund, to be reimbursed with surface water fee revenues. Existing fixed surface water program administrative costs of $152,218 (in 1998 dollars) include a general fund indirect cost allocation of $127,810 and 10% of both the Public Works Director and the Administrative Secretary's salary and benefits, or $24,408.

An analysis was made of the stormwater rate impact to implement the foregoing program. It was assumed in the analyses that the program would be supported strictly by stormwater utility rates on a "pay-as-you-go" basis; in other words, bonding for capital expenditures was not fully assumed. Based on the current and projected stormwater utility rate base, an annual stormwater fee of $110 per single-family residence and equivalent commercial unit would be required to fund the recommended program.

The Comprehensive Storm Drainage Plan has been developed in response to the policies established in the Environmental Management Element of the City's Comprehensive Plan. The specific policies which are related to storm drainage and surface water management are shown on the following pages.

Policy EN1F: Consider entire watersheds in surface water management plans, with responsibility shared between University Place, other cities, and the county.

DISCUSSION: Watersheds often exceed jurisdictional boundaries. Therefore, surrounding jurisdictions need to coordinate surface water management plans for consistency. University Place is in the Chambers-Clover Creek Watershed boundary. Pierce County has completed a report on the condition of the watershed and a Watershed Action Plan. The City should cooperate in implementation of the plan.

Identified Action: *The Storm Drainage Plan has been developed in coordination with surface water programs established by the City of Tacoma and Pierce County. The City of University Place should initiate an ongoing program of communication and cooperative action with both agencies.*

Policy EN1G: Maintain, enhance and protect natural drainage systems to protect water quality, reduce public costs and prevent environmental degradation. Do not alter natural drainage systems without acceptable measures which eliminate the risk of flooding or negative impacts to water quality.

DISCUSSION: Alteration of a natural drainage system can result in stream scouring (removal of existing sedimentation of the system) or excessive sedimentation of the system. The first condition increases flow rate of the stream and increases the scouring potential. The second impedes flow rate, increases the chance for flooding, and can affect upstream developments as water backs up. Other effects include destruction of wildlife habitat

and degradation of vegetative cover over and around the stream.

Identified Action: *The Capital Improvement Program identified in the Storm Drainage Plan includes projects directed to improvement of the Leach Creek stream channel and the protection and restoration of riparian habitat. Additional opportunities for improvement and maintenance of natural drainage systems should be pursued whenever possible.*

Policy EN1H: Protect water quality and natural drainage systems by controlling stormwater runoff.

DISCUSSION: Uncontrolled stormwater runoff can seriously affect or eradicate fish habitat. Peak storm flows scour stream beds, undercut stream walls, fill spawning areas with silt, thereby destroying them.

In developed areas, runoff can carry oil, fertilizers, or a number of other pollutants into streams. Fertilizers foster heavy algae growth that can sap the drainage system of oxygen and asphyxiate fish. Oil and other hydrocarbons are toxic to fish. Hydrocarbons come from streets and inadequately maintained or inadequate storm drainage systems. Controlling water quality within a drainage basin is vital to preserving fish and shell fish resources.

Water quality should be protected by requiring use of best management practices for stormwater drainage.

Identified Action: *The Storm Drainage Plan has been specifically developed to control stormwater runoff through the application of technical criteria and practices established by the Department of Ecology Stormwater Management Manual for the Puget Sound*

Basin and the Stormwater Program Guidance Manual for the Puget Sound Basin. Specific technical criteria of the King County Surface Water Design Manual have also been applied in development of the plan. These criteria are specifically directed to protection of water quality from both new and existing development and enhancement of natural drainage systems.

Policy EN1I: Require new developments to minimize areas of impervious surface and restrict runoff from new developments to predevelopment rates.

DISCUSSION: Increasing stormwater runoff discharge may result in the following problems:

1. Downcutting and scouring of stream channels damages spawning areas and destroys organisms which live in the stream channel on and under rocks. These organisms are a prime food source for fisheries habitat. High stream flows wash them downstream.
2. Sedimentation of the stream.
3. Slumping of stream walls by undercutting their support.

Identified Action: The City's Public Works Standards (Ordinance No. 142) include state-of-the-art specifications for stormwater control. Careful application and controlled conformance with these specifications will minimize the effects of new developments on the natural drainage systems. The Storm Drainage Plan includes procedures for review of proposed development plans to assure proper application of the Public Works Standards.

Policy EN1J: Require site plan designs and construction practices that minimize erosion and sedimentation during and after construction.

DISCUSSION: Using careful and effective construction practices can minimize erosion of soils and

prevent sedimentation of stream channels. Piping water to the bottom of a stream ravine, rather than directing it over the side of the raving will avoid erosion. Temporary erosion control measures include filter fabric fences, hay bales, or hydroseeding.

Identified Action: *The technical specifications imposed by the City's Public Works Standards include requirements for design and construction practices. The Storm Drainage Plan includes procedures to be employed by the City in on-site inspection during construction and recommendations for post-construction monitoring. Capital improvements are recommended to reduce the flow of water to erosion-sensitive areas.*

Policy EN1K: Require natural resource industries to use best available management to prevent pollutants from entering ground or surface waters.

DISCUSSION: Resource industries such as mining and logging often leave large areas exposed. Adequate erosion control is needed to prevent impacts on water resources.

Identified Action: *The Storm Drainage Plan includes definitive requirements for management practices to control erosion resulting from runoff which is a result of logging, land clearing, and natural resource industries.*

WATER QUALITY

Policy EN3A: Enhance and protect water quality. Preserve the amenity and ecological functions of water features through planning and innovative land development.

DISCUSSION: Whether it is located in streams, lakes, wetlands, or comes from the tap, clean water is always a positive aspect of a city. It reduces the fear of infections from water-borne organisms. Clean water also enhances the image of a city, both for its livability and for its concern about the natural environment. Clean water can be achieved through some of the following methods:

1. Requiring sewers for development.
2. Requiring adequate stormwater control for new development.
3. Emphasizing public education on how to maintain water quality within the natural drainage basins.
4. Reducing or controlling pollutants in runoff from paved surfaces.

Identified Action: *The Storm Drainage Plan is specifically oriented to protection of the quality of the natural drainage systems. The plan includes specific programs for water quality and riparian habitat protection. Water quality protection measures include system maintenance, best management practices, and development standards. Riparian habitat protection, in addition to existing sensitive area development controls, includes the acquisition of stream buffers along Leach Creek and regional detention facilities.*

Policy EN3B: Manage water resources for the multiple uses of recreation, fish and wildlife habitat, flood protection, erosion control, water supply, and open space.

DISCUSSION: Clean water provides benefits for many activities. In streams or water bodies, it enables water activities such as swimming and fishing, and if properly managed, can preserve fish and wildlife habitat. Residents would not have to travel as far to view wildlife or enjoy water activities. The City's overall livability would be increased. Because Leach Creek feeds into Chambers Creek, a salmon-bearing stream, and into Puget Sound, it is important to maintain clean water for fisheries and wildlife habitat.

Identified Action: The water quality programs identified by the Storm Drainage Plan are directed to improvement and protection of existing streams and Puget Sound as well as natural drainage channels.

Policy EN3C: Work with neighboring jurisdictions and other agencies and organizations to enhance and protect water quality in the region.

DISCUSSION: Enhancing and protecting clean water throughout a stream watershed often requires that many jurisdictions work together. Preserving water quality in University Place will have an impact on the water quality of Chambers Creek, Leach Creek, and other smaller creeks, and downstream in Steilacoom and Lakewood. Upstream, Flett and Clover Creeks (and Steilacoom Lake) affect water quality in Chambers Creek. Therefore, there must be coordination among many interests. University Place has shoreline along Puget Sound; the City has a major stakehold in preserving water quality of the Sound. The

City should work with government agencies and other organizations to reach these goals.

Identified Action: *The programs identified by the Storm Drainage Plan require proactive coordination and cooperative actions with neighboring agencies as well as regional special interest organizations. The regional nature and effects of the stormwater management program activities necessitate joint activities by affected agencies, rather than singular actions by individual municipalities.*

Policy CF1F: Evaluate needed improvements to the City's public facilities on an annual basis.

DISCUSSION: Public facilities must be kept in good repair and need to be maintained or expanded as the city grows. Well-maintained facilities with appropriate capacity contribute to quality of life. Each year, the City should evaluate the condition of public facilities and determine needed repairs (non-capacity projects). Additionally, the City should annually assess expansion needs based on projected growth (capacity projects). This will assist in the timely identification of improvements needed to achieve minimum LOS standards.

Identified Action: The maintenance and operations programs of the Storm Drainage Plan provide for regular inspection and maintenance of facilities and for water quality monitoring to assess condition and performance. The overall Storm Drainage Plan, including the capital improvement program, will be reviewed in preparing annual budgets.

Policy CF6B: Require best management practices and facilities that comply with the City's stormwater design guidelines for new development.

DISCUSSION: Flooding in University Place has been a concern. Following its incorporation, the City of University Place assumed responsibility for the stormwater drainage management system. While many flooding difficulties have been addressed, new development will place additional strain on the existing stormwater system. To avoid creating new problems and/or to avoid previously existing problems from re-emerging, state-of-the-art stormwater/drainage facilities that comply

with the City's stormwater design standards shall be required of new development.

Identified Action: *The City's Public Works Standards (Ordinance No. 142) include state-of-the-art specifications for control of storm runoff and erosion from new development.*

Policy CF6C: Maintain the existing storm drainage system to prevent blockage and backups.

DISCUSSION: The City needs to review and program maintenance into its budget to help ensure that stormwater systems function effectively, especially as the City relies in part on natural creeks for the drainage system. Blockage can result from silt, vegetation, trees and other debris within the drainage course. Facilities maintenance as well as enforcement of the City's regulations can reduce/prevent blockage-related problems to the existing drainage systems.

Identified Action: *The Storm Drainage Plan includes a maintenance program identifying the types and frequencies of necessary maintenance activities and the staff, equipment and funding required to conduct the maintenance.*

Policy CF6D: Adopt a Stormwater Management Plan that identifies existing flooding problems and includes a strategy to make improvements.

DISCUSSION: To address existing and future possible flooding problems, the City should develop a Stormwater Management Plan. This plan could identify existing flooding problems, their causes, and prepare a programmed strategy to address the problems. Pursuit of funding opportunities and establishing best management practices to minimize development impacts would also be appropriate.

Identified Action: *The Storm Drainage Plan includes a capital improvement program to address existing and anticipated future flooding problems. The plan also recommends a funding strategy to implement the improvements, along with best management practices, to limit development impacts to drainage systems.*

Chapter 1: Introduction

1.01 PURPOSE

Since its incorporation, the City of University Place has assumed the responsibility for surface and stormwater management within the City's boundaries. There currently exist a number of stormwater-related problems within the City. Unless proper surface water management strategies are implemented, continued development will increase pressures on the drainage infrastructure and receiving waters, and opportunities to cost effectively correct existing problems may be lost. To develop such strategies, the City of University Place authorized Earth Tech to conduct studies of the City's surface and stormwater systems and prepare this Surface Water Plan.

1.02 AUTHORIZATION AND SCOPE

Preparation of the Surface Water Plan was authorized by the City of University Place through a consulting agreement between Earth Tech, Inc., dated April 20, 1998.

The study area includes the entire city limits of University Place. Limited adjoining areas of neighboring jurisdictions were also considered in the hydrologic analyses.

Chapter 2: Study Area Characterization

2.01 STUDY AREA

The study area is bounded by the 1995 incorporated limits of the City of University Place and is shown in Figure 2.1. University Place, with a population of approximately 30,000, is located directly south of the Tacoma Narrows bridge and is bordered by Puget Sound to the west. The 8.5-square-mile area is comprised largely of single-family residential neighborhoods, with commercial development existing in areas along Bridgeport Way, 67th Avenue and South Orchard Street. Little undeveloped land remains.

2.02 CLIMATE

University Place is located at the eastern edge of the Puget Sound Lowlands climatic region and experiences typical weather patterns brought about with the absorption of maritime influences by the Cascade Mountains. Summer temperatures in the 80s can be sustained, while winter temperatures usually are in the 40s. The recorded maximum and minimum temperatures for the area are 102 and –3°F, respectively. The average annual precipitation, as measured at the Chambers Creek Wastewater Treatment Plant, is 42 inches.

2.03 BASIN DESCRIPTIONS

For analysis purposes, the study area was divided into the 12 drainage basins shown in Figure 2.1. Surface water for all of University Place eventually drains into Puget Sound; primarily through Leach, Peach and Chambers Creeks to the south and Day, Crystal and Brookside Creeks to the north. Summary descriptions of the drainage basins are given below.

Crystal Springs Creek Basin

The Crystal Springs Creek watershed is an area in the north end of University Place which drains directly into Crystal Creek. The basin is segmented by an overpass of the creek on Grandview Drive. Catch basins on Grandview collect the majority of the surface water in this vicinity, routing it north to the North Day Island watershed. Two 36-inch culverts underneath the railroad tracks at the lower end of this basin route the creek into an outfall to the Day Island Lagoon.

Unnamed — City of Tacoma Basin 1

This watershed, also on the north border of University Place, all drains to the catch basins and 18-inch storm sewer existing along 19th Street West. The storm sewer flows by gravity to a low point in the street, near the corner of 19th and Crystal Springs Road, where a detention pond routes the water north into Tacoma.

North Day Island Basin

The North Day Island watershed is a large drainage basin comprising the northeast portion of University Place. Surface water drainage is conveyed largely through street storm sewers in this

area, with numerous detention ponds and a pump station. The storm sewers range in size between 12-inch and 30-inch, with all runoff eventually being conveyed into a 24-inch storm sewer, which drains into a 36-inch storm sewer on Crystal Springs Road in the northwest corner of the basin. The water is eventually routed to Day Island Lagoon and Puget Sound through a 42-inch storm drain along 19th Street West. The watershed also contains a large pothole drainage area.

Day Island Lagoon Basin

The Day Island Lagoon watershed is a small basin bordering Puget Sound which drains to a 12-inch storm sewer along 94th Avenue West. Runoff is discharged to the Sound through a 24-inch culvert which runs underneath the railroad tracks.

Day Island Waterway Basin

The Day Island Waterway watershed all drains northward by storm sewers, culverts and detention ponds to 24-inch storm sewer along 27th Street West. This storm sewer becomes 36 inches in diameter at the lower portion of the basin towards the northwest and parallels the north side of Day Island Bridge Road and discharges into the Puget Sound through a pair of 36-inch culverts underneath the railroad tracks. A small portion of the basin on the south side of Day Island Bridge Road drains to Puget Sound through a natural creek.

Curtis Pothole Basin

The Curtis Pothole watershed, encompassing the central area of University Place, generally drains by 12-inch storm sewer and culvert to an undeveloped depression in the topography towards the northwest portion of the basin near Curtis High School. Here, the runoff ponds and eventually infiltrates into the ground.

Soundview Basin

The Soundview watershed drains exclusively through street storm sewers ranging from 12-inch to 30-inch in size. Runoff water is eventually collected and routed to Brookside Creek at the merge of Brookside Way and Palisades Place, where the creek and intermittent 30-inch culverts channel flow underneath the railroad tracks and into Puget Sound.

Unnamed Basin

This unnamed basin, comprising the Sunset Beach area of University Place, does not currently have any appreciable stormwater conveyance facilities. Drainage into Puget Sound is accomplished through sheet flow and minor channels.

Unnamed (Glacier) Basin

This watershed, adjacent to Puget Sound and representing the southwest portion of University Place, includes Chambers Creek Properties and is, to this point, undeveloped. No surface water conveyance facilities exist within the basin, with most drainage following the natural slope of the land to Puget Sound. Some surface water does drain to a large pond which exists within the Lone Star Industries gravel pit and to a natural depression to the north.

Westside Sewer District Basin

The Westside Sewer District watershed drains through storm sewers to two main collectors. The northern and eastern portions of the basin, in the Beckonridge and Park Ridge areas, drains to a 36-inch storm sewer which runs along Beckonridge Drive to Grandview Drive. The southwest portion of the basin, encompassing Bristonwood and Grandview Park, drains to a 30-inch storm sewer along Bristonwood Drive and 52nd Street West and merges with the northern collector on Grandview Drive. A 36-inch storm sewer then proceeds westward and empties into Puget Sound through a culvert underneath the railroad tracks.

Chambers Creek Basin

The Chambers Creek watershed represents the southern portion of University Place. The western part of this basin drains directly into Chambers Creek through a 36-inch storm sewer running south from 64th Street West. The eastern part of the basin discharges into Peach Creek in the Westhampton, University Woods, and Chambers Point areas through culverts ranging in size from 12-inch to 21-inch. Peach Creek drains into Chambers Creek at the southern limit of University Place.

Leach Creek Basin

Surface water from the Leach Creek watershed discharges to Leach Creek in the Fir Crest and Trikalla areas as well as along Cirque Drive West and Bridgeport Way West. Storm sewers range in size between 12-inch and 36-inch with detention ponds in places.

Flett Creek Basin

A small portion of the Flett Creek watershed lies within the southeast corner of University Place. A 12-inch storm sewer running south along 54th Avenue drains the stormwater to the south.

2.04 SOILS

University Place consists largely of a series of moderately well to excessively well drained soil types including the following: Alderwood-Everett association, Everett sandy gravelly loam, Spanaway gravelly sandy loam, Nisqually loamy sand and Xerochrepts. Alderwood-Everett association constitutes the majority of the soils in areas with slopes less than 30 percent. Everett sandy gravelly loam is found in the Sunset Beach, Beckonridge, Westhampton, and Brookridge neighborhoods as well as at the Curran Apple Orchard. Spanaway gravelly sandy loam occurs in an area from Peach Acres west to Grandview and south to the rim of Chambers Creek Canyon. Nisqually loamy sand is found in the Bristonwood neighborhood. Xerochrepts occur on steep slopes ranging from 45 to 70 percent along the Puget Sound as well as the Chambers and Peach Creek Canyons. Crystal Springs, Day Island, Sunset Beach and Morrison Pond contain small pockets of poorly drained Bellingham silty clay and Dupont Muck.
The locations of the various soil types are shown in Figure 2.2.

2.05 VEGETATION

Native vegetation benefits the area by abating surface and ground water runoff, as well as providing oxygen, noise reduction, and habitat for the ecosystem. The most common trees indigenous to University Place include Douglas fir, Western red cedar, red alder, and Western hemlock. Other trees found within the study area are Oregon white oak, big leaf maple, cottonwood, and Pacific madrona. Native shrubs include Salal, red elderberry, salmonberry, evergreen and Himalaya blackberry, Indian plum and vine maple. Herbs include bracken fern, creeping buttercup, horsetail, lady fern and sword fern.

2.06 LAND USE

A breakdown of the 1996 land use inventory, included in the recent Comprehensive Plan, is given in Table 2-1 and was used as a basis for hydrologic modeling. Impervious surface area characteristics for the various land use types were determined from 1997 aerial photography. Future land use patterns and projections, as they pertain to modeling, are discussed in the analysis included in Chapter 5.

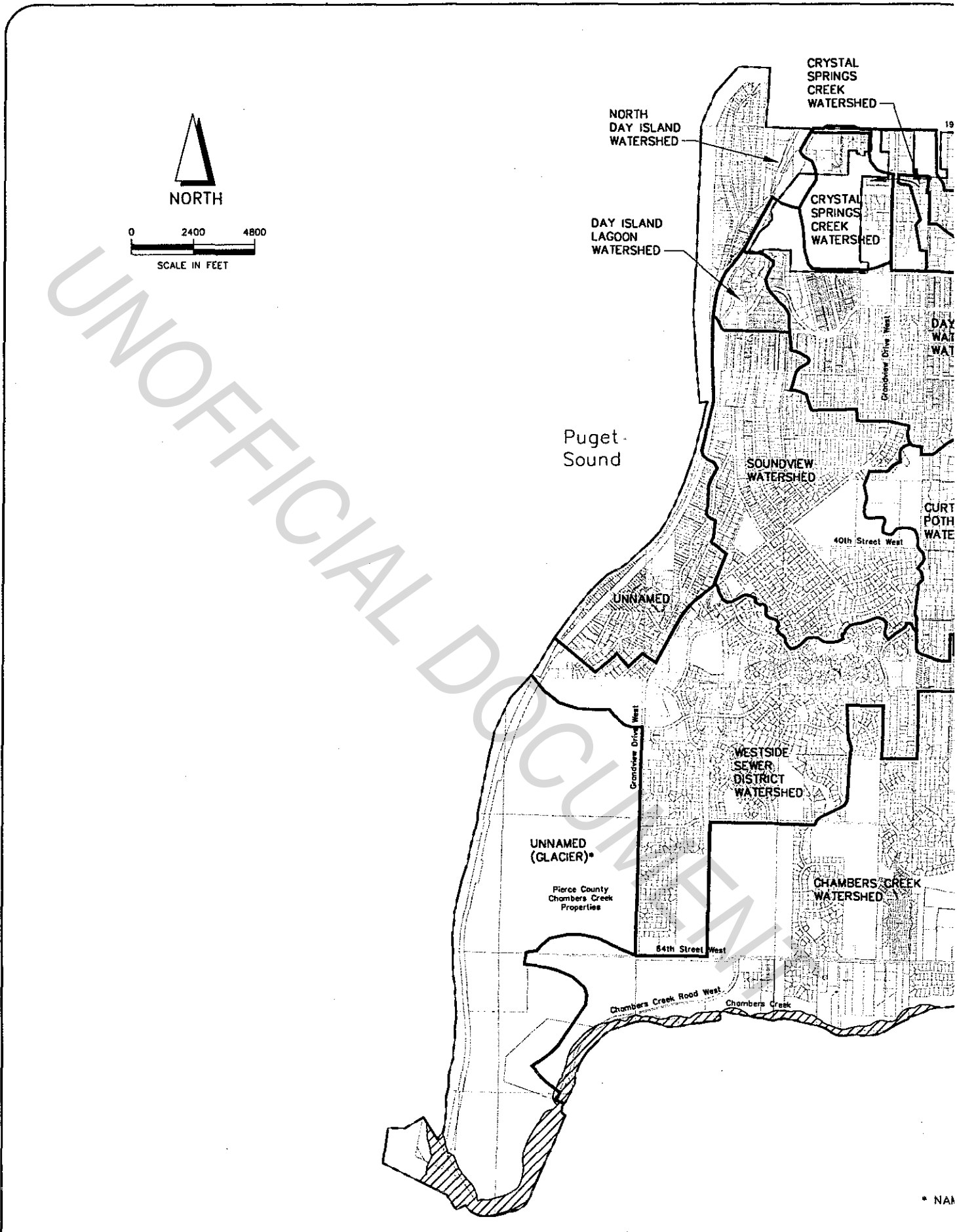
Table 2-1: 1996 Land Use Inventory

1996 Land Use Inventory	No. of Units, Lots or Businesses	Acres	Percent
Single-Family	6,546	1,931.79	35.40
Duplexes	919	295.36	5.41
Multi-Family	4,530	276.44	5.06
Manufacturing	12	35.46	0.65
Retail & Service	444	169.44	3.11
Churches & Clubs	22	225.87	4.14
Parks & Open Space	34	38.25	0.70
Utilities	35	3.88	0.07
Civic/Public Facility	53	888.73	16.30
Vacant – Residential	1,050	613.98	11.25
Vacant – Commercial	38	37.36	0.68
Constrained Lots	160	22.79	0.42
Roads & Railroad	1,455	757.11	13.88
Open Water		160.13	2.93
TOTAL		**5,456.9**	**100.00**

2.07 SENSITIVE AREAS AND RESOURCES

There are defined sensitive areas present within University Place. Existing soil conditions and the possibility of water presence in some areas with slopes in excess of 15 percent could produce slope failure resulting in landslide, erosion, and seismic hazards. These areas are outlined in the

City's Comprehensive plan and generally coincide with drainages, creeks and shoreline areas along the Puget Sound. Natural resources include topographical features such as creeks, wetlands, ponds and wildlife habitats.



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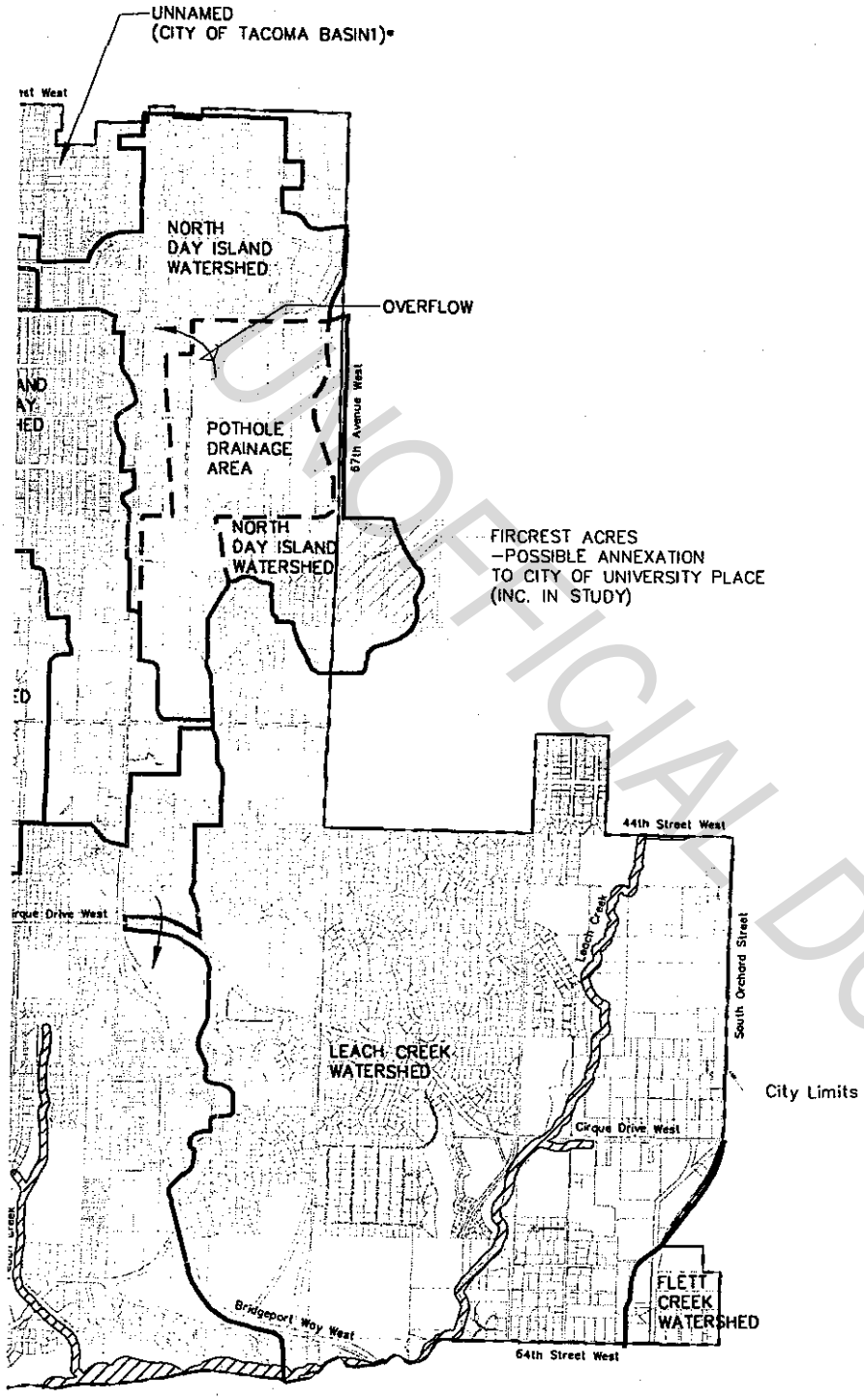


SED FOR MODELING

FIGURE 2.1
STUDY AREA WATERSHEDS

EARTH TECH

A tyco INTERNATIONAL LTD. COMPANY

SOIL TYPES LEGEND

SOIL TYPE NAME	SOIL TYPE NUMBER
ALDERWOOD GRAVELLY SANDY LOAM	1
AQUIC XEROFLUVENTS	2
BELLINGHAM SILTY CLAY LOAM	4
COASTAL BEACHES	11
DUPONT MUCK	12
EVERETT GRAVELLY SANDY LOAM	13
INDIANOLA LOAMY SAND	18
KITSAP SILT LOAM	20
NISQUALLY LOAMY SAND	25
SPANAWAY GRAVELLY SANDY LOAM	41
XEROCREPTS	47

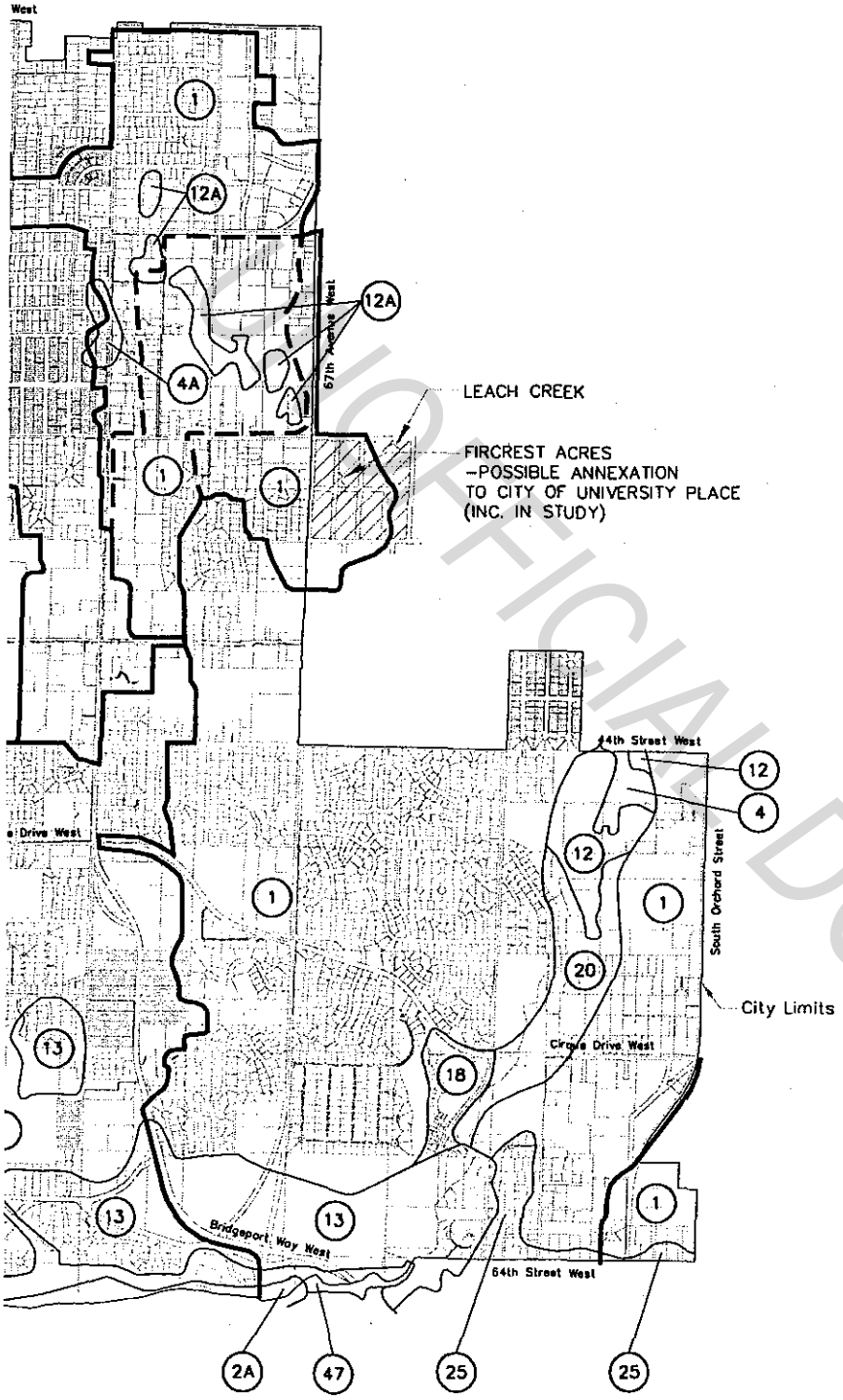


FIGURE 2.2
SOIL TYPES

EARTH TECH

A tyco INTERNATIONAL LTD. COMPANY

Chapter 3: Regulatory Analysis

This chapter includes a review of existing state and federal policies, regulations and ordinances relevant to surface water management. Also included are recommendations for bringing the City's regulatory program into compliance with state and federal regulations consistent with addressing local needs.

3.01 PERTINENT CITY ORDINANCES

The following established ordinances either directly control or may affect storm runoff and quality:

- *Public Works Standards (Ordinance No. 142)* – Under Section 1.010, conformance with the requirements of the following documents is established:

  1. King County Surface Water Design Manual.

  2. Stormwater Management Manual for the Puget Sound Basin and Stormwater Program Guidance Manual for the Puget Sound Basin – Department of Ecology.

  Under Chapter 3, general requirements and specifications for storm drainage systems are established.

- *Interim Streets, Drainage and Right-of-Way Standards* (Ordinance No. 63, amended by Ordinance No. 93).

3.02 RELEVANT STATE AND FEDERAL REGULATIONS AND PROGRAMS

There are a number of federal and state regulations and programs relevant to stormwater management planning and activities. Tables 3-1 and 3-2 summarize the state and federal regulations affecting the stormwater programs. Further discussion of the more significant regulations follows.

Puget Sound Water Quality Management Plan

The Puget Sound Water Quality Management Plan (PSWQMP) establishes a comprehensive plan to protect and improve water quality and aquatic resources in Puget Sound. The Puget Sound Water Quality Authority was directed to identify water quality problems and corresponding pollution sources affecting marine life and human health, and to develop effective pollution control and management programs that could be implemented in a comprehensive multi-jurisdictional manner throughout the Puget Sound Basin. Responsibility for implementing the PSWQMP lies with the Department of Ecology and with the Puget Sound Water Quality Action Team which was formed by the legislature when the Puget Sound Water Quality Authority was dissolved.

The 1994 Plan, adopted by the legislature, together with amendments adopted in 1996, incorporates and builds on the Authority's 1987, 1989 and 1991 Management Plans. The PSWQMP also constitutes the Puget Sound Comprehensive Conservation and Management Plan under the Puget Sound Estuary Program, as authorized by the federal Clean Water Act.

A number of programs regarding stormwater management have been included in the PSWQMP. State authority to require jurisdictions to implement the provisions contained in the PSWQMP is inherent with the legislature's adoption of the plan. These programs are as follows.

Table 3-1: State Regulations Affecting Stormwater Programs

State Agency/Regulation	Summary of Regulatory Effects On Stormwater Programs	Local Compliance Issues
PUGET SOUND WATER QUALITY ACTION TEAM & DEPARTMENT OF ECOLOGY: • *Puget Sound Water Quality Management Plan (PSWQMP)*	Establishes requirements for local stormwater program content, including: • minimum development standards • minimum wetland protection guidelines • scope of local stormwater ordinances • operation and maintenance program • inspection, compliance and enforcement • water quality monitoring, control and response • interagency cooperation • public education	Expand O&M, enforcement, monitoring, and education.
DEPARTMENT OF ECOLOGY: • *Stormwater Management Manual for the Puget Sound Basin*	• Defines minimum technical requirements for controlling stormwater discharges • Provides guidance in applying BMPs	Redevelopment standards, BMPs, detention performance.
DEPARTMENT OF ECOLOGY: • *Water Quality Standards* • *Sediment Standards*	• Water quality standards establish constituent concentration criteria to support designated uses of water bodies • Sediment standards establish criteria for marine sediment constituent concentrations	Water quality standards not met in area streams.
DEPARTMENT OF ECOLOGY: • *Shoreline Management Act*	• Regulates activities in or near wetlands and shorelines consistent with shoreline designations	None.
DEPARTMENT OF ECOLOGY: • *State 401 Certification*	• Requires short term water quality modifications approval for work in or near waters of the state	None.
DEPARTMENT OF FISHERIES & WILDLIFE • *Hydraulic Code Rules*	• Regulates activities within waters of the state and which may affect stream channels	Detention performance.
DEPARTMENT OF ECOLOGY: • *Floodplain Management Program*	• Coordinates local floodplain regulation under NFIP • Assists in floodplain delineation • Establishes land management criteria in floodplain	None.
DEPARTMENT OF NATURAL RESOURCES: • *Forest Practices Act*	• Permitting authority for land clearing	None.
DEPARTMENT OF COMMUNITY, TRADE & ECONOMIC DEVELOPMENT: • *Growth Management Act*	• Comprehensive planning requirements relating to sensitive resources and concurrency of infrastructure with growth	Implement CIP concurrent with growth.

Table 3-2: Federal Regulations Affecting Stormwater Plans

Federal Agency/Regulation	Summary of Regulatory Effects on Stormwater Programs	Local Compliance Issues
U.S. ENVIRONMENTAL PROTECTION AGENCY • *Clean Water Act - National Pollutant Discharge Elimination System*	• Stormwater discharge permits for municipalities and selected industries (administered by Department of Ecology)	Refer to Table 3-1, PSWQMP
U.S. ARMY CORPS OF ENGINEERS • *Clean Water Act - Wetlands* (Sections 401 & 404)	• Section 401 requires federally permitted activities in wetlands comply with the CWA and state water quality standards • Section 404 regulates dredging and filling in and near waters/wetlands of the U.S.	None.
U.S. ARMY CORPS OF ENGINEERS • *Rivers and Harbors Act* (Section 10)	• Permit requirements for construction in and along navigable waters and their wetlands	None.
U.S. DEPARTMENT OF AGRICULTURE • *Food Security Act of 1985*	• "Swamp buster" provision promotes wetland conservation by denying eligibility for USDA farm programs to farmers who convert wetlands to croplands	None.
COASTAL ZONE MANAGEMENT • *Coastal Zone Act Reauthorization Amendments*	• Coastal Zone Management determinations • Establishes management guidelines for nonpoint pollution control programs	None.
FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) • *National Flood Insurance Act* • *Flood Disaster Protection Act*	• Makes available flood insurance in flood-prone areas • Flood Insurance Rate Maps (FIRM) • Flood Insurance Studies • Floodplain management criteria	None.
NATIONAL MARINE FISHERIES SERVICE • *Endangered Species Act*	• Prohibits actions that kill or injure subject species, including significant habitat modification or degradation	• Stormwater standards • Maintenance practices • CIP design

Basic Stormwater Program

The provisions in the PSWQMP for achieving the program's goal of controlling pollution from stormwater is to implement best management practices (BMPs), assess their effectiveness and, as necessary, require further water quality controls that may include treatment. This includes a requirement for all local jurisdictions in the Puget Sound Basin to adopt ordinances with

minimum standards for new development and redevelopment. Basic Stormwater Programs were to be in effect as of January 1, 1995.

The required ordinances must address, at a minimum:

1. Control of off-site water quality and quantity impacts
2. Use of source control best management practices and treatment best management practices
3. Effective treatment of the six-month design storm for proposed development
4. Use of infiltration, with appropriate precautions, as the first consideration for stormwater disposal
5. Protection of stream channels and wetlands
6. Erosion and sedimentation control for new construction and redevelopment projects.

In conjunction with the runoff control ordinances for development, the PSWQMP also requires each jurisdiction adopt a stormwater management manual containing state-approved BMPs. A local government may adopt the manual prepared by Ecology *(Stormwater Management Manual for the Puget Sound Basin*) or prepare its own manual as long as it has equivalent technical standards to those prepared by Ecology. The City has adopted the KCSWDM from which the Ecology manual draws much, if not most of its technical design guidance. The two manuals differ, however, in several ways. A discussion of the differences between University Place's requirements and those of Ecology's manual is presented later in this chapter.

The PSWQMP also requires that each county and city also develop and enforce operation and maintenance programs and ordinances for new and existing public and private stormwater systems. To meet the requirements in the PSWQMP, local governments must ensure that all publicly and privately owned permanent stormwater facilities are properly operated and adequately maintained. Each county and city shall maintain records (i.e., mapping, plans, maintenance records) of new public and private storm drainage systems and appurtenances. Maintenance of public stormwater systems in University Place is discussed in Chapter 7 of this plan. The City has adopted such ordinances governing maintenance and operation of stormwater systems and is regularly updating and maintaining its mapping and records.

Each City or county that adopts a comprehensive land use plan and development regulations under the provisions of Chapter 36-70A RCW (the Growth Management Act) shall incorporate the goals of the local stormwater program into the goals of the comprehensive plan and shall incorporate the required ordinances into the development regulations. This has been accomplished in University Place's Comprehensive Plan.

Consistent with the Growth Management Act, each local jurisdiction in the Puget Sound Basin is expected to cooperate with neighboring jurisdictions in stormwater basin planning.

The Department of Ecology monitors compliance with these requirements, reviewing the status of city and county operations and maintenance and runoff control programs to ensure consistent and adequate implementation. Ecology's oversight role pertains only to compliance with the objectives of the plan's stormwater program and with appropriate rules, statutes, and technical suggestions to improve implementation. This is intended to ensure maximum flexibility and creativity for local governments to resolve site-specific stormwater problems in accordance with their land use and other local policies.

The recommended surface water management program presented in this Plan is directed, in part, to establish compliance with the above Basic Stormwater Program requirements and with the Comprehensive Stormwater Program requirements described below.

Comprehensive Stormwater Program

The Comprehensive Stormwater Program defined in the PSWQMP applies to U.S. Census Bureau designated urbanized areas. In Puget Sound, urbanized areas can be generally described as including the metropolitan core extending from Everett to Tacoma, and the areas including and surrounding Olympia, Bremerton and Bellingham. University Place lies within this urbanized area designation.

The purposes of the Comprehensive Stormwater Program for urbanized areas are:

1. To control erosion and manage the quantity and quality of stormwater runoff from public and private activities in receiving waters.

2. To protect and enhance water quality, and achieve water quality and sediment quality standards in receiving waters.

3. To reduce the discharge of pollutants to the maximum extent practicable within the constraints of federal and state laws.

4. To protect beneficial uses, as described in Chapter 173-201 WAC.

5. To achieve the four items above in a manner that makes efficient use of limited resources to address the most critical problems first.

Each Comprehensive Stormwater Program shall seek to control the quality and quantity of runoff from public facilities and industrial, commercial and residential areas, including streets and roads. Each program shall cover both new and existing development. Early action by urbanized areas that are prepared to implement stormwater control programs shall be allowed. Emphasis shall be placed on controlling stormwater through source controls and BMPs.

At a minimum, each Comprehensive Stormwater Program shall include:

1. Identification and ranking of significant pollutant sources and their relationship to the drainage system and water bodies through an ongoing assessment program.

2. Investigations and corrective actions of problem storm drains, including sampling.

3. Programs for operation and maintenance of storm drains, detention systems, ditches and culverts.

4. A water quality response program, to investigate sources of pollutants, and respond to citizen complaints or emergencies such as spills, fish kills, illegal hookups, dumping, and other water quality problems. These investigations should be used to support compliance and enforcement efforts.

5. Assurance of adequate local funding for the stormwater program through surface water utilities, sewer charges, fees or other revenue-generating sources.

6. Local coordination arrangements such as interlocal agreements, joint programs, consistent standards, or regional boards or committees.

7. Ordinances requiring implementation of stormwater controls for new development and redevelopment.

8. A stormwater public education program aimed at residents, businesses and industries in the urban area.

9. Inspection, compliance and enforcement measures.

10. An implementation schedule.

11. If, after implementation of the control measures listed in the points above, there are still discharges that cause significant environmental problems, retrofitting of existing development and/or treatment of discharges from new and existing development may be required.

The Department of Ecology has oversight responsibilities for the Comprehensive Stormwater Programs. Ecology reviews each program to ensure consistent and adequate implementation.

Stormwater Management Manual for the Puget Sound Basin

As mentioned in the above discussion of the PSWQMP, the Department of Ecology has produced a technical manual ("Ecology Manual") for use by local jurisdictions in administering new development and redevelopment. The Ecology Manual sets forth minimum requirements for controlling runoff from development, and it provides technical guidance for best management practices (BMPs) and pollutant source controls. The PSWQMP requires that local agencies in the

Puget Sound basin adopt either the Ecology Manual or another manual with equivalent technical standards such as the King County Surface Water Design Manual (KCSWDM).

Department of Fish and Wildlife – Stormwater Requirements

The State of Washington Department of Fish and Wildlife issued draft Hydraulic Code Rules (WAC 220-110) containing stormwater requirements. The purpose of the requirements is to protect fisheries habitat in stream channels, prevent erosion, and to protect freshwater and near-shore marine aquatic life. The requirements would be administered through the Hydraulic Permit Approval process. The HPA is intended to require quantity and quality controls that mitigate impacts from new development.

The requirements duplicate the water quality and quantity control standards included in the Ecology Manual. Projects would be exempted from the rules if they are located within communities that implement standards approved by Ecology or if they discharge to a regional stormwater detention facility.

National Pollutant Discharge Elimination System

The Environmental Protection Agency regulates stormwater discharges under the National Pollutant Discharge Elimination System (NPDES) process. As a result, some stormwater dischargers are required to submit permit applications. Under Phase I of the NPDES program, permits are required for three categories of stormwater discharges:

1. Large cities with population greater than 250,000;
2. Medium cities with population between 100,000 and 250,000; and
3. Discharges associated with certain industrial activities.

The City is not currently required by federal law to apply for a municipal permit because its population is less than 100,000. However, under Phase 2 of the NPDES program, University Place will be subject to a permit. Federal rules will be promulgated by November 1999; Ecology's schedule for implementation is uncertain at present.

The non-point source permits differ from standard NPDES permits in that the industrial discharge permits can be issued to a class or group of dischargers, and the municipal stormwater permit can be issued on a jurisdiction-side basis. EPA has stated that the ideal permit basis would be the watershed, and that individual permits for each outfall are not required.

Municipal stormwater permit programs include a combination of required ordinances, mapping, discharge characterization, source identification, and public education. Stormwater associated with industrial activities is also regulated. Some industrial activities within the City may be regulated depending on their *Standard Industrial Code* (SIC). The City also conducts specific industrial activities that require NPDES permits for stormwater. This includes operation of the City's maintenance shops.

Endangered Species Act

Federal agencies have listed the Chinook Salmon as an endangered specie under the Endangered Species Act (ESA). The provisions of the ESA pose significant impacts on the actions undertaken by, and regulated by, the City. The core objective of the ESA is to prohibit actions which kill or injure a listed specie or which significantly modifies or degrades the habitat of a listed specie. The impacts of the listing upon the City's operations are still being defined; however, the following can be anticipated to result from a listing:

- The City would be compelled to adopt and enforce stormwater standards designed to protect salmon habitat in its receiving waters.
- The City may be required to undertake projects which expand or enhance salmon spawning or rearing habitat.
- The City may have to participate in the preparation of a habitat conservation plan (HCP) for selected watersheds.
- Capital projects to be undertaken by the City will be required to perform biological assessments to determine the potential impacts of a project on salmon habitat. This can be expected to delay construction, add to the costs of design and permitting, and possibly add to the direct costs of construction.

In anticipation of the listing, City staff have been conferring regularly with their counterparts from other local agencies to coordinate prospective actions to respond to ESA requirements. This consultation should continue as a focal point for discussions with neighboring jurisdictions.

Federal Wetlands Regulations

The primary federal laws regulating activities in or near wetlands are Sections 401 and 404 of the Clean Water Act (CWA), Section 10 of the Rivers and Harbors Act of 1899, and the "Swampbuster" provision of the Food Security Act (FSA) of 1985. All federal actions are also subject to the 1969 National Environmental Policy Act (NEPA) and many to the Coastal Zone Management Act of 1972.

Section 401 of the CWA mandates that federally permitted activities in wetlands comply with the CWA and state water quality standards. Under Section 404 of the CWA, the U.S. Army Corps of Engineers (Corps) has been given the responsibility and authority to regulate the discharge of dredged or fill materials into waters and adjacent wetlands of the United States (Federal Register, 1986). Under the Rivers and Harbors Act, the Corps also issues permits for construction in or along navigable waters, including any wetlands within those waters. The "Swampbuster" provision of the FSA denies eligibility for all U.S. Department of Agriculture farm programs to farmers who convert wetlands to croplands.

Of the above regulations, Section 404 permitting is the most commonly applicable to freshwater wetlands. Two kinds of permits are issued by the Corps: General and Individual. General Permits (also known as Nationwide Permits, or NWPs) cover proposal that would have minimal adverse impacts on the environment. The most commonly used NWP for wetland alterations is NWP 26; this NWP specifically addresses wetlands which are (1) above the headwaters of a river or stream (that point in the watercourse at which the mean annual discharge is less than 5 cubic feet per second), or (2) hydrologically isolated. Such permits apply to fills and other impacts of less than one acre, although impacts of up to two acres may be covered by a General Permit. However, proposed impacts from one to two acres require a Water Quality Certification under Section 401 of the CWA from the Department of Ecology. The Corps recently announced plans to increase the thresholds under the NWP 26 program and to discontinue NWP 26 altogether within 2 years. It is expected, however, that a series of new NWPs will replace NWP 26. Further, state regulatory authority, in the form of the Water Quality Certification process, will continue to limit the extent of wetland impacts in Washington State. Other NWPs allow impacts to wetlands for specific purposes. For example, a NWP 12 is used for wetland impacts due to utility installation and maintenance.

Unless projects are covered by one of the NWPs, those projects with wetlands impacts of more than two acres require Individual Permits. The Corps evaluates Individual Permits based upon the probable impacts of a project on environmental quality and on a determination of whether or not the project is in the public interest. Applicants seeking Individual Permits must comply with the Section 404(b)(1) guidelines which require that an applicant prove that there are no other practicable alternatives to the proposed project and that the project has avoided and/or minimized impacts to wetlands to the maximum extent practicable.

State Wetland Regulations

The principal Washington State regulations governing activities in or near wetlands are the Shoreline Management Act (SMA) of 1971 (Chapter 90.58 RCW), the 1949 State Hydraulic Code (RCW 75.20.100-140), State 401 (Water Quality) Certification, Coastal Zone Management Determinations, and the Floodplain Management Program. All actions are also subject to the State Environmental Policy Act (SEPA) of 1971 (with implementation rules adopted in 1984, Chapter 197-11 WAC) and, in Western Washington, to the Puget Sound Water Quality Act (Chapter 90.70 RCW). Some actions may also be subject to the Forest Practices Act (Chapter 76.09 RCW).

The preservation and enhancement of wetlands is a prominent issue in the Pacific Northwest, spurred in large part by the Growth Management Act. Two relevant wetland protection programs which provide guidelines and standards for wetlands protection are the Department of Ecology's Model Wetlands Protection Ordinance (1990) and element W-2 of the PSWQMP (1994).

Model Wetlands Protection Ordinance C Department of Ecology

The purpose of the model ordinance is to provide guidance to local jurisdictions in developing standards and regulations governing wetlands. It is written as a template which cities and counties may adopt and modify according to their needs and provides minimum guidelines for

wetlands protection. The model ordinance provides guidance on: lands to which the ordinance would apply; regulated and allowed activities; procedures for wetland permits; and standards for wetland permit decisions.

Element W-2 C Puget Sound Water Quality Management Plan (1994)

This element of the PSWQMP directs local jurisdictions to develop and implement a comprehensive wetlands protection program encompassing both regulatory and non-regulatory components. Assistance in developing a wetlands program is available from the Department of Ecology and the Department of Community, Trade, and Economic Development (DCTED). The goals of the program are no net loss of wetlands function and acreage over the short term, and a measurable gain in wetland acreage and function over the long term. The components of the program should include:

1. *Comprehensive land use planning*. Integration wetlands protection in the City's Comprehensive Plan.

2. *Preservation*. Encourages acquisition of wetlands through public acquisition, land trusts and private stewardship.

3. *Restoration*. Both in the form of mitigation and in non-regulatory enhancement activities.

4. *Regulation*. Recommends use of Ecology's model wetland ordinance to protect wetlands and meet the mandates of the Growth Management Act.

5. *Education*. Suggests interpretive facilities, volunteer programs, and school curricula.

6. *Program evaluation*. Establishing means of measuring progress achieved through the program.

Federal Floodplain Regulations

The Federal Emergency Management Agency administers the National Flood Insurance Program and provisions of the Flood Disaster Protection Act. FEMA ensures the availability of flood insurance in flood-prone areas and the development of floodplain management plans that limit flood damage in these same areas. Details of the NFIP and associated regulations are presented in 44 CFR.

The technical basis for the NFIP is the development of a Flood Insurance Rate Map (FIRM) delineating the boundaries of flood hazard areas. The FIRMs are produce from hydrologic and hydraulic analyses determining flood elevations and correspondingly inundation areas. Insurance rates are based upon a characterization of the flood hazard as delineated by several zones:

- *Zone A*. Special flood hazard areas inundated by the 100-year flood, determined by approximate methods.

- *Zone AE*. Special flood hazard areas inundated by the 100-year flood, determined by detailed methods.

- *Zone AO*. Special flood hazard areas inundated by types of 100-year shallow flooding (sheet flow) at depths between 1.0 and 3.0 feet (depths shown on FIRM).

- *Zone AH*. Special flood hazard areas inundated by types of 100-year shallow flooding (ponding) at depths between 1.0 and 3.0 feet (base flood elevations shown on FIRM).

Floodplain management criteria for development within floodplains are included in the regulations. These criteria must be adopted as minimum standards by local agencies to maintain NFIP eligibility.

State Floodplain Regulations

The Department of Ecology is authorized under Chapter 86.16 RCW to coordinate floodplain management elements of the (NFIP) within Washington State. Under Chapter 173-158 WAC, local governments are required by Ecology to adopt and administer programs regulating floodplain activities complying with the NFIP. Ecology assists local agencies with floodplain location and in administering local floodplain ordinances.

Ecology establishes land management criteria in the floodplain area by adopting as minimum state standards the federal standards contained in 44 CFR, Parts 59 and 60. Beyond the federal standards, the state has adopted additional regulations for residential development in floodplains. Whereas federal standards allow residential development in floodplains where it can be demonstrated the development will not increase the base flood elevations in the floodway, state regulations allow only for repair or reconstruction of existing residential structures in the floodway which: (1) do not expand the building footprint, and (2) do not exceed 50 percent of the value of the existing structure.

3.03 RECOMMENDED REGULATORY PROGRAM

The following actions are recommended to bring the City into full compliance and to control activities with the potential to degrade surface water resources.

It is recommended that the City's current stormwater management ordinance be modified to include provisions addressing:

1. Minimum requirements for drainage from land undergoing redevelopment.

2. Application of source control BMPs.

3. Application of treatment BMPs to smaller-scale development not subject to general stormwater requirements.

4. More rigorous detention facility performance standards consistent with those set forth in the Ecology manual. The primary distinction between the standards is control of smaller storms to lower peak flow rates, such as reducing 2-year discharges to 50 percent of the predevelopment 2-year peak flow rate. When the updated KCSWDM is approved by the Department of Ecology, University Place should consider adopting methods of either the new KCSWDM or the Ecology manual.

The following are also recommended:

1. Allocate greater resources to the implementation and enforcement of current regulations. Additional staff and equipment are necessary for water quality investigative studies, tracking of illicit discharges, and followup.

2. Initiate a water quality monitoring program. The program will identify significant pollutant sources and assist in determining appropriate corrective actions. The program can also serve to assess the effectiveness of City activities in protecting and improving water quality. The resources of this program would also be used to respond to citizen complaints or water quality emergencies and to support compliance and enforcement efforts.

3. Implement a stormwater public education program designed to eliminate pollution sources and aimed at residences, businesses and industries. Utilize education first to correct problems, followed by compliance and enforcement actions where response is inadequate. Staff and material resources are required to perform site investigations, provide information to owners and followup.

4. Continue to cooperate on regional surface water management issues, studies, and projects with adjacent agencies. Areas of regional concern are management of the Leach Creek and Chambers Creek systems.

Chapter 4: Water Quality

This chapter addresses general stormwater characteristics of urban drainage and summarizes existing available data for water bodies in University Place. Information presented in this chapter was collected from federal, state and local sources. Also included in this chapter are recommendations for development of an ongoing water quality monitoring program within the city that complements existing data and ongoing water quality monitoring performed by other agencies.

4.01 EXISTING WATER QUALITY CONDITIONS

Surface Water Bodies of Interest

Several surface water bodies are present within the limits of the city of University Place. The southern and eastern portions of the city drain to Chambers Creek via Leach Creek, Peach Creek, unnamed drainage courses, and numerous storm drainage ditches and piped systems. Chambers Creek empties into Puget Sound at Chambers Bay. Runoff from several small drainage areas within the central portion of the city is conveyed to topographic depressions with no surface outlets, where it infiltrates the ground in gravelly soils and recharges ground water. The remainder of the city drains to Puget Sound via a series of small streams that flow generally northwesterly down the slopes above the shoreline. Two of these streams, Day Creek and Crystal Springs Creek, flow into the Days Island lagoon. This lagoon is actually a channel of Puget Sound, but is characteristic of a sheltered bay due to a narrow passage at the southern end.

Of these surface waters, Chambers Creek and Leach Creek are considered the most important because they are the largest streams in the University Place vicinity and they provide good salmonid habitat. These streams are considered Class AA (i.e., extraordinary) according to Washington state surface water quality standards (WAC 173-201A), and support a variety of beneficial uses. Because of their Class AA status, the water quality standards for Chambers Creek and Leach Creek are the most stringent (high) of all freshwaters. To maintain high quality conditions in these creeks, the quality of runoff flowing to them must not be significantly degraded. The Chambers/Clover Creek watershed has been the subject of intensive management efforts in recent years due to increasing development pressure, worsening water quality, and declining fisheries.

Peach Creek is an intermittent stream that does not flow in the dry season, and the smaller streams on the west side of the city offer minimal fisheries habitat. Although these streams are of lesser concern than Chambers Creek or Leach Creek, their protection is an important objective. Pollutant loadings to these streams must be limited to maintain high quality conditions in downstream waters, including Puget Sound and the Days Island lagoon.

Characterization of Typical Stormwater Quality

Stormwater runoff quality typically varies depending on the types of land uses and related activities that are prevalent in a given area. In general, for comparable land areas, the pollutant

content is greatest in runoff from industrial and commercial areas, and successively lower in runoff from highways, high-density residential areas, low-density residential areas, and open space and forest areas (Horner et al. 1994). This same contribution pattern of pollutant source areas likely occurs in the city of University Place.

The predominant land use in the respective drainage basins of all of the surface waters listed above is single family residential housing. There are also relatively large contributing areas comprised of multifamily residential housing, schools, churches, and open space. Commercial and industrial/manufacturing uses do not constitute a large proportion of the city area. Therefore, it is expected that runoff in the various drainage basins in the city contains pollutant levels comparable to what is typically observed in runoff from residential areas and other moderately developed areas in western Washington.

Runoff from residential developments frequently contains a variety of pollutants in low concentrations. Oil and grease, petroleum hydrocarbons, other assorted organic compounds, sediments, grit, and metals are common in runoff from roadways and driveways, due mostly to deposition from vehicles. Many of these pollutants are toxic to aquatic life in receiving waters. Nutrients (nitrogen and phosphorus) and fecal coliform bacteria are common in runoff from lawns and other landscaped areas due to pet wastes, applications of fertilizers, and also from failing septic systems. Elevated nutrient concentrations in receiving waters can stimulate algal productivity, which in turn can lead to reduced oxygen concentrations in the water, reduced water clarity, and odor problems. Finally, excessive applications of pesticides and herbicides can also result in elevated levels of toxic organic compounds in runoff from residential areas. As residential densities increase, the concentrations of these pollutants in runoff tend to increase.

Compared to residential areas, the commercial areas of the city likely generate slightly higher loadings of metals, oil and grease, suspended solids, and toxic organic compounds due to higher traffic levels, higher quantities of waste materials, and generally increased human activity. In addition, commercial areas tend to have greater impervious surface coverage, which results in relatively direct discharge of pollutants into storm drainage systems. In areas with less open space and vegetation, there is reduced opportunity for contaminated runoff to come into contact with vegetation and soil that can naturally remove some of the pollutant content.

Construction sites are often significant sources of contaminants in runoff. Erosion of disturbed soils typically results in high suspended sediment concentrations in construction site runoff, which can reduce water clarity in downstream waters and lead to sedimentation impacts in salmon spawning areas of streams. A variety of other toxic pollutants can also enter construction site runoff due to leaks, drips, or spills of fuels, lubricants, solvents, concrete leachate, asphalt emulsion, paints, and other construction products.

Results of Water Quality Monitoring in the Vicinity

Limited water quality data are available for the surface waters within and near the city of University Place. Recent sampling data from Chambers Creek, Leach Creek, and Crystal Springs Creek provide a general indication of the types of pollutants that are present in runoff from the residential neighborhoods and commercial areas of the city.

Chambers Creek exhibits elevated fecal coliform bacteria concentrations that typically exceed Washington state standards, and periodically elevated ammonia nitrogen concentrations, low dissolved oxygen concentrations, and warm temperatures (Ecology 1995, Pierce County 1996). The sources of this water quality degradation include land development and urban runoff (Ecology 1995). Most of the Chambers Creek watershed area, which comprises a total of 95,300 acres (149 square miles) (Pierce County 1996), is outside (upstream) of the city of University Place boundaries. Therefore, most of the pollutant loading that enters the creek is due to land uses and related human activities occurring outside of the city. Because of this, the water quality characteristics of Chambers Creek do not necessarily reflect the quality of water draining from the streets, neighborhoods, and commercial properties in the city.

Leach Creek exhibits generally good water quality, although it is prone to periodic episodes of poor quality. The *Chambers-Clover Creek Watershed Action Plan* (Pierce County 1996) notes that Leach Creek has experienced high levels of polynuclear aromatic hydrocarbons (PAHs), which indicate pollution due to synthetic organic chemicals. Water quality data for the period February 1996 through May 1998, from monitoring conducted by members of a citizen stream team, show that Leach Creek typically has pH levels, dissolved oxygen concentrations, temperatures, and aesthetic characteristics that are indicative of ecologically healthy conditions (Brown 1998 personal communication). However, the Leach Creek stream team data show that dissolved oxygen concentrations are occasionally below state standards, nitrate concentrations are often higher than normal for urban streams in the Puget Sound area, and the water appearance is sometimes foamy or cloudy in color. Because some drainage from the City of Tacoma Landfill enters Leach Creek, it is difficult to determine whether the occasional water quality problems in the creek are attributable to the landfill or to runoff from streets, parking lots, neighborhoods, and businesses in the surrounding areas. Water quality degradation in the creek may be attributable to both sources.

Pierce County sampled water quality in Crystal Springs Creek near its outlet to Days Island lagoon in 1993 in conjunction with the county's National Pollutant Discharge Elimination System (NPDES) permit (which is administered by the state Department of Ecology). As part of the NPDES permit documentation process, Pierce County collected discreet surface water samples at numerous locations and analyzed the samples for a variety of pollutants. The available data for a single storm flow sample in Crystal Springs Creek do not show a contamination problem (Kibbey 1998 personal communication). Although a single sample cannot be relied upon to indicate typical water quality conditions, the results for that sample support an assessment that the creek does not have major water quality problems. The unusually good quality of that sample may have been due to dilution with ground water seepage flows or unusually clean urban runoff. The *Chambers-Clover Creek Watershed Action Plan* (Pierce

County 1996) reports that Crystal Springs Creek and Day Creek have exhibited high coliform bacteria concentrations. The timing and extent of the sampling upon which these findings were based is unknown, but these results are not surprising. As discussed previously, high coliform bacteria concentrations are often present in runoff from residential areas.

Pierce County also sampled stormwater runoff flows near Grandview Drive West and 48th Street West for the NPDES permit, to assess existing stormwater runoff quality conditions in a representative multifamily residential neighborhood. The results of two storm flow samples were somewhat inconsistent, which is typical for urban runoff sampling, but indicated that high concentrations of suspended solids, oxygen-demanding substances, and nutrients are likely to occur (Kibbey 1998 personal communication). These results are not surprising, because runoff from residential neighborhoods typically carries a variety of pollutants, as discussed previously.

4.02 SOURCES OF POLLUTANTS IN STORMWATER RUNOFF

Probable sources of point and nonpoint source pollution were assessed for this study based upon a review of available documents and agency records, land use information, and a field reconnaissance. Point sources of pollution include industrial sites, wastewater treatment plants, and other sites where relatively large quantities of wastewater and/or potentially contaminated stormwater are concentrated in a pipe or other conveyance system for discharge into the environment. These types of sources tend to be regulated by numerous governmental agencies, and therefore pollution prevention and minimization efforts have already been implemented. As noted previously, the City does not contain many of these types of sources. Nonpoint sources of pollution, on the other hand, are widespread in the City. These sources are not as obvious as point sources because runoff from nonpoint source areas are not concentrated in a discreet location. Those types of nonpoint pollution sources present in the City include residential lawns, streets, parking lots, construction sites, and waste storage areas.

Point Sources

The extent of point sources of runoff pollution in the city of University Place was characterized based on a review of Washington Department of Ecology (Ecology) records of NPDES permittees. Certain municipal, commercial, and industrial facilities are required to obtain an NPDES permit from Ecology because they are known sources of potentially large quantities of pollutants.

Ecology maintains databases of NPDES permittees that are accessible electronically via the worldwide web. One of these databases includes wastewater dischargers, and another includes facilities where stormwater runoff discharges are the focus. These databases were reviewed to determine the sites of interest in zip codes 98466 (which includes the northern portion of the city of University Place) and 98467 (which includes the southern portion of the city). The list shown below summarizes those facilities identified within the city limits that have NPDES permits, including their addresses.

Table 4-1: NPDES Permittees in the City of University Place

NPDES Permittee	Location
Days Island Yacht Harbor Service, Inc.	at Days Island lagoon
Pierce County Public Works Department, Chambers Creek Shop	on 64th Street S.W.
Lone Star NW Steilacoom Pit	6320 Grandview Drive W.
Chambers Creek Wastewater Treatment Plant	10311 Chambers Creek Road W.
Pace Industries Puget Division, Inc.	2101 Mildred Street W.
Pacific International Pipe Enterprises	4601 S. Orchard Street
Carino Homes/Martha's Vineyard	Cirque Drive W. & Alameda Avenue W.

The Carino Homes development is included in the above list because construction sites with greater than 5 acres of planned soil disturbance and with surface discharges of runoff are required to obtain a temporary NPDES permit for the period of construction. The other permittees noted above are permanent facilities. All of these permanent facilities are regulated with regard to stormwater runoff discharges. Because of this, it is likely that best management practices (BMPs) for stormwater pollution prevention, and possibly for stormwater treatment, are being implemented at these sites to comply with the NPDES permit conditions.

Nonpoint Sources

Based on discussions with city staff (O'Neil 1998 personal communication) and Pierce County staff who formerly managed water resource issues in the city area (Bucich 1998 personal communication), it is apparent that most of the stormwater runoff from lands within city limits is not treated prior to discharge to surface or ground waters. In addition, pollution source control efforts have not been implemented on a widespread scale in the city. Therefore, most of the developed properties in the City, and the commercial and residential activities occurring on those properties, are contributing to stormwater contamination. The field reconnaissance conducted for this study confirmed that typical nonpoint source pollution problems are occurring in University Place, as they do in most developed areas in the Puget Sound region.

4.03 IDENTIFICATION OF STORMWATER QUALITY PROBLEMS AND RECOMMENDED SOLUTIONS

Seven general water quality problems related to stormwater runoff in the city (WQ-1 through WQ-7) have been identified in this study. These problems are discussed separately in the following paragraphs, along with recommended actions to improve water quality conditions. These problems are *not* listed in order of their relative importance.

WQ-1. Lack of Public Education Regarding Nonpoint Source Pollution

Problem: The City has no formal public education or business partnership programs that address the prevention of nonpoint source pollution. As a result, businesses (those

without NPDES permits) and residences generally do not know the types of best management practices (BMPs) they could employ to improve stormwater quality on their properties.

Solution: A public education program aimed at source control of runoff contamination should be implemented. This program could result in cumulative reductions of pollutants in stormwater runoff and noticeable improvement in the water quality of streams in the area, including Leach Creek, Days Creek, Crystal Springs Creek, and Peach Creek. An effective education program would involve informational mailings, placement of posters and/or other materials in public buildings, seminars or other informational meetings, and readily available resources for answering questions and soliciting input from citizens. This program should include resources for working cooperatively with individual businesses to identify and resolve site-specific pollution prevention issues cost-effectively. The city should consider issuing window stickers designating businesses as "environmentally friendly" (or using some other form of recognition) if they actively implement and maintain pollution prevention BMPs.

Examples of activities for which BMPs could be effectively used, and that should be targeted in a public education program, include:

- Waste storage
- Storage of chemicals and petroleum products
- Applications of products that have toxic components such as paints, stains, solvents, and oils
- Storage and applications of pesticides and fertilizers
- Storage of raw materials
- Vehicle and equipment washing
- Vehicle maintenance, and
- Vehicle parking.

There are many more activities that can potentially contribute pollutants to stormwater runoff throughout the City. Likewise, there are many associated BMPs that can be used to reduce or eliminate such contamination. It is much easier and more cost effective to control pollution at the source rather than attempting to remove it after it has been introduced to stormwater or receiving waters.

WQ-2. Lack of Effective Enforcement for Construction Site Erosion and Sediment Control

Problem: The City does not currently have effective construction site erosion and sediment control (ESC) enforcement capability. While the City requires development projects to comply with the ESC requirements set forth in the *King County Surface Water Design Manual*, and site development plans are reviewed to ensure that sufficient ESC measures are proposed, there is limited follow-up by a field inspector to ensure that erosion-related problems do not occur during

construction. Even the most thorough ESC plans can fail in practice due to inadequate attention to maintenance, unforeseen conditions on the construction site, or extreme weather conditions. Therefore, routine field inspections of every construction site are critical. The City is seeking to hire a full-time field inspector, whose duties would be divided between city infrastructure projects and private development sites (O'Neil 1998 personal communication). Sufficient resources should be allocated so that this inspector is able to spend enough time on each construction site to ensure that ESC measures are functioning effectively. If this can be done, potentially significant reductions in sediment transport to streams and other receiving waters could be achieved.

Solution: The City should make sure that the field inspector's duties are prioritized in a manner that allows sufficient time for enforcing ESC requirements on individual development and redevelopment sites. In addition to the necessary funding to support field inspections and coordination with contractors, this effort would require educating city inspectors about effective application of ESC techniques and recent innovations in the ESC industry. In addition, the City should establish regulatory authority to penalize those projects that fail to satisfactorily implement ESC measures and that refuse to abide by the directions of the ESC inspector.

WQ-3. Lack of Water Quality Benefits in Street Sweeping Program

Problem: The City jointly owns one broom-type street sweeper with the city of Steilacoom. This sweeper was purchased in 1997 and should have a useful life of at least 10 years. The arterial streets in the city are swept twice per month, and the residential streets in the city are swept three times per year (Cooper 1998 personal communication). Although this broom-type sweeper is capable of collecting larger-sized particles for disposal, it is incapable of removing fine sediments and associated pollutants from the streets. Most of the pollutants on roadways tend to concentrate in this smaller particle size range. Other types of street sweepers are able to collect more of the fine particles, thereby reducing the pollutant content left on the streets. Research has shown that recent innovations in street sweeper technology have enabled much greater capture of sediments and associated pollutants as compared to conventional broom-type sweepers (Sutherland 1995).

Because the City's street sweeper is new, it will likely be several years before another one is needed. As a result, runoff from city streets will continue to carry relatively high amounts of sediments and associated pollutants into drainage systems. Although some of this sediment loading is, and will continue to be, retained in catch basins, drain inlets, and ditches in the drainage systems, much of it passes downstream to surface waters.

Solution: There are three potential solutions to this problem, two of which relate to other issues discussed in this document. One option would be to increase the frequency of vactor truck cleanouts of catch basins in roadway drainage systems (see WQ-4

below), to accomplish pollutant removals comparable to what could be achieved with a different type of street sweeper. Another option would be to install (retrofit) stormwater treatment facilities in roadway drainage systems to decrease the pollutant loadings discharged from selected street segments (see WQ-7). The third option would be to sell the existing city-owned street sweeper and purchase a newer vacuum-assisted dry sweeper for the purposes of improved water quality protection.

WQ-4. Infrequent Removal of Sediments in Catch Basins and Manholes

Problem: Throughout the City, catch basin and inlet structures in the storm drainage system contain excessive deposits of sediments. These structures have historically not been cleaned out, and therefore trapped pollutants (primarily oil, metals, and miscellaneous solids) are flushed downstream during heavier storm events. Storm drain structures can remove a significant amount of pollutants in runoff (Horner et al. 1994), but only if the accumulated sediments are removed frequently.

The City recently purchased a vactor truck for catch basin and drain inlet cleaning. It is anticipated that the vactor truck operations will clean the entire network of drainage structures in the City's storm drainage systems within approximately two years. Subsequent cleaning of storm drainage structures in future years should take slightly less time because the heavy buildup of sediment deposits will have been removed in the initial cleaning that is now underway. Sediment cleanout is now being conducted primarily for improved conveyance capacity, not because collection of contaminated sediments is a priority for water quality protection.

If the current rate of storm drainage structure cleaning generally occurs in the future, very few catch basins in the City will be cleaned out frequently enough to achieve water quality benefits. Ideally, sediment deposits in storm drainage structures are removed several times each year to achieve and maximize water quality benefits, especially in commercial and industrial areas where the sediments have higher pollutant content (Mineart and Singh 1994). However, it is recognized that the cost of sustaining such frequent cleanouts on a city-wide scale can be prohibitive, and therefore a more practical compromise is necessary. The rate of sediment removal currently being accomplished by the City is not sufficient to alleviate the associated water quality problems, though it will help slightly.

Solution: The solution to achieving better water quality protection in conjunction with storm drain structure cleaning has two components: 1) identifying those areas of the city that generate the greatest quantities of sediments in runoff, and 2) increasing the rate of structure cleanouts to the maximum level that can be afforded, particularly in those areas identified to have greater sediment loading rates. Drainage systems that have lower rates of sediment accumulation can be

cleaned less often to offset the increased maintenance frequency in the targeted systems.

Those maintenance and operations staff responsible for drainage systems likely know of areas that have a large proportion of clogged gutters and storm drain inlets, which indicates greater than normal sediment production in the contributing drainage area. It can be expected that parking lots, busy streets, and recently developed areas will generate relatively high volumes of sediments. Older, more established residential sections of the city will likely have less sediment accumulation in nearby catch basins and drain inlets because there is more vegetation present which serves to filter and trap sediments in runoff and help resist erosion. Overall, the areas that are expected to generate more sediments should be targeted for catch basin cleaning more frequently.

Decisions on where to focus catch basin cleaning efforts should also be based on the density of storm drain inlets and catch basins. That is, individual structures in areas containing numerous catch basins and inlets can be cleaned less often as compared to those structures collecting runoff from a large area.

It is recommended that structures be cleaned at least twice per year in those areas where high sediment yields are anticipated, once in late summer and once again (probably mid-winter) when sediment buildup in the bottom of the structure exceeds half of the sediment storage capacity. Structures in lower priority areas should be cleaned at least once every two years, preferably in late summer before the wet season begins.

WQ-5. Lack of Coordination with Pierce County on Water Resource Protection Efforts

Problem: The City and Pierce County presently do not coordinate their efforts with regard to protection of sensitive areas such as wetlands and streams. Pierce County essentially relinquished oversight of drainage basins within University Place city limits, prior to the City's incorporation in 1995, as the county anticipated that management efforts in these areas would likely not be continued or endorsed by the new city government. Since that time, the city has not solicited input on stormwater management issues from those county staff who have extensive knowledge of streams and wetlands in the area.

Solution: The City should initiate coordination with the Pierce County Storm Drainage and Surface Water Management Utility, which has offices in the city, to foster consistency with regard to ongoing and future stormwater management plans, water quality studies, and resource protection efforts in surrounding areas of the county. For instance, if the City of University Place decides to implement a water quality monitoring program, it would be beneficial to coordinate sampling locations, analytical parameters of interest, and timing of sampling with similar data collection efforts undertaken by the County.

WQ-6. Lack of Runoff Treatment Facilities in Developed Areas

Problem: Because the City of University Place consists mostly of residential neighborhoods and commercial areas that were established at a time when stormwater treatment requirements did not exist (as they do now), runoff from most of the parking lots, streets, and other nonpoint pollution source areas in the city is not treated prior to discharge to streams and wetlands. The parking lots of concern are located in the commercial corridors along Bridgeport Way W., 67th Avenue W., and 27th Street W.; at churches and schools throughout the city; and at older apartment and condominium complexes throughout the city. City streets which likely generate the most pollution in runoff are the larger streets with relatively heavy traffic volumes, such as Bridgeport Way W., Grandview Drive W., 67th Avenue W., Cirque Drive W., 19th Street W., 27th Street W., 35th Street W., 40th Street W., Sunset Drive W., S. Orchard Street, and Chambers Creek Road W.

Solution: The City should implement a capital improvements program for retrofitting stormwater treatment facilities in older drainage systems. This program should successively target the most cost-effective retrofit options, based on an assessment of pollutant loadings in runoff in various drainage systems around the city and an evaluation of drainage system configurations to determine advantageous retrofit locations. Water quality monitoring of stormwater runoff in some of these drainage systems could improve the accuracy and utility of this type of assessment. Although they are difficult to accommodate in established urban areas, larger-scale treatment systems (i.e., "regional" water quality ponds or similar facilities) would be preferable to a series of smaller systems. Regional treatment facilities can generally achieve greater overall pollutant removal for the money spent, and also enable simplification of maintenance activities that are critical to long-term treatment effectiveness.

WQ-7: Illicit Connections of Wastewater Discharges to Storm Drainage Systems

Problem: It is highly likely that in the City of University Place, as in most other cities with older drainage systems, there are numerous connections of wastewater flows to the storm drainage system. These types of connections can potentially result in excessive pollutant loadings to receiving waters because the water quality of the discharges is much worse than typical stormwater.

Solution: The City of University Place should take actions to determine where illicit connections to the storm drainage system exist. Smoke tests or dye tests are commonly performed to identify these types of connections. The commercial areas of the city could be targeted in this effort, and the focus could be further narrowed to businesses that are likely to produce process wastewater. Certain residential areas of the city could be included if it is determined that flows other than natural ground water seepage discharges occur in storm drainage pipes and ditches during dry periods. These plumbing connections are often unknown to the

property owner. If illicit discharges are discovered, they should be disconnected from the storm drainage system and rerouted to the sanitary sewer or septic system, a sump, or onsite process water treatment system. The City should also seek to identify illicit connections when conducting occasional video surveys of storm drainage systems for other purposes.

Additional Recommendations

In addition to the water quality improvement measures discussed above, the following stormwater management policies and pollution prevention measures should be considered for improved water resource protection:

- Impervious surface areas should be minimized in new developments and in redevelopment projects to reduce the incidence of stormwater runoff that in turn carries pollutants into receiving waters. Consideration should be given to using porous pavements in light traffic areas and in pedestrian areas where conventional pavements would otherwise be used.

- When storm sewers are in need of replacement or repair, consideration should be given to using open conveyance systems, such as grass-lined ditches or rock-lined ditches. These conveyance systems allow for some infiltration of runoff and also enable greater retention of pollutants as compared to underground pipe systems. Open ditches also slow down the velocity of runoff, thereby protecting receiving streams from erosive flows. The native soils in the University Place area are predominantly Alderwood gravelly sandy loams (USDA SCS 1979), which are relatively porous to depths of several feet. Use of open conveyance systems in these soils would likely be beneficial and result in extensive infiltration during and following lighter storm events.

- Signs should be posted in public parking lots discouraging oil changes and other vehicle maintenance activities.

- Storm drains should have signs stenciled or posted near them stating "dump no waste, drains to stream" or other similar warnings. Some storm drains in the city currently are stenciled as such, but many more are not. This simple measure can prevent much of the illegal dumping that occurs out of ignorance of the serious downstream effects. Many other municipalities have had success stenciling warning signs near a large number of storm drains through the efforts of educational projects with school students and citizen volunteers.

4.04 SUMMARY AND CONCLUSIONS

In comparison to many other urbanized areas of Puget Sound, University Place has relatively fewer stormwater pollution problems. This is due primarily to two factors: 1) construction activity is limited because most of the city is developed, and 2) land uses that produce high levels of pollutants in runoff are not predominant. However, there are several water quality issues

related to the city's drainage systems that should be addressed in the coming years. Pollutants in runoff throughout the city are contributing to water quality degradation in downstream waters.

The solutions offered for the water quality problems discussed in this report should be implemented to the extent feasible or, at the very least, prioritized for future funding. The goals and action items highlighted in Pierce County's *Chambers-Clover Creek Watershed Action Plan* have many elements in common with the water quality issues discussed in this report. The City should be proactive in implementing meaningful nonpoint source pollution control measures to keep in step with the county's plan.

Chapter 5: Hydrologic/Hydraulic Analysis

5.01 GENERAL

A hydrologic/hydraulic computer model was developed to simulate the response of the City's surface water system to rainfall events. The purpose of the hydrologic/hydraulic analysis was to:

- Compare simulated flows to channel and pipe system capacities at selected locations.
- Estimate changes in simulated flows based on forecasted/projected land use changes and potential hydraulic changes within the drainage system.
- Validate existing flooding problems identified by City staff and consultant staff observations.
- Predict future flooding problems based on build-out land conditions.
- Develop a model which can be used to evaluate alternative structural and regulatory solutions to flooding problems.

Computer simulation models of runoff responses to rainfall were developed using WaterWorks©. The projected flows for the 2-, 5-, 10-, and 100-year storm events were calculated.

5.02 MODEL PARAMETERS

WaterWorks© requires the input of several parameters in order to calculate the amount of runoff generated by the various storms. These parameters include; the total basin area, the percent impervious, the percent pervious, the amount of rainfall, the duration of the storm, the time of concentration, the CN number and the type of storm.

The total basin area was determined by using the *Pierce County Comprehensive Drainage Maps.* These maps define the individual drainage basins. The City of University has a total of 12 distinct drainage basins located within the City limits. Each of these basins were divided into subbasins for the purposes of modeling.

The percent pervious and the percent impervious were determined using the *Pierce County Comprehensive Drainage Maps,* a 1996 aerial photograph of the City and field observations. The amount of impervious varies from 10 to 90 percent of the individual basins.

Rainfall amounts were taken from *NOAA Atlas 2, Precipitation-Frequency Atlas of the Western United States, Volume IX-Washington.* For modeling purposes the amount of rainfall for the 2-year, 24-hour storm was 2.0 inches; for the 5-year, 24-hour storm was 2.5 inches; for the

10-year, 24-hour storm was 3.0 inches; for the 25-year, 24-hour storm was 3.5 inches; and for the 100-year, 24-hour storm was 4.0 inches.

The time of concentration, the amount of time it takes a drop of rain from the farthest point in the drainage basin to reach the discharge point, was calculated for each subbasin. The time of concentration for the subbasins vary from 6 minutes to almost 100 minutes.

SCS Runoff Curve Numbers (CN) were obtained from the King County Surface Water Design Manual. The CN's vary depending on the soil types and the amount of impervious area.

5.03 BASIN ANALYSIS

The table below outlines the results of the modeling for the individual basins/subbasins for the 2- through 100-year storms.

Table 5-1: Existing Conditions Basin Discharge

Basin	Subbasin	2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	100-Yr (cfs)
Crystal Springs		29.3	38.4	45.6	60.8	71.9
Day Island Lagoon		6.1	9.1	12.3	15.6	19.1
Day Island Waterway		81.7	106.8	138.2	170.4	203.1
Flett Creek		2.7	3.9	5.2	6.5	7.9
Westside Sewer Dist.	Subbasin A	54.5	83.9	110.4	143.9	174.8
	Subbasin B	3.5	5.0	6.8	8.7	10.8
	Subbasin C	0.9	1.2	1.7	2.3	2.9
	Subbasin D	1.0	1.3	1.9	2.6	3.5
Unnamed (Glacier)	Subbasin A	41.5	57.2	74.3	92.3	111.0
	Subbasin B	11.9	15.6	20.5	25.0	29.6
	Subbasin C	11.5	15.6	20.3	25.3	30.5
	Subbasin D	12.8	17.6	22.5	27.6	32.8
Curtis Pothole		42.1	58.9	76.4	93.8	
Unnamed (Tacoma1)		25.3	35.4	46.0	59.7	67.9
Chambers Creek		77.1	94.0	144.5	179.3	216.5
Soundview		56.7	81.2	107.2	134.2	146.0
North Day Island		90.2	115.8	141.3	167.9	194.1

Table 5-2: Primary Storm Drainage Systems

Basin Name	Conveyance Description	Extent/Area Served
Crystal Springs	Open Ditch/12" Culvert	Crystal Springs to Mountain View Dr & 26th St W to 27th St W
	Creek/12" Culvert	Portion of 85th Ave W to Crystal Springs & 21st St W to 26th St W
	Creek	85th Ave W to Railroad Tracks & 19th St W to 27th St W
Day Island Lagoon	Open Ditch/12" Culvert	26th St W to 31st St W & Parkway W to Railroad Tracks
Day Island Waterway	12" Culvert/15" Culvert	44th St W to 40th St W & 77th Ave Ct W to 72nd St W
	18" Culvert	40th St W to 37th St W & 75th Ave W to 77th Ave W
	18" Culvert	35th St W to 37th St W & 75th Ave W to 78th Ave W
	12" Culvert	35th St W to 35th St Ct W & 78th Ave W to Crystal Springs
	12" Culvert/Open Ditch/ Drywells	35th St W to 35th St Ct W & Crystal Springs to 89th Ave W
	18" Culvert/Open Ditch/ Drywells	27th St W to 35th St W & 80th Ave W to 75th Ave W
	12" Culvert/Open Ditch/ Drywells	35th St W to 27th St W & 80th Ave W to Crystal Springs
	12" Culvert/Open Ditch	35th St W to 27th St W & Crystal Springs to 90th Ave W
	21", 30", 48" & 36" Culverts	Entire Basin
No Day Island	12" Culvert	75th Ave W from 35th St W to 37th St W
	12" Culvert/Pothole	67th Ave W to 75th Ave W & 27th St W to 35th St W
	18", 21", 30" Culvert	72nd Ave W to 67th Ave W & 19th St W to 27th St W
	12" Culvert	300' Corridor along 75th Ave W from 27th St W to 37th St W
	30", 24" Culvert	26th St W to 27th St W & Mt View Dr to 75th Ave W
	24" Culvert	Mt View Dr to Crystal Springs & 26th St W to 19th St W (portion of)
	36" Culvert	Entire Basin
Unnamed (Glacier)	No System	—
Unnamed (Tacoma1)	12" Culvert/Open Ditch	Crystal Springs Rd to 7th Ave W & 19th St W to 26th St W
Unnamed	Drywells/Open Ditch/No Drainage	48th St W to 37th St W & Railroad Tracks to Grandview/Soundview
Curtis Pothole	12" Culvert	Sunset Dr to 77th Ave Ct W & 40th St W to 46th St W
	Open Channel	37th St W to 40th St W & Sunset Dr to 82nd Ave W
	12" Culvert	37th St W to 40th St W & Sunset Dr to 78th Ave Ct W
	Open Channel	Polo Club Apartments
	Open Ditch	35th St W to 37th St W & Sunset to 78th Ave W
	24" Culvert/Open Channel	Entire Basin
Leach Creek	36" Culvert	40th St W to 35th St Ct W & 67th Ave W to 72nd Ave W
	36" Culvert	40th St W to 44th St W & 72nd Ave W to 67th Ave W
	36" Culvert	72nd Ave W to 67th Ave & 44th St W to 48th St W
	30" Culvert	44th St W to 48th St W & 67th Ave W to 64th Ave W
	36" Culvert	48th St W to 51st St W & 67th Ave W to 64th Ave W
	12", 15", 24" Culverts	Bridgeport to 67th Ave W & 48th St W to 52nd St W
	30", 15" Culverts	Cirque Drive Corridor
Flett Creek	12" Culvert/Drywells/Open Ditch	64th St W to 60th St W & 54th Ave Ct W to 52nd Ave W
Soundview	12" Culvert/Open Ditch	Grandview to Sunset Dr & Olympic/40th St W to 45th St W
	12" Culvert	
	12" Culvert/Open Ditch	84th Ave W to Olympic Blvd & 35th St W to Grandview
	18" Culvert/Open Ditch	Palisades Pl to Grandview & Olympic to Rock Rd
	24", 36" Culvert	Almost Entire Basin
Westside Sewer Dist	12", 15", 18" Culverts	Dark Ridge Dr to 86th Ave Ct W & Cirque Dr to 51st St Ct W
	24" Culvert	86th Ave Ct W to 83rd Ave W & Cirque Dr to 52nd St W
	24", 36" Culverts	83rd Ave W to Grandview Dr & Breckonridge Dr to 48th St W
	36", 24" Culverts	Entire Basin

**Approximate boundary only. The culverts/ditches/channels convey the area described plus all the upstream area.*

Chapter 6: Capital Improvement Program

A number of problems in the City's drainage infrastructure and receiving waters were identified from field investigations, reviews of City records, prior studies, interviews with City and County staff, public meetings, and analysis of computer model simulations. This section describes known problems along with proposed measures to reduce or eliminate each.

The following discussion of projects is organized by watershed and presents the recommended measures along with descriptions of each problem. The locations of the recommended capital improvements are depicted in Figure 6.1, and the improvements are summarized with their estimated costs in the accompanying table.

6.01 LEACH CREEK BASIN

Much of the east portion of the City of University Place drains to Leach Creek. The required solutions to the channel erosion and bank stability problems in Leach Creek, and to restore and protect the stream from degradation, extend beyond University Place and involve the cities of Tacoma and Fircrest, and Pierce County. The City should participate in an interlocal agreement with other local and state agencies in developing an overall plan for restoring and protecting Leach Creek. Following are descriptions of those capital improvements recommended along Leach Creek:

- *Project 1:* The foremost component of a creek restoration and protection plan for Leach Creek is sufficient flow control. Opportunities are limited for reducing peak flows from urbanized areas within the city, however one such area exists on a parcel, referred to as the 'Broback Parcel,' situated between Alameda Avenue and Leach Creek at approximately 47th Street West (extended). This property should be acquired by the City to develop a detention facility for runoff from a tributary area of 185 acres. Currently flows from this basin discharge to the creek through a 30-inch diameter outfall. The detention facility would divert flows from the 30-inch storm drain, detain and treat the runoff, and discharge either to the outfall or to an adjacent channel leading to the creek. (Refer to Figure 6.2.)

- *Fircrest Project:* Another opportunity for runoff detention is located at the natural depression south of 40th Street West at approximately 63rd Avenue West. It is recommended that the storm drainage from 40th Street West be diverted into the depression for detention and subsequent discharge through the 15-inch storm drain to the south at 44th Street West. This project and the tributary area lie within the Town of Fircrest.

- *Tacoma Project:* The improvement which would have the greatest benefit to the Leach Creek system is enhanced operation of the regional detention facility at 37th Street West operated by the City of Tacoma. Extending the pump station force main so as to discharge to the Nalley Valley interceptor at a point further east will allow the

pump station to operate at full capacity during major storm events and reduce flooding and erosion effects throughout the length of the stream system.

- *Project 16:* Once adequate flow control has been achieved in the Leach Creek system, both within University Place and upstream, stream restoration efforts can be undertaken without undue risk of their being destroyed by erosive flows. It is anticipated that techniques such as biostabilization of banks, placement of large woody debris and other measures will be appropriate to enhancing system stability and restoring habitat features.

- *Project 14:* In order to provide an effective buffer between development and the creek, it is recommended that a buffer acquisition program be undertaken to preserve setbacks from the creek banks and provide access to the creek for maintenance and enhancement efforts. The buffer acquisition could take different forms including fee simple purchase, easement, conservation easement, and others. (Refer to Figure 6.15.)

- *Project 7:* The residence at 7014 37th Street West experiences frequent flooding with stormwater entering the garage during heavy rains, and several neighboring yards are flooded. The source of the problem is an extremely flat and small (10-inch diameter) storm drain system serving this area. The drainage system historically discharged to a pothole feature which has since been filled and developed, leaving a much smaller detention pond to serve a more urbanized basin.

  It is recommended that the 10-inch storm drain system be replaced with an 18-inch-diameter storm drain constructed along the existing pipe alignment. (Refer to Figure 6.8.)

- *Project 18:* Standing water has been reported near the intersection of 57th Avenue West and 62nd Street West. This area is served by drywells, and it is suspected that the drywells, which are several decades old, have ceased to infiltrate effectively due to silt deposition.

  It is recommended that the existing drywells be cleaned to restore their infiltration capacity. If cleaning is insufficient, construction of new, multi-chambered infiltration facilities is recommended. (Refer to Figure 6.18.)

- *Project 19:* Localized flooding is reported along 64th Street W, near the Meadow Park Golf Course maintenance facility. This area is served by drywells, and it is suspected that the drywells, which are several decades old, have ceased to infiltrate effectively due to silt deposition.

  It is recommended that the existing drywells be cleaned to restore their infiltration capacity. If cleaning is insufficient, construction of new, multi-chambered infiltration facilities is recommended. An alternative was considered that would construct storm drains to convey the flow to Leach Creek; however, it is recommended that direct

discharges to Leach Creek be minimized to avoid aggravating existing problems in the stream. (Refer to Figure 6.19.)

6.02 CURTIS POTHOLE BASIN

- *Project 2:* A short segment of the 12-inch diameter storm drain along the west side of Sunset Drive, approximately 150 feet south of the intersection with 37th Street Court West, is constructed at a flat grade and causes surcharging in the system. No flooding problems have been reported to result from this condition, therefore no immediate improvements are recommended. The pipe should be reconstructed with sufficient grade when 40th Street West is scheduled for roadway improvements under the TIP. (Refer to Figure 6.3.)

- *Project 3:* Approximately 200 lineal feet of 12-inch diameter storm drain located on the north side of 40th Street West, between Sunset Drive and 80th Avenue West, is constructed at a flat grade and causes surcharging in the system. No flooding problems have been reported to result from this condition, therefore no immediate improvements are recommended. The pipe should be reconstructed with sufficient grade when Sunset Avenue is scheduled for roadway improvements under the TIP. (Refer to Figure 6.4.)

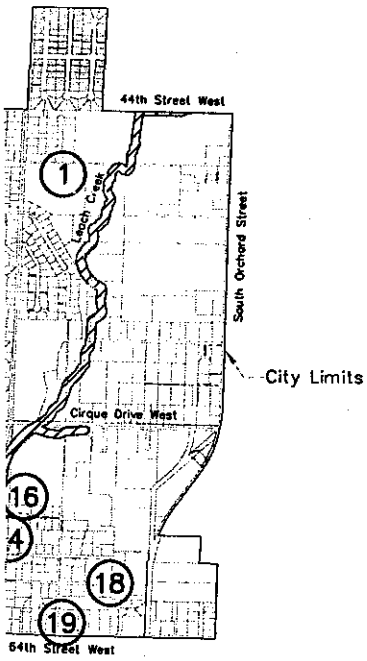
- *Project 8:* Flooding within the pothole located at Curtis Senior High School has increased in frequency, magnitude and duration over the last several years. Standing water within the pothole will occur after as little as two days of rain. School district staff have observed as much as four feet of water standing on the tennis courts.

  The amount of storage historically available in this deep pothole has been reduced over time by the construction of various facilities for Curtis Junior High and Curtis Senior High. In addition to a significant loss of storage, construction within the bottom of the pothole has eliminated much of its infiltration capacity by constructing tennis courts and through the compaction of surface soils by construction equipment in the area surrounding the courts. The other factor responsible for the aggravated flooding is the increased urbanization within the tributary area and the diversion of high flows to the pothole at the flow splitting structure behind the Greenfirs complex.

  It is recommended that the remaining undeveloped area in the bottom of the pothole be excavated to: (1) increase the storage volume available below the tennis court grade and (2) restore the infiltration capacity of the underlying soils. (Refer to Figure 6.9.)

  A related recommendation is described under Project 9 in the Day Island Waterway section.

RCREST ACRES
POSSIBLE ANNEXATION
) CITY OF UNIVERSITY PLACE
NC. IN STUDY)



1. BROBACK DETENTION FACILITY
2. PIPE REPLACEMENT–SUNSET DRIVE
3. PIPE REPLACEMENT–40TH STREET W
4. ADDITIONAL PIPE–BROOKSIDE/SOUNDVIEW
5. RESTORE POND CAPACITY–PLAZA WEST
6. CATCHMENT IMPROVEMENTS–MT. VIEW & 21ST ST W
7. PIPE REPLACEMENT–37TH ST W TO 70TH AVE W
8. CURTIS POTHOLE STORAGE & INFILTRATION
9. PIPE REPLACEMENT–77TH AVE & 27TH ST W
10. RETROFIT 19TH STREET POND
11. RETROFIT DAY ISLAND BRIDGE POND
12. ARMOR 27TH STREET W OUTFALLS
13. MORRISON POND DETENTION FACILITY
14. LEACH CREEK BUFFER ACQUISTION
15. DETENTION TANK–79TH AVE W
16. LEACH CREEK STREAM RESTORATION
17. INSTALL SYSTEM IN ARBORDALE AVE W
18. INFILTRATION SYSTEM–57TH AVE & 62ND ST W
19. INFILTRATION SYSTEM–64TH ST W

FIGURE 6.1
DRAINAGE PROJECT LOCATIONS

6.03 DAY ISLAND WATERWAY BASIN

- *Project 9:* The 18-inch diameter storm drain system that originates behind the Greenfirs retail complex and receives runoff from the complex and other commercial areas has insufficient capacity to convey the required flows. Immediately north of the Greenfirs complex is a flow splitting structure which allows low flows to continue north in the storm drain system along 77th Avenue West; this system eventually discharges to the storm drainage in 27th Street West and to the Day Island Bridge pond and the Day Island Lagoon. During high flow storm events, the excess runoff is diverted at the flow-splitting structure and into storm drains to the Curtis pothole which experiences flooding (refer to discussion of flooding problems in the Curtis pothole under Project 8). The flow-splitting structure is in need of maintenance (sediment deposits) to ensure it is working properly.

  Alternatives considered to correct this problem included (1) additional pipe capacity in the 77th Avenue West system and (2) detention storage above the flow-splitting structure. Diverting additional flow to the pothole to was not viewed as a viable approach to off-loading the 77th Avenue West system.

  Increasing pipe capacity in 77th Avenue West requires capacity upgrades to several thousand feet of the downstream storm drain system so as to avoid moving the flooding problem to another location. This alternative would, however, allow more flow to be diverted away from the Curtis pothole problem. It is concluded that approximately 7,400 feet of storm drain capacity must be upgraded, either by replacing the existing storm drain or constructing parallel pipe. A substantial portion of the required upgrading is located along 27th Street West and should therefore be constructed with the TIP work scheduled on 27th Street West.

  A second solution considered is to construct underground tank storage in the parcel immediately west of the Greenfirs complex and upstream of the flow-splitting structure. This would require an extensive, large-diameter tank or vault system which could be constructed within a service drive in concert with future development. This detention system would reduce peak flows to the flow-splitting structure allowing more of the runoff to pass to the north without exceeding the capacity of the 77th Avenue West system. Subsequent to developing this alternative, however, it was learned that development on this parcel is imminent. Without this or other opportunities for detention storage in the basin upstream of the diversion to the Curtis pothole, the first alternative of storm drain upgrades must be implemented to resolve the problem. (Refer to Figure 6.10.)

- *Project 11:* The pond known as the 'Day Island Bridge' pond is located immediately east of the railroad tracks and north of the Day Island Bridge Road. This pond was historically the responsibility of the City of Tacoma. The pond discharge is tidally influenced as evidenced by marine growth around the inlet to the twin discharge pipes. With more frequent cleaning, the pond's sediment removal efficiency can be

enhanced. This will require improvement of the access road into the pond to facilitate regular maintenance

The pond should also be reconfigured to improve sediment removal and concentrate sediment deposition within a smaller area in the facility, thereby enhancing discharge quality and maintenance efficiency. The pond should be excavated to remove accumulated sediments and create multiple cells to promote sedimentation. . (Refer to Figure 6.12.)

6.04 SOUNDVIEW BASIN

- *Project 4:* Substantial drainage problems are present along Brookside Way and Soundview Drive. The catch basins and manholes along Brookside Way surcharge, and in some instances the water exits the catch basins through their grates and flows over the ground surface. The overland flow passes through a yard near the intersection of Brookside and Soundview, then through a second yard west of Soundview Drive, and eventually is intercepted by catch basins on a recently reconstructed outfall pipe that extends over the steep bank and into Puget Sound.

  The surcharging effect appears to be caused by a combination of inadequate pipe capacity and by energy losses induced by the multiple 90-degree turns through catch basins in the drainage network as it flows down Brookside Way. It is recommended that the single pipe system which crosses back-and-forth along Brookside be modified to create two parallel storm drains with fewer, and more gradual, changes in flow direction. (Refer to Figure 6.5.)

- *Project 17:* The outlet from a storm drain located at the intersection of 41st Street West and Arbordale Avenue West is buried. There are visual indications that the stormwater has surcharged from the backed up storm drain and has caused erosion where it flowed overland.

  It is recommended that the pipe outlet be exposed and connected to discharge to the existing storm drain system in Robin Road West. (Refer to Figure 6.17.)

6.05 CRYSTAL SPRINGS BASIN

- *Project 10:* A small single cell pond, known as the 'Railroad Crossing pond,' is situated immediately south of 19th Street West and east of the railroad tracks. The pond was constructed by Pierce County and serves primarily as a siltation basin to trap large-fraction sediments in Crystal Springs Creek flows before entering the outfall to the Day Island lagoon. Flows in the nearby storm drain along 19th Street West do not enter the pond; this storm drain receives discharges from the pond at a junction structure west of the railroad tracks.

  The pond requires more frequent maintenance to remove accumulated sediments before they have opportunity to be scoured out by succeeding storm flows and re-

suspended in the pond's discharge. With more frequent cleaning, the pond's sediment removal efficiency can be enhanced. In addition, the pond treats flows from the Crystal Springs Creek drainage only not all of the flow from 19th enters the pond. Only that portion from Crystal Creek actually flows through the pond.

In addition to more frequent maintenance, it is recommended that the pond be reconstructed for greater sediment removal efficiency. The pond should be excavated to enlarge its volume as much as the site will permit, thereby increasing the transit time through the pond and reducing velocities to promote sedimentation. The pond should also be reconfigured into multiple cells, either (1) to pass the flows through two cells in series, or (2) to split the flows so that high velocity flows from larger storm events are bypassed around the sedimentation zone to avoid scouring of deposited materials. These modifications should increase the pond's sediment removal efficiency. During design of the improvements, consideration should be given to diverting additional flow from smaller storms to the facility from the storm drain in 19th Street West that currently bypasses the pond.

It is suggested that design of the facility improvements also consider modifying the pond discharge outlet to promote trapping of floatables so as to prevent their discharge to the outfall.

According to the owner's of the Day Island Marina, excessive sedimentation has occurred at the 19th Street outfall to the Day Island Lagoon. Silt depositions were observed during field observations near the 19th Street West outfall. The marina owner has claimed that accelerated sediment accumulation has created the need for dredging to maintain the necessary water depths in the marina. According to a prior report (Robison, 1995)[1], the rate of sedimentation in the lagoon may, in fact, be less than was experienced prior to development in the watershed. The marina had not provided evidence of increased sedimentation at the time of Robison's report; subsequent data has not been made available because of the marina owner's outstanding claim.

The recommended improvements to the Railroad Crossing pond sediment removal efficiencies, and non-structural measures (recommended elsewhere in this plan) to prevent erosion, to monitor construction sites and water quality, and to perform frequent system maintenance, provide appropriate safeguards against excessive sediment discharges from the City's drainage system to the lagoon. (Refer to Figure 6.11.)

[1] Robison, Edward C., Report of: Storm Drainage and Surface Water Management Master Planning and Program Implementation, Phase I Preliminary Planning and Information Collection, City of University Place, August 24, 1995.

6.06 NORTH DAY ISLAND BASIN

- *Projects 5 and 13:* A detention pond associated with the Plaza West Development, is located southwest of the intersection of 27th Street West and 73rd Avenue West. The pond is severely overgrown with vegetation and in need of maintenance to restore its capacity and function. The pond discharges to the west through a series of pipes that connect into the storm drainage system in Bridgeport Way, then 27th Street West, and eventually into the storm drainage discharging to the 19th Street West outfall. The storm drain system from 27th Street West to Crystal Springs Road is constructed at relatively flat grades and does not have the capacity to convey tributary storm flows. This causes water to back up in the pond and flood the surrounding area, including the lower floor of commercial businesses fronting on 27th Street West (International House of Pancakes).

  During periods of heavy rainfall, storm flows from the Morrison Pond, a pothole feature located to the east of 73rd Avenue West, overtops 73rd Avenue and flows aggravates the flooding surrounding the Plaza West pond. Approximately 200 acres drain to the Morrison Pond site. County records indicate the outlet from the pond is a 12-inch-diameter concrete culvert, with a capacity of 5.5 cfs. The County had imposed special development restrictions to limit the rate of discharge into the Morrison Pond pothole.

  Two approaches to correcting this problem were considered. Increasing the capacity of the storm drain in 27th Street West would require installation of almost 4,000 feet of storm drain, and the accelerated discharge would be problematic for the downstream drainage system. A second approach is recommended which improves detention of storm flows to reduce peak discharges to a rate the existing storm drain network can handle. Two specific projects are recommended.

  The smaller project, denoted Project 5, involves restoring the capacity of the Plaza West pond to its design configuration to increase runoff storage volume and reduce the frequency of flooding from smaller, more frequent storm events. If the pond can be enlarged further within its site, it would be of yet greater benefit. The overflow in the pond's control structure should be inspected and modified, as necessary, to ensure it does not contribute to the flooding problem. (Refer to Figure 6.6.)

  The second project, labeled Project 13, will serve to alleviate the larger problem of insufficient storm drain capacity in and below 27th Street West. This project will increase the detention storage volume available in the Morrison Pond pothole. It is recommended that a berm be constructed to impound water to a greater depth in the pothole and a formal control structure be installed to regulate discharges from the pond. This project will require acquisition of flooding easements and rights-of-way for construction and maintenance. (Refer to Figure 6.14.)

- *Project 6:* Residents at 8001 21st Street West reported runoff flows down 21st Street from Willows Lane, across Mt. View Road and onto their property. An asphalt berm and additional storm drains were added in the past six months; however, larger storm flows are not captured by this system and continue onto their property.

  It is recommended that additional catch basins be installed and connected to the drainage system to improve interception at the intersection. In addition, the ditch conveying flows to the north from the intersection should be regraded to ensure it carries runoff away from the intersection. (Refer to Figure 6.7.)

- *Operations:* The pothole feature located south of 35th Street West and west of 67th Avenue West currently has a 'Fill Wanted' sign posted adjacent to it. This depression serves as a detention facility and forebay for a 2 cfs duplex pump station. The pump station discharges through a 10-inch-diameter force main to the storm drain system located on the north side of 27th Street West.

  The City should prohibit fill placement below the 300-foot elevation on the site, and monitor for compliance with this prohibition, so as not to reduce the effective storage available the pothole. Loss of storage in the pond will result in more frequent and rapid fluctuations in the pond's water surface elevation which, in turn, increases the duration over the pump station must operate at its full 2 cfs capacity. The greater duration of higher discharges correspondingly increases the potential for capacity problems downstream in the 27th Street West system.

  It is also recommended that operation of the pump station be modified to minimize the frequency and duration at which the pump station runs at full capacity. The elevations of the floats signaling the second pump to turn on should be raised to utilize the available storage more fully and reduce the frequency of dual-pump operation.

6.07 DAY ISLAND LAGOON BASIN

- *Project 12:* Localized scour is evident at the discharges from the outfalls in the vicinity of 27th Street West (extended), creating deposition zones immediately below the outfalls, near the upper end of the Day Island Lagoon. Three outfalls – two at railroad grade crossings and one directly to the lagoon – should be armored to prevent scouring. It is recommended that the bank immediately below the outfall to the lagoon be stepped as well as armored to dissipate energy of the falling water. (Refer to Figure 6.13.)

6.08 CHAMBERS CREEK BASIN

- *Project 15:* A segment of 21-inch-diameter storm drain extending north and east from the intersection of 79th Avenue West and 54th Street West, is undersized for the required flows. A 36-inch storm drain discharges to the undersized segment which is paralleled by a 12-inch-diameter storm drain. Downstream of this location, the system

discharges to the head of Peach Creek where there have been problems with scour at the outfall.

In order to address both the capacity and scour problems, it is recommended that, instead of simply replacing the pipe with another pipe providing greater conveyance capacity, the parallel 12-inch pipe in 79th Avenue West be replaced with an oversized pipe system providing in-line detention of peak storm flows. The detention system should be sized to control the discharge rate to Peach Creek to below erosive levels. (Refer to Figure 6.16.)

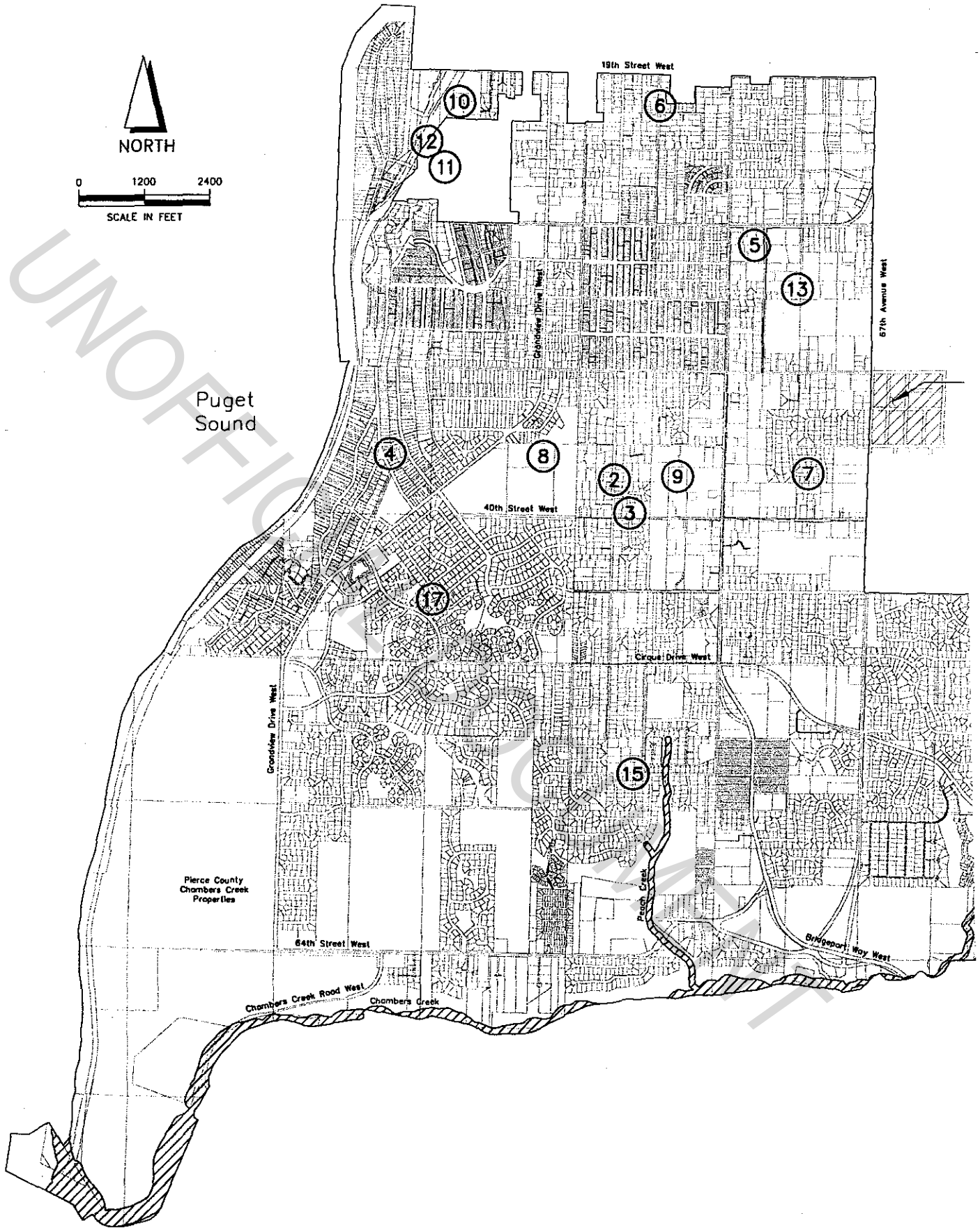
- *Private Facility:* Extensive flooding problems have occurred in the Danbridge subdivisions located north of 64th Street West, along 84th Avenue West. The drainage facilities in these subdivisions are privately owned and maintained.

6.09 RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

The required specific improvement projects outlined in the preceding sections are summarized in Table 6-1 and constitute the basic Capital Improvement Program. The estimated expenditures presented in Table 6-1 form the basis for the financial analysis presented in Chapter 8.

Table 6-1: Capital Improvement Program Summary

Description	Estimated Cost (1998 Dollars)
Retrofit 19th St pond to improve sediment control	$ 133,000
Retrofit Day Island Bridge pond to improve sediment control	133,000
Armor 27th St outfalls (3) to reduce scour	9,000
Enhance detention at Morrison Pond to relieve flooding d/s	193,000
35th St pond operational improvements	8,000
Storm drainage system upgrades from 77th Ave W	1,619,000
Expand regional facility operation at 37th St	by Tacoma
Broback Property regional detention facility	231,000
Replace pipe in Sunset Dr at 37th St Ct W	35,000
Replace pipe in 40th St W between Sunset Dr & 80th Ave W	96,000
Modify drainage system in Brookside Way/Soundview Dr	198,000
Install storm drainage in Arbordale from 41st to Robin Dr	90,000
Curtis Pothole excavation	133,000
Detention tank at 79th Ave W at 54th St W	182,000
Infiltration system at 57th Ave W & 62nd St W	116,000
Infiltration system in 64th St W	116,000
Collection system improvements at Mt. View & 21st St W	43,000
Replace drainage system from 37th St W to 70th Ave W	259,000
Stream channel and habitat restoration – Leach Creek	182,000
Stream buffer acquisition – Leach Creek	125,000
Drainage for Traffic Improvement Program	5,600,000
Neighborhood Capital Improvement Program	400,000
TOTAL	**$9,901,000**



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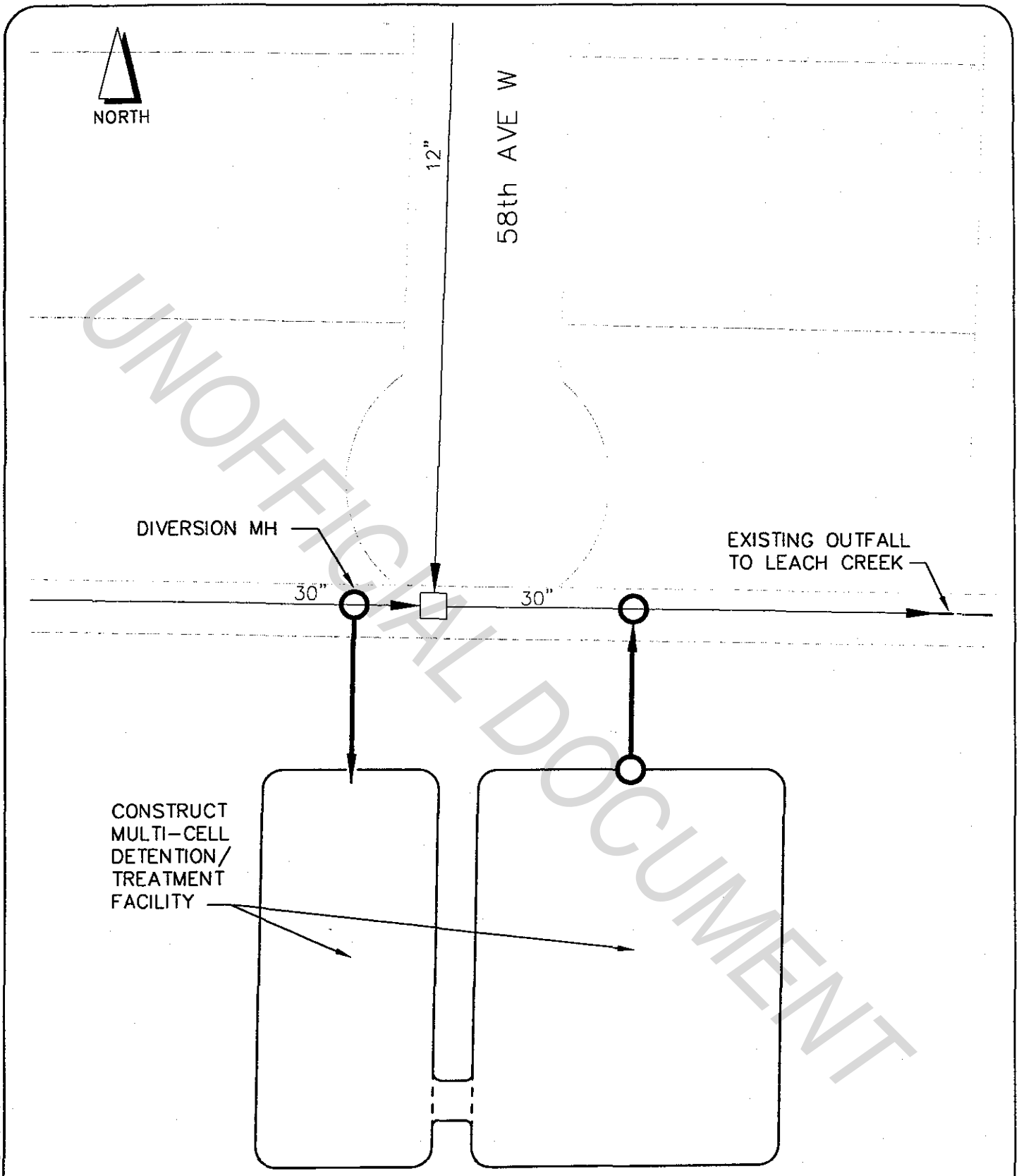

LEACH CREEK BASIN
PROJECT 1
FIGURE 6.2

EARTH TECH

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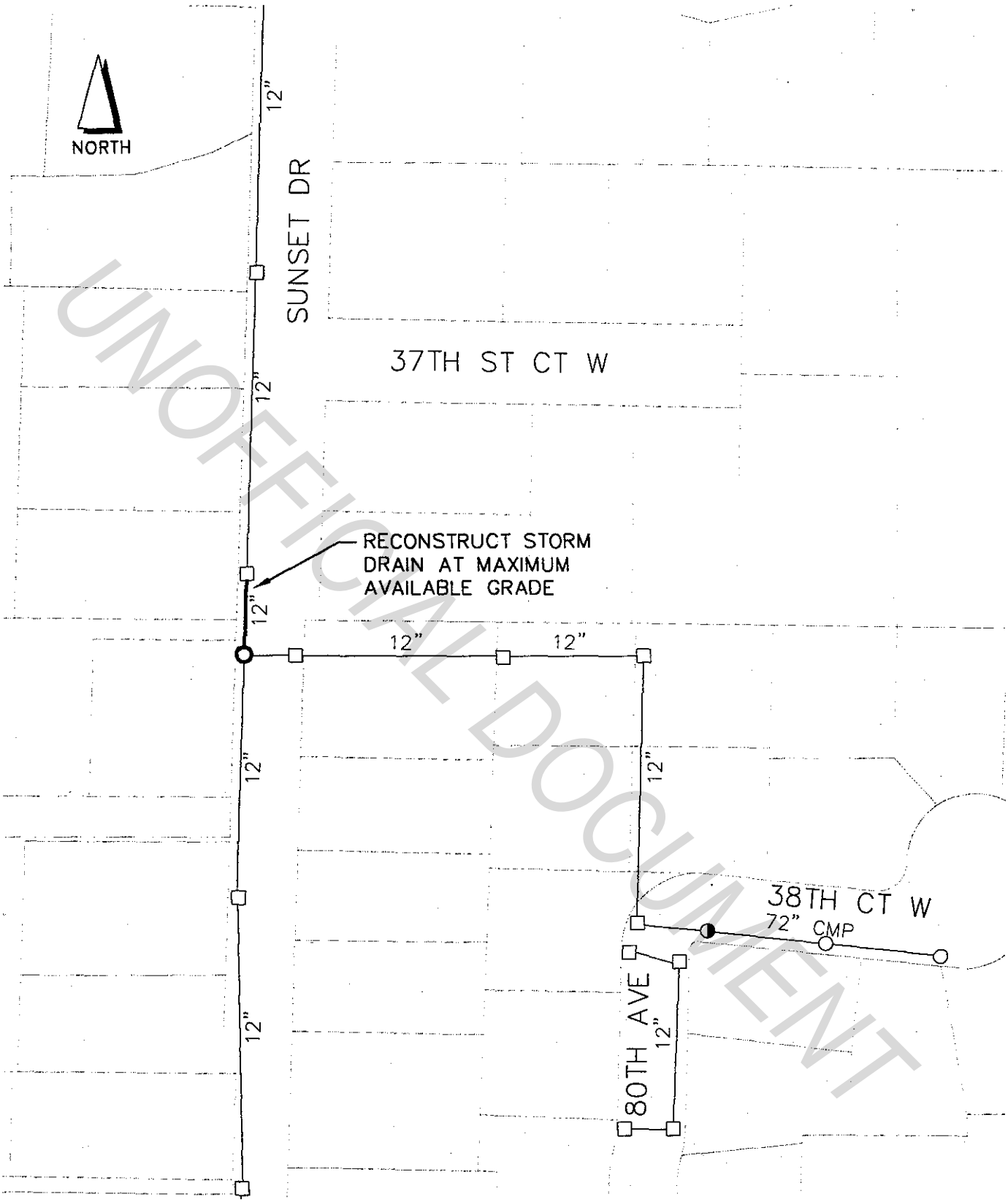

CURTIS POTHOLE
PROJECT 2
FIGURE 6.3

EARTH TECH

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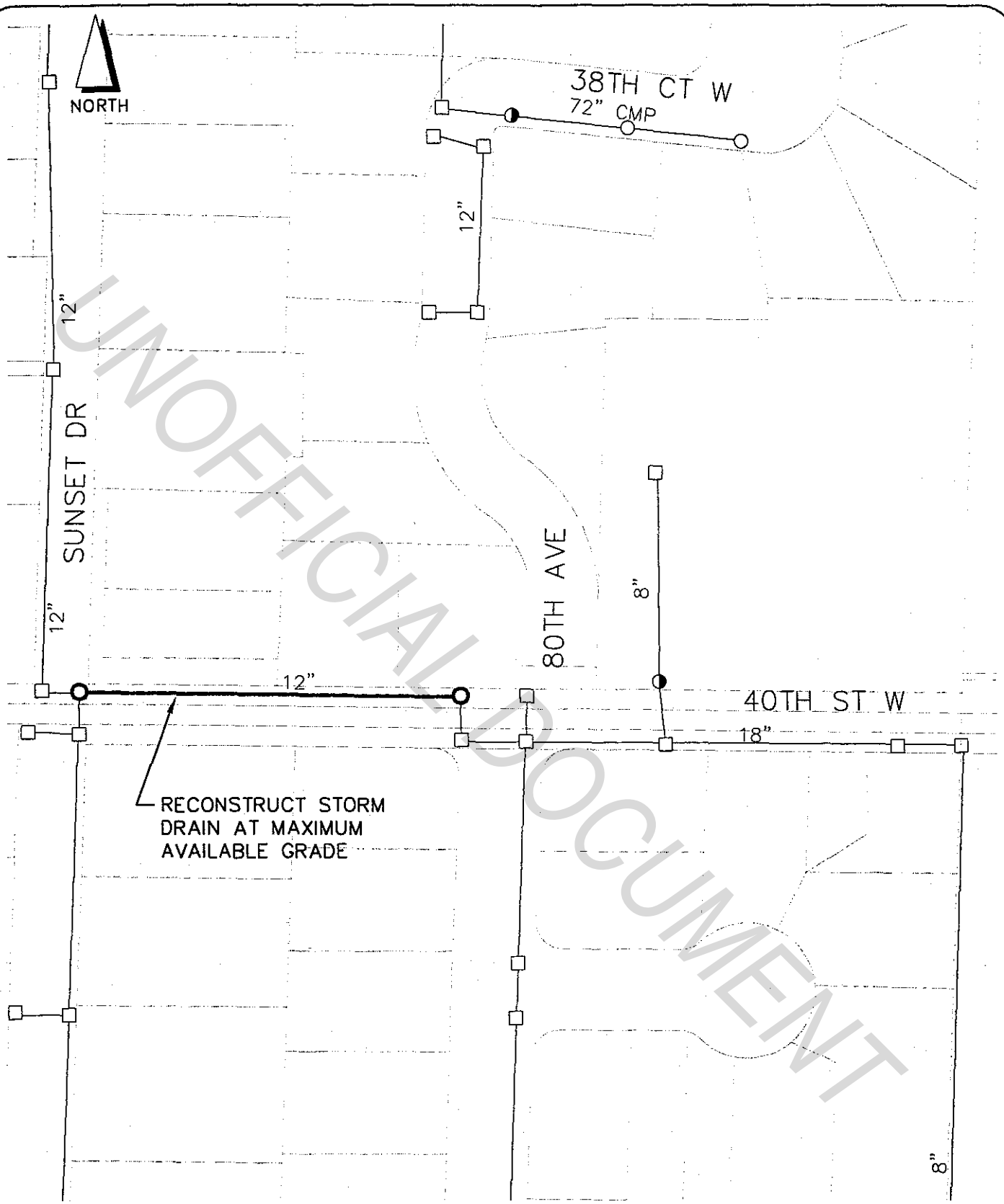

CURTIS POTHOLE
PROJECT 3
FIGURE 6.4

EARTH TECH

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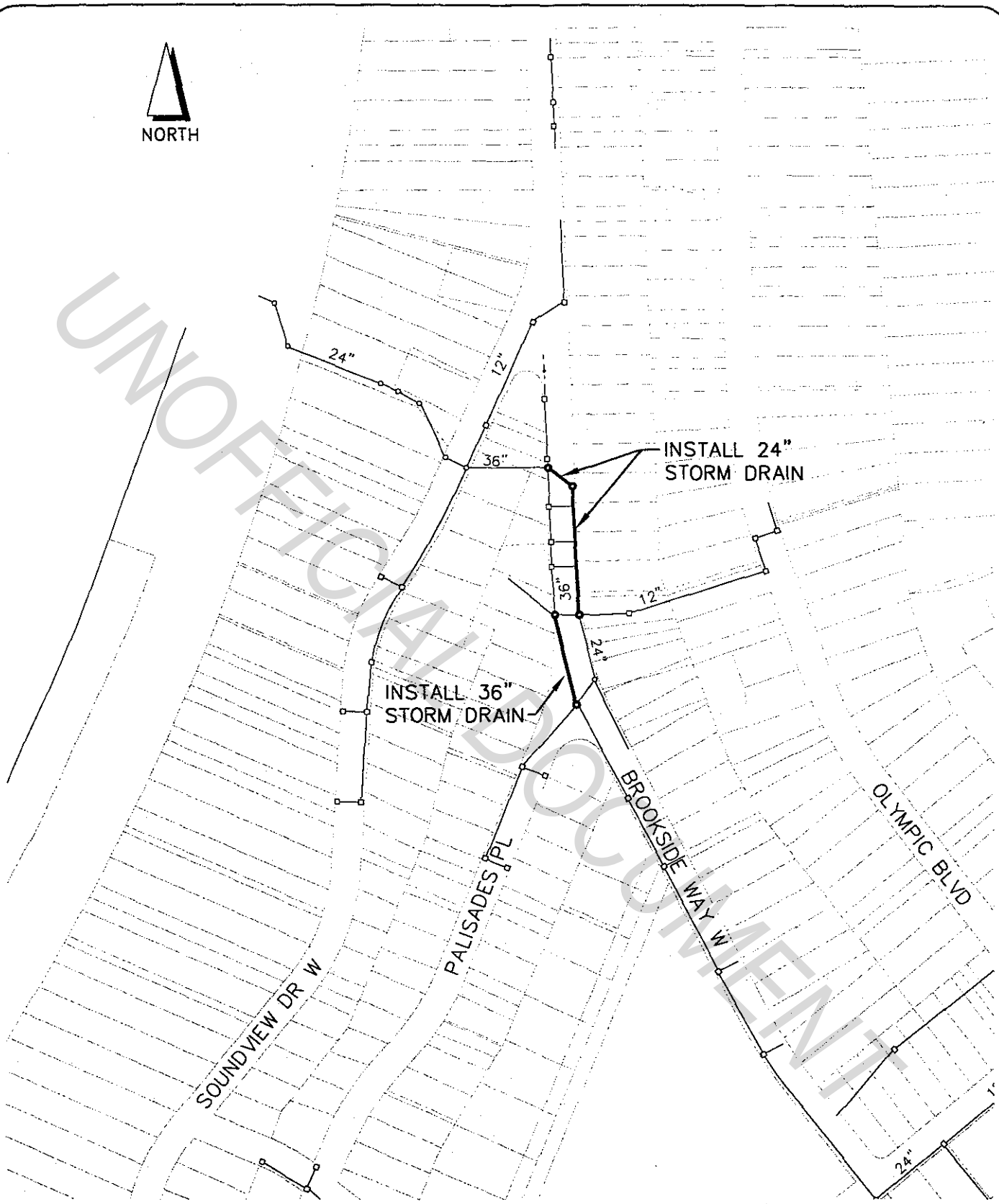

SOUNDVIEW BASIN
PROJECT 4
FIGURE 6.5

EARTH TECH

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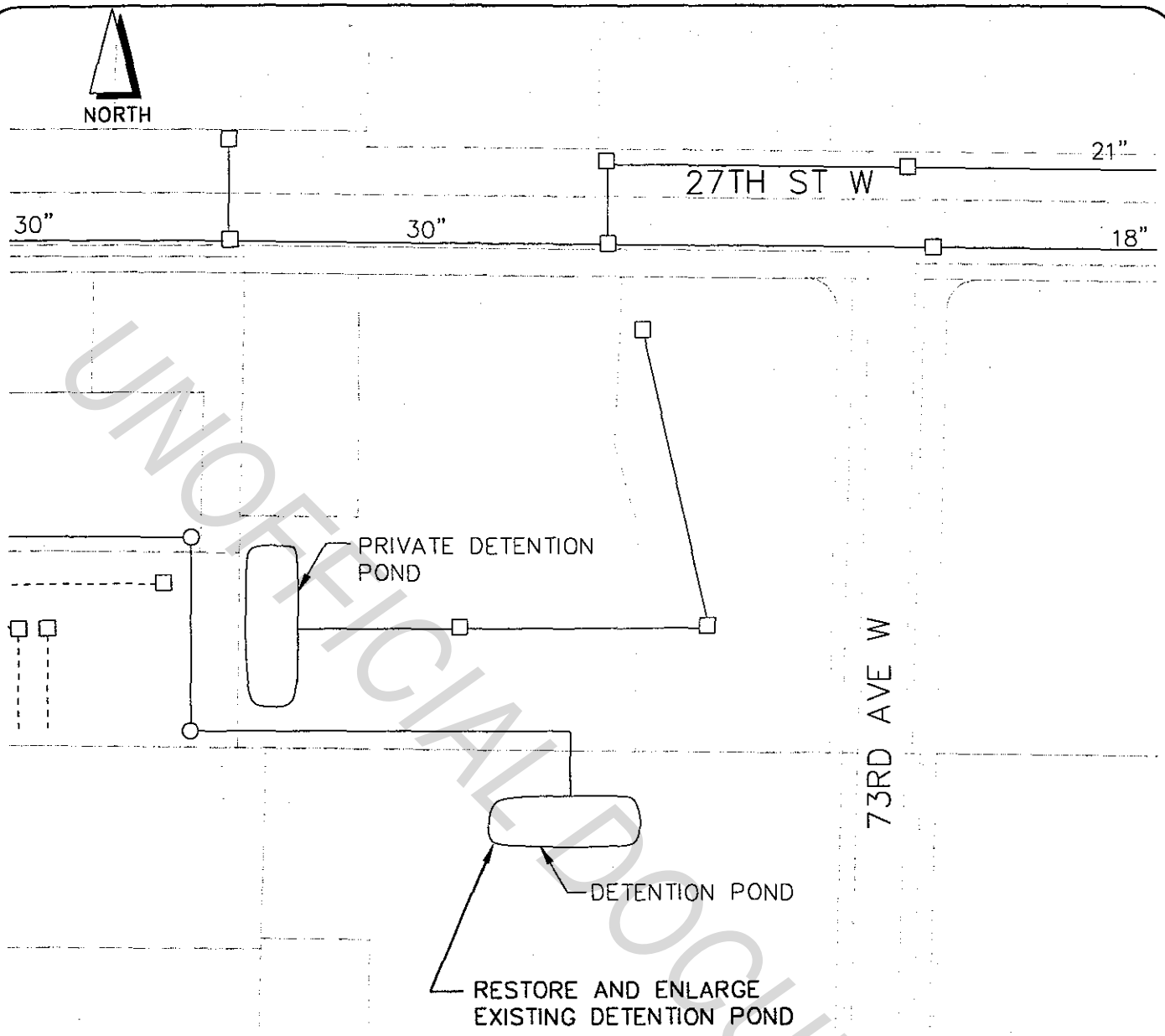

NORTH DAY ISLAND BASIN
PROJECT 5
FIGURE 6.6

EARTH TECH

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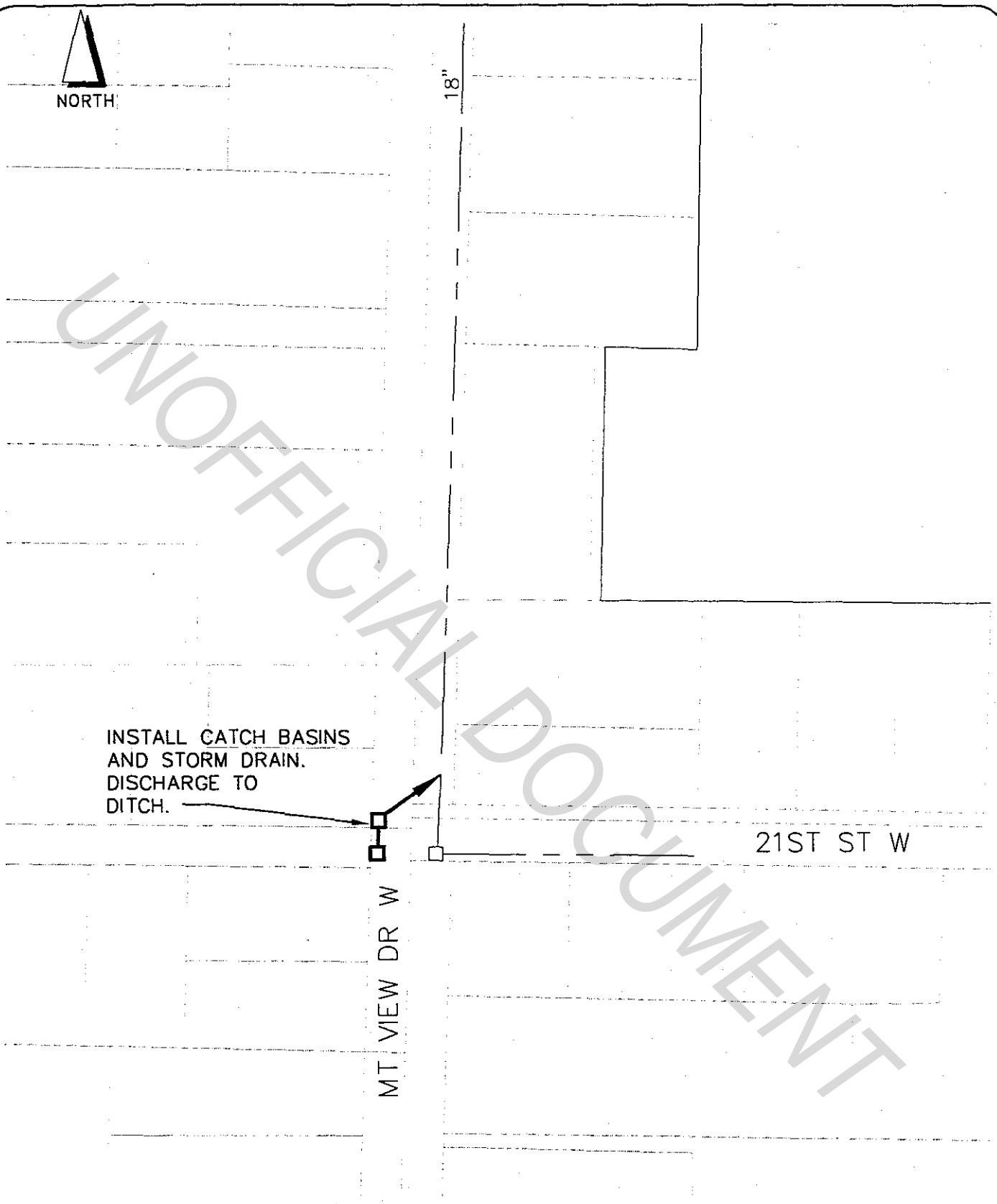

NORTH DAY ISLAND BASIN
PROJECT 6
FIGURE 6.7

EARTH TECH

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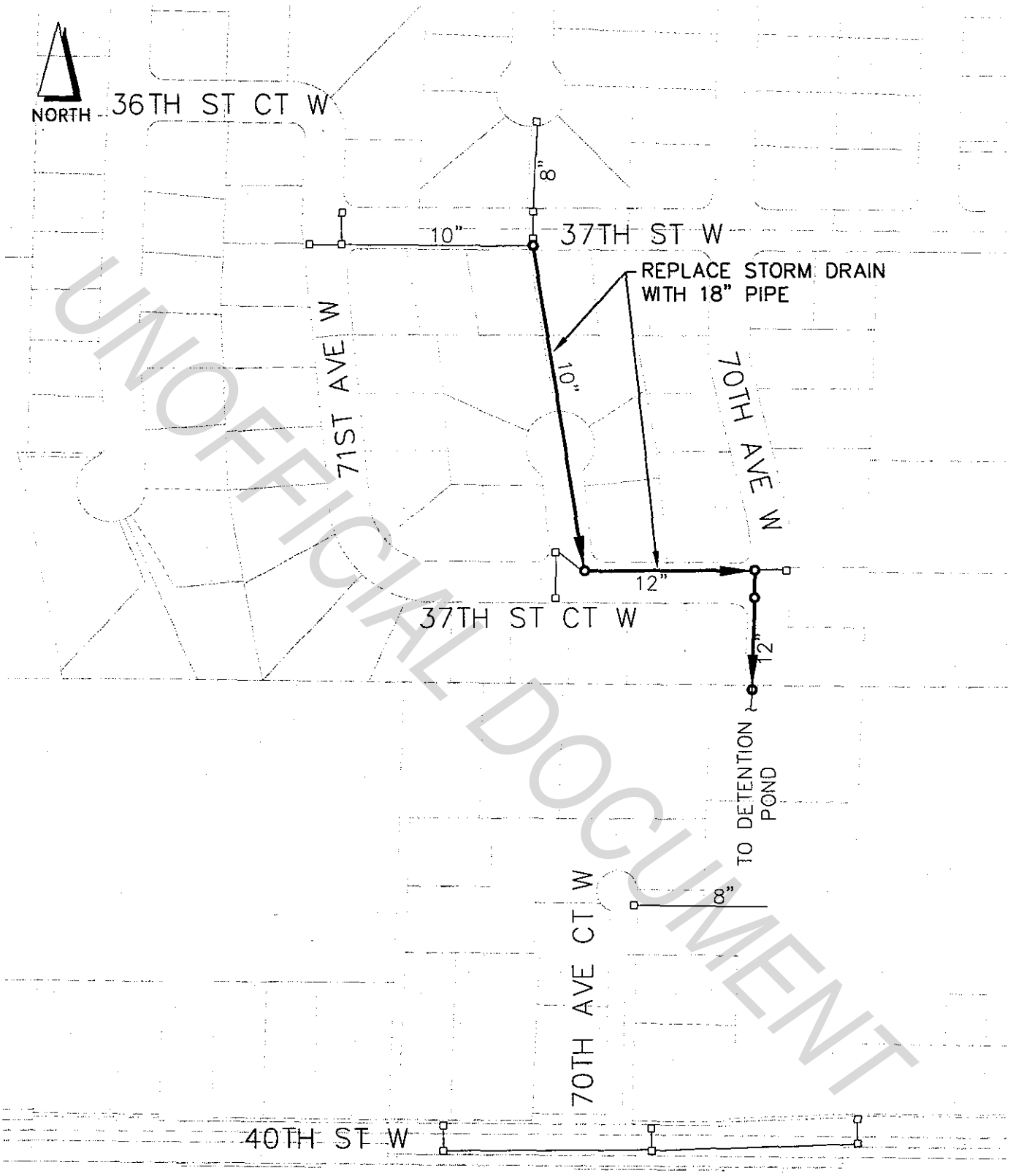

LEACH CREEK BASIN
PROJECT 7
FIGURE 6.8

EARTH TECH

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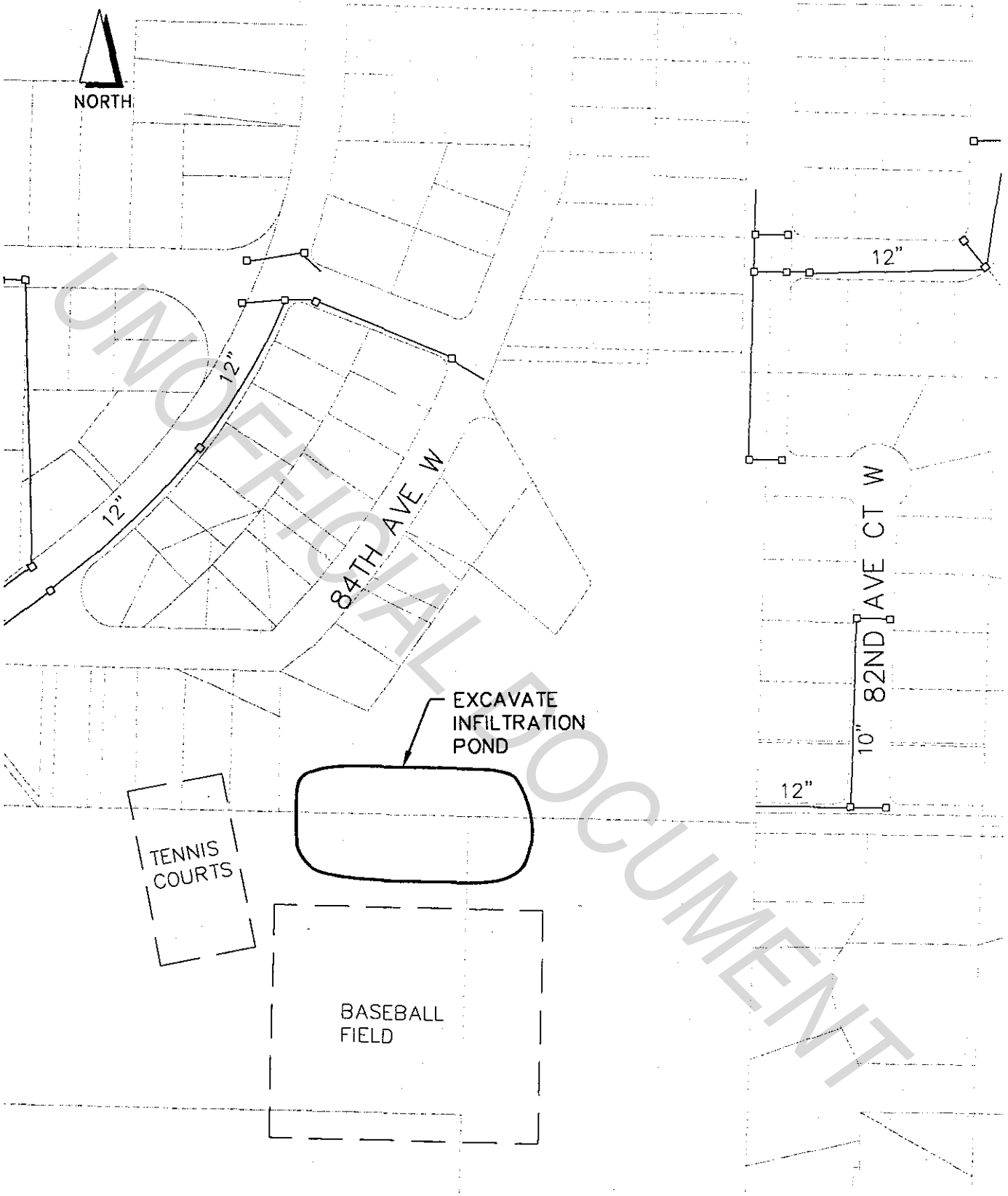

CURTIS POTHOLE
PROJECT 8
FIGURE 6.9

EARTH TECH

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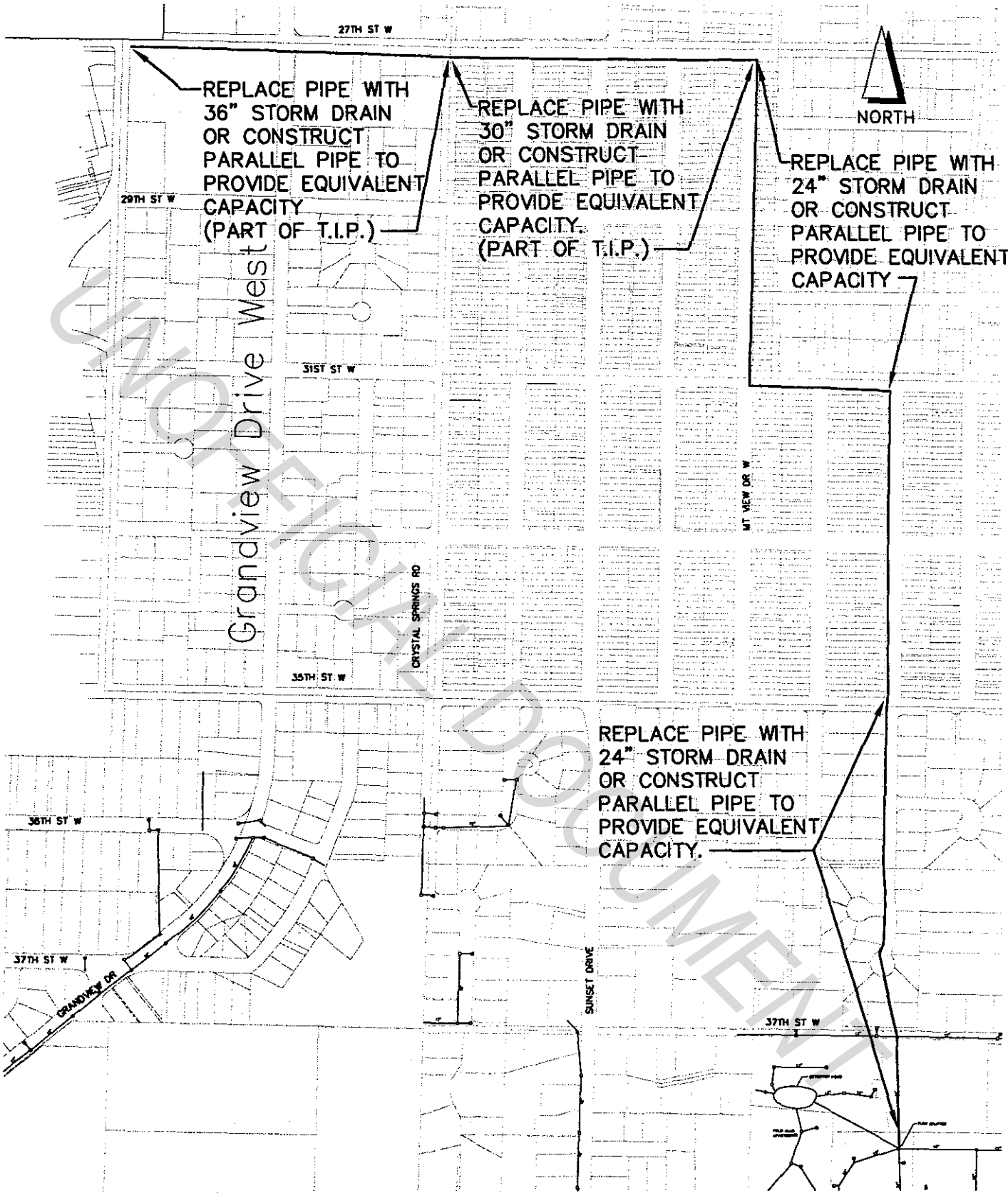
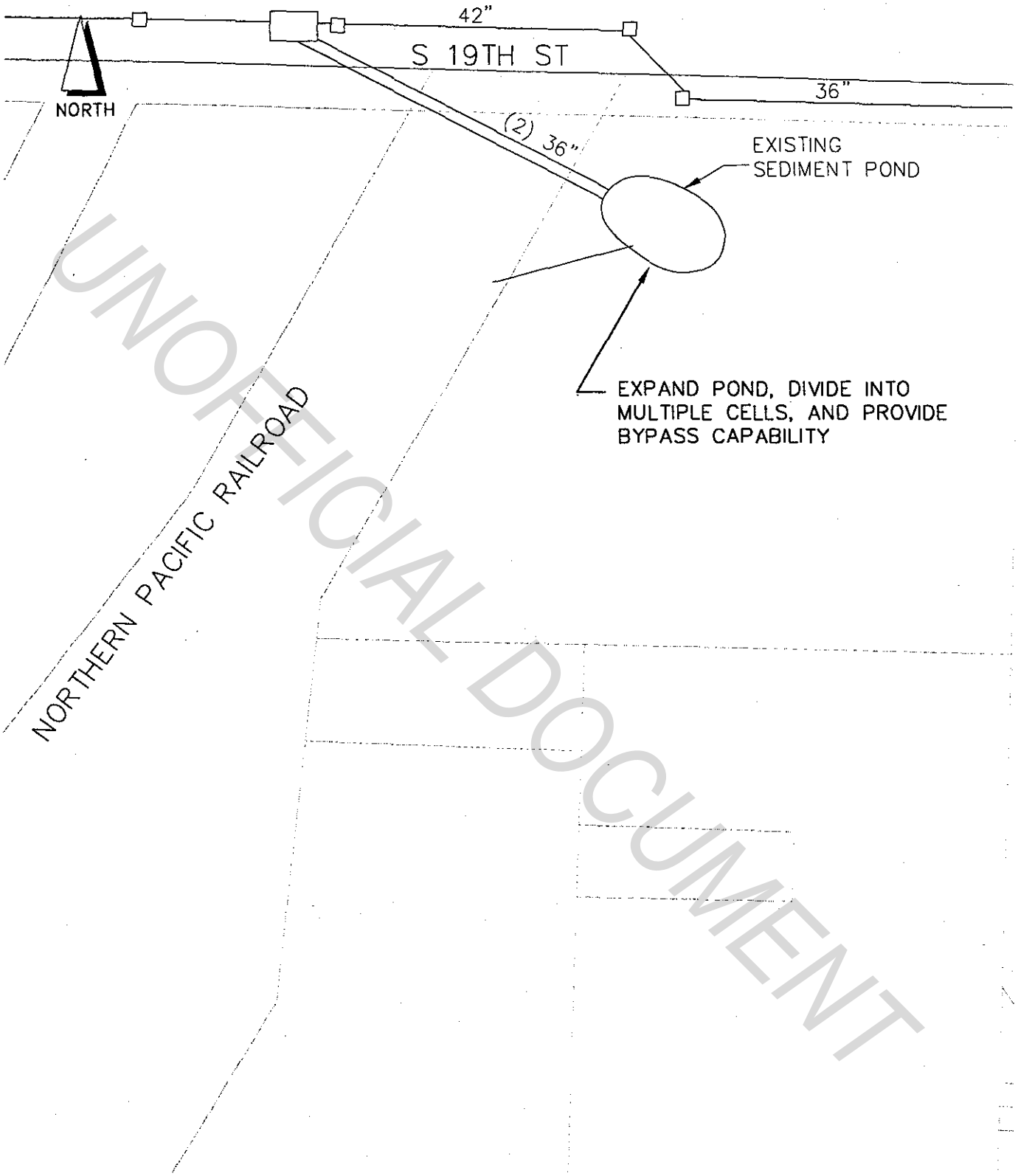


DAY ISLAND WATERWAY BASIN
PROJECT 9
FIGURE FIG 6.10

EARTH TECH

A tyco INTERNATIONAL LTD. COMPANY



CRYSTAL SPRINGS BASIN
PROJECT 10
FIGURE 6.11

EARTH TECH

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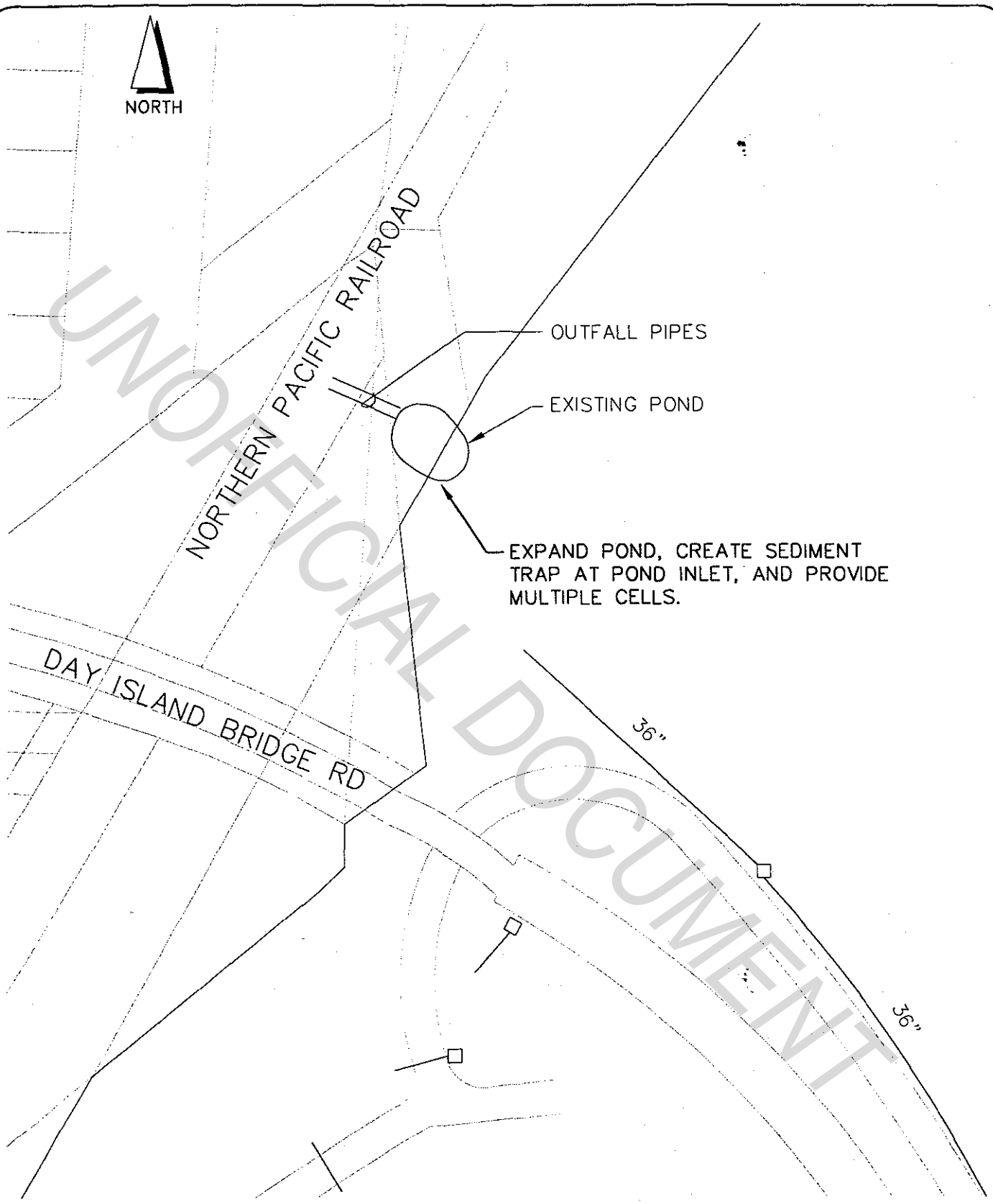

DAY ISLAND WATERWAY BASIN
PROJECT 11
FIGURE 6.12

EARTH TECH

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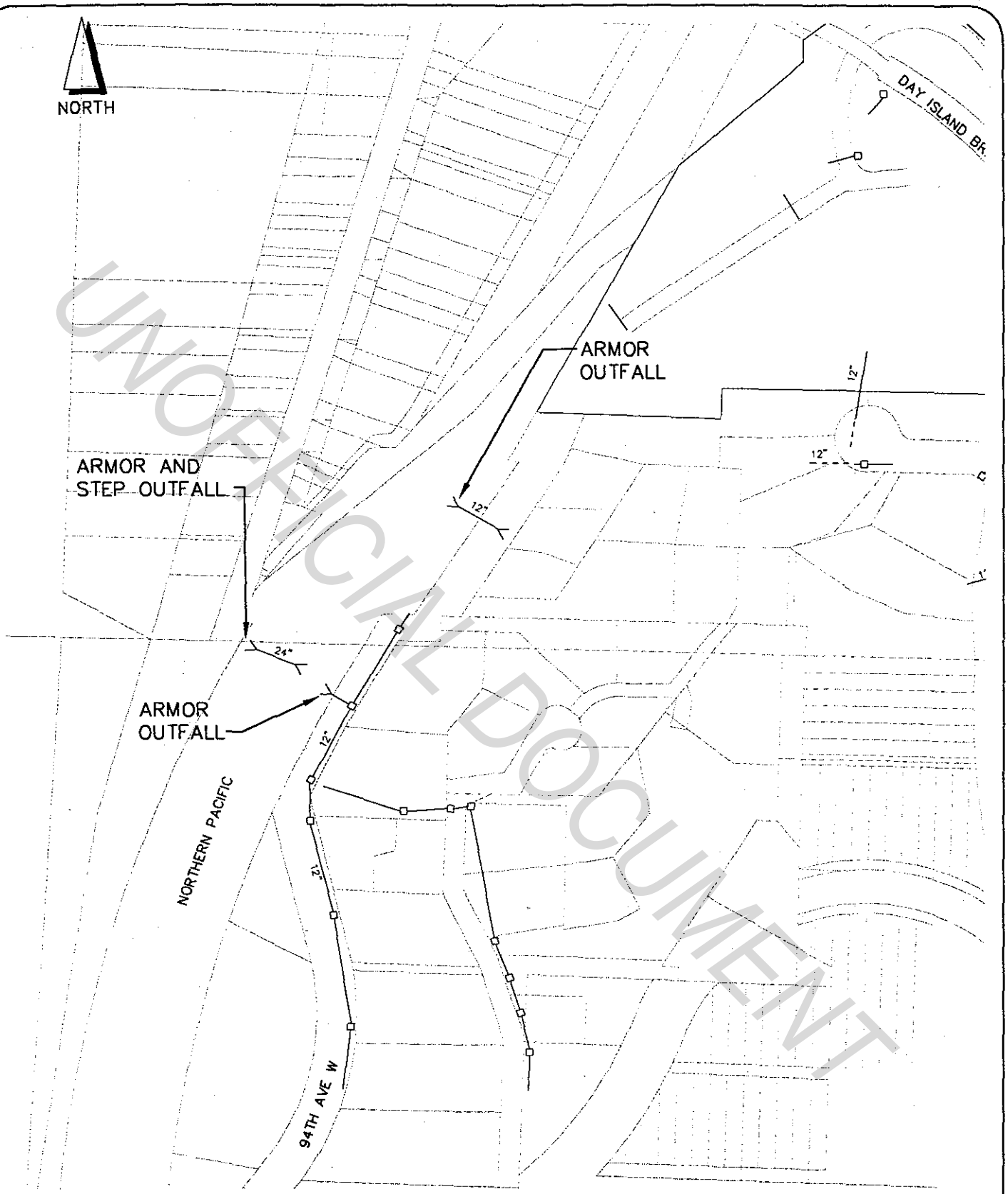

DAY ISLAND LAGOON BASIN
PROJECT 12
FIGURE 6.13

EARTH TECH

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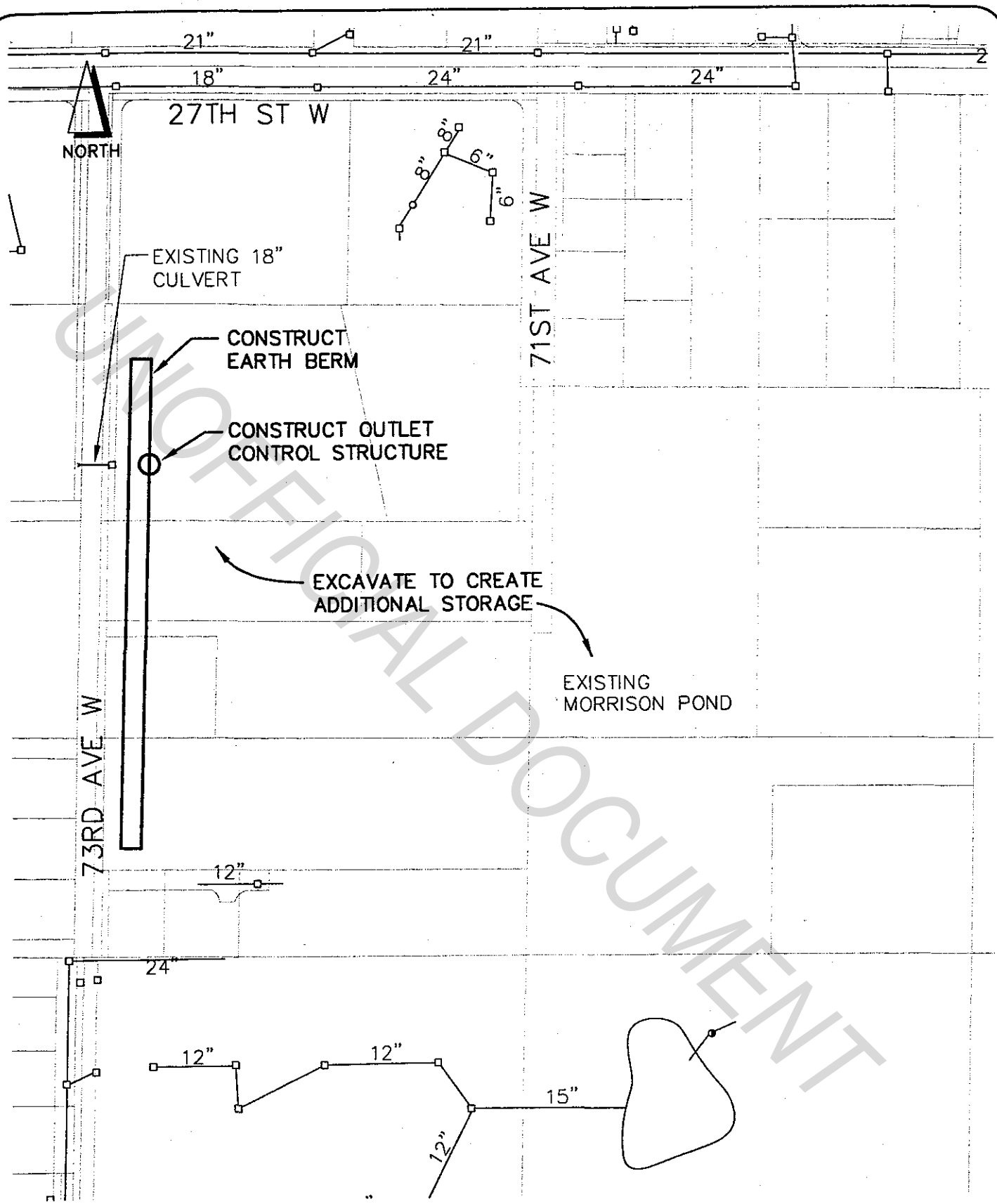

NORTH DAY ISLAND BASIN
PROJECT 13
FIGURE 6.14

EARTH TECH

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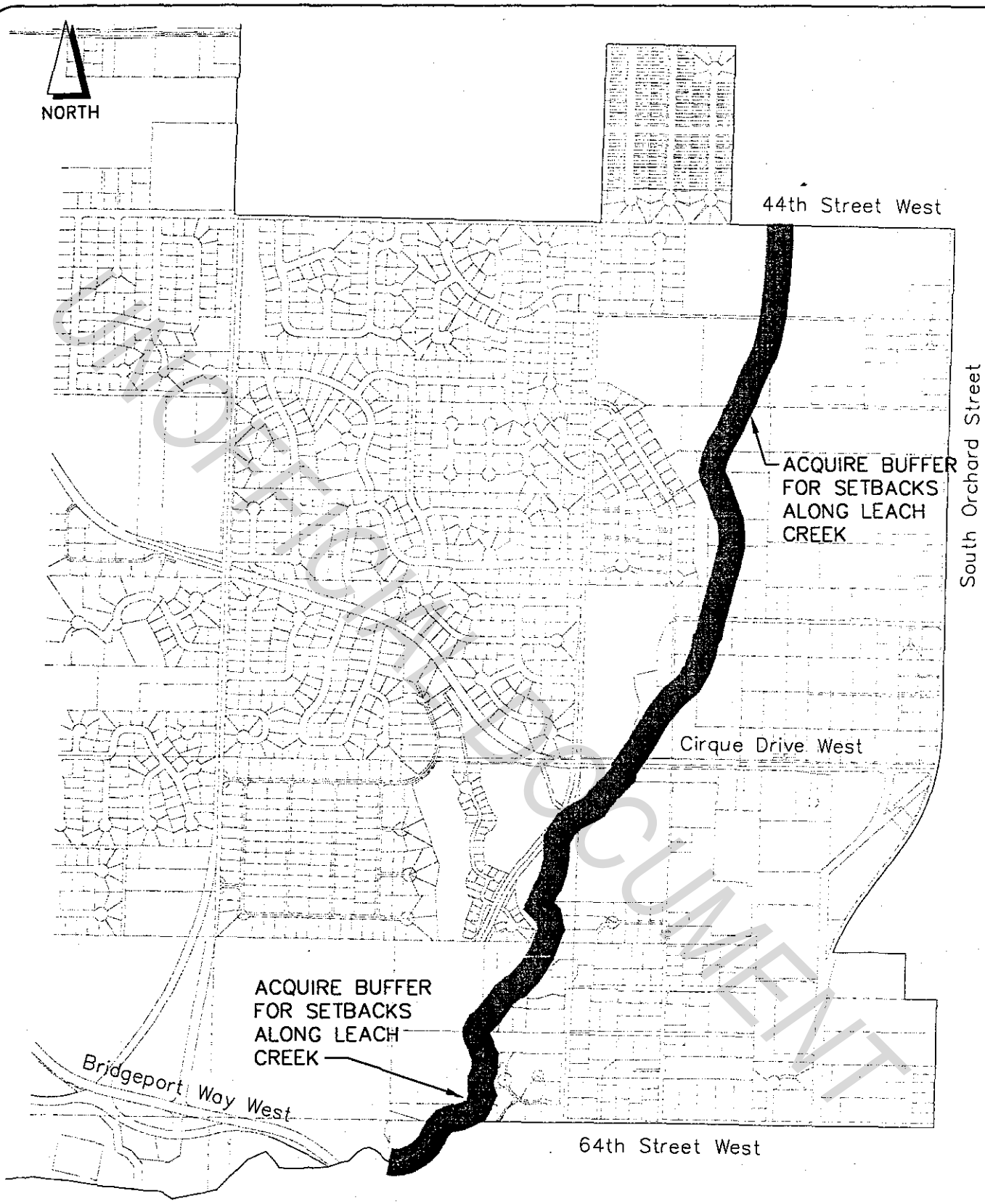
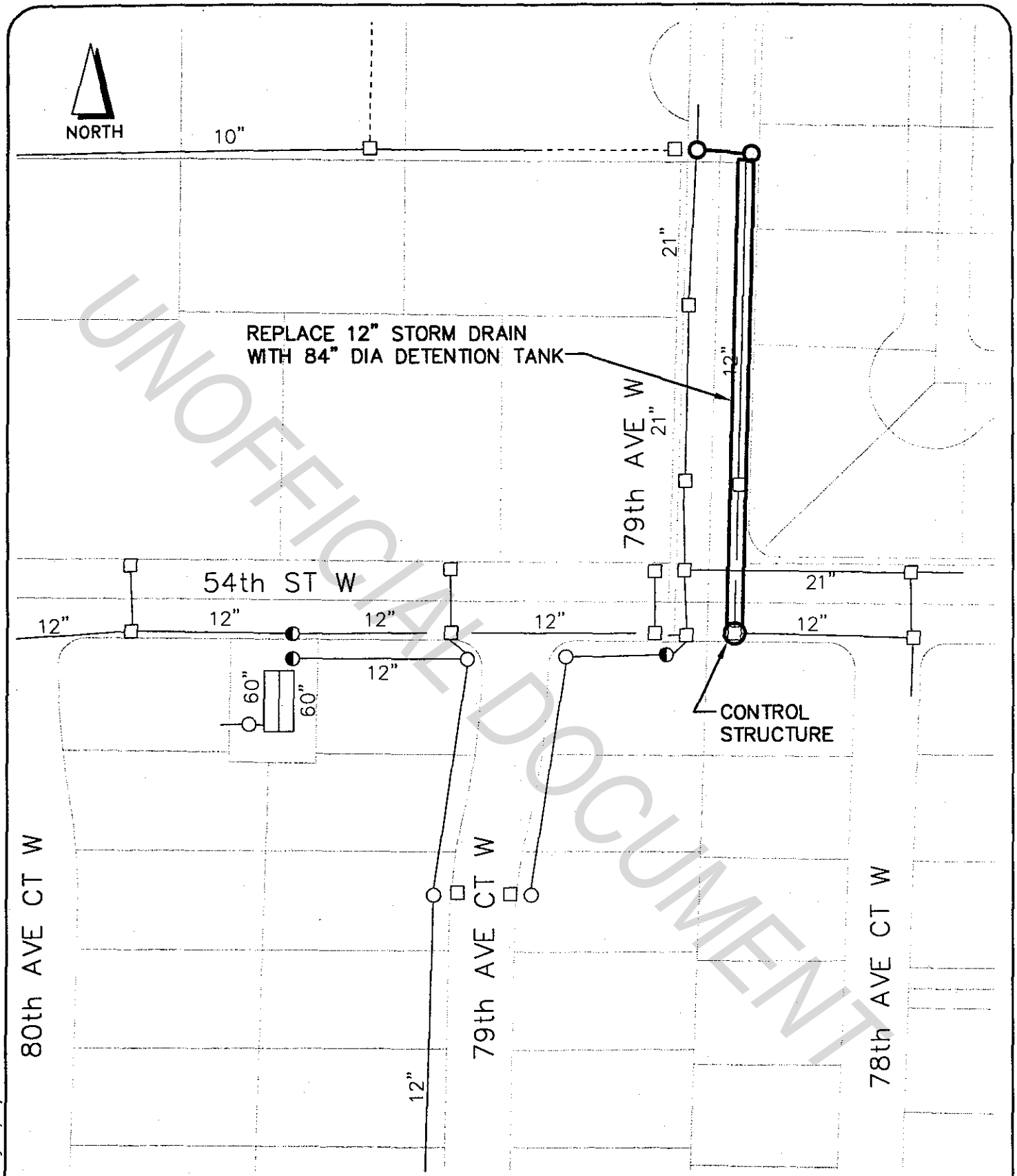


LEACH CREEK BASIN
PROJECT 14
FIGURE 6.15

EARTH TECH

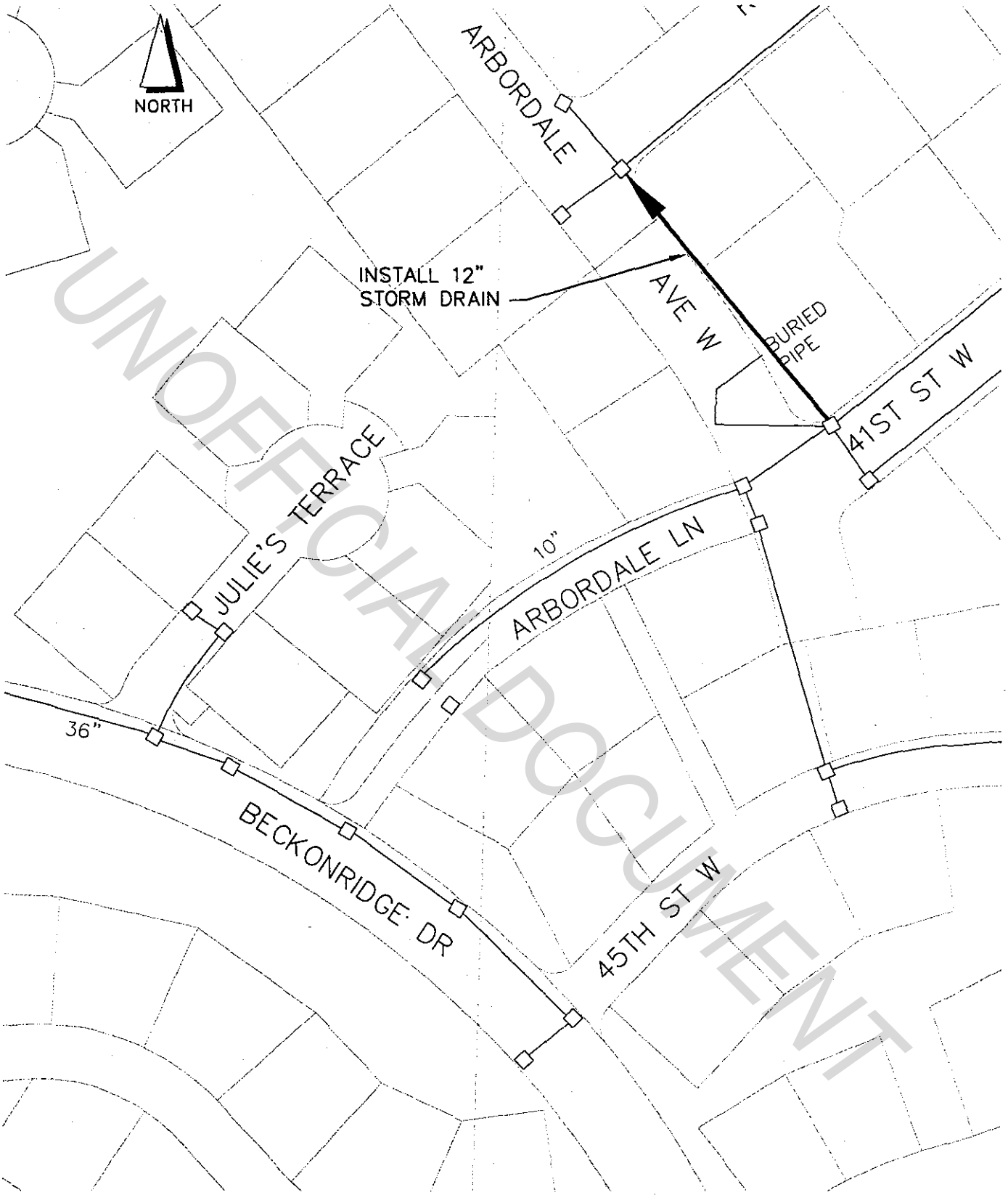
A tyco INTERNATIONAL LTD. COMPANY



CHAMBERS CREEK BASIN
PROJECT 15
FIGURE 6.16

EARTH TECH

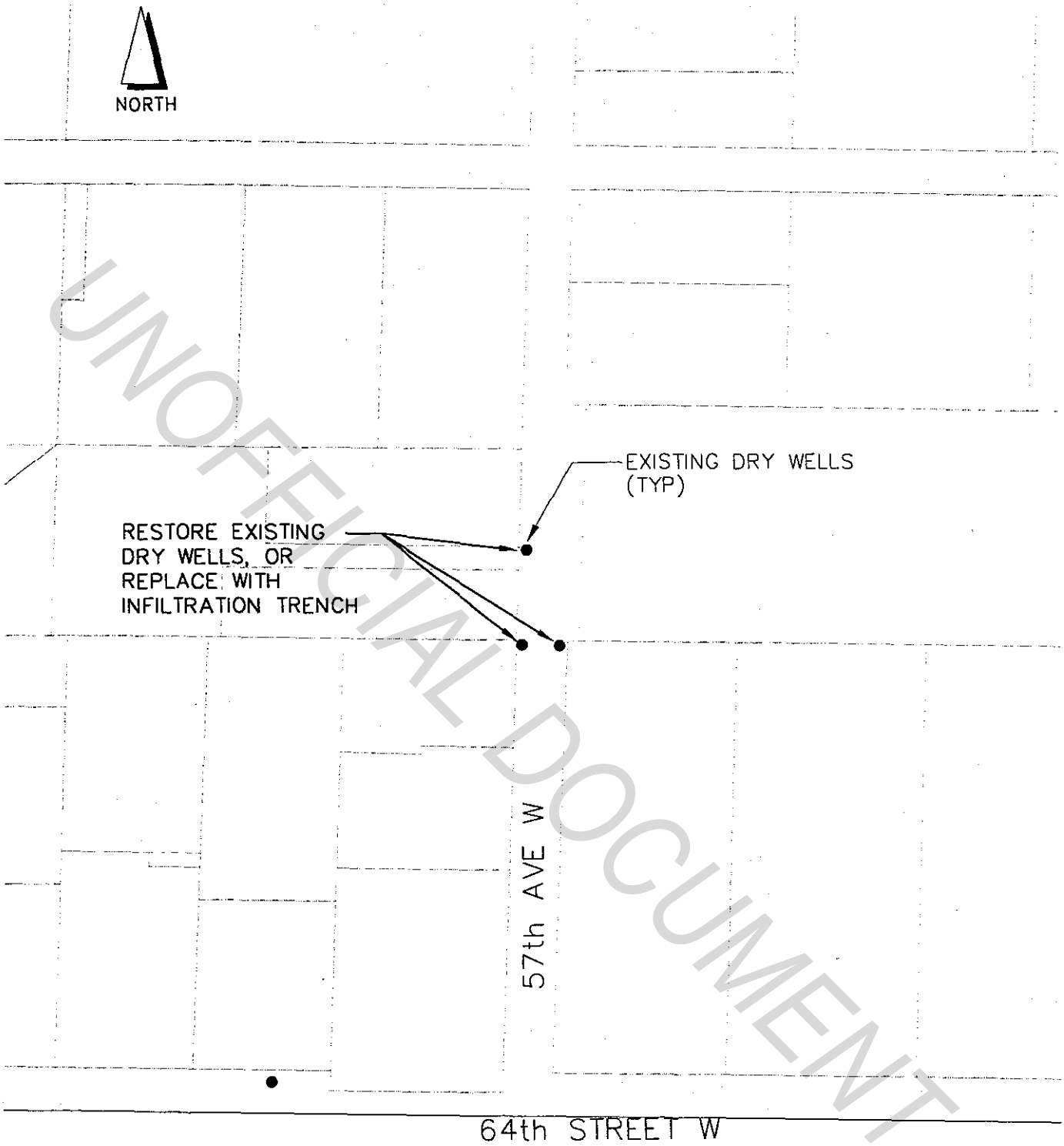
A tyco INTERNATIONAL LTD. COMPANY



SOUNDVIEW BASIN
PROJECT 17
FIGURE 6.17

EARTH TECH

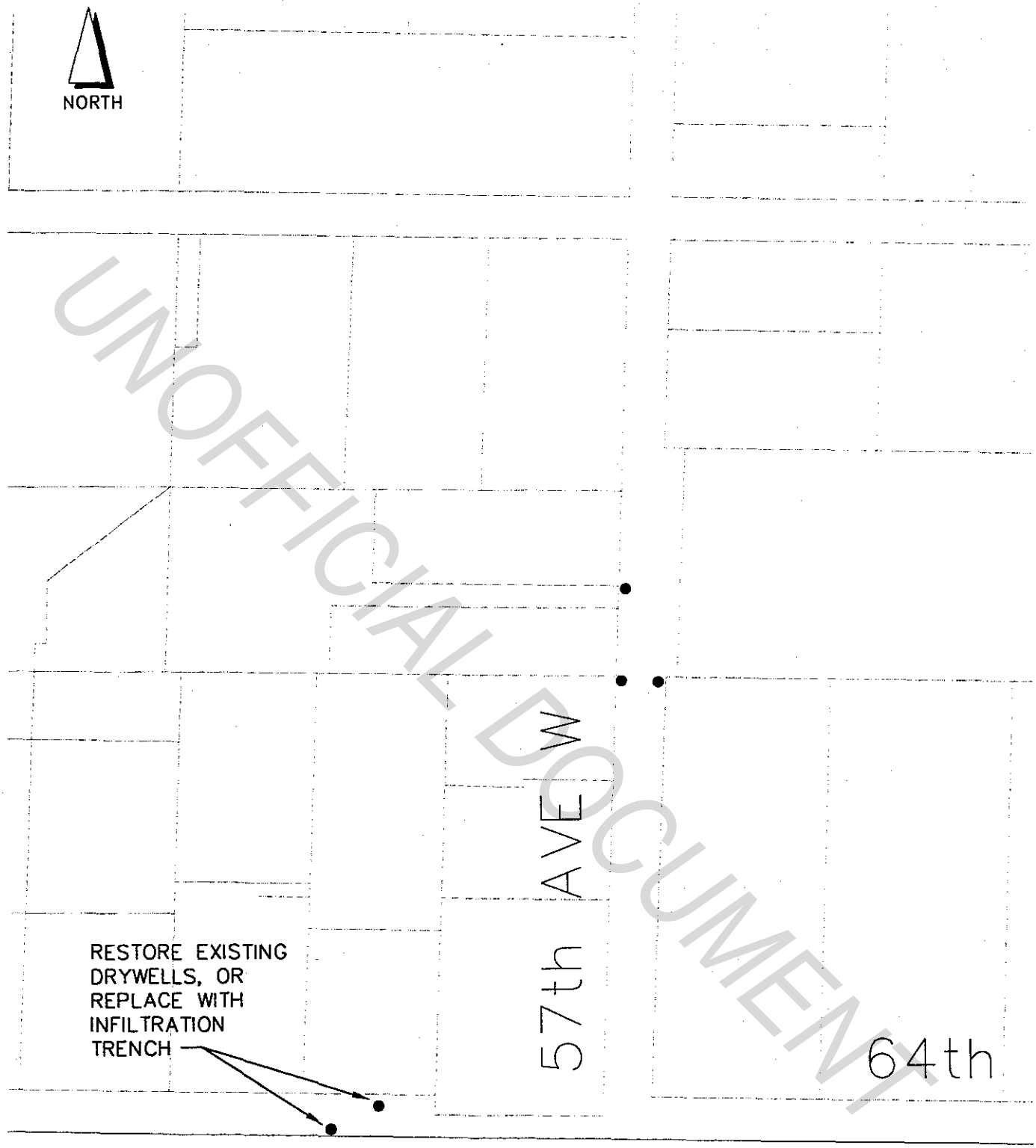
A tyco INTERNATIONAL LTD. COMPANY



LEACH CREEK BASIN
PROJECT 18
FIGURE 6.18

EARTH TECH

A tyco INTERNATIONAL LTD. COMPANY



LEACH CREEK BASIN
PROJECT 19
FIG 6.19

EARTH TECH

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Chapter 7: Maintenance and Operations

7.01 GENERAL

The objective of a surface water maintenance and operation program is to assure the reliability and dependability of the stormwater infrastructure including, but not limited to, catch basins, pipe and culvert network, detention basins, open ditches, treatment facilities, and outfalls. Such a program is designed to extend facility life, minimize life-cycle costs, protect the lives and property of the residents living in the affected watersheds, and enhance water quality.

In response to limited stormwater operating budgets, municipalities have often deferred maintenance until a facility fails or a problem occurs. Over the long term, this approach will cost far more than ongoing maintenance. The costs of inadequate maintenance are realized through the premature need for facility rehabilitation and reconstruction, flooding and property damage caused by reduced system capacity, and environmental damage caused by failed systems and sediment- laden discharges to receiving waters. Maintenance management principles should be applied to the stormwater infrastructure, specifically analyzing maintenance frequencies and the levels of maintenance required to ensure reliability and achieve the lowest life-cycle cost.

This chapter presents a discussion and analysis of the maintenance management program; recommended elements of a surface water maintenance program for the City of University Place (including an inventory of facilities, crew and equipment configurations, and performance standards); staffing and equipment budget estimates; and a brief discussion regarding the use of maintenance management software.

The surface water program described in this chapter uses generally accepted maintenance practices and planning standards. All data are based on best available estimates.

7.02 FINDINGS AND RECOMMENDATIONS

Soon after incorporation, the City of University Place assumed responsibility for maintenance of the local surface water infrastructure. The City has utilized both City forces and contractors for system maintenance, relying on contractors for work involving specialized equipment, such as a Ditchmaster. The City has acquired the equipment necessary to perform the bulk of the maintenance itself, including a street sweeper, dump trucks, an excavator, and recently, a Vactor truck.

Structural street and storm drainage maintenance activities, such as repairs and rehabilitation of catch basins and manholes, is performed by City crews. City forces available to perform both stormwater and street maintenance consist of 7 crew members. Stormwater maintenance activities performed by both the City and contractors are directed by the maintenance supervisor. This supervisor is also responsible for street maintenance and the equipment pool, and between 20 to 30 percent of his time is directed at stormwater activities. During the summer months, the City's work force is supplemented by several temporary interns.

City-owned equipment available for storm drainage maintenance includes: two 5-yard dump trucks, a backhoe with trailer, two 1½ -ton flatbed dump trucks, and a Vactor 2100 sewer cleaning truck.

The current (1998) annual budget for storm drainage operations and maintenance is $141,613. Catch basin cleaning locations are assigned periodically, and known problem areas in the drainage system are scheduled for more frequent proactive cleaning; the remainder of the system is cleaned as the available budget allows, or in response to a reported problem.

Mowing of vegetation in ditches and along roadsides is performed beginning in the spring. The roadway mowing is performed 3 to 4 times per year along arterials and as needed in residential areas.

The City inspects and maintains detention facilities serving residential developments where the City is provided an easement. There are 32 detention facilities in the service area for which the City is directly responsible.

There are also a number of detention facilities serving commercial properties which are the property owners' responsibility to maintain. Where inspections reveal the need for facility maintenance, the City notifies the property owner, who then is responsible for correcting the noted deficiencies. The City has limited staff resources to perform regular inspections or to enforce compliance.

An alternative to owner maintenance of on-site facilities is to have the City assume the maintenance responsibility. The facility inspection function could be consolidated with other maintenance activities. Other considerations in deciding whether to assume on-site facility maintenance include: sufficient equipment access to the facilities, ingress and egress rights, and liability exposure. Prior to assuming responsibility, the City would need to perform a detailed evaluation of each facility to confirm that it is in good working order so that the City does not assume responsibility for defective facilities.

Several recommendations are provided for enhancing the City of University Place's current surface water maintenance program. First, with the recent acquisition of the Vactor truck, the scope and frequency of catch basin cleaning should be expanded. Increasing the maintenance frequency is an effective way to improve water quality, preserve conveyance capacity, and reduce localized flooding. By cleaning catch basins more frequently, sediments and accompanying contaminants will be removed from the surface water systems. This reduces both the level of solids and associated contaminants discharged to water bodies and the potential for pipe and culvert blockage. Based on the City's current inventory of catch basins, manholes, pipes, and detention facility control structures, the Vactor truck can be fully utilized.

Maintenance activities for ditches and swales should continue to focus on vegetation control (i.e., with the contracted Ditchmaster) and trash removal and away from sediment removal, especially removal that involves a backhoe. Backhoe operation typically removes all vegetation from the

invert of the channel, exposing bare soils to erosion. Operation of a backhoe in a swale should be limited to removing pockets of sedimentation, such as those that form near culvert openings.

A condition rating scheme should be prepared and implemented to facilitate developing a maintenance history for each component of the City's surface water system. Recording condition information during inspections and maintenance or repair activities will enable a condition history to be created for each component of the system. A condition history is critical to developing an efficient and effective maintenance program since it will provide the information needed to determine the optimal frequency for maintaining system components in various locations within the City.

When conducting inspections, indicators should be utilized to determine when maintenance is necessary. The following conditions are typical indicators of the need for maintenance.

- *Pipes.* Accumulated sediment exceeds 20% of the pipe diameter.
- *Catch basins.* Accumulated sediment exceeds 35% of basin capacity, or is within inches of the outlet pipe invert.
- *Detention basins.* Accumulated sediment exceeds 10% of the design for bay/basin depth and unmowed grass/groundcover exceeds 12 inches.
- *Detention tanks.* Accumulated sediment exceeds 10% of pipe diameter for one-half the length of the pipe, or exceeds 15% of pipe diameter at any point.
- *Biofiltration swale.* Accumulated sediment inhibits healthy grass cover.
- *Oil/water separators.* At least in the fall prior to the wet season and after the first significant storm (more than 0.5 inches in 24 hours).

The expanded field operations will require administrative support to maintain system records, prepare work orders, and assist the supervisor in coordinating maintenance activities and administering contracts.

The City should endeavor to obtain easements for existing storm drains serving multiple properties that lie outside of City rights-of-way. This will provide the City with clear rights to access, inspect, maintain and thereby ensure the reliable operation of these facilities. Priority should be placed on the larger and most critical storm drains.

Based upon an approximate inventory of the City's stormwater infrastructure, current contract rates, and accepted maintenance practices, the proposed maintenance program will eventually require an estimated annual budget (based on 1998 dollars) of $222,000, including $75,000 for contractors to provide storm drain jetting and video inspection services. The balance of $147,000 is allocated to equipment and labor (3.3 FTEs) to perform the remaining maintenance activities, and to perform necessary inspections. Supervision and administrative and related mapping

technical support of the maintenance program will require additional staffing not included in the above costs. The current structure of joint supervision of street and stormwater maintenance should be continued, with the cost of the supervisory staff and associated administrative support shared between the stormwater and street funds. Mapping and utility location technical support for the stormwater utility is estimated at 0.25 FTE. Table 7-1 summarizes the distribution of maintenance costs for the storm and surface water system. A detailed breakdown of the proposed program maintenance costs is provided in Table 7-2.

Table 7-1: Annual Stormwater Maintenance and Operation Costs*

Description	Estimated Annual Cost (1998 Dollars)
OPERATION & MAINTENANCE	
Contract Maintenance Expenditures	$ 75,000
Direct Maintenance Expenditures	152,000
Subtotal, Maintenance	**$227,000**
Administration, Supervision	10,000
System Mapping, Database Management, Location Services	12,000
TOTAL	**$249,000**

**including Fircrest Acres*

The scope and frequency of maintenance activities reflected in Table 7-3 are objectives which should be attained within 2 years. In the interim, the City should continue its efforts to restore neglected facilities which have deteriorated over the past many years. During this transition period, it is expected that productivity will be reduced because of the volume of deposited material that must be removed from ponds and catch basins to restore capacities. Maintenance productivity and frequencies should steadily increase through the 2-year transition period as crews work through the backlog of deteriorated facilities. As a track record of productivity is documented, this information will become useful in maintenance budgeting in succeeding years.

It is recommended that all costs incurred for maintaining and operating the storm and surface water infrastructure be supported through the City's stormwater utility. Costs for street sweeping, although this activity provides water quality benefits, should continue to be funded through the street fund.

7.03 MAINTENANCE MANAGEMENT PROGRAMMING

This section describes the general components of a surface water maintenance management program along with guidance specific to conditions in the City of University Place. Table 7-2 presents specific levels of effort proposed to maintain and operate the stormwater infrastructure.

Table 7-2
Annual Stormwater Maintenance Costs

Facility	Activity	Total Quantity	Unit	Annual Program Costs	
				In House	Contracted
Catch Basins	Clean and inspect	2,470	each	52,200	
Manholes	Clean and inspect	160	each	4,800	
Storm Drains <= 24" diam.	Clean	307,055	l.f.		49,800
Storm Drains <= 24" diam.	Video inspection	307,055	l.f.		15,400
Storm Drains > 24" diam.	Clean	23,140	l.f.		7,300
Storm Drains > 24" diam.	Video inspection	23,140	l.f.		1,700
Force Main	Video inspection	3,400	l.f.		600
Pump Station	Inspect, clean and service	1	each	1,400	
Outfalls	Clean and inspect	53	each	5,000	
Roadway Culverts	Clean and inspect	70	each	5,300	
Driveway Culverts	Clean and inspect	-	each	-	
Water Quality Ponds	Clean & inspect control structure	1	each	300	
Water Quality Ponds	Remove sediment	1	each	100	
Water Quality Ponds	Vegetation control	1	each	600	
Retention/Detention Ponds	Clean & inspect control structure	31	each	9,800	
Retention/Detention Ponds	Remove sediment	31	each	4,500	
Retention/Detention Ponds	Vegetation control	31	each	19,600	
Retention/Detention Vaults	Clean & inspect control structure	11	each	3,500	
Retention/Detention Vaults	Remove sediment	11	each	1,900	
Dry Wells	Clean and inspect	75	each	3,200	
Biofiltration Swales	Vegetation control	6,200	l.f.	2,100	
Biofiltration Swales	Remove sediment	6,200	l.f.	1,700	
Ditches	Vegetation control	59,000	l.f.	19,800	
Ditches	Remove sediment	59,000	l.f.	10,100	
Vactor Waste Decanting	Solids & liquids - handling	1	l.s.	5,100	
On-site Facilities	Inspect	29	each	900	
Vactor Waste Disposal	Landfill & wastewater fees	1	l.s.		5,000
			Total Cost	**$ 151,900**	**$ 74,800**
			Combined Annual Costs	**$ 226,700**	

A maintenance management program is a set of policies, procedures, and management tools for planning, organizing, directing, and controlling maintenance activities. Maintenance management is not a "speed up the work," highly controlled, punitive approach to work, but rather it is a system of "working smarter."

A typical maintenance management program consists of six basic modules. These include: 1) inventory of facilities; 2) needs assessment; 3) optimal crew configurations; 4) planning factors; 5) schedule and resource allocation; and 6) reporting and control. These six basic modules of a maintenance management program are described in more detail below:

1. *Inventory of Facilities.* An inventory is a complete record of all physical facilities that are maintained. This inventory should document the number, condition, and locations of each facility. A procedure for keeping the inventory current is critical.

   For the purposes of this plan, existing maps of the stormwater system have been updated from City records and field reconnaissance. From this mapping, an estimate of the system inventory has been made and is summarized in Table 7-2. It is recommended that the updates be incorporated into the system, and that the maps be updated regularly and translated onto the City's anticipated geographic information system when it is brought on line.

   With the advent of Geographic Positioning Satellite (GPS) systems, the task of field locating culverts, catch basins, manholes, and other infrastructure elements has become more efficient. Use of GPS equipment is recommended for updating the utility mapping system.

2. *Needs Assessment.* Assessing needs (i.e., determining which facilities need how much maintenance, of what type, and why) is the initial step in a comprehensive maintenance management program. This module consists of several components, each of which assist in answering those questions. These components include:

   - Condition Assessment. Closely connected to the facilities inventory is the condition assessment. Some form of rating scale should be established for describing the condition of each type of facility that is maintained. A procedure is needed to describe the methods for evaluating and recording the condition of each facility. Like the inventory, the condition needs to be updated regularly.

   - Level of Service. Level of service goals or standards identify the conditions that necessitate maintenance (e.g., sedimentation exceeding 20 percent of pipe diameter or 35 to 50 percent of catch basin capacity as measured by depth).

   - Frequencies. Frequencies identify how often maintenance activities must be performed if the program is to achieve the desired level of service.

Facilities such as catch basins, manholes, and pipes should be periodically inspected. The condition of the facility should be recorded at the time of inspection or maintenance (if an inspection has not been performed since the last time the facility was maintained).

A condition assessment scheme, or a common rating system, is recommended below. Four levels of criticality are suggested to prioritize maintenance needs for each type of surface water facility.

- Maintenance needed immediately. Failure to perform maintenance will threaten public health or safety or will result in imminent damage to other publicly-owned facilities or private property.
- Maintenance needed sooner than scheduled. Maintenance can be scheduled on a short-term basis but will be required before the following year's annual work plan is developed or before the regularly scheduled preventive maintenance for a particular facility/equipment.
- Regularly scheduled maintenance program. The regularly scheduled preventive maintenance activities will be sufficient.
- Maintenance done only when unused resources are available. Maintenance should be performed only after the above three categories of maintenance requirements have been accomplished.

As stated above, the levels of service for surface water facilities have been established in terms of maintenance frequencies. These frequencies are the time intervals for performing recurring maintenance in order to realize the desired level of service. Average annual frequencies typical to the region appear in Table 7-3. Frequencies will vary between facilities depending upon conditions within the drainage basin and the criticality of individual facilities to system operation.

Table 7-3: Maintenance Frequencies

Activity	Recommended Frequency (times per year)
Clean catch basins*	1.0 - 1.5
Clean manholes	1.00
Clean outfalls	2.00
Roadside ditches (remove sediments)	0.20
Biofiltration swales (vegetation control)	2.00
Clean pipes	0.25
Regional detention basins (vegetation control)	2.00
Regional detention basins (remove sediments)	0.20
On-site detention basins (inspection)	1.00

Activity	Recommended Frequency (times per year)
Clean streets	12.00
Clean detention vaults	1.00
Repair, replace catch basins	0.02
Repair, replace manholes	0.02
Repair, replace pipes	0.02

**Catch basin cleaning frequencies vary widely, typically from 2.0 times per year to once every 2 years.*

3. *Optimal Crew Configuration.* Optimal crew configurations are based on the accepted fact that for every activity, there is a combination of resources that results in the most efficient performance of work. Thus, optimal crew configurations are the compilation of the number and skills of people, the types of equipment, and the kinds and amounts of materials required to perform a task most efficiently. There are, however, a minimum number of people necessary to ensure safety in conducting several tasks, such as traffic control.

   In preparing this operation and maintenance plan, suggested crew and equipment configurations have been included in developing Table 7-2.

4. *Planning Factor.* Inventorying needs, converting those needs to long- and short-term work plans, scheduling, and assigning individual work projects are all ingredients of an extremely important aspect of effective maintenance management, which is planning. To engage in these planning activities, it is necessary to establish planning factors.

   Planning factors are those identifiers, measurement units, and standards that are necessary for planning and budgeting maintenance activities and reporting actual versus planned costs and performance. Planning factors include a list of all maintenance activities, such as catch basin cleaning, performed by the municipality and charts of accounts, output measures, and performance standards for each activity.

   a. Chart of Accounts. A chart of accounts is a list by task code of tasks or activities for which the municipality needs to plan and collect costs. As a general rule, a separate task code should be established for each activity.

   b. Output Measures. Output measures are the appropriate units of measure for documenting production for each of the work tasks or activities contained within the chart of accounts. Examples of output measures include lineal feet, number of catch basins, and lane-miles.

      As a part of the development of this surface water maintenance program, measurement units were identified for each of the activities. These output measures are used to document the amount of activity or production. They

also allow for the identification of unit costs, which are the costs of labor, equipment, and materials associated with one unit of production. This information is used for planning, budgeting, scheduling, and reporting actual accomplishment.

c. Planning/Performance Standards. These standards are used to determine resource requirements as measures of efficiency. Planning/performance standards are expressed in terms of an average or reasonable amount of daily crew accomplishment. The performance standards, applied in developing the recommended maintenance program, are consistent with those standards used by other comparable municipalities, and they represent a reasonable starting point. These standards should be reviewed at least annually, and refined as historical daily production data become available.

5. *Scheduling and Resource Allocation.* In order to perform needed work activities at the appropriate time, a program for prioritizing work needs to be established. Given established priorities, a long-term work plan and budget can be developed to make the most efficient use of available resources. Once a long-term plan is completed, short-term scheduling facilitates the actual performance of maintenance activities.

a. Priorities. Priorities represent the relative importance of maintaining each type of facility and, therefore, conducting each type of maintenance activity. Priorities are used in preparing both long- and short-term work plans and schedules.

While a maintenance management program is designed to ensure that all facilities will receive the appropriate level of maintenance, the reality is that this may not always be possible, due to emergencies, weather, inadequate resources, etc. Consequently, there is a need to establish relative priorities for various types of facilities and associated deficiencies. Under Needs Assessment, a general prioritization scheme was suggested. This scheme should be used to prioritize the need for certain types of maintenance activities on specific facilities.

b. Annual Work Plans and Budgets. Annual work plans and budgets identify the types and locations of maintenance work to be performed during the coming year. The work plan is derived by scheduling work to be performed during the year over quarterly, monthly, or seasonal periods, in order of priority. Attention is given to: 1) spreading the workload throughout the time period (i.e., resource leveling); and 2) preparing the work program in light of resource constraints (e.g., budget limitations).

The work that needs to be performed is determined by applying the desired level of service or frequencies to the inventory of physical facilities. In developing the work plan, consideration must also be given to emerging or unexpected needs, complaint response, non-project loss factors such as vacations, holidays, and sick leave, as well as requirements for replacements and improvements.

Cost estimates for work included in the proposed annual work plan are computed by applying crew configurations and planning standards to the quantity of work to be performed to determine the crew-hours, various skill types, and equipment required. The cost of the necessary resources can then be computed by applying wage rates and equipment rental rates. This method has been used in Table 7-2 to develop a proposed program budget. Material costs for budgeting purposes also need to be determined, using estimated or historical data.

c. Short-term Work Plans and Schedules. Short-term plans and schedules are the means by which the work activities identified in the annual program are translated into actual work assignments in the field. The process of work planning and scheduling determine who will do the work, where it will be done, when it will be done, and how much will be done.

Short-term (e.g., weekly or bi-weekly) schedules should be prepared by the maintenance supervisor. Schedules should be based on planned preventive maintenance activities, improvements or small works projects, and outstanding work orders generated from complaints, system failures, and emergency needs.

Weekly scheduling permits the flexibility to respond to:

(1) Unscheduled breakdowns and failures.
(2) Weather.
(3) Reduced resource availability due to vacation and sick leave.
(4) Construction projects planned by private utilities and other City crews.

Most importantly, the weekly schedule permits the supervisor to coordinate and plan in detail the resources, labor, and equipment needed to accomplish the proposed monthly work plan.

6. *Reporting and Control*

a. Reports. Work reporting is the critical feedback mechanism that enables the comparison of actual versus planned costs, production, and efficiency. Work reporting is necessary to provide deserved recognition for a job well

done, develop a database that can be used for improved planning and maintenance management in future years, and monitor group performance in order to take corrective action as needed to bring actual and planned performance into conformance.

Work reporting should provide a timely and accurate flow of information with a minimum of paperwork. Variables include time, equipment hours, materials used, and units of production. Reporting may encompass a series of reports that provide an appropriate level of detail.

A cost and performance report by activity should be produced monthly, which provides both monthly and year-to-year data. By tracking labor hours, equipment hours, and production data, comparisons can be made of planned versus actual costs and performance. This will enable supervisors and management to identify and reconcile performance problems in a timely manner. The records of actual production and cost will also be valuable for developing an historical database that can be used to refine planning, scheduling, and budgeting.

b. Control. Control includes establishing clear accountability for specific results and for the resolution of problems or variances from the plans. Consequently, it is necessary to establish thresholds which, when exceeded, will trigger timely corrective action on the part of the appropriate manager. Thresholds will vary in sensitivity depending on the level of detail contained in the report and level of management that is receiving the report. Exception reporting is useful for highlighting only those instances where thresholds have been exceeded.

Finally, control includes determining the cause of the variance, assigning the appropriate resources to take corrective action, and describing the nature of the corrective action. Corrective actions may include changing work practices or amending the original work plan.

7.4 BUDGET, STAFFING AND EQUIPMENT REQUIREMENTS

Proper maintenance of the surface water facilities requires adequate budget, staff, and equipment to support the desired level of service. Annual costs necessary to accomplish the recommended maintenance program for the City of University Place were presented in Table 7-1. Again, the level of maintenance activity should be shifted over two years to transition from system restoration emphasis to system maintenance.

If actual personnel project time is assumed to be 220 days per year or about 85 percent of available time, then 3.3 full-time equivalents (FTEs), plus contractors, are required to accomplish the recommended maintenance program; additional staff time is necessary for supervision, mapping and administrative support of stormwater maintenance.

7.5 MAINTENANCE MANAGEMENT TOOLS

The ideal next step in establishing a stormwater maintenance management program is to automate program record keeping and scheduling. An automated program will support scheduling, tracking, reporting, and accomplishment of maintenance activities. Ideally, an automated maintenance program should be linked with other databases, such as a geographic information system (GIS). The reporting component of the program should be integrated with cost-accounting and financial reporting systems, so that performance and associated cost data is easily available in a useful format. Once maintenance standards are adopted, and planning, scheduling, and reporting procedures are in place, software can either be acquired or developed to meet data management requirements.

Software can be developed in-house or purchased through a vendor. Developing programs in-house using common database management software (e.g., Access, DBASE, RBASE, and Paradox) is not recommended based upon the amount of time, effort, and knowledge necessary to develop an effective maintenance management program.

Vendor-supplied software can be acquired in two ways. First, software can be acquired by issuing a Request for Proposals to develop a "custom" program. Second, software can be obtained by acquiring "off-the-shelf" packages. Custom developed programs can be time consuming and costly. Commercially available maintenance management software packages (e.g., R.J. Hansen) typically represent the most cost-effective product.

Chapter 8: Program Funding

As part of the funding analysis, several policy issues were reviewed. A summary of the key issues, analyses, and preliminary recommendations are provided below.

8.01 BILLING

The City of University Place currently bills the surface water fee through Pierce County. The County includes the fee on the property tax statement and transfers funds collected to the City on a monthly basis. The resulting cash flow to the City peaks in May and November following the property tax due dates in April and October.

Two billing alternatives were considered in this analysis:

- Continue County billing of the surface water fee
- Initiate City billing of the surface water fee

Analysis of these two alternatives is provided below using several criteria:

- *Cost.* The County charges approximately $22,000 per year for billing and collecting City stormwater management fees. This cost could change, depending on the new rates adopted by the City. The set-up cost of establishing a City billing system has been estimated at $80,000[2]. There would also be ongoing costs of at least a partial full-time equivalent for maintaining a City billing system.

- *Public Relations.* The public is already accustomed to the fee on the property tax statement. A new fee on a separate statement could generate a negative public response for a fee they are in fact already paying. A disadvantage to continuing to bill on the County tax statement is a perceived lack of City "ownership" of the surface water program, as people may connect the fee to the County by the method of billing.

- *Cash Flow.* As stated previously, cash flow under the existing billing method results in May and November peaks. The City would plan to bill semi-annually, coinciding with property tax due dates in April and October. The City has not had a problem with this in the past, and through careful planning and fiscal management should not have a problem in the future.

Our preliminary recommendation is that the City continue to use the County for billing of the surface water fee.

[2] Estimate for a Springbrook system (hardware + software); includes cash receipting, plus GIS and location-based capabilities.

8.02 RATE STRUCTURE

The City currently uses the Pierce County rate structure. The County rate structure charges a uniform rate for single family and other residential customers, and a rate for measured impervious surface area for nonresidential customers. The City could choose to investigate other rate structures and / or the addition of new rate distinctions such as for density of development or water quality.

Analysis of these alternatives is provided below using several criteria:

- *Feasibility.* A change in the rate structure, with or without the addition of new rate distinctions, would require programming changes in order to bill. The County would need several months of lead-time in order to make those changes in time to implement them before tax statements go out in January 1999.

- *Equity.* The existing County rate structure is sufficiently equitable. As stated previously, the existing rate structure is based on impervious surface area, an accepted estimate of contribution of runoff. It is possible that the equity of the rate structure could be improved by adding a density of development factor. The density of development, or percent impervious coverage on a parcel has been shown to impact the amount of runoff that reaches the public system. It is further possible that rate equity could be improved by adding a water quality component to recognize the fact that the runoff from some types of development is more harmful to water quality.

Our preliminary recommendation is that the City continue to use the County rate structure at this time.

8.03 FUND TYPE

Surface water revenues and expenses are currently accounted for in a special revenue fund. A special revenue fund is a fund type designated to account for the proceeds of specific revenue sources that are legally restricted to expenditures for specific purposes. The City could choose to continue this practice or to establish an enterprise fund for the surface water program. In general, an enterprise fund is intended to emulate a stand-alone business and is appropriate for a utility service that owns or invests in capital facilities.

Analysis of these alternatives is provided below using several criteria:

- *Accessibility by the General Fund.* A special revenue fund can be accessed by the general fund unless it is restricted. An enterprise fund, on the other hand, is a fund dedicated to the function for which the fees are charged and collected. Governments have less legal flexibility to access the cash equity of an enterprise fund for use in general fund organizations. Revenues of either fund type can be subject to a City utility tax.

- *Bond Issuance.* Rate revenues through a special revenue fund may secure revenue bonds, but it is easier to meet bond covenants and secure revenue bond debt when employing an enterprise fund statement of income and expenses. Rates and charges are dedicated to the fund and are less likely to be accessed for other uses, except for paying for legitimate support from general fund organizations.

- *Asset Management.* Under a special revenue fund structure, utility assets are the property of the general fixed assets account group, and are not tracked or depreciated. Under an enterprise fund structure, utility assets are fully accounted for and depreciated. Assets are the property of the utility, subject to utility accounting practices such as retirements, replacements, and gains or losses in disposal procedures.

- *Reporting.* Special revenue funds are accounted for on a spending or "financial flows" measurement focus, which means that typically only current assets and current liabilities are included on related balance sheets. The operating statement measure changes in financial position, rather than net income.

  Enterprise funds are used to account for activities similar to those found in the private sector, where the intent of the governing body is to finance the full cost of providing services, including depreciation, primarily through user charges. The measurement focus for these funds is based in the commercial model, which uses a flow of economic resources approach. Under this approach, the operating statement focus on a measurement of net income and both current and non-current assets and liabilities is reported on related balance sheets.

  An enterprise fund accounts for operations that are financial and operated in a manner similar to private business enterprises, where the intent of the City is to finance or cover, primarily through user charges, the cost of providing goods or services to the general public on a continuing basis.

Our recommendation is that the City change from a special revenue fund to an enterprise fund for the surface water program, especially since the City will be investing in capital for utilities and for issuing revenue bonds. However, this cannot be accomplished until the City has a complete inventory of its surface water infrastructures.

8.04 CAPITAL FUNDING STRATEGY

A total of approximately $10 million in capital improvements is planned for the City over the next ten years. The City could choose from any number of methods to fund the proposed capital improvement program (CIP). At its most basic, however, the question is whether the City should address its capital needs on a pay-as-you go basis, without the use of debt, or utilize debt to finance all or part of the CIP. An analysis of this issue is provided below.

Debt financing offers a way to spread out the repayment of construction and related costs. A major advantage of debt financing is that the system is paid for as it depreciates over time, although debt repayment is over 20 years and depreciation is assumed to occur over 50 years or more. In general, there are two kinds of conventional tax-exempt debt, revenue bonds and general obligation bonds.

- A dedicated revenue stream, often utility rates, normally secures revenue bonds. As a protection against fluctuations in revenue, bond issuers usually require that a utility collect an amount over and above the actual debt service payments, known as coverage. There are usually additional reserve requirements, as well.

- General obligation bonds are secured by the full faith and credit of the City. The City's general fund (the taxpayer) is ultimately responsible for meeting general obligation bond debt service should there be a default. There is a statutory ceiling on the amount of general obligation bond debt a city may incur. Thus, general obligation debt used for surface water purposes directly affects the amount of debt "capacity" available for other, often more visible, purposes. Regardless, this form of debt can be the least expensive to the ratepayer.

Rate funding capital on a pay-as-you-go basis has one major advantage:

- Once the project is constructed and paid for in the same year, the financial obligation is finished and, barring other needs, the rate may be decreased.

Among the disadvantages of a pay-as-you-go strategy are the following:

- There are often significant rate "spikes" as capital needs and their commensurate costs vary from year to year. Capital spending will be more difficult to match with fund balances and positive cashflows.

- Although the improvements funded will serve future customers as well as the existing customer base, the existing customer base bears the full burden of funding the project in the year of construction.

It should be noted that there are a number of special State-administered funding programs that offer grants and low-cost loans for qualifying projects. It is important to note that competition for funding is substantial and successful acquisition of that funding cannot be assured:

- *The Flood Control Assistance Account Program.* The Flood Control Assistance Account Program (FCAAP), administered by the Washington Department of Ecology, assists local jurisdictions in comprehensive planning and maintenance efforts to reduce flood hazards and flood damages.

- *Centennial Clean Water Fund.* The Centennial Clean Water Fund (CCWF), administered by the Washington Department of Ecology, provides grants and low-cost loans to public bodies to plan, design and construct facilities and to conduct planning, implementation, educational and other activities related to improving water quality.

- *The Washington State Water Pollution Control Revolving Fund.* The State Revolving Loan Fund (SRF), administered by the Washington Department of Ecology, provides low-cost loans to public bodies "for construction of wastewater treatment facilities and implementation of activities that improve and protect the state's water quality."

- *"Federal 319" Program.* The "Federal 319" Program, also administered by the Washington Department of Ecology, provides funding for the implementation of nonpoint source projects which directly improve water quality.

- *Public Works Trust Fund.* The Public Works Trust Fund (PWTF), administered by the Washington Department of Community, Trade, and Economic Development, is a revolving loan fund that funds the "repair, replacement, reconstruction, or improvement of eligible public works systems to meet current standards for existing users." Projects designed to serve future growth are not eligible for PWTF funding, unless the replacement project returns capacity to the system.

Our recommendation is for the City to adopt the following funding strategy:

- Pursue applicable special grants and loans. These special funding sources, although difficult to obtain, can significantly reduce the cost of capital to the City;

- Rate fund capital on a pay-as-you-go basis to the extent practical; and

- Use conventional debt when absolutely necessary.

8.05 CAPITAL FACILITIES CHARGES

Capital Facilities Charges (CFCs) are one-time charges imposed as conditions of development, and are designed to recover an equitable share of the cost of existing facilities as well as a share of planned capital investment to be incurred by the utility. As such, CFCs are usually made up of two components: (1) a "buy-in" to existing facilities, or general facilities charge (GFC), and (2) a proportionate share of planned facilities, or system development charge (SDC). Each component is calculated by dividing the allocable cost of facilities, existing or planned, by the appropriate estimate of system capacity. Specifically, the following calculation would apply in most jurisdictions:

GFC		SDC		CFC
Cost of Existing Facilities / Existing Customer Base + Growth	+	Cost of Future Facilities / Existing Customer Base + Growth	=	Total CFC

This SDC approach reflects the assumption that planned facilities will serve both existing customers and new development proportionally. In cases where capacity-expanding projects and their associated costs are separate and distinct, the relevant calculation is:

SDC
Cost of Capacity-Expanding Future Facilities / Customer Base Growth

In order to implement a system development charge, the program must have adequate planning documents to identify capital needs, estimated costs, and capacity provided. In order to implement a general facilities charge, the program must have adequate fixed asset records to identify the cost of existing facilities for "buy in." The City does not have such records for its surface water system. This information would be part of the balance sheet if the City implements an enterprise fund. However, if all current assets were taken over or donated to the City, at no cost, then such assets would be contributions-in-aid of construction, and there would be no current cost basis for a GFC.

Applying the first SDC approach, shown above, the estimated City of University Place preliminary SDC is $757 per equivalent residential unit (2,640 square feet of impervious surface area). Our recommendation is that the City adopt a CFC in order to ensure that remaining development pays its fair share of planned facilities.

8.06 RATE CREDITS FOR ON-SITE MITIGATION

Some newer construction in the City has, as a condition of development approval, been required to provide on-site surface water management facilities. Pierce County has provided rate credits for such on-site improvements according to the following schedule:

Retention Facility	Percent Credit
100-Year Storage	85%
50-Year Storage	40%
25-Year Storage	20%
10-Year Storage	10%

Detention Facility	Percent Credit
100-Year Storage; release rate of 50% of the predevelopment discharge rate for 2-year storm [3]	85%
50-Year Storage; 2-year release	40%
25-Year Storage; 2-year release	20%
10-Year Storage; 2-year release [4]	10%

Many surface water programs do provide for credits against service charges to recognize the effects of on-site detention, water quality mitigation or other means of stormwater control. The level of credit should reflect the reduced effect a property with on-site controls has over a similar property lacking this mitigation. The amount of reduction is a function of the service charge rate structure. Under the impervious surface approach, the credit usually results in a reduction of the equivalent units attributable to the property.

Under conditions where the City has established surface water development standards, credit eligibility is typically based on the policy decision of whether the on-site controls *meet* or *exceed* those standards. In addition, the City must evaluate whether these on-site facilities effectively reduce the flow of surface water from these sites and, as a result, reduce the City's costs in providing conveyance systems to handle these flows. The premise being that credits are applied when it can be shown or estimated that on-site facilities reduce the utility's costs in managing runoff generated from these impervious surfaces. Often the actual cost reduction to the program warrants only a credit of 25% to 30% — much less than the current 85% maximum credit.

Our recommendation is that the City of University Place's surface water rates continue to include a provision for credits where it can be determined that the surface water facility requirements established as a condition of development approval will effectively reduce the utility's costs in managing the flows from the site. In short, the City should allow credits only for exceeding City standards for on-site mitigation and limit the maximum credit amount.

[3] Meets Washington State Department of Ecology Standards.

[4] Currently applied (1994) King County Standard.

Chapter 9: Recommended Plan

9.01 GENERAL

The recommended plan consists of structural and non-structural solutions to the City's surface water needs as well as the funding and operational support to implement the solutions. Structural solutions include major capital facility construction and smaller retrofit-types of improvements. Non-structural measures include preventative and remedial activities such as maintenance, monitoring, public education, investigative studies, and protective ordinances and regulations. Collectively, this plan of activities and improvements will guide the City in solving current and future flooding and water quality problems as well as protecting related environmental resources.

This plan also includes a funding strategy to implement the structural and non-structural recommendations.

9.02 STRUCTURAL IMPROVEMENTS

Table 9-1 summarizes the recommended structural solutions developed in Chapter 6. The improvements have been identified in drainage basins throughout the City, and they were developed to both correct existing problems and to accommodate the effects anticipated from further growth in the City. These improvements are directed at relieving flooding, controlling erosion in streams, and protecting water quality. The improvements consist of storm drain pipelines, culverts, detention facilities, stream channel restoration, and a maintenance and storage facility. Structural measures include both construction of new facilities and restoring existing facilities to their design capacity.

Where sufficient information was available, preliminary design concepts were configured as specific improvement recommendations, and construction costs were estimated based on the design concepts. In those areas where more detailed investigative analysis will be required to develop a recommended design concept, a cost estimate of the probable capital expenditure required was developed.

Proposed regional detention facilities are intended to complement the storage provided by on-site detention facilities installed in the course of development. Regional facilities were sized to control the peak flow rates in streams and storm drain systems such that discharges do not increase beyond current conditions. The final configuration of some of these facilities should be selected in consultation with other jurisdictions in the watersheds. It is anticipated that overall cost savings will result from a cooperative basin-wide approach.

Cost estimates prepared for the recommended solutions include allowances for contractor mobilization, construction contingency, state sales tax, surveying, permitting, engineering, and administrative costs. All cost estimates are based on 1998 construction costs.

Table 9-1: Capital Improvement Program

Capital Expenditure				Estimated Expenditures (escalated for inflation)									
No.	Description	Basin	Estimated Cost (in 1998 $s)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	Broback Property regional detention facility	Leach Creek	$ 231,000			260,000							
2	Replace pipe in Sunset Drive at 37th St. Ct. W	Curtis Pothole	$ 35,000		38,000								
3	Replace pipe in 40th St. W betw. Sunset Drive & 80th Ave. W	Curtis Pothole	$ 96,000							126,000			
4	Modify drainage system in Brookside Way/Soundview Drive	Soundview	$ 198,000	206,000									
5	35th Street pond operational improvements	No. Day Island	$ 8,000		9,000								
6	Collection system improvements at Mt. View & 21st St W	No. Day Island	$ 43,000		47,000								
7	Replace drainage system from 37th St W to 70th Ave W	Leach Creek	$ 259,000		280,000								
8	Curtis Pothole excavation	Curtis Pothole	$ 133,000			150,000				175,000			
9	Storm drainage system upgrades from 77th Avenue W	Day Isl Watrwy	$ 1,619,000							533,000	554,000	576,000	599,000
10	Retrofit 19th Street pond to improve sediment control	Crystal Springs	$ 133,000		144,000								
11	Retrofit Day Island Bridge pond to improve sediment control	Day Isl Watrwy	$ 133,000		144,000								
12	Armor 27th Street outfalls (3) to reduce scour	Day Isl Lagoon	$ 9,000		10,000								
13	Enhance detention at Morrison Pond to relieve flooding d/s	No. Day Island	$ 193,000						244,000				
14	Stream buffer acquisition - Leach Creek	Leach Creek	$ 125,000							164,000			
15	Detention tank at 79th Ave W at 54th St. W	Chambers Cr	$ 182,000			205,000							
16	Stream channel and habitat restoration - Leach Creek	Leach Creek	$ 182,000								249,000		
17	Install storm drain in Arbordale from 41st to Robin Dr.	Soundview	$ 90,000									128,000	
18	Infiltration system at 57th Ave W & 62nd St W	Leach Creek	$ 116,000									165,000	
19	Infiltration system in 64th St W	Leach Creek	$ 116,000										172,000
	Drainage for Traffic Improvement Program	Various	$ 5,600,000	767,000	461,000	155,000	759,000	755,000	771,000	141,000	766,000	797,000	829,000
	Neighborhood Capital Improvement Program	Various	$ 400,000	42,000	43,000	45,000	47,000	49,000	51,000	53,000	55,000	57,000	59,000
	Expand regional facility operation at 37th Street	Leach Creek	by Tacoma										
	Divert drainage to pond south of 40th Street at 62nd Ave. W	Leach Creek	by Fircrest										
	Danbridge Subdivision Improvements	Chambers Cr	private										
	Total		$ 9,901,000	1,015,000	1,176,000	815,000	806,000	804,000	1,066,000	1,192,000	1,624,000	1,723,000	1,659,000

Assumed capital cost escalation rate 4.0% per year

9.03 NON-STRUCTURAL RECOMMENDATIONS

Non-structural measures are recommended primarily to prevent future problems from occurring (such as through effective development standards) and to correct and prevent water quality problems (such as informing the public on source control best management practices). In some instances non-structural measures are effective in solving existing surface water problems. An example of a non-structural approach to correct minor flooding would be more rigorous maintenance of pipe inlets and culverts that are subject to frequent plugging. Non-structural measures are generally most effective when applied in problem prevention and in correcting water quality problems. Recommended non-structural measures are summarized below.

Maintenance

Chapter 7 presents the recommended frequencies and resources necessary for maintaining the City's drainage infrastructure. Table 7-3 identifies the various types of maintenance and their recommended frequencies. These levels should be attained by progressively expanding maintenance activity over the next few years.

With the new eductor (Vactor) truck, the scope of the storm drain and catch basin cleaning should be expanded so that (1) the entire system is cleaned, inspected and its condition assessed; (2) the system functions at capacity; and (3) deposited sediments and attached pollutants are removed before they can be carried to receiving waters.

As the City's proposed GIS mapping system is developed, it can be utilized to store maintenance and system condition records. With the use of maintenance management software, the database contained in such a GIS system will be valuable in optimizing maintenance frequencies and scheduling.

Public Education

The benefits of public awareness in controlling water pollution have been realized in communities across the Puget Sound region. Specific efforts to enhance the public's understanding of their impacts on local receiving waters can result in improved source control of pollutants and preservation of the City's streams, lakes and wetlands. The public education program should foster public stewardship of resources and responsibility for stormwater quality and quantity. Recommended public education elements are summarized as follows:

A. *Maintenance of Private Systems:* Develop a program to educate commercial and industrial business owners of the benefits of proper catch basin cleaning and maintenance of detention systems. Information may be distributed in the form of flyers, newspaper articles, outreach by City staff, and speaking at business group meetings. The City should take advantage of existing materials, sources of information on "green" practices targeted to the business community, and programs such as Business Partners for Clean Water. A catalog of existing education materials and sources is provided in Volume II of Ecology's *Stormwater Program Guidance Manual for the Puget Sound Basin.*

A. *Erosion Control:* Develop a program to inform and educate area contractors about erosion control requirements of the City. Again, there are existing sources of material and information available through the state, King County and other local jurisdictions which share similar erosion control standards.

B. *Source Control BMPs:* Develop a public education program that encourages control of pollution at the source and informs the community of the connection between water pollution and household and commercial practices. Appropriate objectives for such a program would include:

- Reducing the use of household products that are harmful to the environment.
- Proper disposal of environmentally toxic materials.
- Eliminating dumping of lawn clippings, pet wastes, and other waste products.
- Reducing exposure of stored toxic materials to rainfall and stormwater.
- Proper application of pesticides, herbicides and fertilizers.
- Use of integrated pest management practices, rather than chemicals, where possible.

C. *Spills and Dumping:* Develop an education program to inform individuals and business employees of the impacts to water quality from illicit dumping of waste. Also, the community should be informed of how to respond to a spill, such as immediately contacting a spill response agency using the 911 telephone system.

D. *Natural Resource Preservation and Protection:* Develop an education program to increase community awareness of stream, lake and wetland resources and their value in the ecosystem and to the quality of life in the city. City staff could be charged with coordinating with school district personnel responsible for establishing science curricula, establishing a volunteer program, and maintaining communications with established water-oriented community groups. Planting activities could be planned, in conjunction with the City Parks personnel and resource agencies, to enhance shade cover, bank stability, and visual and filtering buffers for streams, lakes and wetlands.

Public education must be an ongoing effort if it is to be effective. For continuity, specific staff member(s) should be responsible for coordinating and implementing education program activities.

Monitoring and Investigations

The City should conduct a structured water quality monitoring program to evaluate conditions in receiving waters and to measure the effectiveness of the surface water program. Benefits to be derived from a monitoring program are:

1. Establishing a baseline of water quality conditions in the City's lakes, streams and wetlands.

2. Identification of water quality problems and sources so that corrective action can be taken.

3. Evaluation of the effectiveness of program activities such as source controls.

4. Input to optimizing program efforts and cost-effectiveness.

Monitoring should be coordinated with ongoing sampling being performed by the City of Tacoma, Pierce County, and other agencies. Sampling should be conducted at major outfalls and in streams during dry weather and storm conditions and should include testing for the following pollutants:

- total petroleum hydrocarbons
- total suspended solids
- nitrate plus nitrite nitrogen
- total phosphorous
- pH
- ammonia nitrogen
- temperature
- lead
- copper
- zinc (dissolved and total)
- dissolved oxygen
- hardness
- fecal coliform bacteria
- turbidity
- conductivity

Investigative monitoring efforts, such as locating illicit discharges or sewer cross-connections, may utilize less costly field screening test procedures.

In order to further the design of major capital facilities, detailed drainage basin investigations will be necessary in some drainages. The modeling information and conclusions presented in this plan should serve as a basis for more detailed investigative and preliminary design studies.

Spill Containment and Response

It is recommended that the City conduct an analysis of needs for spill containment facilities to prevent transportation-related spills from entering area surface and groundwaters.

The City should also review its emergency spill response program to ensure proper information on the drainage infrastructure is made available to the fire department for containing spills and for tracing spills to their source. An inventory should be made of industrial and commercial facilities that store hazardous materials, and copies of this inventory along with drainage system maps should be kept on file at the Fire Department. Transferring and updating this information

would be facilitated when the GIS system is on line. Facilities with Standard Industrial Classification codes indicating a concern for hazardous materials which are located near water bodies should receive priority in developing spill response and containment programs.

9.04 PROGRAM FUNDING PLAN

The funding plan is a strategy to provide sufficient, reliable revenue to support the recommended surface water program on a continuing basis. It is recommended that the City continue to primarily rely upon revenue from the stormwater utility service charge. The service charge should be adjusted to provide sufficient revenue for operating costs, maintenance, and capital improvements, including repayment of the revenue bond debt.

Based on the revenue analysis presented in Chapter 8, to fund the program on a cash basis the stormwater utility rates would need to be increased from the current rate of $40 per year to a rate of $110 per year per equivalent service unit (ESU) effective in 1998.

The City should actively pursue grant and low-cost loan opportunities to defray the cost of proposed capital improvements. Projects which are viewed as candidates for such programs are those which provide substantive flood control or water quality improvements on a watershed-wide basis, such as the regional detention projects and stream restoration projects. Joint public/private opportunities should also be pursued to reduce the overall net cost of regional facilities to the community.

APPENDIX A

Stormwater Rate Analysis

Summary of the Surface Water Rate Technical Analysis

In addition to the policy issues discussed in Chapter X, the funding component of the study included an analysis of the impact of the current program, and two additional levels of service, on surface water rates. A summary of the rate analysis, included in full as an appendix to this report, is provided below.

The Current Program

Using the Pierce County surface water rate structure, provided below, the City of University Place will generate an estimated $510,843 in surface water fee revenues. Against operating expenses of $573,951[1] and planned capital expenditures of $371,793, the surface water fund is projected to draw down its beginning balance of $1,514,008 by over $430,000. This beginning fund balance is an accumulation of previously collected, non-recurring, surface water fee revenues. A summary of the current program profile is also provided below.

Existing Rate Structure

Customer Class	Annual Rate	Unit	Notes
Single Family Residential	$40.00	Per DU	One ESU
Duplexes	25.80	Per DU	.645 ESUs per DU
Mobile Homes	22.075	Per site	+$.01515 per sq ft impervious
Undeveloped	.20	Per acre	
State & County Roads	.00454	Per ft^2	Impervious surfaces only
Other (commercial, etc.)	.01515	Per ft^2	Impervious surfaces only

Current Program Profile

Available Cash	**1998**
Beginning Fund Balance [2]	$1,514,008
Service Charges	510,843
Operating Fund Interest	2,144
Total Available Cash	$2,026,995
Expenditures	**1998**
General & Administrative	$152,218
Engineering	28,385
Billing (to Pierce County)	21,628
System O & M	141,613
Capital Transfers / Capital Acquisition	230,107
Total Expenditures	$573,951

[1] Includes one-time purchase of a vactor truck in 1998.
[2] Includes SWM Fund transfer from County.

Planned Capital Expenditures	1998
Day Island / 27th Avenue	$11,250
Comprehensive Plan	150,000
Water Quality Site Purchase	100,000
Emergency Storm Drain (Soundview)	110,543
Total Capital Expenditures	$371,793

Level of Service Approach

Before the City began providing surface water management service within its boundaries, Pierce County was the service provider. County service consisted primarily of baseline operations and maintenance without significant infrastructure improvements. As a result, the City now faces a number of capital needs. These specific projects are detailed in Chapter X. In addition, certain additional operating activities, including regulatory reporting, public education, basin studies, and water quality monitoring, are needed.

In the rate analysis, two operating levels of service, "medium" and "high", were considered in addition to the planned capital improvement program. Contrary to the high service level, the medium service level included no additional funding for basin studies and investigations or public involvement.

Based on the City's past practices, and direction from City staff, it was assumed that the City would utilize a "pay-as-you-go" funding strategy for the capital program. In order to levelize projected rate increases over the course of the study period, projected annual spending levels were adjusted on the drainage-related portion of the traffic improvement program.

A summary of the rate analysis for the medium service level is provided below:

Medium Service Level

Projected Revenue Requirement and Rates: Pay-as-you-go Capital Funding

	1998	1999	2000	2001	2002	2003
Rate Revenue Requirement						
Operating Expenses						
Administration	$152,218	$157,546	$163,060	$168,767	$174,674	$180,787
Engineering	50,000	51,750	53,561	55,436	57,376	59,384
Operations and Maintenance	248,700	257,405	266,414	275,738	285,389	295,378
Water Quality Monitoring	30,000	31,050	32,137	33,262	34,426	35,631
Basin Studies / Investigations	0	0	0	0	0	0
Regulatory Compliance	10,000	10,350	10,712	11,087	11,475	11,877
Public Involvement	0	0	0	0	0	0
subtotal	$490,918	$508,100	$525,884	$544,290	$563,340	$583,057
Capital Funding						
Rate Funded Capital	$0	$809,744	$807,313	$806,668	$807,319	$805,668
Gross Revenue Requirement	$490,918	$1,317,844	$1,333,197	$1,350,958	$1,370,659	$1,388,724
less: Nonrate Revenues	60,560	6,447	3,341	3,341	3,341	3,341
Net Rate Revenue Requirement	**$430,358**	**$1,311,397**	**$1,329,856**	**$1,347,617**	**$1,367,318**	**$1,385,383**
Resulting Annual Rate per ESU		**$110.00**	**$110.00**	**$110.00**	**$110.00**	**$110.00**
Annual % Increase Required		*152.92%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
Cumulative % Increase		*152.92%*	*152.69%*	*152.28%*	*152.18%*	*151.74%*

A similar summary for the high service level is provided below:

High Service Level

Projected Revenue Requirement and Rates: Pay-as-you-go Capital Funding

	1998	1999	2000	2001	2002	2003
Rate Revenue Requirement						
Operating Expenses						
Administration	$152,218	$157,546	$163,060	$168,767	$174,674	$180,787
Engineering	50,000	51,750	53,561	55,436	57,376	59,384
Operations and Maintenance	248,700	257,405	266,414	275,738	285,389	295,378
Water Quality Monitoring	30,000	31,050	32,137	33,262	34,426	35,631
Basin Studies / Investigations	100,000	103,500	107,123	110,872	114,752	118,769
Regulatory Compliance	10,000	10,350	10,712	11,087	11,475	11,877
Public Involvement	10,000	10,350	10,712	11,087	11,475	11,877
subtotal	$600,918	$621,950	$643,718	$666,249	$689,567	$713,702
Capital Funding						
Rate Funded Capital	$0	$809,744	$809,446	$808,636	$807,319	$805,668
Gross Revenue Requirement	$600,918	$1,431,694	$1,453,164	$1,474,885	$1,496,887	$1,519,370
less: Nonrate Revenues	60,560	3,951	3,951	3,951	3,951	3,951
Net Rate Revenue Requirement	**$540,358**	**$1,427,743**	**$1,449,213**	**$1,470,933**	**$1,492,935**	**$1,515,418**
Resulting Annual Rate per ESU		**$120.00**	**$120.00**	**$120.00**	**$120.00**	**$120.00**
Annual % Increase Required		*160.32%*	*0.00%*	*0.00%*	*0.00%*	*0.01%*
Cumulative % Increase		*175.36%*	*175.37%*	*175.36%*	*175.35%*	*175.37%*

Resulting rates, under the existing structure, are provided below for the recommended medium level of service.

Land Use Category	Annual 1999 Charge	Basis
Single Family Residential	**$110.00**	*per dwelling unit*
Duplex	**$141.90**	*per duplex*
Duplex / Condo	**$141.90**	*per duplex / condo*
Multi-Family	**$0.0417**	*per sq ft impervious*
Mobile Home Parks	**$60.71**	*per occupied site, plus*
	$0.0417	*per sq ft impervious*
Office/Condo Conversions	**$0.0417**	*per sq ft impervious*
Other Parcels	**$0.0417**	*per sq ft impervious*
State & County Public Highways	**$0.0125**	*per sq ft impervious*

Area Rate Comparison

For comparative purposes, a compilation of area rates for a typical single family residence is provided below.

Location	Annual Rate
Clear / Clarks Creek Basin	$ 124.00
Clover Creek / Steilacoom Basin	$ 124.00
University Place (1999 recommended)	*$ 110.00*
Mid-Puyallup River Basin	$ 101.00
Upper Puyallup River Basin	$ 92.00
Puyallup	$ 83.16
Federal Way	$ 74.00
Des Moines	$ 63.00
Fircrest	$ 60.00
SeaTac	$ 60.00
Chambers Bay Basin	$ 40.00
City of Lakewood	$ 40.00
University Place (1998)	*$ 40.00*
Tacoma West Basin (Fircrest Acres)	$ 31.00

Several of the rates shown are for basins served by Pierce County. The levels of service provided in these basins varies, from basic operations and maintenance in the Tacoma West Basin to basic operations and maintenance, plus significant "level 2" capital construction in the Clear / Clarks Creek and Clover Creek / Steilacoom basins.

City of University Place
Stormwater Rate Analysis
Summary of Key Findings

Projected Revenue Requirement and Rates: Pay-as-you-go Capital Funding

	1998	1999	2000	2001	2002	2003
Rate Revenue Requirement						
Operating Expenses						
Administration	$152,218	$157,546	$163,060	$168,767	$174,674	$180,787
Engineering	50,000	51,750	53,561	55,436	57,376	59,384
Operations and Maintenance	248,700	257,405	266,414	275,738	285,389	295,378
Water Quality Monitoring	30,000	31,050	32,137	33,262	34,426	35,631
Basin Studies / Investigations	0	0	0	0	0	0
Regulatory Compliance	10,000	10,350	10,712	11,087	11,475	11,877
Public Involvement	0	0	0	0	0	0
subtotal	$490,918	$508,100	$525,884	$544,290	$563,340	$583,057
Capital Funding						
Rate Funded Capital	$0	$809,744	$807,313	$806,668	$807,319	$805,668
Gross Revenue Requirement	$490,918	$1,317,844	$1,333,197	$1,350,958	$1,370,659	$1,388,724
less: Nonrate Revenues	60,560	6,447	3,341	3,341	3,341	3,341
Net Rate Revenue Requirement	**$430,358**	**$1,311,397**	**$1,329,856**	**$1,347,617**	**$1,367,318**	**$1,385,383**
Resulting Annual Rate per ESU		**$110.00**	**$110.00**	**$110.00**	**$110.00**	**$110.00**
Annual % Increase Required		*152.92%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
Cumulative % Increase		*152.92%*	*152.69%*	*152.28%*	*152.18%*	*151.74%*

Capital Fund Activity

	1998	1999	2000	2001	2002	2003
Initial Balance	$0	$573,298	$465,406	$9,308	$186	$194
plus: Transfers from Operating Fund	1,433,307	77,661	0	0	0	0
plus: Direct Funding from Rates	0	809,744	602,127	201,801	807,319	805,668
less: Contribution to Project	871,250	1,015,664	1,067,533	211,109	807,319	805,668
plus: Fund Earnings	11,241	20,367	9,308	186	7	8
Ending Balance	$573,298	$465,406	$9,308	$186	$194	$201

City of University Place
Stormwater Rate Analysis
- Key Findings -

Operating Activity

In $ 1998

		Program Administration	Engineering	Operations & Maintenance	Water Quality Monitoring	Basin Studies & Investigations	Regulatory Compliance	Public Involvement
Level of Service	*Low=1*	$0	$0	$0	$0	$0	$0	$0
	Medium=2	152,218	50,000	248,700	30,000	0	10,000	0
	High=3	152,218	50,000	248,700	30,000	100,000	10,000	10,000
	Budget=4	152,218	28,385	393,348	0	0	0	0
Designated Level of Service		2	2	2	2	2	2	2
Resulting Cost		$152,218	$50,000	$248,700	$30,000	$0	$10,000	$0

Capital Program

Project Description	1998	1999	2000	2001	2002	2003	TOTAL
Sampling: SWM Improve-Day Island/27th Ave	$11,250	$0	$0	$0	$0	$0	$11,250
Storm Drain Comp Plan	150,000	0	0	0	0	0	150,000
SWM Water Quality Site Purchase	100,000	0	0	0	0	0	100,000
Brookside Way drainage system (Soundview)	0	205,920	0	0	0	0	205,920
Public Works Operations Site Purchase	610,000	0	0	0	0	0	610,000
Retrofit 19th Street pond (Crystal Springs)	0	0	143,853	0	0	0	143,853
Retrofit Day Island Bridge pond (Day Island Waterway)	0	0	143,853	0	0	0	143,853
Armor 27th Street outfalls (3) (Day Island Lagoon)	0	0	9,734	0	0	0	9,734
Enhance detention at Morrison Pond (N Day Island)	0	0	0	0	0	0	0
35th Street pond operational improvements (N Day Island)	0	0	8,653	0	0	0	8,653
System Upgrades from 77th Ave., W (Day Island Waterway)	0	0	0	0	0	0	0
System Upgrades from 77th Ave., W (Day Island Waterway)	0	0	0	0	0	0	0
System Upgrades from 77th Ave., W (Day Island Waterway)	0	0	0	0	0	0	0
System Upgrades from 77th Ave., W (Day Island Waterway)	0	0	0	0	0	0	0
Brobeck Property regional detention (Leach Cr)	0	0	0	259,844	0	0	259,844
Sunset Drive at 37th St. Ct. W Pipe Repl. (Curtis Pothole)	0	0	37,856	0	0	0	37,856
40th St. W betw. Sunset & 80th W Pipe Repl. (Curtis Pothole) (3)	0	0	0	0	0	0	0
Arbordale storm drain from 41st to Robin Dr. (Soundview)	0	0	0	0	0	0	0
Curtis Pothole excavation	0	0	0	149,607	0	0	149,607
Curtis Pothole excavation	0	0	0	0	0	0	0
79th Ave W at 54th St. W Detention Tank (Chambers Creek)	0	0	0	204,725	0	0	204,725
57th Ave W & 62nd St W Infiltration System (Leach Creek)	0	0	0	0	0	0	0
64th St W Infiltration System (Leach Creek)	0	0	0	0	0	0	0
Mt. View & 21st St. W collection improvements (N. Day Island)	0	0	46,509	0	0	0	46,509
37th St. W & 70th Ave. W system replacement (Leach Creek)	0	0	280,134	0	0	0	280,134
Stream channel & habitat restoration (Leach Creek)	0	0	0	0	0	0	0
Stream buffer acquisition (Leach Creek)	0	0	0	0	0	0	0
—	0	0	0	0	0	0	0
Drainage for Traffic Improvement Program (Various)	0	761,904	0	0	0	0	761,904
Drainage for Traffic Improvement Program (Various)	0	0	552,373	0	0	0	552,373
Drainage for Traffic Improvement Program (Various)	0	0	0	150,057	0	0	150,057
Drainage for Traffic Improvement Program (Various)	0	0	0	0	753,506	0	753,506
Drainage for Traffic Improvement Program (Various)	0	0	0	0	0	749,702	749,702
Drainage for Traffic Improvement Program (Various)	0	0	0	0	0	0	0
Drainage for Traffic Improvement Program (Various)	0	0	0	0	0	0	0
Drainage for Traffic Improvement Program (Various)	0	0	0	0	0	0	0
Drainage for Traffic Improvement Program (Various)	0	0	0	0	0	0	0
Drainage for Traffic Improvement Program (Various)	0	0	0	0	0	0	0
—	0	0	0	0	0	0	0
Neighborhood Capital Improvement Program (Various)	0	47,840	0	0	0	0	47,840
Neighborhood Capital Improvement Program (Various)	0	0	49,754	0	0	0	49,754
Neighborhood Capital Improvement Program (Various)	0	0	0	51,744	0	0	51,744
Neighborhood Capital Improvement Program (Various)	0	0	0	0	53,813	0	53,813
Neighborhood Capital Improvement Program (Various)	0	0	0	0	0	55,966	55,966
Neighborhood Capital Improvement Program (Various)	0	0	0	0	0	0	0
Neighborhood Capital Improvement Program (Various)	0	0	0	0	0	0	0
Neighborhood Capital Improvement Program (Various)	0	0	0	0	0	0	0
Neighborhood Capital Improvement Program (Various)	0	0	0	0	0	0	0
Neighborhood Capital Improvement Program (Various)	0	0	0	0	0	0	0
—	0	0	0	0	0	0	0
Net Construction Cost	$871,250	$1,015,664	$1,272,719	$815,976	$807,319	$805,668	$5,588,596

Projected Revenue Requirement and Rates: Pay-as-you-go Capital Funding

	1998	1999	2000	2001	2002	2003
Rate Revenue Requirement	$510,843	$1,311,397	$1,329,856	$1,347,617	$1,367,318	$1,385,383
Resulting Annual Rate per ESU	NA	$110.00	$110.00	$110.00	$110.00	$110.00
Annual % Increase Required	*NA*	*152.92%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
Cumulative % Increase	*NA*	*152.92%*	*152.69%*	*152.28%*	*152.18%*	*151.74%*

City of University Place
Stormwater Management Plan
Capital Improvement Program - Estimates Only

Construction Cost Escalation Rate: 4.00%

Rank	Cost in Fiscal Year 1998	Year	Description	1998	1999	2000	2001	2002	2003	TOTAL
1	11,250	1998	Sampling: SWM Improve-Day Island/27th Ave	$11,250	$0	$0	$0	$0	$0	$11,250
2	150,000	1998	Storm Drain Comp Plan	150,000	0	0	0	0	0	150,000
3	100,000	1998	SWM Water Quality Site Purchase (1)	100,000	0	0	0	0	0	100,000
4	198,000	1999	Brookside Way drainage system (Soundview) (2)	0	205,920	0	0	0	0	205,920
5	610,000	1998	Public Works Operations Site Purchase	610,000	0	0	0	0	0	610,000
6	133,000	2000	Retrofit 19th Street pond (Crystal Springs)	0	0	143,853	0	0	0	143,853
7	133,000	2000	Retrofit Day Island Bridge pond (Day Island Waterway)	0	0	143,853	0	0	0	143,853
8	9,000	2000	Armor 27th Street outfalls (3) (Day Island Lagoon)	0	0	9,734	0	0	0	9,734
9	193,000	2004	Enhance detention at Morrison Pond (N Day Island)	0	0	0	0	0	0	0
10	8,000	2000	35th Street pond operational improvements (N Day Island)	0	0	8,653	0	0	0	8,653
11	404,750	2005	System Upgrades from 77th Ave., W (Day Island Waterway)	0	0	0	0	0	0	0
12	404,750	2006	System Upgrades from 77th Ave., W (Day Island Waterway)	0	0	0	0	0	0	0
13	404,750	2007	System Upgrades from 77th Ave., W (Day Island Waterway)	0	0	0	0	0	0	0
14	404,750	2008	System Upgrades from 77th Ave., W (Day Island Waterway)	0	0	0	0	0	0	0
15	231,000	2001	Brobeck Property regional detention (Leach Cr)	0	0	0	259,844	0	0	259,844
16	35,000	2000	Sunset Drive at 37th St. Ct. W Pipe Repl. (Curtis Pothole)	0	0	37,856	0	0	0	37,856
17	96,000	2005	40th St. W betw. Sunset & 80th W Pipe Repl. (Curtis Pothole) (3)	0	0	0	0	0	0	0
18	90,000	2007	Arbordale storm drain from 41st to Robin Dr. (Soundview)	0	0	0	0	0	0	0
19	133,000	2001	Curtis Pothole excavation	0	0	0	149,607	0	0	149,607
20	133,000	2005	Curtis Pothole excavation	0	0	0	0	0	0	0
21	182,000	2001	79th Ave W at 54th St. W Detention Tank (Chambers Creek)	0	0	0	204,725	0	0	204,725
22	116,000	2007	57th Ave W & 62nd St W Infiltration System (Leach Creek)	0	0	0	0	0	0	0
23	116,000	2008	64th St W Infiltration System (Leach Creek)	0	0	0	0	0	0	0
24	43,000	2000	Mt. View & 21st St. W collection improvements (N. Day Island)	0	0	46,509	0	0	0	46,509
25	259,000	2000	37th St. W & 70th Ave. W system replacement (Leach Creek)	0	0	280,134	0	0	0	280,134
26	182,000	2006	Stream channel & habitat restoration (Leach Creek)	0	0	0	0	0	0	0
27	125,000	2005	Stream buffer acquisition (Leach Creek)	0	0	0	0	0	0	0
28				0	0	0	0	0	0	0
29	732,600	1999	Drainage for Traffic Improvement Program (Various)	0	761,904	0	0	0	0	761,904
30	510,700	2000	Drainage for Traffic Improvement Program (Various)	0	0	552,373	0	0	0	552,373
31	133,400	2001	Drainage for Traffic Improvement Program (Various)	0	0	0	150,057	0	0	150,057
32	644,100	2002	Drainage for Traffic Improvement Program (Various)	0	0	0	0	753,506	0	753,506
33	616,200	2003	Drainage for Traffic Improvement Program (Various)	0	0	0	0	0	749,702	749,702
34	605,000	2004	Drainage for Traffic Improvement Program (Various)	0	0	0	0	0	0	0
35	560,000	2005	Drainage for Traffic Improvement Program (Various)	0	0	0	0	0	0	0
36	560,000	2006	Drainage for Traffic Improvement Program (Various)	0	0	0	0	0	0	0
37	560,000	2007	Drainage for Traffic Improvement Program (Various)	0	0	0	0	0	0	0
38	560,000	2008	Drainage for Traffic Improvement Program (Various)	0	0	0	0	0	0	0
39				0	0	0	0	0	0	0
40	46,000	1999	Neighborhood Capital Improvement Program (Various)	0	47,840	0	0	0	0	47,840
41	46,000	2000	Neighborhood Capital Improvement Program (Various)	0	0	49,754	0	0	0	49,754
42	46,000	2001	Neighborhood Capital Improvement Program (Various)	0	0	0	51,744	0	0	51,744
43	46,000	2002	Neighborhood Capital Improvement Program (Various)	0	0	0	0	53,813	0	53,813
44	46,000	2003	Neighborhood Capital Improvement Program (Various)	0	0	0	0	0	55,966	55,966
45	46,000	2004	Neighborhood Capital Improvement Program (Various)	0	0	0	0	0	0	0
46	46,000	2005	Neighborhood Capital Improvement Program (Various)	0	0	0	0	0	0	0
47	46,000	2006	Neighborhood Capital Improvement Program (Various)	0	0	0	0	0	0	0
48	46,000	2007	Neighborhood Capital Improvement Program (Various)	0	0	0	0	0	0	0
49	46,000	2008	Neighborhood Capital Improvement Program (Various)	0	0	0	0	0	0	0
50				0	0	0	0	0	0	0
	$10,847,250		Net Construction Cost	$871,250	$1,015,664	$1,272,719	$815,976	$807,319	$805,668	$5,588,596

NOTES:
(1) Brobeck property.
(2) Updated cost estimate.
(3) Additional to 1998 site purchase estimate.

City of University Place
Stormwater Management Plan
Debt Service Sizing
- Estimates Only -

Financing Assumptions:

Fund Earnings %	4.00%	Interim Financing:	
		BANs Used? (1=Y,0=N)	0
CIP Bond Financed or Pay-as-you-go?		BAN Interest Rate:	5.00%
(1=Debt, 0=No Debt)	0		
		Long-Term Financing:	
Issuance Cost:		Revenue Bonds:	
Short-Term	2.50%	Life of Debt (Years)	20
Long-Term:		Interest Rate	5.50%
Revenue Bonds	3.00%	Coverage Factor Required	1.25
State Revolving Fund	0.00%	Fund Reserve from Proceeds? (1=Y,0=N)	1
		State Revolving Fund	
		Life of Debt (Years)	10
		Interest Rate	3.50%

Fiscal Year	1998	1999	2000	2001	2002	2003
Type of Long Term Debt Issued (1=Y,0=N):						
Revenue Bonds	1	1	1	1	1	1
State Revolving Fund	0	0	0	0	0	0
Project Duration in years (if SRF used)	0	0	0	0	0	0

Capital Improvements Financing	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Capital Costs to be Funded	$871,250	$1,015,664	$1,272,719	$815,976	$807,319	$805,668
less: Grant Funding	0	0	0	0	0	0
less: Direct Rate Funding (pay-as-you-go)	0	0	205,186	604,868	0	0
less: Capital Fund Contribution	871,250	1,015,664	1,067,533	211,109	807,319	805,668
Amount to be Financed	$0	$0	$0	$0	$0	$0
Interim Borrowing:						
BANs Issued:	$0	$0	$0	$0	$0	$0
less: Borrowing Cost	0	0	0	0	0	0
less: Interest Payments	0	0	0	0	0	0
plus: Interest Earnings	0	0	0	0	0	0
Net Available from BANS	$0	$0	$0	$0	$0	$0
Long-term Borrowing:						
Revenue Bonds:						
Amount Borrowed	$0	$0	$0	$0	$0	$0
less: Financing Cost	0	0	0	0	0	0
less: Reserve Funding	0	0	0	0	0	0
less: Refunding of BANs	0	0	0	0	0	0
Net Funds from Revenue Bonds	$0	$0	$0	$0	$0	$0
State Revolving Fund:						
Amount Borrowed	$0	$0	$0	$0	$0	$0
less: Financing Cost	0	0	0	0	0	0
less: Refunding of BANs	0	0	0	0	0	0
Net Funds from SRF	$0	$0	$0	$0	$0	$0
New Annual Debt Service:						
Debt Service						
Revenue Bonds	$0	$0	$0	$0	$0	$0
State Revolving Fund Loan	$0	$0	$0	$0	$0	$0
Coverage	$0	$0	$0	$0	$0	$0
Reserve Funding	$0	$0	$0	$0	$0	$0

Capital Fund Activity						
Initial Balance	$0	$573,298	$465,406	$9,308	$186	$194
plus: Transfers from Operating Fund	1,433,307	77,661	0	0	0	0
plus: Direct Funding from Rates	0	809,744	602,127	201,801	807,319	805,668
less: Contribution to Project	871,250	1,015,664	1,067,533	211,109	807,319	805,668
plus: Fund Earnings	11,241	20,367	9,308	186	7	8
Ending Balance	$573,298	$465,406	$9,308	$186	$194	$201

City of University Place
Stormwater Management Plan
Statement of Revenues and Expenses
- Estimates Only -
Pay-as-you-go Capital Funding

Economic Assumptions:	
% Growth in ESU's per Year	1.50%
Annual O&M Cost Inflation	3.50%
State Excise Tax Rate (1)	0.000%

Revenue & Expense Category	1998	1999	2000	2001	2002	2003
Operating Revenue:						
Charges for Services	$510,843	$518,506	$526,283	$534,177	$542,190	$550,323
Planning Review Fees	0	0	0	0	0	0
Operating Fund Interest (Expense)	60,560	6,447	3,341	3,341	3,341	3,341
Total Operating Revenues:	571,403	524,953	529,624	537,518	545,531	553,664
Operating and Administrative Expenses:						
Administration	152,218	157,546	163,060	168,767	174,674	180,787
Engineering	50,000	51,750	53,561	55,436	57,376	59,384
Operations and Maintenance	248,700	257,405	266,414	275,738	285,389	295,378
Water Quality Monitoring	30,000	31,050	32,137	33,262	34,426	35,631
Basin Studies / Investigations	0	0	0	0	0	0
Regulatory Compliance	10,000	10,350	10,712	11,087	11,475	11,877
Public Involvement	0	0	0	0	0	0
State Excise Tax	0	0	0	0	0	0
Total Expenses:	490,918	508,100	525,884	544,290	563,340	583,057
Debt Service Interest	0	0	0	0	0	0
Capital Outlays (2)	0	0	0	0	0	0
Net Operating Income	$80,485	$16,853	$3,741	($6,771)	($17,809)	($29,393)
Operating Fund Activity						
Beginning Balance	$1,514,006	$161,184	$83,523	$83,523	$83,523	$83,523
plus: Additions to Fund to Meet MIN Balance	0	0	0	0	0	0
plus: Cash Surplus	80,485	0	0	0	0	0
less: Transfers to Capital Fund	1,433,307	77,661	0	0	0	0
Ending Balance	161,184	83,523	83,523	83,523	83,523	83,523
MIN Balance (30 days operating expenses)	*$40,349*	*$41,762*	*$43,223*	*$44,736*	*$46,302*	*$47,922*
MAX Balance (60 days operating expenses)	*$80,699*	*$83,523*	*$86,447*	*$89,472*	*$92,604*	*$95,845*

NOTE:

(1) Tom Southas, a Washington State DOR field officer, advised that the applicable tax rate is 1.75%. The City has determined that the tax does not apply, based on the practices of other cities, and directed FCS Group to omit it.

City of University Place
Stormwater Management Plan
Projection of Revenue Requirements & Monthly Rates
Pay-as-you-go Capital Funding

	1998	1999	2000	2001	2002	2003
Projection of Cash Flow:						
Rate Revenues	$510,843	$518,506	$526,283	$534,177	$542,190	$550,323
SRF Loan Proceeds	0	0	0	0	0	0
Operating Fund Interest	60,560	6,447	3,341	3,341	3,341	3,341
Interest on Bond Reserve	0	0	0	0	0	0
less: Operating Expenses	490,918	508,100	525,884	544,290	563,340	583,057
less: Addition to Operating Reserve	0	0	0	0	0	0
less: Total Debt Service	0	0	0	0	0	0
less: Rate-funded Capital Outlays	0	0	0	0	0	0
less: Pay-as-you-go CIP Funding	0	0	205,186	604,868	0	0
less: Rate-funded CIP Contributions (1)	0	809,744	602,127	201,801	807,319	805,668
less: Bond Reserve Funding	0	0	0	0	0	0
Net Cash	$80,485	($792,891)	($803,572)	($813,439)	($825,128)	($835,060)
Net Deficiency (Surplus)	($80,485)	$792,891	$803,572	$813,439	$825,128	$835,060
Test of Coverage Requirement:						
Operating Expenses	$490,918	$508,100	$525,884	$544,290	$563,340	$583,057
Debt Service - Revenue Bonds	0	0	0	0	0	0
Additional Coverage at 1.25	0	0	0	0	0	0
Total Revenue Req. with Coverage	$490,918	$508,100	$525,884	$544,290	$563,340	$583,057
Total Applicable Revenues	$571,403	$524,953	$529,624	$537,518	$545,531	$553,664
Net Funds less Coverage	$80,485	$16,853	$3,741	($6,771)	($17,809)	($29,393)
Coverage Realized:	0.00	0.00	0.00	0.00	0.00	0.00
Revenue Deficiency (Surplus):	($80,485)	($16,853)	($3,741)	$6,771	$17,809	$29,393
Projection of Revenue Sufficiency:						
Net Deficiency	$0	$792,891	$803,572	$813,439	$825,128	$835,060
Additional State Taxes	$0	$0	$0	$0	$0	$0
Total Deficiency	0	792,891	803,572	813,439	825,128	835,060
Cash Surplus	$80,485	$0	$0	$0	$0	$0
Cumulative Required Increase	0.00%	152.92%	152.69%	152.28%	152.18%	151.74%
Annual Percent Increase Required	0.00%	152.92%	0.00%	0.00%	0.00%	0.00%
Estimated Rate with Required Increase	$44.00	$110.00	$110.00	$110.00	$110.00	$110.00

NOTE

	1999	2000	2001	2002	2003
(1) Additional Rate Funding for Capital to Levelize Rates	0	0	0	0	0

City of University Place
Stormwater Management Plan
Calculation of ESUs
- Estimates Only -

Calculation of ESU's:

Square Feet per ESU: 2,640

Assumed ESUs lost to credits (as %): 5%

Basin #42

Land Use Category	Impervious Square Feet	Calculated ESUs	Number of Units	Applicable Basis	Adjustment Factor	ESUs
Single Family Residential	5,052,708	1,914	2,577	2,577	1	2,577
Duplex	293,929	111	113	113	0.645	73
Duplex/Condo	265,342	101	158	158	0.645	102
Multi-Family	1,913,622	725	N/A	725	1	725
Mobile Home Parks	112,689	43	51	43	0.55	71
Office/Condo Conversions	16,682	6	N/A	6	1	6
Other Parcels	1,823,015	691	N/A	691	1	691
Total	9,477,987	3,590	2,899			4,244

Basin #48

Land Use Category	Impervious Square Feet	Calculated ESUs	Number of Units	Applicable Basis	Adjustment Factor	ESUs
Single Family Residential	7,565,195	2,866	3,999	3,999	1	3,999
Duplex	605,718	229	235	235	0.645	152
Duplex/Condo	63,632	24	42	42	0.645	27
Multi-Family	3,227,521	1,223	N/A	1,223	1	1,223
Mobile Home Parks	0	0	0	0	0.55	0
Office/Condo Conversions	0	0	N/A	0	1	0
Other Parcels	7,114,155	2,695	N/A	2,695	1	2,695
Total	18,576,221	7,036	4,276			8,095

Total

Land Use Category	Impervious Square Feet	Calculated ESUs	Number of Units	Applicable Basis	Adjustment Factor	Total ESUs
Single Family Residential	12,617,903	4,780	6,576	6,576		6,576
Duplex	899,647	341	348	348		224
Duplex/Condo	328,974	125	200	200		129
Multi-Family	5,141,143	1,947	0	1,947		1,947
Mobile Home Parks	112,689	43	51	43		71
Office/Condo Conversions	16,682	6	0	6		6
Other Parcels	8,937,170	3,385	0	3,385		3,385
Total	28,054,207	10,627	7,175			12,339

	1998	1999	2000	2001	2002	2003
Total ESUs	12,339	12,524	12,712	12,903	13,096	13,293
Credits	617	626	636	645	655	665
Net ESUs	11,722	11,898	12,076	12,258	12,441	12,628

City of University Place
Stormwater Management Plan
Proposed Rates

- Existing Rate Structure -

Land Use Category	Annual 1999 Charge	Basis
Single Family Residential	**$110.00**	*per dwelling unit*
Duplex	**$141.90**	*per duplex*
Duplex / Condo	**$141.90**	*per duplex / condo*
Multi-Family	**$0.0417**	*per sq ft impervious*
Mobile Home Parks	**$60.71**	*per occupied site, plus*
	$0.0417	*per sq ft impervious*
Office/Condo Conversions	**$0.0417**	*per sq ft impervious*
Other Parcels	**$0.0417**	*per sq ft impervious*
State & County Public Highways	**$0.0125**	*per sq ft impervious*

City of University Place
Stormwater Management Plan
Example Capital Facilities Charges

CFC Calculation	Value	Notes
Total Cost of Future Facilities	$10,847,250	to serve 10 years of growth
Total Customer Base in 10 years	14,320	ESUs
Example Capital Facilties Charge	$757	per ESU

APPENDIX B

Maintenance Guidelines

WATER QUALITY PONDS MAINTENANCE SCHEDULE:

Inspection Activity	Frequency Interval (months)	Condition Triggering Maintenance	Maintenance Activity	Date Performed
Inspect pond site for trash and debris.	1	Presence of trash or debris.	Clear site of trash and debris.	
Inspect pond for pollution.	1	Oil, gasoline, or other contaminants of 1 gallon or more or any amount that could: 1) cause damage to plant, animal, or marine life: 2) constitute a fire hazard; or 3) be flushed downstream during rainstorms.	Removal of pollutants by personnel trained in removal of hazardous contaminates.	
Inspect pond site for poisonous or excessive vegetation.	6	Presence of poisonous vegetation hazardous to maintenance personnel or public. Presence of other vegetation that interferes with access or maintenance, or that blocks inlet and/or outlet pipes or interferes with proper functioning of spillway.	Remove poisonous and excessive vegetation.	
Inspect pond berm for evidence of rodent holes.	6	Any evidence of rodent holes or of water piping through the berm via rodent holes.	Destroy rodents and repair berm.	
Inspect sediment depth in bottom of pond.	6	Sediment level reaches invert of drain line as evidenced by lack of flow from pond, or evidence of silt in discharge when drain line gate valve is exercised.	Remove sediment to re-establish pond design depth (expected frequency of 5 years). Sediment removal in the ponds will be accomplished using commercially available suction dredge services, which will access the ponds from the outlet structure locations.	
Inspect side slopes of pond for erosion.	12	Erosion damage exceeds 2 inches in depth, and cause of damage is still present or there is potential for continued erosion.	Stabilize slope using appropriate methods (e.g. rock armoring, planting of grass, soil compaction).	
Inspect pond berm for settlement.	12	Any part of the dike has settled 4 inches lower than the design grade elevation.	Contact geotechnical engineer to identify causes and to make recommendations. Regrade dike to design elevation.	

Inspection Activity	Frequency Interval (months)	Condition Triggering Maintenance	Maintenance Activity	Date Performed
Inspect emergency overflow/spillway for settlement or missing or rock.	12	Erosion protection rock is missing, or evidence of erosion of soils at spillway.	Replace rock and/or soil to original design.	
Inspect debris barriers for missing bars.	24	Bars are bent out of shape more than 3 inches. Bars are missing or entire barrier is missing. Bars are loose and rust is causing 50% deterioration to any part of barrier.	Repair or replace bars to design standards.	

CONTROL STRUCTURE/FLOW RESTRICTOR (VAULT) MAINTENANCE SCHEDULE:

Inspection Activity	Frequency Interval (months)	Condition Triggering Maintenance	Maintenance Activity	Date Performed
Inspect control structure for trash and debris.	6	Trash or debris present.	Remove all trash or debris from structure.	
Inspect connection to outlet/inlet pipes for watertightness.	6	Connections are no longer watertight (leaks are observed around pipe at structure wall).	Repair connections to design standards.	
Inspect control structure for settlement/ misalignment.	6	Structure has settled more than 1 inch or evidence of rotation of structure.	Repair structure to design standards. Contact geotechnical engineer to identify causes and to make recommendations.	
Inspect manhole cover/access hatch.	6	Cover is missing or only partially in place. Locking mechanism is not working.	Repair or replace manhole cover/access hatch per design standards.	
Inspect control structure for sediment accumulation.	12	Sediment accumulated to within 6 inches of the invert elevation of lowest entering pipe.	Remove all sediment in structure.	
Inspect control structure for structural damage.	12	Cracks in structure walls, bottom, top slab or weirs.	Repair structure to design standards.	
Inspect riser pipe.	12	Riser pipe is more than 10 degrees from plumb. Riser pipe is not firmly attached to the vault wall.	Repair or replace riser pipe to design standards.	
Inspect cleanout gate.	12	Cleanout gate is not watertight, gate cannot be moved up and down by one maintenance person, or gate is missing.	Repaired or replace gate to design standards.	
Inspect orifice plate.	12	Orifice plate is not working properly because it is blocked, missing, out of place, or deformed.	Repair or replace orifice plate per design standards.	
Inspect Ladder.	12	Ladder is unsafe due to missing rungs, misalignment, rust, cracks, or sharp edges.	Repair or replace ladder per design standards.	

CATCH BASINS/STORM MANHOLES MAINTENANCE SCHEDULE:

Inspection Activity	Frequency Interval (months)	Condition Triggering Maintenance	Maintenance Activity	Date Performed
Inspect catch basin grates for excessive vegetation.	1	Vegetation growing across and blocking more than 10% of the basin opening.	Remove vegetation.	
Inspect catch basin grates.	6	Trash and debris are blocking more than 20% of the grate opening. Grates are broken or missing.	Remove trash and debris. Repair or replace grates to design standards.	
Inspect catch basins/manholes for pollution.	6	Oil, gasoline, or other contaminants of one gallon or more or any amount that could 1) cause damage to plant, animal, or marine life: 2) constitute a fire hazard; or 3) be flushed downstream during rainstorms.	Removal of pollutants by personnel trained in removal of hazardous contaminates.	
Inspect catch basins for trash and debris, including sediment.	6	If trash or debris of more than 1/2 cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of basin by more than 10%. Trash or debris in the basin that exceeds 1/3 the depth from the bottom of basin to invert of the lowest pipe into or out of the basin. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Deposits of garbage exceeding 1 cubic foot in volume.	Clean catch basin/manhole of all trash, debris and sediment.	
Inspect catch basins for structural damage.	12	Cracks in basin walls/bottom or top slab.	Repair or replace catch basin/manhole to design standards.	
Inspect connection to outlet/inlet pipes for watertightness.	12	Evidence that connections are no longer watertight (leaks are observed around pipe at structure wall).	Repair connections to design standards.	

OUTFALLS/ENERGY DISSIPATORS MAINTENANCE SCHEDULE:

Inspection Activity	Frequency Interval (months)	Condition Triggering Maintenance	Maintenance Activity	Date Performed
Inspect rock pad for missing or moved rock.	6	If only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Repair rock pad to design standards.	
Inspect outfall pipe.	6	Sections of pipe are loose or fallen away; pipe is undercut by scour.	Stabilize ground around pipe and extend pipe to energy dissipator.	

CONVEYANCE SYSTEMS (PIPES AND SWALES – EXPOSED STRUCTURES) MAINTENANCE SCHEDULE:

Inspection Activity	Frequency Interval (months)	Condition Triggering Maintenance	Maintenance Activity	Date Performed
Inspect pipe for excess vegetation.	6	Vegetation reduces free movement of water through pipes.	Remove vegetation from pipes.	
Inspect open ditches/swales for sediment and debris.	6	Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch/swale. Sediment exceeds 20% of the design depth.	Remove trash, debris and sediment from ditch/swale.	
Inspect ditches/swales for excess vegetation.	6	Vegetation reduces free movement of water through ditches/swales.	Mow or remove vegetation.	
Check ditches/swales for erosion.	12	If eroded damage exceeds 6 inches in depth where cause of damage is still present or where there is potential for continued erosion.	Stabilize ditches/swales using appropriate methods (e.g. rock armoring, planting of grass, soil compaction).	
Inspect culverts for presence of sediment or debris.	12	Accumulated sediment that exceeds 20% of the diameter of the pipe.	Remove sediment from pipes.	
Inspect debris barriers for trash and debris.	12	If trash or debris is plugging more than 20% of the openings in the barrier.	Remove trash or debris.	
Inspect debris barriers for missing bars.	12	Bars are bent out of shape more than 3 inches. Bars are missing or entire barrier is missing. Bars are loose and rust is causing 50% deterioration to any part of barrier.	Repair or replace bars to design standards.	
Inspect storm drains for damage (video inspection).	120	Offset joints; significant deterioration; deformation that reduces pipe cross-sectional area by more than 20%.	Repair or replace pipe.	

CONVEYANCE SYSTEMS (PIPES– BURIED STRUCTURES) MAINTENANCE SCHEDULE:

Inspection Activity	Frequency Interval (months)	Condition Triggering Maintenance	Maintenance Activity	Date Performed
Inspect pipes for presence of sediment or debris.	24	Accumulated sediment that exceeds 20% of the diameter of the pipe.	Remove sediment from pipes.	
Inspect for pipe damage (video inspection).	120	Offset joints; significant deterioration; deformation that reduces pipe cross-sectional area by more than 20%.	Repair or replace pipe.	

BIOFILTRATION SWALE (BIOSWALE) MAINTENANCE SCHEDULE:

Inspection Activity	Frequency Interval (months)	Condition Triggering Maintenance	Maintenance Activity	Date Performed
Inspect biofiltration swale for excess vegetation.	1	Vegetation reduces free movement of water through ditches/swales.	Mow to no less than 4 inches in height. (Higher than 4 inches is okay.)	
Inspect biofiltration swales for sediment.	6	Sediment depth exceeds 2-inches.	Remove sediment from biofiltration swale.	
Check biofiltration swale for erosion.	6	Where the biofiltration swale has eroded or scoured the bottom due to flow channelization, or higher flows.	Biofiltration swale should be re-graded and re-seeded to specification, to eliminate channeled flow. Overseed when bare spots are evident.	
Inspect inlet/outlet pipe for plugging.	6	Inlet/outlet pipe clogged with sediment and/or debris.	Clean inlet/outlet pipe.	
Inspect biofiltration swales for trash/debris.	6	Trash and debris accumulated in the biofiltration swale.	Remove trash and debris from biofiltration swale.	

DEBRIS BARRIERS (e.g. TRASH RACKS) MAINTENANCE SCHEDULE:

Inspection Activity	Frequency Interval (months)	Condition Triggering Maintenance	Maintenance Activity	Date Performed
Inspect debris barriers for trash and debris.	6	If trash or debris is plugging more than 20% of the openings in the barrier.	Remove trash or debris.	
Inspect debris barriers for missing bars.	6	Bars are bent out of shape more than 3 inches. Bars are missing or entire barrier is missing. Bars are loose and rust is causing 50% deterioration to any part of barrier.	Repair or replace bars to design standards.	