Alternative Name:	Septic Replacement
Description:	Replacement of old and malfunctioning On-site Sewage Facilities (OSSFs) with new units that meet current standards.
Pollutant Addressed:	Bacteria
Conceptual Design Assumptions:	
Soil Suitability	SSURGO Soil Survey for Hood County. Depth to Bed Rock, Minimum Depth to Restrictive Layer
Applicable Treatment Methods	30 TAC §285.91 Table 13 Pretreatment Method: Septic or Aerobic Treatment Disposal Method: Drainfield, Drip Emmitters, Spray Distribution, or Leaching Chambers
Required Area for Disposal	30 TAC §285 Design Discharge 240 gpd/system Soil Absorption 0.2 to 0.38 gpd/sq-ft (sandy clay to sand) Application Rate Irrigation 0.064 Absorptive Rate 0.2 gpd/sq-ft for Drip Emitters and Leaching Chambers *1200 ft^2 for Conventional Drainfield (not in clays), drip emitters, and leaching chambers (not in clays, some reduction allowed for water saving devices)* *3750 ft^2 for Spray Application*
Capital Cost Assumptions:	*Source: Austin Water Utility*
Construction Cost	Cost to install pretreatment tanks and related necessary components. Cost to install disposal field and all necessary components.
Land Costs	Appraisal Value of average lot if more area needed and available for disposal fields. Did not apply in all cases.
Design & Administrative	Estimated - engineering judgement. Assumed $2,500 per system, regardless of type.
Contingency	none included
O&M Cost Assumptions:	*Source: Austin Water Utility* Periodic pumping of tanks, both aerobic and septic Maintenance contracts required for spray application and holding tanks Electrical use for spray application and drip emitters Additional equipment and repairs for spray application and drip emitters
Equivalent Annual Cost Analysis:	
Lifespan Assumption:	25 years
Interest Rate Assumption:	10% Weighted cost of capital, assuming return to inflationary trend within 5 years
Equivalent Annual Cost Index:	Ratio of Equivalent Annual Cost for this alternative compared to the maximum Equivalent Annual Cost of all alternatives considered for the specific subdivision.
Percent Pollutant Reduction:	
Watershed Model	75% of septic potential removed Resultant %reduction of bacteria for watershed considering all sources

Alternative Name:	OSSF (Septic) Replacement							
Alternative ID:	Rolling Hills Shores - Downhill Along Cove	Rolling Hills Shores - Uphill	Oak Trail Shores Section 1	Oak Trail Shores Section 2	Oak Trail Shores Section 3	Long Creek	Sky Harbor	Port Ridglea East
Conceptual Design Assumptions:								
Average Lot Size	< 6,000 ft^2	0.75 acres	14,000 ft^2	10,000 ft^2	10,000 ft^2	26,000 ft^2	15,250 ft^2	10,900 ft^2
Soil Suitability	Null, In floodplain	Some areas have adequate depth to bedrock and restrictive layer for conventional septic tank/drainfield systems.	Significant areas have adequate depth to bedrock and restrictive layer for conventional septic tank/drainfield systems.	Depth to bedrock and restrictive layer as well as proximity to canals makes poor suitability for conventional systems.	Significant areas have adequate depth to bedrock and restrictive layer for conventional septic tank/drainfield systems in northwest portion, remaining soils not suitable for conventional system.	Depth to bedrock and restrictive layer as well as proximity to canals makes poor suitability for conventional systems.	Significant land could be suitable for conventional drainfields	"Null" for both depth to bedrock and depth to restrictive layer Septic tank absorption field suitability "Very Limited"
Applicable Treatment Methods	Holding tanks	Assume 1/2 can utilize conventional systems, remaining half spray distribution with pretreatment.	Conventional Septic Tank and Drainfield	septic tanks with Spray Distribution aerobic tanks with Drip Emitters	conventional septic/drainfield in NW septic tanks with Spray Distribution aerobic tanks with Drip Emitters septic tanks with leaching chambers	septic or aerobic tanks with Spray Distribution aerobic tanks with drip emitters	Assume 1/4 can utilize conventional systems, half spray distribution (septic or aerobic tanks), 1/8 drip emitters (aerobic tanks), 1/8 leaching chambers (septic).	Replace conventional systems with aerobic tanks with drip emitters
Required Area for Disposal	N/A - Waste must be pumped and trucked off-site	Conventional Drainfield 1200 ft^2 Spray Distribution 4404 ft^2	Conventional Drainfield 1200 ft^2	Spray Distribution 4404 ft^2 Drip Emitters 1200 ft^2	Conventional Drainfield 1200 ft^2 Spray Distribution 4404 ft^2 Drip Emitters 1200 ft^2 Leaching Chambers 1200 ft^2	Spray Distribution 4404 ft^2 Drip Emitters 1200 ft^2	Conventional Drainfield 1200 ft^2 Spray Distribution 4404 ft^2 Drip Emitters 1200 ft^2 Leaching Chambers 1200 ft^2	Drip Emitters 1200 ft^2
Capital Costs:		average (assuming 1/2 spray, 1/2 drainfield)		average (assuming 1/2 spray, 1/2 drip emitter)	average (assuming 1/2 spray, 1/4 conventional, 1/8 drip emitters, 1/8 leaching chambers)	average (assuming 1/2 spray, 1/2 drip emitter)	average (assuming 1/2 spray, 1/4 septic/drainfield, 1/8 drip emitter, 1/8 leaching chamber)	assuming all drip emitters with aerobic pretreatment
Construction Cost	holding tank	septic; aerobic tanks drainfield spray application;	septic tank drainfield	septic; aerobic tanks spray application; drip emitter field	septic; aerobic tanks drainfield; spray application; drip emitter field; leaching chamber field	septic; aerobic tanks spray application; drip emitter field	septic; aerobic tanks drainfield; spray application; drip emitter field; leaching chamber field	aerobic tanks drip emitter field
Land Costs	None Some permitting fees may apply. Not included here.	None	None	None	None	None	None	None
Annual O&M Costs:	Pumping and trucking (annual)	average (assuming 1/2 spray, 1/2 drip emitters) Periodic pumping of tanks, both aerobic and septic Maintenance contracts required for spray application Electrical use for spray application Additional equipment and repairs for spray application	Periodic pumping of septic tanks	average (assuming 1/2 spray, 1/2 drip emitter) Periodic pumping of aerobic and septic tanks Maintenance contracts required for spray application and drip emitters Electrical use for spray application and drip emitters Additional equipment and repairs for spray application and drip emitters	average (assuming 1/2 spray, 1/4 conventional, 1/8 drip emitters, 1/8 leaching chambers) Periodic pumping of aerobic and septic tanks Maintenance contracts required for spray application and drip emitters Electrical use for spray application and drip emitters Additional equipment and repairs for spray application and drip emitters	average (assuming 1/2 spray, 1/2 drip emitter) Periodic pumping of aerobic and septic tanks Maintenance contracts required for spray application and drip emitters Electrical use for spray application and drip emitters Additional equipment and repairs for spray application and drip emitters	average (assuming 1/2 spray, 1/4 septic/drainfield, 1/8 drip emitter, 1/8 leaching chamber) Periodic pumping of aerobic and septic tanks Maintenance contracts required for spray application and drip emitters Electrical use for spray application and drip emitters Additional equipment and repairs for spray application and drip emitters	assuming all drip emitters with aerobic pretreatment Periodic pumping of aerobic tank Maintenance contracts required for drip emitters Electrical use for drip emitters Additional equipment and repairs for drip emitters
Equivalent Annual Cost Analysis:								
Equivalent Annual Cost Index:	0.32	0.22	0.17	0.33	0.23	0.36	0.26	0.45
Percent Pollutant Reduction:	46%	Not modeled separately.	41% Sections not modeled separately.			Negligible watershed reduction. 75% Removal from subdivision	9%	75%

Alternative Name:	Low Pressure Wastewater Collection System
Description:	Removal of OSSFs, replacement with low pressure collection system
Pollutant Addressed:	Bacteria
Conceptual Design Assumptions:	LP collection system per vendor design guidelines; TCEQ Chap. 217; SDR-21 pressure class PVC
	200 gal/connection/day
	30 Amp/240V dedicated circuit available at each site
	Assumed TDH (Total Dynamic Head) <185'; design goal is operating pressure below 60 psi.
	Average flowrate at each pump set at 11 gpm.
	Lines to be installed in existing ROW; infrequent conflicts with other utilities, driveways, mailboxes, etc.
	Relief valve assemblies not included (no analysis done to determine need)
	Easements required from service tap to grinder pump would be granted at no cost
	Capacities and costs assume service to each platted lot, whether occupied or not.
	Lift station capacity determined by peak flows (TCEQ CH 217, Subchap B).
Capital Cost Assumptions:	
Construction Cost	LP system includes: grinder pump/tank (station); control panel; lateral assembly; saddle tap to main; bedding material; force main; asphalt repair
	3-phase power is assumed to be available at lift station and plant sites
Design & Administrative	Engineering, Surveying, Permitting, Construction Administration, Contract Administration Total 20% (added to construction cost)
Contingency	Given multiple uncertainties at this stage, 20% assumed and added to construction cost.
O&M Cost Assumptions:	
	Maintenance will be performed under contract, monthly fee assessed
	Pump equipment replacement at year 10, partial equipment (other than pump) replacement at year 21
	Power cost calculated at $0.11/kWh and +/- 9 kWh/month
Equivalent Annual Cost Analysis:	
Lifespan Assumption:	25 years
	10%
Interest Rate Assumption:	Weighted cost of capital assuming inflationary trend
Equivalent Annual Cost Index:	Ratio of Equivalent Annual Cost for this alternative compared to the maximum Equivalent Annual Cost of all alternatives considered for the specific subdivision.

Alternative Name:	Mixed Collection System: Gravity and Low Pressure
Description:	Removal of OSSFs, replacement with mixed low pressure and gravity collection system
Pollutant addressed:	Bacteria
Conceptual Design Assumptions:	LP collection system per vendor design guidelines; TCEQ Chap. 217; SDR-21 pressure class PVC
	200 gal/connection/day
	30 Amp/240V dedicated circuit available at each site
	Assumed TDH <185'; design goal is operating pressure below 60 psi.
	Average flowrate at each pump set at 11 gpm.
	Lines to be installed in existing ROW; infrequent conflicts with other utilities, driveways, mailboxes, etc.
	Relief valve assemblies not included (no analysis done to determine need)
	Easements required from service tap to grinder pump would be granted at no cost
	Capacities and costs assume service to occupied lots only.
	Lift station capacity determined by peak flows (TCEQ CH 217, Subch B).
Capital Cost Assumptions:	
Construction Cost	LP system includes: grinder pump/tank (station); control panel; lateral assembly; saddle tap to main; bedding material; force main; asphalt repair
	8" PVC Gravity main assumed; slope assumed consistent with surface grade; concrete 4' dia manholes assumed at change in direction and every 400'
	3-phase power is assumed to be available at lift station and plant sites
Design & Administrative	Engineering, Surveying, Permitting, Construction Administration, Contract Administration Total 20% (added to construction cost)
Contingency	Given multiple uncertainties at this stage, 20% assumed and added to construction cost.
O&M Cost Assumptions:	Maintenance will be performed under contract/monthly fee assessed
	Pump equipment replacement at year 10, partial equipment (other than pump) replacement at year 21
	Power cost calculated at $0.11/kWh and +/- 9 kWh/month
Equivalent Annual Cost Analysis:	
Lifespan Assumption:	25 years
Interest Rate Assumption:	10%
	Weighted cost of capital assuming inflationary trend
Equivalent Annual Cost Index:	Ratio of Equivalent Annual Cost for this alternative compared to the maximum Equivalent Annual Cost of all alternatives considered for the specific subdivision.

Alternative Name:

Local Wastewater Treatment (Package Plant/MiniWastewater)

Description:

Removal of OSSFs, replacement with a collection system to a package treatment plant

Pollutant Addressed: Bacteria

Conceptual Design Assumptions:

Serves an individual subdivision or an aggregation of subdivisions

Collection by low pressure or mixed system

Treats up to 0.5 MGD

200 gal/connection/day

Plant capacity determined by permitted flows (TCEQ CH 217, Subchapter B).

Steel construction

Plant location not tied to specific property, but "prototypical, neutral property" based on total dynamic head pumping limits

Assumed treatment limits: CBOD-10, TSS-15, NH3-2, DO-4, P-2

Treated wastewater discharged into lake, or immediate tributary to lake after disinfection

Capital Cost Assumptions:

Construction Cost

3-phase power is assumed to be available at lift station and plant sites

Wastewater Treatment Plant is assumed to be steel package plant with limits as described above. Price includes sitework/yardwork/electrical and foundation.

Land Costs

Purchase of land for plant site assumed at 3 times taxroll appraised value due to limitations on pumping (total dynamic head) that will restrict site selection (ie. lack of substitutability).

Design & Administrative

Engineering, Surveying, Permitting, Construction Administration, Contract Administration Total 20% (added to construction cost)

Contingency

Given multiple uncertainties at this stage, 20% assumed and added to construction cost.

O&M Cost Assumptions:

Includes labor, chemicals/materials, equipment replacement

Power cost calculated at $0.11/kWh and +/- 9 kWh/month

Maintenance will be performed under contract/monthly fee assessed

Equivalent Annual Cost Analysis:

Lifespan Assumption: 25 years

Interest Rate Assumption: 10%

Weighted cost of capital assuming inflationary trend

Equivalent Annual Cost Index:

Ratio of Equivalent Annual Cost for this alternative compared to the maximum Equivalent Annual Cost of all alternatives considered for the specific subdivision.

Alternative ID:	RHS-LP-Local	RHS FP-LP-Local
Alternative Name:	Rolling Hills Shores, Low Pressure System, Local Treatment	Rolling Hills Shores Floodplain, Low Pressure System, Local Treatment
Service Area	Rolling Hills Shores and Hidden Valley Estates	Residences in floodplain in Rolling Hills Shores
Collection		
Number of Connections	299 (103 residences and 196 non-floodplain lots)	103
Lift Station	Not considered to be required for chosen treatment site.	Not considered to be required for chosen treatment site.
Wastewater Treatment		
Treatment Facility	Package Plant	Package Plant
Treatment Flows	0.09 MGD	0.03 MGD
Equivalent Annual Cost Index:	0.300	0.310
Pollutant Percent Reduction:	62%	62%

Alternative ID:	OTS-LP-Local	LC-LP-Local
Alternative Name:	Oak Trail Shores, Low Pressure System, Local Treatment	Long Creek, Low Pressure System, Local Treatment
Service Area	Oak Trail Shores	Long Creek
Collection		
Number of Connections	2045	95
Lift Station	Assumed flow from 875 connections to be lifted: 1.05 MGD, 3,300 ft force main	Not considered to be required for chosen treatment site.
Wastewater Treatment		
Treatment Facility	Package Plant	Package Plant
Treatment Flows	0.614 MGD	0.03 MGD
Equivalent Annual Cost Index:	0.32	0.28
Pollutant Percent Reduction:	54%	100%

Alternative ID:	SH-LP-Local	IH-LP-Local
Alternative Name:	Sky Harbor, Low Pressure, Local Treatment	Indian Harbor, Low Pressure, Local Treatment
Service Area	Sky Harbor	Indian Harbor
Collection		
Number of Connections	754	1909
Lift Station	Assumed flow from 215 connections lifted: 0.258 MGD, 5,250 ft force main	Assumed flow from 790 connections lifted: 0.948 MGD, 6,000 ft force main
Wastewater Treatment		
Treatment Facility	Package Plant	Package Plant
Treatment Flows	0.226 MGD	0.573 MGD
Equivalent Annual Cost Index:	0.27	0.25
Pollutant Percent Reduction:	13%	100%

Alternative ID:	NB II-LP-Local	PRE-LP-Local
Alternative Name:	Nassau Bay II, Low Pressure, Local Treatment	Port Ridglea East-Low Pressure-Local Treatment
Service Area	Nassau Bay II	Port Ridglea East
Collection		
Number of Connections	123	248
Lift Station	Not considered to be required for chosen treatment site.	Not considered to be required for chosen treatment site.
Wastewater Treatment		
Treatment Facility	Package Plant	Package Plant
Treatment Flows	0.037 MGD	0.074 MGD
Equivalent Annual Cost Index:	0.28	0.28
Pollutant Percent Reduction:	98%	100%

Alternative ID:	RHS-Mixed-Local	OTS-Mixed-Local	SH-Mixed-Local
Alternative Name:	Rolling Hills Shores, Mixed Collection, Local Treatment	Oak Trail Shores, Mixed Collection, Local Treatment	Sky Harbor, Mixed Collection, Local Treatment
Service Area	Rolling Hills Shores and Hidden Valley Estates	Oak Trail Shores	Sky Harbor
Collection			
Number of Connections	299 (103 residences and 196 non-floodplain lots)	2045	754
Low Pressure Connections	288	875	242
Gravity Connections	11	1170	512
Lift Station	Not considered to be required for chosen treatment site.	Lift flow from 1465 connections: 1.76 MGD, 3,300 ft force main	Lift flow from 215 connections: 0.258 MGD, 1,800 ft force main
Force Main			
Wastewater Treatment			
Treatment Facility	Package Plant	Package Plant	Package Plant
Treatment Flows	0.09 MGD	0.614 MGD	0.226 MGD
Equivalent Annual Cost Index:	0.32	0.16	0.18
Pollutant Percent Reduction:	62%	54%	13%

Alternative ID:	IH-Mixed-Local	NB II-Mixed-Local
Alternative Name:	Indian Harbor, Mixed Collection, Local Treatment	Nassau Bay II, Mixed Collection, Local Treatment
Service Area	Indian Harbor	Nassau Bay II
Collection		
Number of Connections	1909	123
Low Pressure Connections	1119	65
Gravity Connections	790	58
Lift Station	Lift flow from 989 connections: 1.187 MGD, 6,000 ft force main	Lift flow from 123 connections: 0.148 MGD, 4,150 ft force main.
Force Main		
Wastewater Treatment		
Treatment Facility	Package Plant	Package Plant
Treatment Flows	0.573 MGD	0.037 MGD
Equivalent Annual Cost Index:	0.24	0.34
Pollutant Percent Reduction:	100%	98%

Alternative Name: Regional Wastewater Treatment

Description: Removal of OSSFs with a collection system to a regional wastewater treatment plant; Service for subdivisions along Lake Granbury not provided by centralized wastewater treatment

Pollutant Addressed: Bacteria

Conceptual Design Assumptions:

Serves residents along Lake Granbury without centralized wastewater treatment

Subdivisions/local entities provide wastewater collection and tie into extended trunklines to reach City of Granbury's proposed 10 MGD plant north of Granbury or Acton MUD's existing plant on east side of lake.

Collection by low pressure or mixed system

200 gal/connection/day used to determine treatment flows

Lift station location not set to specific property, but governed by total dynamic head (TDH) limits

Package plants constructed for interim treatment may be converted to lift stations to tie into regional plants

Assumed treatment limits: CBOD-10, TSS-15, NH3-2, DO-4, P-2

Treated wastewater discharged into lake, or immediate tributary to lake after disinfection

Capital Cost Assumptions:

Construction Cost Collection system not included; determined separately.

3-phase power is assumed to be available at lift station and plant sites

Wastewater treatment plant cost assumes concrete facilities, sitework, yardwork, electrical and foundation.

Land Costs Purchase of land for plant site assumed at 3 times taxroll appraised value due to limitations on TDH that will restrict site selection (ie. lack of substitutability).

Design & Administrative Engineering, Surveying, Permitting, Construction Administration, Contract Administration Total 20% (added to construction cost)

Contingency Given multiple uncertainties at this stage, 20% assumed and added to construction cost.

O&M Cost Assumptions:

Includes labor, chemicals/materials, equipment replacement

Maintenance will be performed under contract/monthly fee assessed

Power cost calculated at $0.11/kWh and +/- 9 kWh/month

Equivalent Annual Cost Analysis:

Lifespan Assumption: 50 years

Interest Rate Assumption: 10%
Weighted cost of capital assuming inflationary trend

Equivalent Annual Cost Index: Ratio of Equivalent Annual Cost for this alternative compared to the maximum Equivalent Annual Cost of all alternatives considered for the specific subdivision.

Alternative Name:	Cove Dynamics: Dredge and Fill
Description:	Improve water movement through coves to encourage "flushing" of pollutants
Pollutant Addressed:	Bacteria
Conceptual Design Assumptions:	
Dredge	Dredging or deepening a channel increases the volume of water in the canal allowing more dilution and provides a path for improved conveyance to the main lake body. Dredge method assumed as excavation from a small barge. Dredged material hauled off-site, up to 10 miles.
Partial Fill	The cove/canal is partial filled. Areas of water in sections of the canal/cove are replaced with earthen material, reducing the path of runoff to exit. This requires acquiring and hauling suitable PI material for backfill and compaction. Backfill elevation is assumed as one foot greater than the average water depth. Backfill would be level with ground. Backfill is graded to drain.
Partial Fill with Dredge	The cove/canal is partially filled. The channel is dredged in the remaining open sections.
Partial Fill with Dredge and additional outlet (s)	The cove/canal is partially filled, an additional outlet to cove/canal is created, and a channel is dredged in the remaining open sections.
Complete Fill	The cove/canal is completely filled with soil, eliminating the water way.
Capital Cost Assumptions:	
Construction Cost	Fill materials (soils) hauled from offsite where net fill required. Assumed 10 mi round trip.
	Includes dredge, fill placement, compaction, and dewatering.
	Outlet construction requires land acquisition, land clear and grub, pavement removal, excavation, culvert, backfill and compaction, road repair.
Land Costs	Purchase of land for outlet(s) at taxroll appraised value
	Lease of land for temporary spoils disposal and dewatering.
Design & Administrative	Engineering, Surveying, Permitting, Construction Administration, Contract Administration Total 20%
	Permitting costs associated with dredging and filling within waterway not included (e.g., USACE Section 404)
Contingency	Given multiple uncertainties at this stage, 20% assumed.
O&M Cost Assumptions:	
Dredge	Assumed maintenance dredging every 5 years
Partial Fill	N/A
Partial Fill with Dredge	Assumed maintenance dredging every 5 years
Partial Fill with Dredge and construct additional outlet (s)	Includes culvert maintenance, bank stabilization, guard rails; Assume maintenance dredging within 5 years
Complete Fill	N/A
Equivalent Annual Cost Analysis:	
Lifespan Assumption:	
Dredge	5 years
Partial Fill	75 years
Partial Fill with Dredge	10 years
Partial Fill with Dredge and additional outlet (s)	10 years
Complete Fill	100 years
Interest Rate Assumption:	10%
	Weighted cost of capital assuming inflationary trend
Equivalent Annual Cost Index:	Ratio of Equivalent Annual Cost for this alternative compared to the maximum Equivalent Annual Cost of all alternatives considered for the specific subdivision.

Alternative ID:	RHS-Fill	RHS-Partial Fill	RHS- Dredge	RHS -Dredge&PartialFill	RHS -Dredge&PartialFill&Outlet
Alternative Name:	Fill	Partial Fill	Dredge	Dredge and Partial Fill	Dredge, Partial Fill and Outlet
Service Area	Rolling Hills Shores	Rolling Hills Shores	Rolling Hills Shores	Rolling Hills Shores	Rolling Hills Shores
Construction Details and Assumptions:					
	Fill entire cove, assume 4' fill depth	Fill sections of cove, assume 4' fill depth	Dredge channel in cove from lake to shore	Dredge channel in cove from lake to shore	Dredge channel in cove from lake to shore
	Haul 223,574 cy of fill material to site	Haul 187,800 cy of fill material to site	Dredged Channel dimensions: 3’ depth, 20’ width, 1190' length	Dredged channel dimensions: 3’ depth, 20’ width, 1190' length	Dredged channel dimensions: 3’ depth, 20’ width, 1940 ft length
			Dredge method: excavation from a barge	Dredge method: excavation from a barge	Dredge method: excavation from a barge
			Haul 2,644 cy dredge spoils from site	Haul 2,644 cy dredge spoils from site	Fill sections of cove, assume 4 ft fill depth
			Purchase 1 acre spoils site for dredge spoils	Fill sections of cove,assume 4 ft fill depth	Haul 187,800 cy of fill material to site
				Haul 187,800 cy of fill material to site	Outlet: Excavate channel: 20' width, 300' length, 5' depth
				Purchase 1 acre spoils site for dredge spoils	Remove road, place culvert, repair road, land acquistion
					Haul 5,422 cy dredge and excavated spoils from site
					Purchase 1 acre spoils site for dredge spoils
Equivalent Annual Cost Index:	0.30	0.25	1.00	0.73	0.76
Pollutant Percent Reduction:	N/A	0%	4%	0	86%

Alternative ID:	OTS-Fill	OTS-Partial Fill	OTS- Dredge	OTS-Dredge&Outlet
Alternative Name:	Fill	Partial Fill	Dredge	Dredge and Outlet
Service Area	Oak Trail Shores	Oak Trail Shores	Oak Trail Shores	Oak Trail Shores
Construction Details and Assumptions:				
	Fill entire cove, 3-5' fill depth	Partial fill of cove, 3-5' fill depth	Dredge channel in cove from lake to shore	Dredge channel in cove from lake to shore
	Haul 20,132 cy of fill material to site	Haul 7,780 cy of fill material to site	Dredged channel dimensions: 3' depth, 20' width, 1,245' length	Dredged channel dimensions: 3' depth, 20' width, 1,245' length
			Haul 6,260 cy of fill material to site	Haul 6,260 cy of fill material to site
			Purchase 1 acre spoils site for dredge spoils	Outlets: Excavate north and south outlets: 25' width, 4' depth, 921' total length
				Remove road, place culvert, repair road, land acquistion for both outlets
				Haul 9,415 cy dredge and excavation spoils from site
				Purchase 1 acre spoils site for dredge spoils
Equivalent Annual Cost Index:	0.01	0.01	0.99	0.35
Pollutant Percent Reduction:	N/A	0%	30%	65%

Alternative Name: Cove Circulation - Intake-Discharge Circulation System

Description: Water circulation in cove is increased by pumping water from lake to top of cove fingers, reducing stagnation and bacteria accumulation.

Pollutant Addressed: Bacteria

Conceptual Design Assumptions:

Submersible pumps intake water and discharge at the end of canals. Sediment intake is reduced by a pump filter.

Pumps work at 70% efficiency. Pumps is sized to circulate cove volume.

PVC pipes with mechanical restraining joints convey water from pumps and discharge at top of cove. Pipes lay at the bottom of lake.

Discharge is dissiapated with a control device.

Capital Cost Assumptions:

Construction Cost Includes pump, pump filter, intake station frame, pump electrical system, and pvc pipes with mechanical restraining joints

Land Costs None

Design & Administrative Engineering, Surveying, Permitting, Construction Administration, Contract Administration Total 20% (added to construction cost)

Contingency Given multiple uncertainties at this stage, 20% assumed and added to construction cost.

O&M Cost Assumptions:

Includes bi-weekly backflushing of filter media, pump repair, pipe repair, labor, and materials/incidental supplies

Power cost calculated at $0.11/kWh and +/- 9 kWh/month

Equivalent Annual Cost Analysis:

Lifespan Assumption: 15 years

Interest Rate Assumption: 10%

Weighted cost of capital assuming inflationary trend

Equivalent Annual Cost Index: Ratio of Equivalent Annual Cost for this alternative compared to the maximum Equivalent Annual Cost of all alternatives considered for the specific subdivision.

Alternative ID:	PRE Circulation	SH Circulation	IH Circulation
Alternative Name:	Intake-Discharge Circulation System	Intake-Discharge Circulation System	Intake-Discharge Circulation System
Service Area	Port Ridgle East	Sky Harbor	Indian Harbor
Construction Details and Assumptions:			
Conveyance	6" to 18" diameter PVC pipes, 7010 LF	12" to 24" diameter PVC pipes, 5591 LF	9" to 24" diameter PVC pipes, 5060 LF
	Pipe velcity 3-6 fps	Pipe velcity 3-6 fps	Pipe velcity 3-6 fps
Pump	18 hp pump (west section) and 10 hp pump (east section)	64 hp pump	27 hp pump
	System sized for 4 day water turnover rate.	System sized for 4 day water turnover rate.	System sized for 4 day water turnover rate.
Equivalent Annual Cost Index:	0.14	0.11	0.10
Pollutant Percent Reduction:	30%	39%	33%

Alternative Name: Offsite Drainage Bypass

Description: Pet/wildlife waste and pesticides on ground surface are picked up in rainfall runoff. Direct surface run-off away from cove by providing an channel to intercept runoff from uphill and force to drain at location away from cove.

Pollutant Addressed: Bacteria

Conceptual Design Assumptions:

Drainage ditch is a v-shaped channel constructed along the road (in the easement) and toward the lake, as best suited by topography.

Drainage ditch is sized to convey runoff from frequent rainfall events (up to the 5 year event). Channel size limited by available land.
Small diameter drainage pipes is required to provide conveyance under driveways.

Culverts are required to provide conveyance under roads.

Capital Cost Assumptions:

Construction Cost

Channel excavation and 10 mile haul

Install driveway pipes and repair driveways; assume 1 driveway per lot; assume driveway width less than 30 ft (30 ft drainage pipe length)

Remove road, install culvert, repair road; assume 30 ft culvert length

Seeding

Design & Administrative Engineering, Surveying, Permitting, Construction Administration, Contract Administration Total 20% (added to construction cost)

Contingency Given multiple uncertainties at this stage, 20% assumed and added to construction cost.

O&M Cost Assumptions:

Sediment maintenance every 3 years, 3x/year mowing, culvert and drainage pipe cleanout

Equivalent Annual Cost Analysis:

Lifespan Assumption: 50 years

Interest Rate Assumption: 10%

Weighted cost of capital assuming inflationary trend

Equivalent Annual Cost Index: Ratio of Equivalent Annual Cost for this alternative compared to the maximum Equivalent Annual Cost of all alternatives considered for the specific subdivision.

Alternative Name: Wet Ponds

Description: Wet ponds capture and detain runoff before reaching Lake Granbury coves/canals to allow for settlement of pollutants, wet plant uptake and microbiological degradation.

Pollutant Addressed: Bacteria

Conceptual Design Assumptions:

Implement water quality controls to treat watersheds draining to the pollutated areas of the lake. Large watersheds may require several controls in series.

Pond design based on TCEQ Wet Basin guidelines: removal of 80% of total suspended solids (TSS). Assumed natural areas/landscaped areas have a runoff coefficient of 0.03.

Sediment forebay holds 15-25% of permanent pool volume and at least 3 ft deep. Water quality volume based on average annual rainfall of 33 inches. Permanent pool volume is 1.2 times the water quality volume. Permanent pool average depth of 4 to 6 ft. Outflow structure drains the water quality volume in a minimium of 24 hours.

Wet ponds are shallow ponds effective in removing pollutants for drainage areas between 10 acre to 640 acres through settling and biological uptake by plants. Appropriate for drainage areas where a continual or nearly continual base flow is present to sustain vegetation growth. Make up water must be provided if no continuous flow is available.

Capital Cost Assumptions:

Construction Cost Includes general allowances for mobilization, staging, testing; clear and grub land, excavation, haul (10 mi round trip), vegetation/planting allowance, erosion/sedimentation controls, maintenance items (concrete pads, driveway apron), outfall weir/structure and misc. drainage appurtances.

Land Costs Two times the appraised value due to site specific locations

Design & Administrative Engineering, Surveying, Permitting, Construction Administration, Contract Administration Total 20% (added to construction cost)

Contingency Given multiple uncertainties at this stage, 20% assumed and added to construction cost.

O&M Cost Assumptions:

Remove sediment accumulation every 20 years

Maintenance every 5 to 7 years or when 50% of forebay capacity is silted

Annual cost of routine maintenance is approx 3% of construction cost

Equivalent Annual Cost Analysis:

Lifespan Assumption: 25 years

Interest Rate Assumption: 10%

Weighted cost of capital assuming return to inflationary trend within 5 years

Equivalent Annual Cost Index: Ratio of Equivalent Annual Cost for this alternative compared to the maximum Equivalent Annual Cost of all alternatives considered for the specific subdivision.

Alternative ID:	SH-Wet Ponds	OTS-Drainage Bypass	RHS-Property Buyout
Alternative Name:	Catchment Basins	OffSite Drainage Bypass	Property Buyout
Service Area	Sky Harbor	Oak Trails Shores	Rolling Hills Shores
Construction Details and Assumptions:			
	Twelve ponds, sizes range from 0.5 to 2.5 acres, with assumed 3ft depth.	V-shaped channel along the east side of Green Brook St	213 lots identified within the 100-yr floodplain
	Location of ponds determined by topography and a drainage limit of 640 acres.	12.5 ft top width, and 2 ft depth, 3:1 (H:V) side slopes	
	Ponds may require make up water source if not continious flow available.	Outfalls to north and south of canal	
	Ponds designed to remove 80% TSS	Contains runoff from the 2-year and 5-year rainfall events	
Equivalent Annual Cost Index:	0.48	0.03	0.15
Pollutant Percent Reduction:	65%	51%	62%